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CASUALTY ACTUARIAL SOCIETY

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Date: February 1991

To: CAS Membership

Re: Seventh Issue of *The Forum*

Dear CAS Members:

The first issue of *The Forum* for 1991 presents a wide range of reading for our members. There are a number of original works plus several reports from CAS committees. *The Forum* was originally established to provide an outlet for original work and also for printing the output of CAS committees.

The original works in this issue span such diverse topics as Schedule P, experience rating plans, reserving data bases, injured worker mortality, and the impact of inflation on the theory of life contingencies.

Committee reports include the report of the Committee on Reserves on risk margins for discounted loss reserves. In addition, several items from the admissions committees are included. Of special interest is the report of the Partitioned Exam Task Force headed by Jerry Degerness.

We are printing the study of insurance company insolvencies conducted by the American Academy of Actuaries Committee on Property and Liability Insurance Financial Reporting which attempts to measure the effectiveness of casualty loss reserve opinions.

We continue to encourage you to contribute to *The Forum.* Please submit your papers or articles for the next issue by April 30, 1991 to Joel Kleinman at his yearbook address.

Yours very truly,

Irene K. Bass

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Vice President - Continuing Education

TABLE OF CONTENTS

Title		*Page*
Completing and Using Schedule P	Sholom Feldblum	1
An Actuarial Analysis of the NCCI Revised Experience Rating Plan	Howard Mahler	35
A Reserving Data Base	Edward M. Ford	61
The Impact of Inflation on the Theory of Life Contingencies	Cecilia M. LePere	75
Injured Worker Mortality	William R. Gillam	89
Review of Report of Committee on Mortality for Disabled Lives	Gary G. Venter Barbara Schill Jack Barnett	115
Risk Margins for Discounted Loss Reserve	Committee on Reserves of the Casualty Actuarial Society	139
Study of Insurance Company Insolvencies from 1969-87 to Measure the Effectiveness of Casualty Loss Reserve Opinions	American Academy of Actuaries Committee on Property Liability Insurance Financial Reporting	161
March 14, 1989 Letter and White Paper on Flexible Examination System	Kevin Ryan and Education Policy Committee	189
August 10, 1989 Letter Regarding Partitioned Examination System	Michael Toothman	221
November 2, 1990 Letter Regarding Partitioned Examination System	Gustave Krause	227
November 9, 1990 Letter Regarding Partitioned Examination System	Michael Toothman	233
Partitioned Exam Task Force Final Report	Partitioned Exam Task Force	239
December 24, 1990 Letter Regarding Partitioned Examination System	Charles Bryan	461
The Economic Theory of Risk and Insurance (Reprint)	Allan H. Willet (Introduction by Glenn Meyers)	469

COMPLETING AND USING SCHEDULE P

Sholom Feldblum

COMPLETING AND USING SCHEDULE P

Biography:

Sholom Feldblum is an Associate Actuary with the Liberty Mutual Insurance Company in Boston, Massachusetts. He was graduated from Harvard University in 1978 and spent the next two years as a visiting fellow at the Hebrew University in Jerusalem. He became a Fellow of the CAS in 1987, a CPCU in 1986, an Associate of the SOA in 1986, and a member of the American Academy of Actuaries in 1989. In 1988, while working at the Allstate Research and Planning Center in California, he served as President of the Casualty Actuaries of the Bay Area and as Vice President of Research of the Northern California Chapter of the Society of CPCU. In 1989, he served on the CAS Education and Testing Methods Task Force. He is presently a member of the CAS Syllabus Committee, the CAS Committee on Review of Papers, and the Advisory Committee to the NAIC Casualty Actuarial (EX5) Task Force. Previous papers and discussions of his have appeared in *Best's Review*, the *CPCU Journal*, the *Proceedings of the Casualty Actuarial Society*, the *Actuarial Digest*, the *CAS Forum*, and the *CAS Discussion Paper Program*.

Abstract

Schedule P is a complex document, requiring careful preparation for its completion and sophisticated analysis for its use. This paper proceeds step by step through each section of Schedule P, explaining the requirements for each column, showing the cross checks with other Parts of the Schedule and with other exhibits in the Annual Statement, suggesting methods to facilitate the completion of the Schedule, and demonstrating the reserve adequacy analyses that can be performed with these data. This paper should simplify the task of completing your own company's Schedule P and deepen the rewards of analyzing those of your peer companies.**

** I am indebted to Richard Roth and John Bray, each of whom twice reviewed earlier drafts of this paper and suggested numerous corrections and additions. Richard Roth is Assistant Insurance Commissioner of California and the architect of much of the new Schedule P. John Bray has conducted seminars on completing Schedule P, and he prepared many of the Schedule P exhibits for the NAIC *Annual Statement Instructions* manual. I am also indebted to Jerry Scheibl and Ruth Salzmann, who clarified for me several items regarding extended loss and expense reserves in Part 5 and the distribution by accident year of unallocated loss adjustment expense reserves in Part 1. The remaining errors in this paper, of course, are my own.

COMPLETING AND USING SCHEDULE P

Table of Contents

Purposes of the Schedule 1

Experience Period - Liability and Property Lines 2

Part 1 - Current Valuation 4
- Premiums 5
- Loss and Loss Expense Payments 6
- Distribution of Unallocated Expenses 7
- Claim Count 9
- Loss and Loss Expense Reserves 10
- Distributing Unallocated Expense Reserves 11
- Claims Outstanding 13
- Interest Discount 13
- Intercompany Pooling 13
- Excess Statutory Reserves 14
  - Excess Reserves - Long Tailed Lines 14
  - Excess Reserves - Credit Insurance 15

Auxiliary Exhibits 16

Part 3 - Paid Losses 17
- The "Prior" Line 17
- Loss Reserve Adequacy - Prospective Valuation 18
- Paid Loss Link Ratios 19
- Paid Loss Development Factors 21
- Paid Loss Tail Factors 21
- Closed Claim Counts 22

Part 2 - Incurred Losses 23

- IRIS Loss Development Tests 23
  - IRIS Tests 9 and 10 23
  - IRIS Test 11 23
- Case Incurred Losses 25
- Link Ratios and Development Factors 27
- Updating the Part 2 Exhibits 27
- Average Values of Outstanding Claims 28

Part 6 - Bulk Reserves 29

Part 5 - Claims Made Policies 29
- Extended Loss and Expense Reserves 29

Part 4 - Loss Portfolio Transfers 30
- Accounting for Loss Portfolio Transfers. 31

Conclusion 32

COMPLETING AND USING SCHEDULE P

Schedule P is a large and complex section of the Annual Statement, demanding actuarial expertise to complete and to understand. The "cross checks" performed by the National Association of Insurance Commissioners (NAIC) compare the Schedule P figures within its various parts, with other pages of the Annual Statement, and with Schedule P data from the preceding year. The NAIC uses Schedule P for three of the Insurance Regulatory Information System (IRIS) tests, and investment analysts use the Schedule to measure the adequacy of a carrier's held reserves.[1] Actuaries need a thorough understanding of this Schedule, both to complete it for their own company or client and to evaluate the performance of peer companies.

Purposes of the Schedule

Schedule P is designed to measure loss and loss adjustment expense reserve adequacy, both retrospectively and prospectively. Part 2 is a retrospective test, by accident year and line of business, of reserves held in prior years. The totals from the one year and two year retrospective tests, shown in the Part 2 Summary exhibit, are used for the IRIS tests 9, 10, and 11.

Several prospective tests of loss reserve adequacy may be done with Schedule P data. Part 3 provides paid loss development triangles, and the difference between Parts 2 and 6 provides case incurred loss development triangles.[2] Link ratio "tail factors" may be estimated from the Part 2 "prior years" row. Average severities, whether incurred or paid, may be estimated from the claim count figures in Parts 1 and 3, once full histories have been developed.[3]

Schedule P has numerous other functions as well. It provides data to compute the required excess statutory reserves over statement reserves for four lines of business: Automobile Liability (Personal and Commercial), Other Liability, Medical Malpractice, and Workers' Compensation. It shows both direct and net experience, to evaluate the effects of reinsurance recoveries on accident year loss ratios by line of business. It shows payments and reserves for

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[1] For a description of the IRIS tests, see National Association of Insurance Commissioners, *Using the NAIC Insurance Regulatory Information System: Property and Liability Edition* (Kansas City, Missouri: NAIC, 1989). For an example of financial analysis using Schedule P data, see Thomas V. Cholnoky and Jeffrey Cohen, *Property/Casualty Insurance Industry Loss Reserve Analysis* (Goldman Sachs, June 23, 1989).

[2] "Case incurred losses," or paid losses plus case reserves, are often termed "reported losses." A triangle of case loss reserves, or Part 2 minus Part 6 minus Part 3, may also be formed; see the discussion below in the text.

[3] The reporting of claim counts for accident years prior to 1989 is optional, hindering analysis of average claim cost trends. In addition, the lack of claim count data from the Automobile and Workers' Compensation involuntary market reinsurance pools hampered such analysis from the 1989 Annual Statement (this problem is now being resolved).

losses and loss adjustment expenses by accident year, thereby isolating blocks of business with good or poor experience.

Schedule P was extensively revised for the 1989 Annual Statement. This paper explains what data is required for the Schedule, how the exhibits should be completed, and what cross checks are used by the NAIC. It then shows how the Schedule P data allows prospective analyses of loss reserve adequacy, using both paid and incurred loss developments.

Experience Period - Liability and Property Lines

Beginning with the 1989 Annual Statement, all lines of business are included in Schedule P. The liability lines, which were included in the pre-1989 Schedule P, show 10 accident years of data, plus a "prior years" row:

1. Homeowners/Farmowners
2. Private Passenger Auto Liability/Medical
3. Commercial Auto/Truck Liability/Medical
4. Workers' Compensation
5. Commercial Multi-Peril
6. Medical Malpractice
7. Special Liability (Ocean Marine, Aircraft [All Perils], Boiler and Machinery)
8. Other Liability[4]
9. International.[5]

The property lines, which were in Schedules G, K, and O before 1989, show 2 accident years of data, plus a "prior years" row:

1. Special Property (Fire, Allied Lines, Inland Marine, Earthquake, Glass, Burglary & Theft)
2. Auto Physical Damage
3. Fidelity, Surety, Financial Guaranty, Mortgage Guaranty[6]

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[4] In the 1991 and subsequent Annual Statements, Products Liability, which is now included in Other Liability, will be reported as a separate line of business. Presently, Products Liability experience, with complete Schedule P exhibits, is reported in a supplement to the Annual Statement.

[5] The "International" line was included in Schedule O prior to 1989, though it now uses a 10 year exhibit, as the liability lines do.

[6] This is the Schedule P subdivision. In the "Underwriting and Investment Exhibit," pages 8-10 of the Annual Statement, Mortgage Guarantee does not appear as a separate line of business, but may be included as a "write-in" line of business. State regulations for mortgage guarantee coverage vary between guarantees on first and subsequent mortgages. California

4. Other (Including Credit, Accident and Health).

Reinsurance experience that was included in Schedule O (line 30) prior to 1988 is now shown as Reinsurance D, with a "10 year" exhibit format, though data is shown only for accident years 1987 and prior.[7] Reinsurance for accident years 1988 and subsequent is divided into three parts: nonproportional property, nonproportional liability, and financial lines (Reinsurance A, B, and C in Schedule P).[8] Proportional reinsurance is shown as assumed or ceded premiums, losses, and expenses in the exhibits for the appropriate lines of business.

The Summary exhibits show 10 accident years of data, plus a "prior years" row. 10 accident years of data must therefore be kept for *all* lines of business, since all ten years for every line are used for the Summary exhibits.[9]

For the individual accident years, the premiums are calendar year but the losses and expenses are cumulative accident year. For instance, the 1985 premiums shown in column 2, 3, and 4 of Part 1 are calendar year earned premiums; they are not changed for subsequent EBNR (Earned

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statute requires guarantees on first mortgages to be monoline; that is, they can not be issued by an insurer writing other lines of business. Guarantees written on subsequent mortgages may be written by a carrier having "a certificate of authority to transact the business of credit insurance." See the California Legal Code, §12640.10, subsection (a).

[7] There is one exception: unearned premium reserves for the reinsurance line in the 1987 Annual Statement, shown in the Underwriting and Investment Exhibit, Part 2A, "Recapitulation of all Premiums," Column 5, line 30 (page 8), are reported as Reinsurance D earned premiums in the 1988 and subsequent Annual Statements. The Schedule P exhibits for Reinsurance D do not contain rows for accident years subsequent to 1987. If 12/31/87 reinsurance unearned premium reserves are reported as Reinsurance D earned premiums in the succeeding years, these premiums must be included in the Part 1 Summary exhibit to ensure consistency with the "Underwriting and Investment Exhibit," page 7, "Part 2 - Premiums Earned," line 32 (Totals), column 4 (Premium Earned During Year).

[8] Reinsurance A, B, and C correspond to the "2 year," "10 year," and financial lines of business, with the following exceptions: (1) Ocean marine and boiler and machinery, which are part of the "Special Liability" line, are included in reinsurance A. (2) Credit, which is part of the "Other" line, is included in reinsurance C. (3) International is divided among reinsurance A, B, and C according to the type of business reinsured. For a complete listing of the lines, see the NAIC *Annual Statement Instructions: Property and Casualty*, *op. cit.*, page 59-2.

[9] See the NAIC *Instructions*, page 57-1: "Since the Summary of each part contains ten years of development, the information from the "Prior" line in the Property Lines, Sections I through L, must be supplemented for the eight accident years preceding the two most recent years." One widely used Annual Statement software package therefore shows 10 accident years, a "two year prior line," and a "ten year prior line" for the property lines of business Schedule P exhibits.

But Not Reported) adjustments. The 1985 paid loss and expense figures in columns 5 through 11 of Part 1 are cumulative accident year figures: that is, payments from January 1, 1985, through the Statement date for accident year 1985. The 1985 unpaid loss and expense reserves in columns 13 through 21 are the reserves held on the Statement date. For example, in the 1990 Annual Statement, these are the reserves held on December 31, 1990, for accident year 1985.

For the "prior years" row, no earned premiums are shown. In Part 1, the loss and expense payments, and the salvage and subrogation reimbursements, are only those *made or received in the most recent calendar year.*[10] In part 3, the loss and expense payments are those made since January 1 of the *second* calendar year shown along the column headings. (Thus, for the 1990 Annual Statement, these are payments made since January 1, *1982.*) The unpaid loss and expense reserves are the reserves evaluated at the Statement date for Part 1, and at each December 31 for Parts 2 and 6.[11]

Part 1 - Current Valuation

Part 1 shows cumulative experience by accident year at the Statement date. Premiums, losses, and allocated expenses are shown separately for "direct and assumed" and for "ceded," so that the user may determine the effects of reinsurance recoverables on reported loss ratios (columns 27, 28, and 29).[12] [13] If the direct and assumed loss ratio is significantly higher than the net loss ratio, the business ceded may be poor. If so, the reinsurers may cancel treaties, raise reinsurance rates, or underwrite facultative business more carefully. Thus, the *net* loss ratio is influenced by the reinsurance market at the current time. The *direct and assumed* loss ratio reflects the quality of the primary insurer's book of business, and it may be a good predictor of both the direct and net loss ratios in *future* years.[14]

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[10] See the NAIC *Instructions*, page 57-1.

[11] See the exhibits at the end of the "Schedule P" section of the NAIC *Instructions.*

[12] Member allocations from intercompany pooled business are reported in the "direct and assumed" column. The NAIC *Instructions*, page 59-1, consider such business to be "assumed," though not "ceded" (since the cession is from a pool, not from an individual company). See also the "sample situation" on page 59-4 of the *Instructions.*

[13] The assumed business is *proportional* reinsurance only; non-proportional assumptions are reported separately in the reinsurance lines. Thus, the assumed business is similar to the direct, in that it is not subject to the fluctuations of excess of loss treaties.

[14] Note Richard Roth's remarks at the 1989 Casualty Loss Reserve Seminar: "Surprisingly, very few companies - particularly small companies - have any idea how profitable or whether they are making money or whether the business being ceded is profitable or not profitable. Once they pay that reinsurance premium they don't care, it's just gone. . . .

Parts 2, 3, and 6 show historical loss triangles for net losses and ALAE only; there are no corresponding triangles for direct business. However, historical loss triangles for direct and assumed business can be formed by joining Annual Statements from several years. For instance, by March 1, 1994, a five year historical loss triangle of direct and assumed business can be developed from the Schedule P, Parts 1, of the 1989 through 1993 Annual Statements.

Most insurers keep direct premium and loss statistics by calendar year. Ceded and assumed statistics are often available only by fiscal year or contract year. Involuntary market reinsurance pools in Workers' Compensation and Commercial Automobile use fiscal years ending August 31 or September 30.[15] To complete Schedule P, you must take the fiscal year experience - assumed and ceded premiums and losses - add estimated figures for the remainder of the current calendar year, and subtract the amounts added the previous year.

The estimates must be divided by accident year. Voluntary market statistics may be a poor base for the involuntary market division by accident year if these markets are growing at different rates. In Workers' Compensation, for instance, the involuntary pools are expanding in 1989 and 1990, though there is little growth in the voluntary market. Thus, involuntary market losses are now more heavily weighted in recent accident years than are voluntary market losses. To properly allocate the estimates of involuntary market reinsurance pool premiums and losses by accident year, you must adjust the distributions for differing growth rates by calendar year and market.

Premiums

Premiums are recorded by calendar year. Once entered, they are "frozen," and are not adjusted for subsequent EBNR (Earned But Not Reported) developments. Suppose a carrier issues Workers' Compensation retrospectively rated policies. Poor experience on one block of business will raise the loss figures at subsequent valuations for the appropriate accident years. The additional premiums received are coded to the *current* calendar year, not to the years when the policies were issued.[16] Schedule P would show overstated loss ratios for the year of policy

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Well, what happens is if the business that is being ceded is consistently unprofitable, we know that two or three years down the line they're not going to have any reinsurance. Also, it says that the business that they're writing is probably underpriced and that they will soon have problems" (Richard J. Roth, Jr., "Changes to Schedules O and P," *1989 Casualty Loss Reserve Seminar Transcript*, page 86).

[15] The Commonwealth Automobile Reinsurance (CAR) facility in Massachusetts also handles Personal Automobile business, with a fiscal year ending September 30.

[16] That is, the additional premiums in excess of the estimated EBNR reserve calculated at the end of the accounting period when the premiums were earned. This EBNR reserve is shown in the "Underwriting and Investment Exhibit," page 8, Part 2A, "Recapitulation of All

issuance and understated loss ratios for the current year.[17]

In Part 1 of Schedule P, the "prior years" row is used only for payments made or received in the current year, or reserves held on open cases as of the statement date. No figures are shown for premiums on the "prior years" row, since no matching to losses is possible.

The latest calendar year net earned premium shown in Schedule P, Part 1, column 4, row 11, for each line of business must equal the net earned premium shown on page 7, "Underwriting and Investment Exhibit," Part 2, "Premiums Earned," column 4. Premium figures from earlier years must agree with the figures in the preceding years' Annual Statements.[18]

Loss and Loss Expense Payments

Columns 5 through 11 show loss and loss expense payments by accident year. For the individual accident years listed in column 1, these are *cumulative* payments. For instance, for accident year 1985, column 5 shows loss payments on direct and assumed business from January 1, 1985, through the Statement date. For the "prior years" row, the payments are only those made in the *current* calendar year. Thus, for the 1990 Annual Statement, these are the payments made from January 1, 1990, through December 31, 1990.

Columns 5 and 6 are *net* of salvage and subrogation received.[19] Column 9 is for information only; it is not used to calculate subsequent columns. (Note that column 11 equals columns 5-6+7-8+10; it does not involve column 9.) Salvage and subrogation is generally small for all lines of business except automobile physical damage (Part 1J).

Premiums," column 4, "Reserve for Rate Credits and Retrospective Adjustments Based on Experience."

[17] Upon reviewing an earlier draft of this paper, Richard Roth commented: "An acknowledged weakness of Schedule P is the mismatch between losses and premiums by year, especially for reinsurance and Workers' Compensation. Early drafts of Schedule P addressed this problem; however, the problem is not that easy to solve. It is not enough just to add a column for policy year premiums. Whole triangles of premiums must be reported." Richard is correct. EBNR reserve analyses can be as complex as loss reserve analyses, and they require full historical triangles for accurate projections.

[18] If there is an intercompany pooling agreement which has changed over time, then the comparison with prior Annual Statements can be done only on a consolidated basis. See the discussion in the text on intercompany pooling.

[19] See the NAIC *Instructions*, page 59-1: "Loss payments are to be reported net of salvage and subrogation received in Schedule P." Outstanding losses, however, are gross of salvage and subrogation expected. The same procedures are used in the "Underwriting and Investment Exhibit," Parts 3 and 3A, pages 9 and 10.

Distribution of Unallocated Expenses

Allocated loss expense payments, such as defense counsel fees, are related to specific claims and can therefore be assigned to accident years. Unallocated expenses in column 10 are claims department overhead and salaries; they are assigned to accident year by formula. Item #4 of the Schedule P Interrogatories describes the procedure:

> *The unallocated loss expense payments paid during the most recent calendar year should be distributed to the various years in which losses were incurred as follows: (1) 45% to the most recent year, (2) 5% to the next most recent year, and (3) the balance to all years, including the most recent, in proportion to the amount of loss payments paid for each year during the most recent calendar year. If the distribution in (1) or (2) produces an accumulated distribution to each year in excess of 10% of the premiums earned for such year, disregarding all distributions made under (3) such accumulated distribution should be limited to 10% of premiums earned and the balance distributed in accordance with (3).*

The assumptions underlying this procedure are that (1) half of unallocated loss adjustment expenses are incurred when the claim is reported (costs of setting up files and initial investigations), and half are incurred when the claim is settled (costs of issuing checks and final negotiations), and (2) 90% of claims are reported during the year when the accident occurred, and 10% are reported the following year. Thus, unallocated expenses related to claim reporting are assigned to the most recent two accident years in a 9 to 1 (or 45 to 5) allocation, and unallocated expenses related to claim settlement are allocated in proportion to loss payments.

No fixed procedure is suitable for all lines of business. Many Products Liability claims are not reported until years after the accident date, and insurers providing this coverage spend much time negotiating settlements and handling the claims. The statutory distribution procedure assigns too much unallocated expenses to the most recent years. Workers' Compensation permanent disability cases may have weekly indemnity payments extending over the victim's lifetime, though most unallocated expenses are incurred when the claim is first reported and investigated. The statutory distribution procedure assigns too little unallocated expenses to the most recent years. Nevertheless, it is difficult to determine the proper assignment of unallocated expenses to accident year, so the simple statutory procedure has endured.[20]

The Annual Statement instructions do not say whether *direct* or *net* loss payments should be used to distribute the unallocated loss expense payments to accident year. On the one hand, the unallocated expenses are related to direct loss payments. The reinsurance compensation for the ceding insurer's expenses appears as an offset to *commissions*, not to loss adjustment expenses.

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[20] See Ruth Salzmann, "Estimated Liabilities for Losses and Loss Adjustment Expenses," in Robert W. Strain, (ed.), *Property-Liability Insurance Accounting*, Fourth Edition (1988), page 83.

Thus, logic dictates that *direct* loss payments be used to distribute unallocated adjustment expenses.[21]

On the other hand, column 10 contains *net* unallocated expense payments; no direct figures are shown.[22] Moreover, only net loss payments were shown in Schedule P before 1989. The same distribution procedure for unallocated loss expense payments was used prior to 1989. Thus, past practice dictates that we continue to use *net* loss payments to distribute unallocated expenses.

Suppose the company has the following 1990 experience for a line of business all of whose claims are settled within 5 years:

Exhibit 1: Distributing Unallocated Loss Expenses by Accident Year (Figures in thousands of dollars)

Cal/Acc Year	Earned Premium	Losses Paid in 1990	
1986	8,000	200	Calendar year 1990 unallocated
1987	8,500	500	loss adjustment expenses paid: 600
1988	9,000	800	
1989	9,000	2,000	
1990	9,500	2,500	

45% of $600,000, or $270,000, is allocated to 1990, and 5% of $600,000, or $30,000, is allocated to 1989. The remaining $300,000 is allocated in the same proportion as paid losses:

[21] According to Richard Roth, this was the intention of the NAIC. Furthermore, as John Bray has pointed out to me, most companies include all the unallocated loss adjustment expenses in columns 10 and 21 in the "direct and assumed" totals in column 24, implying that all or almost all of these expenses are direct.

[22] See the NAIC *Instructions*, page 59-1: "In Part 1, salvage and subrogation received and unallocated loss expenses paid and unpaid should be reported net of reinsurance, if any." As Richard Roth points out, though, there will be little if any reinsurance recoveries for unallocated loss adjustment expenses.

Exhibit 2: Distributing Unallocated Loss Expenses by Accident Year (Figures in thousands of dollars)

Cal/Acc Year	Losses Paid in 1990	Paid Loss Percentage	Unallocated Expense Distribution: Step 3	Steps 1 & 2	Total
1986	200	3%	10	0	10
1987	500	8	25	0	25
1988	800	13	40	0	40
1989	2,000	34	100	30	130
1990	2,500	42	125	270	395
Total:	6,000	100%	300	300	600

Claim Count

Column 12 shows the number of claims reported on direct and assumed business. The losses incurred to date (that is, paid losses plus case reserves) on direct and assumed business divided by the number of claims reported provides the average claim cost. A comparison of (i) a carrier's trend in average claim cost by accident year for a given line of business with (ii) either industry averages or appropriate monetary inflation indices may help identify deteriorating or improving books of business.

Claims may be counted either "per accident" or "per claimant." Automobile liability insurance illustrates the difference. If an insured driver causes an accident and injures three other persons, each of whom seeks Bodily Injury compensation, are there three claims or just one? Carriers may use either definition, and the choice must be reported in Question 7 of the Schedule P Interrogatories:

7. Claim count information is reported (check one): *(a) per claim* _____
(b) per claimant _____

Column 12 asks for number of reported claims on direct and *assumed* business. The assumed business includes experience assumed from the involuntary market reinsurance pools: Workers' Compensation, Commercial Automobile, and Massachusetts (Commonwealth Automobile Reinsurance, or CAR) Personal Automobile.

In past years, the involuntary market reinsurance pools did not request claim counts from servicing carriers, and they were unable to report the required claim count information to member companies for the 1989 Annual Statement. The NAIC recognized this problem and postponed the requirement for involuntary market assumed claim counts until the 1990 Annual Statement - at which time assumed claim counts must be included in column 12. The Automobile Insurance Plans Services Office (AIPSO), the National Council on Compensation Insurance (NCCI), and the Commonwealth Automobile Reinsurance (CAR) are gathering the

needed data by accident year, and they expect to report the allocations to member companies by the end of 1990.[23]

Loss and Loss Expense Reserves

Columns 13 through 22 show loss and loss expense reserves by accident year, valued as of the Statement date, separately for case and bulk reserves. Before 1989, Schedule P, Part 1F, showed IBNR reserves separately from case reserves. It was unclear whether the development on reported cases should be classified as IBNR or as case reserves, and insurers chose different definitions of IBNR. To avoid inconsistency among carriers, the Annual Statement divided reserves between (i) case and (ii) bulk + IBNR. All formula reserves, whether for development on reported cases or emergence of unreported cases, comprise the "bulk + IBNR" reserves.[24]

Although Schedule P makes no distinction between true IBNR and other bulk reserves, the Underwriting and Investment Exhibit, Part 3A, Unpaid Losses and Loss Adjustment Expense, on page 10, shows separate numbers for each component. Page 10, columns 1a, 1b, 2, and 3, show reserves for reported cases ("Adjusted or in Process of Adjustment"), for direct, assumed, ceded, and net business. Columns 4a, 4b, and 4c show IBNR reserves, for direct, assumed, and ceded business.[25] The cross checks between Schedule P, Part 1, and Page 10 are as follows: The

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[23] The NAIC *Instructions* for claim count reporting in Part 1 say: "The number of claims reported is to be cumulative by accident year. The number of claims reported in each accident year is equal to the number of open claims at the end of the current year plus cumulative claims closed with and without payment for current and prior calendar years" (page 59 thru 71-1), and "For each year, . . . Column [12] should include the cumulative number of claims reported through the annual statement date for pooled and non-pooled business." In other words, *cumulative* reported claims must be shown for each accident year.

The Part 3 instructions say "The number of claims closed with and without loss payment must be reported for 1990 and subsequent years in which losses are incurred" (page 75-1). The term "1990" is an error; it should read "1989." (I am told that the *Instructions* will be revised to substitute 1989 for 1990 in this sentence.)

[24] The NAIC *Instructions* list four categories of bulk reserves: "The bulk and IBNR reserves for losses and allocated loss expenses are intended to include reserves for incurred but not reported claims, for reopened claims, for development on case reserves of reported claims, and for aggregate reserves on newly reported claims without specific case reserves" (page 80-1).

[25] Some insurers, however, show all bulk reserves in columns 4a, 4b, and 4c on page 10, consistent with the reporting in Schedule P. The NAIC *Instructions* provide very brief guidance. For columns 1a and 1b, "Adjusted or in the Process of Adjustment," the *Instructions* say: "Include: All losses which have been reported in any way to the Home Office of the company

sum of columns 13 and 15 in Schedule P, Part 1, row 12, should equal the sum of columns 1a, 1b, 4a, and 4b on page 10. The sum of columns 14 and 16 in Schedule P, Part 1, row 12, should equal the sum of columns 2 and 4c on page 10. Columns 17 - 18 + 19 - 20 + 21 in Schedule P, Part 1, row 12, should equal column 6 on page 10.[26]

Many claims examiners set a single case reserve for a claim, used to pay both losses and allocated loss adjustment expenses. Columns 17 and 18, case basis reserves for allocated adjustment expenses unpaid, would be zero for these insurers. Zero entries in columns 17 or 18 are acceptable to the NAIC, as long as the appropriate reserves are recorded in columns 19 and 20.

Distributing Unallocated Expense Reserves

Schedule P contains no instructions for distributing unpaid unallocated loss adjustment expenses to accident year, as required for column 21. A simple procedure is (i) to use the rationale for the distribution of unallocated expense payments, (ii) to assume that IBNR claims are reported in the year that they are paid, and (iii) to assume that the "bulk + IBNR" reserves consist of true IBNR, not development on known cases. If so, the unallocated expense reserves should be distributed in the same proportion as case reserves plus twice the IBNR reserves.[27]

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on or before December 31 of the current year. Provision for losses of the current or prior years, if any, reported after that date would be made in Columns 4a and 4b as Incurred But Not Reported" (page 10-1). For columns 4a, 4b, and 4c, "Incurred but not Reported," the *Instructions* conclude: "Incurred but not reported reserve estimates should be sufficient to cover claims which may be reopened in future periods." The *Instructions* do not explicitly state where development on case reserves is to be included.

[26] If your company uses the same split between "case" and "IBNR" reserves on page 10 as in Schedule P, then the cross checks are simpler: column 13 in Schedule P, Part 1, row 12, should equal the sum of columns 1a and 1b on page 10, and so forth.

[27] Ruth Salzmann, "Estimated Liabilities for Losses and Loss Adjustment Expenses," in Robert W. Strain, (ed.), *Property-Liability Insurance Accounting*, Fourth Edition (1988), pages 83-84, describes this procedure in more detail:

"By combining the intent and arithmetic of the footnote to the schedules, the total unallocated LAE liability is the sum of two products: (1) the liability for reported losses times the paid/paid ratio @ 50%, and (2) the IBNR liability times the paid/paid ratio @ 100%.

"These two calculations can be reduced to one:

"Unallocated LAE liability = .5 paid/paid ratio x (Total loss liability + IBNR liability)."

[Before 1989, the procedure for distributing unallocated loss adjustment expense payments to

Neither of the latter two assumptions noted above are completely accurate: IBNR claims often have a long lag between report date and settlement date, so assumption (ii) assigns too little unallocated expense reserves to recent years. Most carriers have case reserve development on reported cases, so assumption (iii) also assigns too little unallocated expense reserves to recent years. Since there is no statutory prescription for this distribution, you should choose a procedure that seems most appropriate for the line of business.[28]

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accident years was described in a footnote to Schedule P, Part 1, not in the Annual Statement instructions. Salzmann's *paid/paid ratio* is the ratio of "unallocated loss adjustment expense paid to losses paid for the most recent calendar year(s)."]

As Ruth Salzmann has explained to me, "The method is not put forward on its own merits; rather, it is appropriate only because it is consistent with the *assumption* underlying the formula allocation of paid unallocated loss expenses by accident year. Thus, the method does no more than anticipate future *formula* allocations." Claim reporting and settlement patterns allow a better distribution of both paid and unpaid unallocated expenses by accident year; see the following footnote.

Wendy Johnson, in "Determination of Outstanding Liabilities for Unallocated Loss Adjustment Expenses," *Evaluating Insurance Company Liabilities* (Casualty Actuarial Society 1988 Discussion Paper Program), pages 301-314, suggests another means of using claim emergence and settlement patterns to estimate the unallocated loss adjustment expense liability. She assumes that unallocated expenses are incurred over the life of the claim, with a double weighting during the year when the claim file is set up (though no heavier weighting when the claim is paid). Under this assumption, the distribution of unallocated expense reserves by accident year would give less weight to IBNR loss reserves, with the exact weight depending on the average duration of claims in the given line of business. Moreover, the appropriate distribution would depend on the relative trends for loss costs and unallocated expenses, as Johnson discusses in her paper.

[28] Richard Roth has informed me "the ULAE reserve can be determined from claim count data." A prescribed procedure must wait until claim counts are available for a sufficient number of accident years, since only claim counts for accident years 1989 and subsequent are required. The New York Insurance Department is presently working on a procedure to distribute ULAE reserves to accident year. Richard has added that the statutory formula for distributing paid ULAE is also "an open topic for research."

Ruth Salzmann notes that the statutory distribution of paid unallocated expenses by accident year assumes that 90% of claims reported are incurred in the current accident year, and 10% of these claims are incurred in the previous accident year. In truth, these percentages vary by line: in lines with rapid claim emergence, such as Homeowners', a higher percentage of reported claims are incurred in the current accident year than in lines with slow claim emergence, such as Other Liability. The actual claim emergence pattern by line may eventually supercede the 90%-10% split in the statutory formula.

Claims Outstanding

Column 23 shows the number of claims outstanding on direct and assumed business. If there are few partial payments on open cases, then the ratio of (column 13 minus column 14) to column 23 shows the average value of an outstanding claim. This ratio may be misleading, since (a) loss development on reported cases is included in the bulk reserves shown in columns 15 and 16, but (b) one can not include columns 15 and 16 in calculating the average value - since these columns include IBNR reserves, and IBNR claims are not included in column 23. In lines of business with periodic payments on open cases, such as Workers' Compensation and Automobile No-Fault benefits, the average value of an open case can not be determined from Schedule P.

Columns 24 through 29 are calculated figures. Column 24 equals the sum of columns 5, 7, 10, 13, 15, 17, 19, and 21. Column 25 equals the sum of columns 6, 8, 14, 16, 18, and 20. Column 26 equals the difference between columns 24 and 25, or the sum of columns 11 and 22. Columns 27 through 29 are the ratios of columns 24 through 26 to columns 2 through 4.

Interest Discount

Columns 30 and 31 show the "discount for the time value of money." All loss and expense reserves in Schedule P are *undiscounted*, except for Workers' Compensation pension cases, where the tabular discount may be shown.[29] If the loss and expense reserves on Page 3 of the Annual Statement are *discounted*, these columns are needed to facilitate a reconciliation with the undiscounted values shown in Schedule P. The statutory discount in Workers' Compensation tabular reserves is included in both Schedule P and Page 3, so no entry in column 30 is needed.[30]

Intercompany Pooling

Column 32 shows the intercompany pooling arrangements. Member companies of an insurance group often redistribute premiums, losses, and expenses according to participation formulas. Column 32 shows the company's share of the group figures.

The instructions to the Annual Statement say, *"The pooling percentage is to reflect the Company's participation in the pool as of year-end."* If an insurance group modifies the pooling arrangement, there may be an apparent change in the incurred or paid loss development due to the intercompany agreement, not to changes in claims handling or reserving patterns.

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[29] See the NAIC *Instructions*, page 57-1: "A discount implicit in tabular reserves may be included in Schedule P. Otherwise, Schedule P is to be presented on a non-discounted basis."

[30] John Bray has pointed out to me that columns 33 and 34 show the discounted values at the statement date only. Undiscounted values at prior year ends are reported in the appropriate columns of Part 2. Discounted values at prior year ends, or the figures that would correspond to the balance sheets in previous Annual Statements, can not be obtained from the current year's Schedule P.

Therefore, *"any retroactive change in pooling participation will require appropriate restatement of Schedule P."*[31]

The individual company historical figures in the 1990 Schedule P will not necessarily agree with the entries of previous years. For instance, suppose a member company of an insurance group received 40% of the entire group's revenues and paid 40% of the group's losses and expenses in 1988. In 1990, its pooling participation changed to 70%. Leaving the original 40% participation figures for 1988-1989 would distort the loss development patterns: its loss payments and reserves were 40% of the group total in 1988 and 1989, but its payments and reserves were 70% of the total in 1990. Its loss triangles would show large jumps in both payments and reserves between 1989 and 1990. To facilitate the use of the loss development patterns, the company should restate all past figures to a 70% participation percentage.

Columns 33 and 34 show the effect of the discount for the time value of money on the loss and expense reserves. If no discount is used, column 33 equals columns 13 - 14 + 15 - 16, and column 34 equals columns 17 - 18 + 19 - 20 + 21. If a discount is used, then these sums should be multiplied by the discount factor to obtain columns 33 and 34.

Excess Statutory Reserves

It is difficult to estimate required reserves for immature accident years in long tailed lines of business. Paid loss ratios remain low for several years after the policy period, and optimistic reserving may underestimate ultimate losses. The NAIC therefore requires additional reserves for immature accident years in certain lines of business when the statement reserves seem low.

The *excess statutory reserves* are determined by formula. Two procedures are used: one for the long tailed liability lines of business, and one for credit insurance.

Excess Reserves - Long Tailed Lines

Excess statutory reserves are calculated for four long-tailed lines: Automobile Liability (Personal plus Commercial), Workers' Compensation, General Liability, and Medical Malpractice.[32] The formula uses net earned premium from Part 1, Column 4, and net loss ratios from Part 1, Column 29, for the most recent eight years. If the most recent three accident years do not meet a minimum loss ratio criterion, additional reserves must be held by the company. These reserves are shown in the Schedule P interrogatories (page 82) and on the

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[31] See *Instructions*, page 59-3. I am indebted to Richard Roth for clarification of these statements.

[32] Before 1989, Personal and Commercial Automobile liability were combined on Schedule P, so the excess statutory reserves were determined from the combined loss ratio. Although Personal and Commercial Automobile liability are now shown separately in Schedule P, the procedure for calculating the excess statutory reserve has not changed. Some insurers, however, calculate the required excess reserves for Personal and Commercial Automobile liability separate and add the final figures.

"Liabilities, Surplus and Other Funds" balance sheet, page 3, line 15: "Excess of statutory reserves over statement reserves."

The minimum loss ratio criterion is determined by a combination of historical experience and statute. The net loss ratios in column 29 for the five accident years immediately preceding the three most recent accident years are examined. Accident years that have less than $1 million in net earned premium (column 4) are discarded. If at least three accident years remain, then the lowest one is the minimum loss ratio criterion. The minimum loss ratio is capped between 60% (or 65% for Workers' Compensation) and 75%. If fewer than three accident years have at least $1 million in net earned premium, then 60% (or 65% for Workers' Compensation) is the minimum loss ratio.

If the *reported* net loss ratios in the three most recent accident years are at least as great as the minimum loss ratio, no excess reserves are needed.[33] Otherwise, additional reserves must be carried by the company to bring the net loss ratios in the three most recent years up to the minimum loss ratio.[34]

Excess Reserves - Credit Insurance

The excess statutory reserves for credit insurance do not depend on historical experience. The credit insurance data is divided into three parts: (a) policies in force on the statement date; (b) policies that expired in the fourth quarter of the most recent year; and (c) all other policies.

(a) For policies in force on the statement date, the excess statutory reserve equals 50% of the premiums *earned* on these policies minus the losses incurred (both payments and reserves); the excess reserves may not be less than zero.

(b) For policies that expired in the fourth quarter of the most recent year, the excess statutory reserve equals 50% of the premiums *written* on these policies minus the losses incurred (both payments and reserves); the excess reserves may not be less than zero.

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[33] The *reported* loss ratio here means the loss ratio *reported* in Schedule P, not the loss ratio for *reported* claims.

[34] The NAIC *Instructions* add: "If the company has permission from its state of domicile to discount loss and loss expense reserves, the Company should compute the excess of statutory reserves over statement reserves using its discounted loss and loss expense reserves rather than the undiscounted reserves" (page 83-1). This is particularly important for Medical Malpractice, where permission to discount is often granted.

(c) No excess statutory reserves are needed for other credit insurance policies.[35]

Auxiliary Exhibits

Schedule P provides three loss triangles for each line of business. Part 2 shows *incurred losses*; Part 3 shows *paid losses*, and Part 6 shows *bulk reserves*. The incurred losses in Part 2 are the sum of paid losses, case reserves, and bulk reserves. A triangle of *case incurred losses*, or paid losses plus case reserves (often termed *reported losses*), can be formed as the Part 2 triangle minus the Part 6 triangle. A triangle of *outstanding case reserves* can be formed as the Part 2 triangle minus the Part 6 triangle minus the Part 3 triangle.

Each triangle includes *allocated loss adjustment expenses*.[36] Thus, Part 3 includes paid allocated expenses, Part 2 includes incurred allocated expenses, and Part 6 includes bulk reserves for allocated expenses. Before 1989, Parts 2 and 3 of Schedule P included *all* loss adjustment expenses, not just *allocated* loss adjustment expenses.

The historical triangles show *net* experience, or direct plus assumed business minus ceded business. Historical triangles of direct plus assumed business only can be formed by combining Annual Statements of successive years, using exhibits from Schedule P, Part 1. For instance, in 1993 one can compile historical exhibits of direct plus assumed business for four accident years from the 1989 through 1992 Schedule P's, using columns 5, 7, 13, 15, 17, and 19 of Part 1.[37]

Several other items are shown in the Schedule P auxiliary exhibits. Part 2 shows one and two year loss developments for all lines of business. Part 3 shows the number of claims closed, with and without loss payments, for eight lines of business. Part 4 shows loss portfolio transfers, or portfolio reinsurance ceded and assumed. Part 5 shows experience under claims made policies for three lines of business. All figures are shown by accident year.

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[35] I have heard conflicting opinions about the relationship between Mortgage Guarantee insurance and credit insurance excess statutory reserves. One view is that Mortgage Guarantee insurance is never included with credit insurance. In Schedule P it is included with Fidelity, Surety, and Financial Guarantee, and in the "Underwriting and Investment Exhibit" it is a "write-in" line. The other view is that Mortgage Guarantee insurance should be included with credit insurance on line 28 of the "Underwriting and Investment Exhibit" and its experience should be used in the calculation of the credit insurance excess statutory reserve [Schedule P Interrogatories, question 1(e)]. See also footnote 6, which cites the California statute linking mortgage guaranty and credit insurance.

[36] In the discussions below of Parts 2, 3, and 6, the term "loss" refers to both loss and allocated loss adjustment expense.

[37] After four or five years, loss development patterns should not differ that greatly between direct and net business. Complete 10 year historical triangles for direct plus assumed business may not be worth the effort needed to compile them.

16

The paid loss triangles in Part 3 are the easiest to compile, so we begin the discussion with these exhibits.

Part 3 - Paid Losses

Part 3 shows *cumulative paid losses and allocated loss adjustment expenses* by accident year and evaluation date. The same accident years are shown as in Part 1: 10 years for the liability lines of business, two years for the property lines, and the appropriate segmentation for reinsurance business. Nevertheless, 10 years of data must be gathered for all lines of business, since they are included in the 10 year Part 3 Summary exhibit.

The paid loss figures can be derived from the prior Annual Statement and Part 1 of the current Annual Statement. Historical data for individual accident years - that is, all figures except those in the first row ("prior years") and the right-most column ("current valuation") - are unchanged from those in the previous year's Part 3. The figures in the right-most column must equal the difference between Columns 10 and 11 in Part 1, except for the prior line entries. Note that Part 1, Column 11, includes *all* loss and loss expense payments, whereas Part 3 shows only loss and *allocated* LAE payments. Thus, unallocated LAE payments, or Part 1, Column 10, must be subtracted from Part 1, Column 11.

The "Prior" Line

The Part 3 "prior years" entries can be obtained from the previous year's Annual Statement, after a suitable modification of the figures. Suppose you are completing the 1990 Schedule P, using data (when appropriate) from the previous year. Take the "prior" and "1980" rows from the 1989 Schedule P, subtract from each figure in these two rows the cumulative paid losses and ALAE through 1981, then add the two rows. Discard the cumulative paid losses and ALAE through 1980 (which is now negative), keep the next entry (a zero) as the first figure in the new prior line, and enter the remaining figures in the rest of the row. For the last figure in the row, add the calendar year 1990 paid losses and ALAE for accident years prior to 1981 to the last cumulative total. The calendar year 1990 paid losses and ALAE for accident years prior to 1981 are shown in the 1990 Schedule P, Part 1, column 11 minus column 10, "prior" row.

An illustration should clarify this procedure. Suppose the 1989 Schedule P, Part 3, contains the following entries for one line of business:

Exhibit 3: 1989 Schedule P, Part 3, First Two Rows

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Prior	0	220	350	400	425	450	460	470	475	480
1980	375	600	650	700	750	775	800	840	860	875

Assume that in the 1990 Part 1 exhibit for this line of business, the "prior years" row shows $22 thousand in column 11 ("Total net paid") and $2 thousand in column 10 ("Unallocated loss expense payments").

To complete the 1990 Part 3 exhibit, the cumulative payments through 1981 are subtracted from the first two rows in the 1989 Part 3 exhibit. In the example, $220 thousand is subtracted from the 1989 "prior years" row and $600 thousand is subtracted from the second row, giving the following:

Exhibit 4: Adjustments to the 1989 Part 3 "Prior" Line

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Prior	0	0	130	180	205	230	240	250	255	260
1980	-225	0	50	100	150	175	200	240	260	275

The two rows are summed, and the 1980 column is dropped:

Exhibit 5: Completing the 1990 Part 3 "Prior" Line

	1981	1982	1983	1984	1985	1986	1987	1988	1989
Prior	0	180	280	355	405	440	490	515	530

The 1990 payment is the difference between column 11 and 10 in Part 1. For the "prior years" row, this is $22,000 - $2,000, or $20 thousand. This figure is added to the cumulative payments through 1989 in Part 3 to give the cumulative payments through 1990, or $550 thousand.

Loss Reserve Adequacy - Prospective Valuation

Part 3 is particularly useful for *prospective* evaluations of loss reserve adequacy, since it is not dependent upon company reserving policies. It is most effective for short and medium tailed lines, where there are substantial loss payments in the first year or two and claims settlement rates are stable; examples are Personal Automobile Liability and Workers' Compensation. It is less useful for extremely long tailed lines, when the proportion of loss payments is small in the first year or two, and claim settlement rates may fluctuate; examples are Other Liability and Nonproportional Reinsurance. Financial analysts often evaluate an insurer's reserve adequacy by means of a paid loss development of data from Schedule P, Part 3.[38]

The format of a paid loss development analysis is as follows:[39] Link ratios, or the ratios of

[38] See, for instance, Thomas V. Cholnoky and Jeffrey Cohen, *Property/Casualty Insurance Industry Loss Reserve Analysis* (Goldman Sachs, June 23, 1989).

[39] Good introductory treatments of paid loss development reserving procedures are Ronald F. Wiser, "Loss Reserving," in Matthew Rodermund, et al., *Foundations of Casualty Actuarial Science* (New York: Casualty Actuarial Society, 1990), pages 178-187, and Timothy M. Peterson, *Loss Reserving - Property/Casualty Insurance* (Ernst & Whinney, 1981), pages

cumulative paid losses at one valuation to cumulative paid losses at the preceding valuation, are calculated for each accident year and valuation date. A prospective link ratio is determined from the historical link ratios in each column.

No uniform procedure for determining prospective link ratios is appropriate for all lines and companies. One common approach is to use the average of the most recent three to five link ratios, adjusted for random outliers and known or suspected trends. These prospective link ratios show the expected development between adjoining valuation points. Development factors from each valuation point to 10 years of maturity are the cumulative products of the adjoining link ratios. For example, the development factor from 6 to 10 years is the product of the link ratios (a) from 6 to 7 years, (b) from 7 to 8 years, (c) from 8 to 9 years, and (d) from 9 to 10 years.

We illustrate this procedure with simulated data for a long-tailed line of business. The exhibit below shows the Part 3 entries as they would appear in the 1990 Schedule P, for accident years 1981 through 1990.

Exhibit 6: 1990 Schedule P, Part 3 ($000)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1981	103	226	294	334	363	384	398	412	422	433
1982	0	111	238	309	356	387	409	428	442	454
1983	0	0	108	221	286	328	354	375	391	403
1984	0	0	0	111	238	311	357	392	416	434
1985	0	0	0	0	135	299	394	458	504	534
1986	0	0	0	0	0	146	314	418	490	542
1987	0	0	0	0	0	0	159	343	463	546
1988	0	0	0	0	0	0	0	146	353	485
1989	0	0	0	0	0	0	0	0	152	406
1990	0	0	0	0	0	0	0	0	0	156

Paid Loss Link Ratios

Paid loss link ratios are the ratios of (i) cumulative paid losses at a given valuation date for a specific accident year to (ii) cumulative paid losses for the same accident year at a valuation date one year earlier. For instance, the paid loss link ratio from 2 years to 3 years for accident year 1987 is $463 thousand divided by $343 thousand, or 1.35. The complete set of link ratios is shown in the table below.

181-196. A method for estimating loss development "tail factors" (among other matters) is presented by Richard Sherman, "Extrapolating, Smoothing, and Interpolating Development Factors," *Proceedings of the Casualty Actuarial Society*, Volume 71 (1984), pages 122-192.

Exhibit 7: 1990 Schedule P, Paid Loss Link Ratios

	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10
1981	2.19	1.30	1.14	1.09	1.06	1.04	1.03	1.03	1.02
1982	2.14	1.30	1.15	1.09	1.06	1.05	1.03	1.03	-
1983	2.04	1.29	1.15	1.08	1.06	1.04	1.03	-	-
1984	2.14	1.31	1.15	1.10	1.06	1.04	-	-	-
1985	2.21	1.32	1.16	1.10	1.06	-	-	-	-
1986	2.15	1.33	1.17	1.11	-	-	-	-	-
1987	2.16	1.35	1.18	-	-	-	-	-	-
1988	2.42	1.37	-	-	-	-	-	-	-
1989	2.67	-	-	-	-	-	-	-	-

Note that we have rotated the triangle, turning diagonals into columns. The second column in Exhibit 6 shows cumulative paid amounts on December 31, 1982. The second column in Exhibit 7 shows paid loss development from 1 year after the inception of the accident year to 2 years after the inception of the accident year. In other words, each *column* of Exhibit 7 is the ratio of two *diagonals* in Exhibit 6.

No link ratio is calculated for the 1990 accident year, since we have only one valuation. No link ratios are shown for the "prior years" row, since the time since inception of the accident year differs depending on the policy.

We determine averages of the most recent 3 and the most recent 5 link ratios, and select prospective factors from the historical figures and expectations about changing future conditions. In this illustration, the selected link ratios lie between the three and five year averages.

Exhibit 8: Paid Loss Development Test of Reserve Adequacy

	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10
Averages									
3 yr	2.42	1.35	1.17	1.10	1.06	1.04	1.03		
5 yr	2.32	1.34	1.16	1.09	1.06				
Select	2.35	1.34	1.17	1.10	1.06	1.04	1.03	1.03	1.02
Cumulative	4.83	2.06	1.54	1.31	1.19	1.13	1.08	1.05	1.02
Paid to date	156	406	485	546	542	534	434	403	454
Developed	754	836	744	716	647	601	469	424	463
Ultimate	830	920	819	788	712	662	516	466	510
Incurred	898	866	802	787	707	667	522	475	520

Paid Loss Development Factors

The cumulative link ratios, or paid loss development factors, are the cumulative products of the appropriate "one year" link ratios. For instance, the cumulative link ratio from 7 to 10 years, or 1.08, is the product of 1.03, 1.03, and 1.02, which are the link ratios from 7 to 8, 8 to 9, and 9 to 10 years.

The losses paid to date are taken from the last column of Exhibit 6: $156 thousand is the accident year 1990 paid losses, $406 thousand is the accident year 1989 paid losses, and so forth. The 1990 paid losses are at one year of maturity and are therefore placed below the development factor for one to ten years. (Similar placement is used for paid losses of other accident years.) The next row in Exhibit 8 shows losses developed to ten years of maturity.

Paid Loss Tail Factors

In several long-tailed lines of business, payments continue after ten years . The percent of losses still unpaid after ten years may be estimated either (a) by a comparison of Parts 2 and 3 or (b) from aggregate industry data:

(a) Compare Part 2, row 2, column 11 (incurred losses for the first listed accident year at the latest valuation) with Part 3, row 2, column 11 (cumulative paid losses for the first listed accident year at the latest valuation). This procedure is extremely sensitive to random loss fluctuations, since it uses one ratio from a single company to determine the development factor with the greatest influence on the total estimate. This ratio may be heavily influenced by the mix of open claims after 10 years in a particular block of business, and it may not be indicative of future payments.

(b) Use an *expected* ratio of ultimate losses to cumulative paid losses, based upon both industry averages and the characteristics of the insurer's business. For this illustration, we have selected a final link ratio of 1.10.

The "ultimate" losses in Exhibit 8 are the developed losses increased by 10%. These may be compared with the final incurred losses shown in Part 2, column 11, reported as the final row in Exhibit 8. The ultimate paid losses total $6,221 million, and the incurred losses shown on Part 2 total $6,244. The Part 3 prospective test therefore shows adequate reserves.[40]

This prospective test of loss reserves assumes that incurred loss estimates after 10 years of maturity are adequate. If reserves are adequate for cases 10 or more years old, we would find little adverse development for the "prior years" row in Part 2. If reserves are deficient even after 10 years of maturity, we would find significant adverse development for the "prior years" row.

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[40] Numerous variations of paid loss development analyses may be performed on Schedule P data. For a comprehensive treatment of an alternative method, which emphasizes average payment lags and a more sophisticated treatment of ultimate link ratios, see Richard G. Woll, "Insurance Profits: Keeping Score," *Financial Analysis of Insurance Companies*, (Casualty Actuarial Society 1987 Discussion Paper Program), pages 446-533.

The converse of these statements, however, is not true: adverse development on the Part 2 "prior years" row does not necessarily indicate that similar development should be expected in the future. In some lines of business, insurers have changed policy forms to mitigate late development; the switch from occurrence to claims-made policies in Medical Malpractice is one example. And in some cases, the adverse development on the "prior years" row may be unrelated to reserve adequacy. In Workers' Compensation, for instance, an apparent "adverse development" on the "prior years" row is often the unwinding of the tabular interest discount on lifetime pension cases. In sum, loss development "tail factors" estimated from Schedule P data must be used with caution.

Closed Claim Counts

Columns 12 and 13 show the number of claims closed with and without loss payments. These claim counts are required for 1989 and subsequent accident years for eight lines of business (Homeowners'/Farmowners', Personal Auto liability, Commercial Auto liability, Workers' Compensation, Commercial Multi-Peril, Medical Malpractice, Other Liability, and Automobile Physical Damage).[41] Claim count entries are optional for other accident years in these lines of business. No claim counts should be entered for other lines.

For the 1989 Annual Statement, insurers used different methods for reporting historical claim counts. Many carriers reported only claims closed in 1989 for the 1989 accident year, adhering to the minimum NAIC requirements. Some carriers reported claims *closed in 1989* for all accident years. Other carriers reported cumulative claim counts for all accident years; this is the procedure which all carriers will be using by the end of the century.[42]

If the carrier shows cumulative closed claims for each accident year, the ratio of column 11 to column 12 shows the average cost of a closed claim. Among mature years, this ratio should increase as the accident years move forward by the loss cost trend rate. Among immature years, this ratio may decrease as the accident years move forward, since small claims are generally settled more quickly than large claims are.

No historical claim count triangles are shown in Schedule P. Rather, claim count triangles must be compiled from successive Annual Statements (see the discussion above on loss triangles for direct and assumed business). Claim counts have much shorter development patterns than losses do. Most claims are reported within two or three years and settled within four or five. By the mid-1990's, there should be sufficient Schedule P data to analyze loss cost trends.

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[41] See the NAIC *Instructions*, page 75-1. Claim counts were not required for Homeowners'/Farmowners' in 1989, and even the 1990 *Instructions* do not mention this line. Note, however, that the claim count columns for Homeowners'/Farmowners' are no longer X-ed out, since now claim counts are required. Note also that the reference to accident year 1990 on page 75-1 of the *Instructions* is in error; it will be revised to 1989.

[42] The involuntary market reinsurance pools will be using this procedure for the 1990 and subsequent Annual Statements.

Part 2 - Incurred Losses

Part 2 shows net incurred losses and allocated loss adjustment expenses (ALAE) by accident year and evaluation date. The Part 2 entries are the sum of paid amounts, case reserves, and bulk reserves for both losses and ALAE. Each entry in Part 2 equals the corresponding entry in Part 3 plus the loss and ALAE reserves at that date.

Part 2 is designed as a retrospective test of loss reserve adequacy.[43] If the insurer sets perfectly adequate reserves, the incurred losses for each accident year will show neither upward nor downward development. The NAIC uses Part 2 of Schedule P for the loss reserve development tests in the Insurance Regulatory Information System (IRIS).

IRIS Loss Development Tests

For any accident year, column 11 of Part 2 shows incurred losses valued at the Statement date, and column 10 shows the corresponding valuation one year earlier. If the insurer has reserved adequately, an increase in payments would be offset by a take down of reserves, and there should be no change in incurred losses between valuation dates. Column 12 shows the latest year's change in incurred losses for all accident years except the most recent one (there is no "previous" valuation for the most recent accident year). Column 13 shows the change over the last *two* years in incurred losses for all accident years except the two most recent ones.

These reserve developments are summed over all lines of business and shown in the Part 2 Summary exhibit. The total reserve development shown on row 12 of the Part 2 Summary is compared with policyholders' surplus for the NAIC IRIS tests 9 and 10, which are retrospective tests of reserve adequacy. IRIS test 11, a prospective test of reserve adequacy, updates the "outstanding" loss ratios from the past two years by means of the one- and two-year reserve developments, and compares these ratios with the current year's "outstanding" loss ratio.

IRIS Tests 9 and 10

IRIS test 9 divides the one year reserve development by the policyholders' surplus at the end of the prior year, as shown on page 3, line 26, "prior year" column, or page 4, line 17, "current year" column. The resultant ratio is entered on page 22, line 61: "Percent of Development of Loss and Loss Expenses Incurred to Policyholders' Surplus of Previous Year End." A ratio above 25% indicates a failure of test 9.

IRIS test 10 divides the two year reserve development by the policyholders' surplus at the end of the second prior year, as shown on page 4, line 17, "prior year" column. The resultant ratio is entered on page 22, line 63: "Percent of Development of Loss and Loss Expenses Incurred to Policyholders' Surplus of Second Previous Year End." A ratio above 25% indicates a failure of test 10.

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[43] See the NAIC *Instructions*, page 72-1: "The schedule format provides a loss and allocated expense development overview to test the adequacy of the insurer's reserves."

The "Five Year Historical Data" exhibit on page 22 of the Annual Statement show the one and two year developments and the ratios for tests 9 and 10 for the most recent five years.

IRIS Test 11

IRIS test 11 evaluates the adequacy of the "outstanding" loss ratio. The outstanding loss ratio is the ratio of outstanding losses and loss adjustment expenses to the current year's earned premium. The losses and premiums in this ratio are not matched: the numerator is unpaid losses and loss adjustment expenses for all accident years, whereas the denominator is earned premium for the current calendar year. This mismatch obstructs the usefulness of IRIS test 11, since business volume growth or decline, or changes in the mix of business between property and liability lines, distort the "outstanding" loss ratio.

Unpaid losses and loss adjustment expenses are reported on page 3, "Liabilities, Surplus and Other Funds," lines 1, 1A, and 2. Line 1 shows total loss reserves, including reinsurance payable on *unpaid* losses. Line 1A adds reinsurance payable on *paid* losses, and line 2 adds reserves for unpaid loss adjustment expenses (both allocated and unallocated). Earned premium is shown on page 4, "Underwriting and Investment Exhibit: Statement of Income," line 1.

IRIS test 11 adds the Schedule P, Part 2 Summary, reserve developments to determine updated outstanding loss ratios. The *one* year reserve development is added to the unpaid losses and loss adjustment expenses for the *prior* year. This sum is then divided by the *prior* year's earned premium. The necessary figures are taken from the "previous year" column in the *current* Annual Statement, pages 3 and 4 (see the paragraph above). The *two* year reserve development is added to the unpaid losses and loss adjustment expenses for the *second* prior year, and divides this sum by the *second* prior year's earned premium. The necessary figures are taken from the "previous year" column in the *previous* year's Annual Statement, pages 3 and 4.

The two updated outstanding loss ratios are averaged, and then multiplied by the current year's earned premium (from page 4, column 1, line 1, of the current year's Annual Statement) to derive the indicated outstanding losses and loss adjustment expenses. This figure, minus the reported unpaid losses and loss adjustment expenses (from page 3, column 1, lines 1+1A+2), is the indicated reserve deficiency. A deficiency greater than 25% of policyholders' surplus (page 3, line 26) indicates a failure of IRIS test 11.

The NAIC is aware that changes in premium volume or mix of business may distort the results. Business growth overstates the reserve deficiency, though the NAIC believes the effect is not great: "Within the normal range of variations in premium from year to year, the distortion from changes in premium is not significant."[44] A change in product mix from property to liability lines will understate the reserve deficiency, so the NAIC recommends that "For companies which have had major shifts in product mix, the estimated reserve deficiency or

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[44] National Association of Insurance Commissioners, *Using the NAIC Insurance Regulatory Information System: Property and Liability Edition* (Kansas City, Missouri: NAIC, 1989), page 27.

redundancy should be calculated separately for the major product groups. . . ."[45] A decline in business volume, and a shift in product mix from liability to property lines, have the opposite effects from those mentioned above, though these changes are less common.

Case Incurred Losses

Part 2 includes bulk reserves, in addition to case reserves and paid losses. Actuaries project indicated reserves from historical experience, such as loss payments and reserves set by claims examiners, not from previous actuarial forecasts. Part 6 of Schedule P shows the bulk reserves carried by the company in past years in the same format as in Part 2. Thus, the *difference* between Parts 2 and 6 reflects the historical claims experience of the company. The *case incurred* (or *reported*) loss development patterns derived from this experience can be used to prospectively estimate reserve adequacy.[46]

Once again, we illustrate the analysis with figures as they would appear in parts 2 and 6 of the 1990 Schedule P.

Exhibit 9: 1990 Schedule P, Part 2 ($000)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1981	563	524	514	501	494	482	485	486	486	486
1982	0	578	554	528	526	519	518	518	521	520
1983	0	0	487	495	486	478	478	476	475	475
1984	0	0	0	523	519	520	517	520	522	522
1985	0	0	0	0	603	637	649	661	666	667
1986	0	0	0	0	0	708	708	700	708	707
1987	0	0	0	0	0	0	740	761	786	787
1988	0	0	0	0	0	0	0	800	800	802
1989	0	0	0	0	0	0	0	0	860	866
1990	0	0	0	0	0	0	0	0	0	898

For a well reserved company, Part 2 should show little upward or downward development along the rows. This illustration shows no significant development for accident years 1982, 1983, 1985, and 1987; slight downward development for accident years 1980 and 1981; and slight upward development for accident years 1984 and 1986. For all accident years combined, there

[45] *Ibid.*

[46] Good introductory treatments of incurred loss development reserving procedures are Ruth E. Salzmann, *Estimated Liabilities for Losses and Loss Adjustment Expenses* (West Nyack, NY: Prentice-Hall, 1984), pages 31-34; Ronald F. Wiser, "Loss Reserving," in Matthew Rodermund, et al., *Foundations of Casualty Actuarial Science* (New York: Casualty Actuarial Society, 1990), pages 187-189; and Timothy M. Peterson, *Loss Reserving - Property/Casualty Insurance* (Ernst & Whinney, 1981), pages 196-224. I am indebted to Roy Morell, who first pointed out to me this use of Parts 2 and 6 for a prospective test of reserve adequacy.

is an 0.5% decline in incurred losses from the first report to the statement date, indicating accurate reserving.

Part 6 shows bulk and IBNR reserves. Since bulk reserves are replaced by case reserves and payments as claims are reported and settled, we expect a steady decline along the rows.

Exhibit 10: 1990 Schedule P, Part 6 ($000)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1981	348	177	114	82	61	41	36	26	20	12
1982	0	326	190	119	85	62	47	35	28	20
1983	0	0	265	166	113	76	60	46	40	31
1984	0	0	0	296	167	114	81	60	50	38
1985	0	0	0	0	328	194	131	95	74	58
1986	0	0	0	0	0	410	231	142	100	62
1987	0	0	0	0	0	0	438	246	170	118
1988	0	0	0	0	0	0	0	462	246	146
1989	0	0	0	0	0	0	0	0	515	238
1990	0	0	0	0	0	0	0	0	0	560

The difference between Parts 2 and 6 shows case incurred (or reported) losses plus ALAE, and may be used for prospective loss reserve adequacy tests.

Exhibit 11: 1990 Schedule P, Part 2 minus Part 6 ($000)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1981	215	347	399	419	433	442	449	460	466	474
1982	0	252	363	409	441	457	471	483	493	500
1983	0	0	222	329	373	402	418	430	435	444
1984	0	0	0	227	352	406	436	460	471	484
1985	0	0	0	0	275	443	518	566	592	609
1986	0	0	0	0	0	298	477	558	608	645
1987	0	0	0	0	0	0	302	515	616	670
1988	0	0	0	0	0	0	0	338	554	656
1989	0	0	0	0	0	0	0	0	345	628
1990	0	0	0	0	0	0	0	0	0	338

Link Ratios and Development Factors

Incurred loss link ratios shown below are formed in the same manner as paid loss link ratios.

Exhibit 12: 1990 Schedule P, Case Incurred Loss Link Ratios

	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10
1981	1.61	1.15	1.05	1.03	1.02	1.02	1.02	1.01	1.02
1982	1.44	1.13	1.08	1.04	1.03	1.03	1.02	1.01	
1983	1.48	1.13	1.08	1.04	1.03	1.01	1.02		
1984	1.55	1.15	1.07	1.06	1.02	1.03			
1985	1.61	1.17	1.09	1.05	1.03				
1986	1.60	1.17	1.09	1.06					
1987	1.70	1.20	1.09						
1988	1.64	1.18							
1989	1.82								

Loss reserve projections that rely on incurred loss development patterns are aided by knowledge of the insurer's case reserving practices - and of changes in these practices during the experience period. The three year average incurred loss link ratios are higher than the corresponding five year averages for the first three maturities, so we have selected the three year averages as estimates for the future.

Exhibit 13: Case Incurred Loss Development Test of Reserve Adequacy

	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10
Averages									
3 yr	1.72	1.18	1.09	1.05	1.03	1.02	1.02		
5 yr	1.68	1.17	1.08	1.05	1.03				
Select	1.72	1.18	1.09	1.05	1.03	1.02	1.02	1.01	1.01
Cumulative	2.54	1.48	1.25	1.15	1.09	1.06	1.04	1.02	1.01
Case Incurred	338	628	656	670	645	609	484	444	500
Ult. Incurred	859	927	821	769	705	646	504	453	505
Tot. Reported	898	866	802	787	707	667	522	475	520

For all accident years combined, the estimated ultimate incurred loss plus ALAE is $6,188 thousand, and the reported incurred amounts on Part 2 are $6,244 thousand. The difference of less than 1% indicates accurate reserving.

Updating the Part 2 Exhibits

The figures for individual accident years in Part 2, except for those in the right-most column, may be copied from the corresponding entries in the previous Annual Statement. The entries for the right-most column can be copied from Part 1. For each accident year, Part 2, column 11, equals (column 11 - column 10 + column 22 - column 21) from Part 1. Columns 11 and 22 in Part 1 show total paid and unpaid losses plus loss adjustment expense. Since Part 2 does not

include *unallocated* loss adjustment expense, one must subtract columns 10 and 21 from Part 1.[47]

For the "prior years" row, a slight modification is required. The entries in the previous Schedule P for the "prior" row and for the first accident year should be divided between reserves and paid losses: paid losses are in Part 3 and reserves equal Part 2 minus Part 3. The reserves from the first two rows in the previous year's Schedule P are added together and posted directly to the current Schedule P. The current Schedule P payments can be taken from Part 3. The sum of the reserves and the payments is the current year's "prior years" row on Part 2.[48]

Incurred loss development reserve procedures are important particularly for long tailed lines of business whose loss payments are small at early maturities, such as Other Liability and Excess of Loss Reinsurance.

Average Values of Outstanding Claims

Part 1, column 23, "Number of Claims Outstanding," allows us to determine the average value of an outstanding claim. Case reserves by accident year equal Part 2, column 11, minus Part 3, column 11, minus Part 6, column 11. The case reserves divided by the number of claims outstanding is the average value of an open case.[49]

Unfortunately, there are two problems with this approach. (1) Part 1, column 23, shows the number of claims outstanding for *direct and assumed* business. The auxiliary schedules, Parts 2, 3, and 6, show *net* loss dollars. Changing reinsurance programs and retentions by accident year would distort trends in the observed average values.

(2) Part 1, column 23, shows outstanding claim counts at the Statement date; there is no claim count history in Schedule P. Larger claims take longer to settle. Since the outstanding claim counts are at different maturities, the average value of outstanding cases will decline steadily as the accident years increase. The analysis of average values is valid only if outstanding claims are examined at equivalent maturities. Once again, an accurate analysis requires Annual Statements of successive years.

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[47] Alternatively, column 11 of Part 2 equals (columns 5 + 7 + 13 + 15 + 17 + 19 - 6 - 8 - 14 - 16 - 18 - 20) of Part 1.

[48] Note the NAIC *Instructions*, page 72-1: "Part 2 'Prior' is equal to Part 3 'Prior' plus the reserves outstanding at the end of the respective reporting years for all accident years prior to 1981.

[49] For a discussion of outstanding claim counts and average values, and their use in loss reserve estimates, see Timothy M. Peterson, *Loss Reserving - Property/Casualty Insurance* (Ernst & Whinney, 1981), chapters 8 and 9.

Part 6 - Bulk Reserves

Part 6 shows bulk, or "actuarial," reserves, by accident year and evaluation date. These are reserves "for incurred but not reported claims, for reopened claims, for development on case reserves of reported claims, and for aggregate reserves on newly reported claims without specific case reserves."[50] The use of Part 6 to derive case incurred (or reported) loss figures is described above.

Part 5 - Claims-Made Policies

Part 5 shows experience on claims made policies for three lines of business: Commercial Multi-Peril, Medical Malpractice, and Other Liability. Each line's exhibit must be completed only if claims-made earned premium for that line in the current year exceed (a) $100,000 and (b) 15% of total current year earned premium in that line.

The Part 5 entries are similar to those in Part 1, though only "direct plus assumed" figures are reported. There is almost no "true IBNR" on claims-made policies, though there are other bulk reserves, such as development on known cases. Unpaid losses are divided between "case basis" and "bulk" in column 7 and 8 of Part 5, though all unpaid allocated loss adjustment expenses are combined in column 10. Since claims-made experience is not shown elsewhere in the Annual Statement, there is no need for a "discount for time value of money" column to reconcile this exhibit with other pages of the Statement.

Extended Loss and Expense Reserves

"Extended loss and expense reserves" (column 9) are characteristic of certain claims-made policies. Suppose an insurer issues a one year claims-made Medical Malpractice policy to a physician on January 1, 1990. Claims are covered only if they are reported during the policy term - that is, in 1990.

Suppose the insured ceases to practice medicine on December 31, 1990. Even though he is no longer practicing as a physician, malpractice claims relating to prior accidents may be reported in future years. To obtain insurance coverage for such claims, he must purchase "tail coverage" (or an "extended reporting endorsement") from the carrier that wrote the claims-made policy.

Insurers sometimes promise to provide this "tail" coverage at reduced cost.[51] For instance, the insurer may provide free "tail coverage" to physicians who become disabled during the claims-made policy term. Similarly, free or reduced cost tail coverage may be provided to physicians

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[50] NAIC *Instructions*, page 80-1.

[51] Frequently, there is no contractual guarantee for such free or reduced cost tail coverage in the claims-made policy. However, if the insurer intended to provide the coverage and priced for it when setting rates, conservative accounting may suggest that a liability should be set up - despite the lack of contractual guarantees.

who retire or to the estates of physicians who die.[52] The anticipated future cost of this coverage must be included in column 9.

These are neither unearned premium nor loss reserves; rather, they are similar to life insurance policy reserves. Thus, footnote (2) on Part 5 reads: "Such a liability [i.e., the extended loss and expense reserve] is to be reported here even if it was not reported elsewhere in Schedule P, but otherwise reported as a liability item on Page 3." Except for column 9, all the figures in Part 5 are included in Parts 1E, 1F, or 1H. The extended loss and expense reserves, however, may be shown as a write-in liability on line 21 of Page 3.

No procedures for estimating the extended loss and expense reserves have yet been promulgated by the NAIC, nor are any suggested here.[53] The anticipated reserves for death and permanent disability are small, because of the rarity of these occurrences during the insured's lifetime, *and because of limitations on the time that suits may be brought against the decedent's estate.* The costs for tail coverage after retirement depend on whether the physician ceases work abruptly or slowly curtails his practice, as well as on the benefits provided by the carrier.[54] The reserve estimation procedures will probably be addressed by the NAIC during the coming years. Until then, carriers must independently formulate the proper reserves.

Part 4 - Loss Portfolio Transfers

Part 4 shows loss portfolio transfers. Suppose an insurer wrote policies for a block of business in policy year 1988. By December 31, 1989, all the policies had expired and the premiums had been earned, though outstanding loss and expense reserves remained. On July 1, 1990, the insurer transferred the outstanding reserves on this block of business to another carrier, the reinsurer. In exchange for the reinsurer's acceptance of these reserves, the insurer pays a consideration, which is reported as premium in Part 4.

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[52] *Compare footnote (2) on Part 5: "An example of an extended loss and expense reserve* is the actuarial reserve for the free tail coverage arising upon death, disability, or retirement in most medical malpractice policies."

[53] Charles L. McClenahan, in "Liabilities for Extended Reporting Endorsement Guarantees Under Claims-Made Policies," *Evaluating Insurance Company Liabilities* (Casualty Actuarial Society 1988 Discussion Paper Program), pages 345-363, provides both an estimation procedure as well as a perceptive discussion of the influences on the reserve. Note *particularly his comments on anti-selection (insureds aware of potential claims are more* likely to seek extended tail coverage) and changes of limits (insureds nearing retirement may seek higher limits to ensure sufficient coverage during the tail period).

[54] Note, however, McClenahan's observation: "The difference between the occurrence-based pure premium and the claims-made pure premium for any year can be expressed in terms of the required accrual for the extended reporting exposure." In other words, if the tail coverage after retirement is free, and the insured will indeed receive the coverage, the extended *loss and expense reserve equals the difference between the accumulated occurrence-based pure* premiums to date and the corresponding accumulated claims-made pure premiums.

For a transaction to be considered a loss portfolio transfer, *the premiums must already have been earned*. If the insurer transfers its obligations on a policy for which premiums are still unearned, the transaction is a standard reinsurance arrangement.

Loss portfolio transfers may be effected for both operational and financial reasons. An example of the former is an insurer leaving a line of business who wishes to transfer all its remaining obligations to another carrier. An example of the latter is an insurer who transfers its undiscounted loss reserves at their present (or market) values to a reinsurer, thereby strengthening its statutory policyholders' surplus.[55]

Accounting for Loss Portfolio Transfers

There are two acceptable methods of accounting for loss portfolio transfers. Suppose an insurer has $10 million in outstanding loss reserves, and it pays a reinsurer $8 million to accept these future obligations. One accounting method is to code the $8 million as a paid loss and take down the reserves by $10 million. The other method is to code the $8 million as reinsurance premium ceded, and code a reinsurance loss recoverable of $10 million.[56]

The latter accounting method must be used for Part 4. The footnote to this exhibit says, "Show the consideration paid for losses ceded or consideration received for losses assumed in the premiums earned (ceded or assumed, respectively) columns regardless of how the transaction was actually reported in Parts 1, 2, and 3."

The format of the exhibit is similar to the Part 1 format, though there are several differences:

1. Part 1 is a *cumulative* exhibit: losses, expenses, and reserves for any accident year are the cumulative values at the Statement date. Part 4 is a "current year" exhibit: loss portfolio transfers are reported only if they were effected in the current year.

   For instance, suppose an insurer underwrote business during policy year 1987, incurring outstanding losses and expenses for accident years 1987 and 1988. During 1989, it transferred part of its unpaid losses to another carrier, and in 1990 it transferred the remaining reserves. *In the 1990 Annual Statement, only the 1990 loss reserve transfer would be reported in Schedule P, Part 4, in the accident year 1987 and 1988 rows.* The 1989 transaction, of course, would still be reflected as assumed and ceded business in Schedule P, Part 1, and will affect the net amounts in Parts 2, 3, and 6.

2. Loss portfolio transfers are all reinsurance transactions. The "direct and assumed" headings

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[55] See, for instance, Stephen P. Lowe and Stephen W. Philbrick, "Issues Associated with the Discounting of Property/Casualty Loss Reserves," *Journal of Insurance Regulation*, Volume 4, No. 4 (June 1986), pages 72-102.

[56] See Lee R. Steeneck, "Loss Portfolios: Financial Reinsurance," *Financial Solvency* (Casualty Actuarial Society 1984 Discussion Paper Program), pages 31-50.

in the premium, loss, and allocated expense columns of Part 1 are replaced by "assumed" in Part 4.

3. There is no subdivision by line of business in Schedule P, Part 4. However, the insurer must keep records by line, since the loss portfolio transfers affect the line of business figures in Parts 1, 2, 3, and 6.

Schedule P assists regulators in evaluating an insurance company's solvency. Parts 1, 2, 3, and 6 show underwriting experience by accident year and thereby help ascertain the adequacy of loss reserves. For these purposes, cumulative experience by line of business is essential. Part 4 examines transactions that provide surplus relief, in addition to their operational functions. Loss portfolio transfers effected in past years are of little importance, since the investment income generated by the assets supported loss reserves provides the same "relief" without the portfolio transfer, though much more slowly. Loss portfolio transfers effected in the current year, however, regardless of line of business, affect statutory policyholders' surplus. These are the arrangements that are shown in Schedule P, Part 4.

Conclusion

Schedule P is a complex document, requiring careful preparation for its completion and sophisticated analysis for its understanding. Working with Schedule P can be a satisfying experience, if you understand its intricacies and the interrelationships of its parts. Conversely, this experience can be frustrating, if you are unprepared, if your data do not match those in previous years or elsewhere in the Annual Statement, or if you do not systematically check your entries as you complete the form. A careful reading of this article before you begin completing or analyzing Schedule P should smooth your task and help you avoid needless pitfalls.

AN ACTUARIAL ANALYSIS OF THE NCCI REVISED EXPERIENCE RATING PLAN

Howard Mahler

1121

AN ACTUARIAL ANALYSIS OF THE NCCI REVISED EXPERIENCE RATING PLAN

by Howard C. Mahler

Abstract

Recently the National Council on Compensation Insurance has significantly revised the Experience Rating Plan for Workers' Compensation. The new plan is referred to as the Revised Experience Rating Plan. It is a practical application of credibility theory using parameter uncertainty and risk heterogeneity.

This paper compares the revised plan to the prior experience rating plan, with particular emphasis on a comparison of the credibility formulas used in the two plans.

Examples are shown to illustrate the overall pattern and general conclusions concerning the differences between the prior and revised plans.

The dependence of credibility on size of risk is discussed from a more theoretical point of view in an Appendix.

1122

AN ACTUARIAL ANALYSIS OF THE NCCI
REVISED EXPERIENCE RATING PLAN

INTRODUCTION

Recently the National Council on Compensation Insurance has significantly revised the Experience Rating Plan for Workers' Compensation. This followed a detailed actuarial study of the performance of the prior plan and possible alternatives. This study is explained in Venter [1] and Gillam [2].

The new plan that is the result of this study was originally given the acronym SERA (Simplified Experience Rating Adjustment), but it is now referred to as the Revised Experience Rating Plan. This paper compares the revised plan to the prior experience rating plan.

As shown in Exhibit 1, the revised plan shares many of the features of the prior plan. Administratively the plans are the same. Actuarially there have been important changes. The revised plan is a single split plan rather than a multi-split plan. Also, the credibilities that are determined by the W and B values are very different.[1]

The first section reviews the actuarial formulas underlying the two experience rating plans. Readers who do not want to deal with a lot of formulas may wish to go right to the second section.

The second section compares the credibilities under the two experience rating plans. Examples are shown to illustrate the overall pattern and general conclusions concerning the differences between the prior and revised plans.

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[1]The W (Weighting) and B (Ballast) values are defined in formulas 6 and 8, and are used in formula 1.

The Revised Experience Rating Plan is a practical application of Credibility Theory using parameter uncertainty and risk heterogeneity. The dependence of credibility on size of risk is discussed from a more theoretical point of view in an Appendix.

ACTUARIAL FORMULAS UNDERLYING EXPERIENCE RATING

The following formula is used in both the prior plan and the revised plan in order to calculate the experience modification.

$$M = \frac{A_p + B + WA_e + (1-W)E_e}{E_p + B + WE_e + (1-W)E_e} \qquad (1)$$

Where M = Experience Modification

A_p = Actual Primary Losses

A_e = Actual Excess Losses

E_p = Expected Primary Losses

E_e = Expected Excess Losses

B = Ballast Value

W = Weighting Value

Under both plans the W and B values vary with the expected losses and are displayed in a table. However, the formulas used to determine W and B are significantly different under the two plans. An example of W and B values for both plans is shown in Exhibit 5.

In order to compare the plans, it is useful to reframe the formulas in terms of credibilities. Following the development in Snader [3]:

$$\text{Let } Z_p = \frac{E}{E + B} \qquad (2.a)$$

$$Z_e = \frac{E}{E + \frac{B + (1-W)\,E}{W}} = \frac{W\,E}{E + B} = WZ_p \qquad (2.b)$$

This can also be written in terms of the usual Bayesian formula for credibility as:

$$Z_p = \frac{E}{E+K_p} \qquad (3.a)$$

$$Z_e = \frac{E}{E+K_e} \qquad (3.b)$$

with the credibility parameters K_p and K_e depending on the expected losses E, W and B:

$$K_p = B \qquad (4.a)$$

$$K_e = \frac{B + (1-W)\,E}{W} \qquad (4.b)$$

Then the modification formula 1 becomes in terms of the credibilities:

$$M = \frac{(1-Z_p)\,E_p + Z_p\,A_p + (1-Z_e)\,E_e + Z_e\,A_e}{E} \qquad (5)$$

under the prior plan:

$$B = (1-W)\ 20000 \qquad (6.a)$$

$$W = \begin{cases} 0 & E \le 25000 \\ \dfrac{E-25000}{S-25000} & S \ge E \ge 25000 \\ 1 & E \ge S \end{cases} \qquad (6.b)$$

Where S is the self-rating point.

Under the revised plan, the values of the credibility parameters K_p and K_e are given via formula, and then B and W follow from them. The formulas in terms of the state reference point S are:

$$K_p = E\left[\frac{.1E + .01028S}{E + .0028S}\right] \qquad (7.a)$$

K_p is subject to a minimum of 7500. K_p subject to this minimum is labeled B by the NCCI.

$$K_e = E\left[\frac{.75E + .8153S}{E + .0204S}\right] \qquad (7.b)$$

K_e is subject to a minimum of 150,000. K_e subject to this minimum is labeled C by the NCCI.

Formulas 7 can also be stated in terms of g.[2] These formulas are the ones used by the NCCI.[3]

$$K_p = E\left[\frac{.1E + 2500g}{E + 700g}\right] \qquad (7.a')$$

$$K_e = E\left[\frac{.75E + 200,000g}{E + 5100g}\right] \qquad (7.b')$$

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[2]The state specific parameter g is defined by the NCCI as the average claim cost in the state divided by $1000; g is rounded to the nearest .05.

[3]The two sets of formulas only differ due to rounding. The NCCI has rounded 2570 to 2500 and 203,825 to 200,000.

Thus under the revised plan, the credibility parameters have the form

$E \frac{Linear}{Linear}$.

As explained in the Appendix, this is the form that is expected when the phenomena of parameter uncertainty and risk heterogeneity are important.[4] The NCCI determined the particular coefficients used in the revised plan by empirical testing.[5]

By solving the set of equations 4 one can express W and B in terms of K_p and K_e. These equations are used to determine W and B from K_p and K_e.[6]

$$B = K_p \qquad (8.a)$$

$$W = \frac{E + K_p}{E + K_e} \qquad (8.b)$$

W is subject to a minimum of .07.

CREDIBILITIES, PRIOR PLAN VS. REVISED PLAN

Under the revised plan the credibilities differ from the prior plan. The credibilities assigned to the primary[7] and excess losses are each significantly

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[4]In Mahler [4] at page 178, the result for a split plan is given as $E \frac{Quadratic}{Quadratic}$. However, when the covariance of excess and primary losses is not extremely important, the *no-split plan* result of $E \frac{Linear}{Linear}$ is a sufficiently close approximation. Since the observed correlation between the excess and primary losses is usually 95% or more, this is an area for further research.

[5]See Venter [1] and Gillam [2].

[6]The NCCI actually defines B as K_p subject to the minimum. The NCCI defines C as K_e subject to the minimum. Then W=(E+B)/(E+C).

[7]Under the revised plan the definition of primary losses is changed. Thus the D-ratios, which measure the expected portion of the losses that will be
(Footnote Continued)

different, as can be seen in Exhibits 2, 3 and 4:

1. For small risks, Primary Credibilities are larger.
2. For large risks, Primary Credibilities are smaller. The maximum Primary Credibility is 91%, rather than 100% as under the prior plan. This means no more self-rating.
3. For small risks, Excess Credibilities are a little larger. Even very small risks have a small non-zero Excess Credibility, as opposed to zero under the prior plan.
4. For large risks, Excess Credibilities are much smaller. The maximum Excess Credibility is 57%, rather than 100% as under the prior plan.

Thus one important change is that under the revised plan there are no longer self-rated risks. The primary losses are assigned a maximum credibility of 91%, while the excess losses are assigned a maximum credibility of 57%. Thus the maximum credibility assigned to any risk is approximately 70%.[8]

It follows from formulas 3 and 7 that under the revised plan the credibilities as a function of the size of risk are of the form $\frac{\text{linear}}{\text{linear}}$. This can be written as:

$$Z = \frac{E + I}{JE + I + K} \qquad \begin{matrix} 0 \leq I \\ J \leq I \\ 0 \leq K \end{matrix} \qquad (8)$$

(Footnote Continued)
primary, have to be recalculated with the adoption of the revised plan. In one state (Massachusetts) the average D-ratio decreased from about .35 to about .30. The results will vary by state, depending on the size of loss distribution, which depends heavily on the particular state Workers' Compensation Law.

[8]Assuming a D-ratio of D, the maximum credibility is (Dx91%) + ((1-D)x57%). For D=.50 the maximum credibility is 74%. For D=.35 the maximum credibility is 69%. For D=.20 the maximum credibility is 64%.

with one formula for primary credibility and one formula for excess credibility, each with different constants I, J, and K. This is the form of credibility one expects if both parameter uncertainty and risk heterogeneity are important.[9] The more familiar formula for credibility is a special case of formula 8, with I = 0 and J = 1.

In the more familiar formula Z = E/(E+K) the parameter K is a "scale parameter." Changing K changes the overall scale of the credibility curve without changing its shape. As will be discussed below K, and thus the scale of the curve, depends on a state specific inflation sensitive parameter.

In formula 8 used in the revised plan, there are two additional parameters I and J which are "shape parameters." Changing I and/or J changes the shape of the credibility curve. The size of the parameter I relative to the parameter K adjusts the shape of the credibility curve for small risks. The minimum credibility is given by I/(I+K), which is determined by the ratio of I to K.

The parameter J adjusts the shape of the credibility curve for large risks. The maximum credibility is given by 1/J.

Thus the revised plan uses a more general formula for credibility, which is better able to approximate those credibilities that would have performed well in the past and thus are expected to work well in the future.[10] As shown in the Appendix, one could derive even more general formula than formula 8. As a function of the size of risk, the credibilities given by formulas A.11 in the Appendix are of the form quadratic.
quadratic

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[9]See Equation 1.6 in Mahler [4]. What was denoted as K there, is denoted as I+K here. This is a matter of notation rather than substance. The notation used here allows K to have the same underlying source in both formula 8 and the more familiar formula for credibility.

[10]The criterion used by the NCCI to determine which credibilities performed well are discussed in Venter [1] and Gillam [2].

This more general formula for credibility is somewhat better able to approximate those credibilities that would have performed well in the past. The two additional parameters can be adjusted so as to adjust the shape of the credibility curve for medium-size risks. In any given application, one has to decide whether the extra generality introduced by these additional parameters is worth the extra complications also introduced.

The specific formulas for Z_p and Z_e used in the revised plan are:

$$Z_p = \frac{E + .0028S}{1.1E + .01308S} \qquad (9.a)$$

$$Z_e = \frac{E + .0204S}{1.75E + .8357S} \qquad (9.b)$$

where S is the State Reference Point.[11]

These formulas can also be stated in terms of the parameter g:[12]

$$Z_p = \frac{E + 700g}{1.1E + 3270g} \qquad (9.a')$$

$$Z_e = \frac{E + 5100g}{1.75E + 208925g} \qquad (9.b')$$

Thus under the revised plan, the primary and excess credibilities are each given by formula 8, with the following parameters:

	Primary	Excess
I	.0028S = 700g	.0204S = 5100g
J	1.1	1.75
K	.01028S = 2570g	.8153S = 203825g

[11]The State Reference Point is calculated as 250 times the average cost per case in the particular state.

[12]The parameter g is calculated as the average cost per case in the particular state divided by 1000. g is rounded to the nearest .05.

If for example, S=$500,000, and g=2,[13] then the parameters would be:

	Primary	Excess
I	$1,400	$10,200
J	1.1	1.75
K	$5,140	$407,650

Note that the curves for primary and excess credibilities under the revised plan have a significantly different scale from each other due to their vastly different values of the parameter K. As is shown in Exhibit 2, the two curves also have significantly different shapes due to their different values of the parameter J and different ratios of I to K.

The values for the credibilities underlying actual experience ratings may differ slightly from those calculated using formulas 9 due to the rounding process involved in establishing a table of W and B values. Also they will differ for small risks (those with expected losses below about $20,000) because of the minimums imposed on the parameters W, Kp and Ke.[14]

For the smaller risks, there are maximum values imposed on the experience rating modification under the revised plan.

Expected Losses	Maximum Modification
0 to $5,000	1.6
$5,000 to $10,000	1.8
$10,000 to $15,000	2.0

The maximum debit and credit for small risks are compared in Exhibit 6.

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[13]These correspond to an average case of $2,000.

[14]The imposition of minimums on Kp and Ke reduces the credibility assigned to very small risks (those with expected losses below about $6,000). The imposition of a minimum on W increases the credibility assigned to the excess losses of small risks.

POSSIBLE FURTHER RESEARCH

It would be interesting to compare the more general formula A.11 versus formula A.10 using the same types of tests as performed by the NCCI.

Another area for possible research is the number of years of data used in the experience period. Currently three years are given equal weight.[15] One could test whether some other combination of number of years and weights could produce a more accurate result.[16]

SUMMARY

The Revised Experience Rating Plan is based on significantly different credibility formulas than the prior plan. This results in a significantly more responsive plan for small risks and a significantly less responsive plan for large risks.

While the Revised Experience Rating Plan has a firmer theoretical and empirical basis than the prior plan, there remain areas for further actuarial research.

ACKNOWLEDGEMENTS

The author would like to thank William R. Gillam and Robert A. Bear for providing helpful comments on an earlier version of this paper.

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[15] Actually since more recent years have more payroll on average due to inflation, the most recent year on average has somewhat more weight.

[16] As pointed out in Mahler [4], the optimal set of years and weights will depend on to what extent the risk parameters of an insured are shifting over time.

Comparison of Workers' Compensation Experience Rating Plans

Prior	Revised
Primary and Excess Losses	Primary and Excess Losses
Multi-split Plan: Primary portion of a loss is determined via formula[1] or from a table.	Single Split Plan: Primary portion of a loss is the first $5000.
Experience Modification depends on a comparison of actual losses to expected losses, taking into account credibilities.	Experience Modification depends on a comparison of actual losses to expected losses, taking into account credibilities.
W and B values are shown in a table, and depend on the expected losses for the risk.	W and B values are shown in a table, and depend on the expected losses for the risk.
The table of W and B values depends on a state specific value, the Self-Rating Point. (SRP)	The table of W and B values depends on a state specific value, the State Reference Point. (SRP)[2]
The per claim accident limitation is 10% of the State's Self-Rating Point.	The per claim accident limitation is 10% of the State Reference Point.
The State Multiple Claim Accident Limitation is twice The State Per Claim Accident Limitation.	The State Multiple Claim Accident Limitation is twice The State Per Claim Accident Limitation.

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[1] $A_p = 10000\ A/(A + 8000)$. For losses less than 2000, the whole loss is considered primary.

[2] The State Reference Point is equal to 250 times the average claim cost in the particular state. The NCCI uses the state specific parameter g which is defined as the average claim cost in the state divided by $1000; g is rounded to the nearest .05. g=SRP/250,000.

NCCI Revised Experience Rating

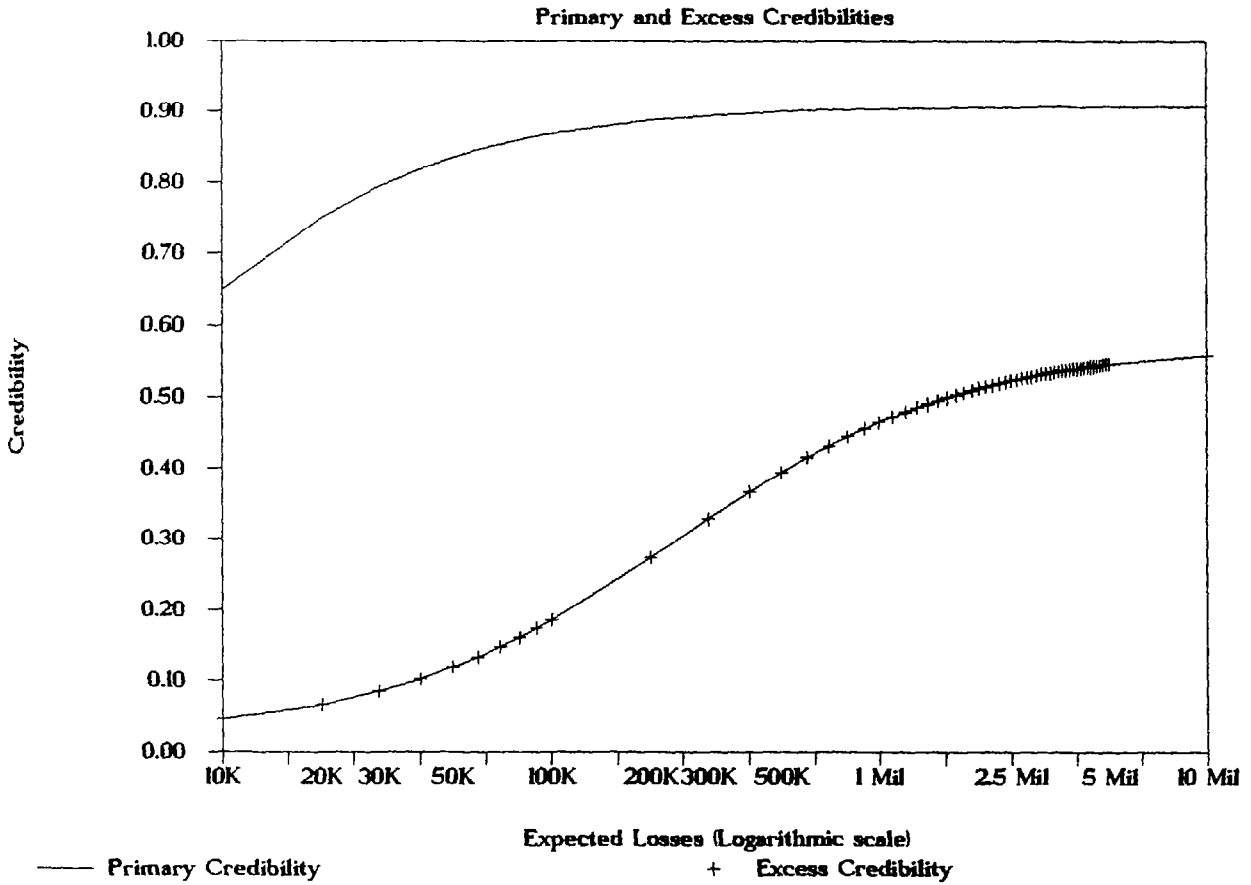

EXHIBIT 3

Workers' Compensation Experience Rating

Credibilities
(Weighted Average of Primary & Excess Credibilities)

Expected Losses ($000)	Prior*	Revised**	Revised Minus Prior***
3****	5%	10%	5%
5	7	14	7
7.5	10	18	8
10	12	20	9
15	15	24	9
20	18	26	9
25	19	28	9
50	27	33	7
75	31	37	6
100	34	39	5
125	36	41	5
150	39	43	4
200	43	46	3
300	51	50	-1
400	58	53	-5
500	66	55	-11
750	83	58	-24
1000	100	59	-41
2000	100	63	-37
3000	100	65	-35
4000	100	65	-35
5000	100	65	-35
7500	100	66	-34
10000	100	66	-34
∞	100	67	-33

* NCCI Experience Rating Plan prior to revision, assuming a Self-Rating Point of $1,000,000 and a D-ratio of .35.

** Revised Experience Rating Plan, assuming a State Reference Point of $500,000 and a D-ratio of .30.

*** Result may differ slightly due to intermediate rounding.

**** Eligibility requirements vary by state. In most states $3,000 in expected losses is currently close to the minimum size ever experience rated.

EXHIBIT 4

Workers' Compensation Experience Rating

Credibilities

Expected Losses ($000)	Primary		Excess	
	Prior*	Revised**	Prior*	Revised**
3***	13%	29%	0%	2%
5	20	40	0	3
7.5	27	50	0	4
10	33	57	0	5
15	43	67	0	6
20	50	73	0	7
25	56	77	0	8
50	72	83	2	12
75	80	86	4	15
100	84	87	7	18
125	87	88	9	21
150	90	88	12	24
200	92	89	17	28
300	95	90	27	33
400	97	90	37	37
500	98	90	48	40
750	99	90	73	44
1000	100	90	100	46
2000	100	91	100	52
3000	100	91	100	54
4000	100	91	100	54
5000	100	91	100	54
7500	100	91	100	55
10000	100	91	100	55
∞	100	91	100	57

* NCCI Experience Rating Plan prior to revision, using Self-Rating Point of $1,000,000 (assumes average serious case of $40,000).

** Revised Experience Rating Plan, using State Reference Point of $500,000 (assumes average case of $2,000).

*** Eligibility requirements vary by state. In most states $3,000 in expected losses is currently close to the minimum size risk ever experience rated.

EXHIBIT 5

Workers' Compensation Experience Rating

W and B Values

Expected Losses ($000)	B ($00)		W	
	Prior*	Revised**	Prior*	Revised**
3***	200	75	0	.07
5	200	75	0	.08
7.5	200	75	0	.08
10	200	75	0	.08
15	200	75	0	.09
20	200	75	0	.09
25	200	75	0	.10
50	194	99	.03	.14
75	190	124	.05	.18
100	184	149	.08	.21
125	180	174	.10	.24
150	174	200	.13	.27
200	164	250	.18	.31
300	144	350	.28	.37
400	124	450	.38	.41
500	102	550	.49	.44
750	52	800	.74	.49
1000	0	1050	1.00	.51
2000	0	2050	1.00	.57
3000	0	3050	1.00	.59
4000	0	4050	1.00	.60
5000	0	5050	1.00	.60
7500	0	7550	1.00	.61
10000	0	10050	1.00	.61

* NCCI Experience Rating Plan prior to revision using a Self-Rating Point of $1,000,000 (assumes average serious case of $40,000).

** Revised Experience Rating Plan, using State Reference Point of $500,000 (assumes average case of $2,000).

*** Eligibility requirements vary by state. In most states $3000 in expected losses is currently close to the minimum size risk ever experience rated.

EXHIBIT 6

Workers' Compensation Experience Rating

Revised Experience Rating Plan*

Expected Losses ($000)	Maximum Credit** D-ratio=.40	D-ratio=.30	D-ratio=.20	Maximum Debit
3***	13%	10%	7%	60%
4	15	12	9	60%
5	18	14	11	60%
6	20	16	12	80%
7	22	17	13	80%
8	23	18	14	80%
9	24	19	14	80%
10	26	20	15	80%
11	27	21	16	100%
12	28	22	16	100%
13	28	23	17	100%
14	29	23	17	100%
15	30	24	18	100%
16	31	25	19	No Limit

* Revised Experience Rating Plan, using State Reference Point of $500,000 (assumes average case of $2,000).

** The maximum credit depends on the particular D-ratio. The maximum credit is the credibility which is equal to D x primary credibility + (1-D) x excess credibility.

*** Eligibility requirements vary by state. In most states $3,000 in expected losses is currently close to the minimum size risk ever experience rated.

References

[1] G. G. Venter, "Experience-Rating-Equity and Predictive Accuracy," NCCI Digest, Volume II, Issue I, April 1987, p. 27.

[2] W. R. Gillam, "Parametrizing the Workers' Compensation Experience Rating Plan," CAS Discussion Paper Program 1990.

[3] R. H. Snader, "Fundamentals of Individual Risk Rating and Related Topics," Part I of Study Note, Casualty Actuarial Society, 1980.

[4] H. C. Mahler, Discussion of G. G. Meyers "An Analysis of Experience Rating," PCAS LXXIV, 1987, p. 119.

[5] G. G. Meyers, "An Analysis of Experience Rating," PCAS LXXII 1985, p. 278.

Appendix, Dependence of Credibility On Size of Risk

In this appendix, the variation of credibility with size of risk will be discussed. Formulas A.10 are those used in the revised experience rating plan. The theoretical underpinnings of these formulas, as well as the more general formulas A.11, are discussed.

Following the development in Mahler [4] let

a = total variance of the primary losses
b = total variance of the excess losses
c = variance of the hypothetical means of the primary losses
d = variance of the hypothetical means of the excess losses
r = total covariance of the primary and excess losses
s = covariance of hypothetical means of the primary and excess losses

Then the optimum least squares credibilities Z_p and Z_e are derived in Appendix F of Mahler [4] and given in equations 5.3 and 5.4 of that paper as:

$$Z_p = \frac{(c+s)b - (d+s)r}{ab-r^2} \qquad \text{(A.1.a)}$$

$$Z_e = \frac{(d+s)a - (c+s)r}{ab-r^2} \qquad \text{(A.1.b)}$$

Thus both the primary and excess credibilities can be written in terms of variances and covariances.

Thus the dependence of the credibilities on the size of the risk can be derived from the dependence of the various variances and covariances on the size of the risk.

Again following Mahler [4] let

t = a-c = process variance of the primary losses
u = b-d = process variance of the excess losses
v = r-s = process covariance of the primary and excess losses

Then substituting into equations (A.1) one gets:

$$Z_p = \frac{(c+s)(u+d)-(d+s)r}{(t+c)(u+d)-(v+s)^2} \qquad \text{(A.2.a)}$$

$$Z_e = \frac{(d+s)(t+c)-(c+s)r}{(t+c)(u+d)-(v+s)^2} \qquad (A.2.b)$$

The NCCI credibility parameters K_p and K_e are defined so that:

$$Z = \frac{E}{E+K}$$

and therefore

$$K = E(\frac{1}{Z}-1) \qquad (A.3)$$

Substituting into equation A.3 the expressions for Z_p and Z_e given in equations A.2 one obtains:

$$K_p = E\frac{tu+td+vd-su-sv-v^2}{cu+su+cd-s^2-sv-dv} \qquad (A.4.a)$$

$$K_e = E\frac{tu+uc+vc-st-sv-v^2}{dt+st+cd-s^2-sv-cv} \qquad (A.4.b)$$

If the covariances between the primary and excess losses are zero, $v=s=0$,[1] i.e., if there is no useful information about the primary losses contained in the excess losses and vice versa, then these equations are greatly simplified:

$$K_p = E\frac{t}{c} \qquad (A.5.a)$$

$$K_e = E\frac{u}{d} \qquad (A.5.b)$$

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[1]This assumption would yield a good approximation if these covariances are small in magnitude compared to the variances and covariances that enter into the formulas. In fact these covariances are observed to be significantly different from zero. The total covariance of primary and excess losses, $r=s+v$, is generally positive in actual applications. For Workers' Compensation the correlation between primary and excess losses is generally 95% or more.

Each of the two separate pieces, which are assumed to be uncorrelated with each other, has credibility parameter given by the familiar Buhlmann result.

It is formulas A.5 that form the theoretical bases of the credibilities used by the NCCI in the revised experience rating plan, rather than the more complicated but more general formulas A.4.[2]

It is generally assumed that process variances and covariances (so-called "within" variances and covariances) such as t, u and v, increase proportionally with E, the size of risk.

$$t \sim E \qquad \text{(A.6.a)}$$
$$u \sim E \qquad \text{(A.6.b)}$$
$$v \sim E \qquad \text{(A.6.c)}$$

However, as shown in Meyers [5] when the phenomena of parameter uncertainty is important, formulas A.6 do not hold. Instead, t, u, and v increase partially proportionally with E and partially proportionally with E squared.[3] When parameter uncertainty is important:

$$t \sim E \text{ Linear } [E] \qquad \text{(A.7.a)}$$
$$u \sim E \text{ Linear } [E] \qquad \text{(A.7.b)}$$
$$v \sim E \text{ Linear } [E] \qquad \text{(A.7.c)}$$

It is generally assumed that variances and covariances of the hypothetical means (so-called "between" variances and covariances) such as c, d, and s, increase proportionally with the square of E, the size of risk.

$$c \sim E^2 \qquad \text{(A.8.a)}$$
$$d \sim E^2 \qquad \text{(A.8.b)}$$
$$s \sim E^2 \qquad \text{(A.8.c)}$$

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[2]However, both formulas A.5 and A.4 will be treated in the remainder of this appendix. Formulas A.11 follow from formulas A.5, while formulas A.10 follow from formulas A.4.

[3]As discussed in Mahler [4], the portion of the process variance or covariance which is proportional to the square of E represents the variation of the parameters due to the different states of the universe.

However, as shown in Mahler [4] in the presence of risk heterogeneity, formulas A.8 do not hold. Instead, c, d, and s increase partially proportionally with E and partially proportionally with E-squared.[4] When risk heterogeneity is important:

$$c \sim E \text{ Linear } [E] \qquad \text{(A.9.a)}$$
$$d \sim E \text{ Linear } [E] \qquad \text{(A.9.b)}$$
$$s \sim E \text{ Linear } [E] \qquad \text{(A.9.c)}$$

One can substitute the behavior of the variances and covariances with size of risk into the equations for the credibility parameters K. The revised experience rating plan is based on formulas A.5, with parameter uncertainty (formulas A.7) and risk heterogeneity (formulas A.9). Substituting formulas A.7 and A.9 into formulas A.5 gives:

$$K_p \sim \frac{E \text{ Linear } [E]}{\text{Linear } [E]} \qquad \text{(A.10.a)}$$

$$K_e \sim \frac{E \text{ Linear } [E]}{\text{Linear } [E]} \qquad \text{(A.10.b)}$$

This is the form of the credibility parameters used in the revised experience rating plan shown in the equations 7 in the main text.[5] This form of the credibility parameters, leads directly to the form of the credibilities shown in equations 9 in the main text.

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[4]As discussed in Mahler [4], the portion of the variance or covariance of the hypothetical means which is proportional to E represents the variation caused by grouping submits together to form a single risk. For example, several factories might belong to a single insured.

[5]This is the form for the No-Split Plan with parameter uncertainty and risk heterogeneity given at page 178 of Mahler [4].

If instead of the special case equation A.5, one starts with the more general equations A.4, one gets a different form for the credibility parameters. Substituting equations A.7 and A.9 into equations A.4, gives the following general form of the credibility parameters with parameter uncertainty and risk heterogeneity.[6]

$$K_p \sim E\frac{\text{Quadratic [E]}}{\text{Quadratic [E]}} \qquad \text{(A.11.a)}$$

$$K_e \sim E\frac{\text{Quadratic [E]}}{\text{Quadratic [E]}} \qquad \text{(A.11.b)}$$

Formulas A.10 are a special case of formulas A.11.

Therefore, formulas A.11 will always perform at least as well as and usually perform better than formulas A.10 in any empirical tests, including the type of studies conducted by the NCCI in its development of the revised experience rating plan. Practical considerations will determine whether in a particular application the extra generality represented by formulas A.11 is worth the extra complication introduced by the additional parameters contained in formulas A.11.

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[6]This is the form for the Split Plan with parameter uncertainty and risk heterogeneity given at page 178 of Mahler [4].

A RESERVING DATA BASE

Edward M. Ford

A RESERVING DATA BASE:
Design and Implementation

INTRODUCTION

This paper describes the development and characteristics of a computer system that produces loss development and exposure data that are used in pricing and reserving at the Progressive Insurance Companies. This system does no analysis; it only produces the summary data for analysis.

In writing this, I am assuming that the reader has some familiarity with reserving data and data processing. My goal is to describe the system development process from the actuarial perspective.

COMPANY BACKGROUND

I joined Progressive in December of 1982 and assumed responsibility for loss reserving. At Progressive, the manager of the loss reserve function is the decision maker for loss reserves (there is no reserve committee) and is held accountable for their accuracy. I hope to demonstrate that the high degree of authority of this position was a major advantage in building the system.

In 1982, Progressive wrote $247 million of net premiums. All the business was auto related: non-standard personal auto, motorcycle, motorhome, travel trailer, mobile home, non-standard commercial (light to medium weight) auto, and lenders collateral protection on auto loans. The non-standard personal auto was the dominant product with 70% of the volume. The company had a history of explosive growth (in 1972, the company wrote $33 million) when the underwriting cycle was favorable, and planned to continue that approach.

The company is structured with individuals, called product managers, responsible for results (both volume and underwriting margin) for fairly small segments of business. For example, there is an Ohio non-standard auto product manager. These individuals are evaluated quite strictly on calendar year results. Quite naturally, this structure creates pressure to set reserves for these small segments individually (i.e. using the segment's development data as the dominant input).

RESERVING SYSTEMS BACKGROUND

At the end of 1982, Progressive's reserving systems produced four types of data:

1) Accident year data, ending 12/31. It contained dollars and counts of payments and case reserves.
2) Report within accident year data, ending 12/31. This was a straightforward refinement of the accident year data.
3) Accident year data, ending 12/31, for paid allocated loss adjustment expenses.
4) Case and IBNR runoff data. For any calendar quarter-ending date, the system displayed the case and IBNR emergence for individual accident years or all accident years combined. It contained dollars and counts of payments and case reserves.

After analyzing this data, reserve levels changes were implemented by revising tables in three separate systems for case, IBNR, and ALAE reserves. For more detail about Progressive's reserving approaches, the Progressive Report on Loss Reserves is available from the company.

NEW RESERVE SYSTEM JUSTIFICATION

Progressive's reserve systems at the end of 1982 were fairly extensive, and the company's reserves had been adequate historically. Why build new systems? There was no overwhelming reason, rather a number of smaller ones that jointly argued for a new system:

User perspective:

1) The systems had been built and modified with great speed because of the company's growth. As a result, there were material inconsistencies between the four data systems. For example, counts from the accident year system and the runoff system did not match. The frequency of past modifications and the turnover of the programming staff had created computer code that was almost indecipherable. It is a sobering experience to hear for the first time a smart and experienced programmer say, "I can't understand the code so I'll run some dummy records through and see what comes out." As an actuary, I am comfortable with uncertainty, but this "random variable" was particularly disturbing.

2) Reconciling these systems' data to the data used by the accounting systems for internal and external reporting was difficult.

3) The systems were not flexible enough to accommodate

Progressive's rate of change. As stated above, the company's structure forced continual study of and change in segmentation of the data. An example would be a state's rapid growth requiring separate analysis of its data. Further, the systems could not provide data in smaller time intervals than years, and for the most part the evaluation dates were limited to calendar year-ends.

Data processing perspective:

1) The systems were "fragile": a conceptually straightforward change would often produce unintended results.

2) The systems' master files were summarized and so needed to be "rebuilt" when a change was made.

3) The systems' ran very inefficiently.

DESIGN, FEASIBILITY, APPROVAL - 5/84 through 11/84

The team was comprised of myself, the two other members of the reserving area, and four data processing people (most of whom had worked on the current systems). As I mentioned above, the Progressive structure was such that I enjoyed almost complete autonomy over the system's design from a user's view. The process was simple: the reserving area described needs and the DP folks translated those needs into systems. This describing of needs sounds straightforward, but it is quite hard because people of different disciplines view the world differently and the same words can create widely divergent images. In my view this was the most critical part of the project. We made only one significant communication error (discussed below) which happily was correctable.

This process produced a schematic of the system:

1) The four current data systems would be replaced with one.

2) This one system would contain both premium (including exposure data) and loss data.

3) The table-driven system that produced the IBNR reserve at every month-end would use the data system's premium master file.

4) The premium and loss master files would be updated, edited, and balanced monthly. These files should not be summarized to minimize file rebuilding, and to provide clearer audit trails.

5) All reports would be able to show data by month, quarter, half-year, or year; and the time periods could end at any month-end.

6) The user should have control over the aggregation level (e.g. geographic, product, coverage), report type (e.g. accident, report, policy effective data), and time intervals (point 5 above).

The approval process was characterized by a disagreement within the data processing department. The people who did the feasibility study wanted to use simple flat files with COBOL; the common approach for most of Progressive's systems. They did want to use a new operating environment for efficiency and the ability to more easily create menus for user input (point 6 in the schematic above). Other data processing people argued for a "data base" approach and to consolidate this system with the system that was used to price rating variable differentials (e.g. territory, age, driving record).

I decided on the simpler approach. The decision was not that hard because the data base proponents never answered the performance and cost concerns that arose from the operation of the rating variable system.

In marketing the system to the organization, I committed to make only the absolutely minimum changes to the current systems to minimize the development costs (in other words, I promised to use the DP resources that were allocated to maintenance for development of the new system so no additional DP staff was required). I felt that I could use the current systems without modification while the new system was being built.

PREMIUM PHASE - 11/84 through 12/85

We decided to do the premium side first because it was simpler than the loss side in that there were only four statistics: written and earned premium, and written and earned exposures. There was also less concern about the quality of the historical data and there was only one source of the historical data - a file that was produced monthly containing the previous month's premium transactions.

The first task was to precisely design the reports. This naturally fell to the reserving area. A "segment" was defined as a user specified combination of company (legal entity), state, product, coverage, and limit/deductible. For example, a segment might be $12,500/$25,000 limits bodily injury for non-standard auto written in Ohio by Progressive Mutual Insurance Company. We decided we wanted

to be able to view the data on a calendar or policy effective date basis and the periods could a month, quarter, half-year, or year (see schematic point # 5 above). We also defined a limit/deductible distribution report on a calendar basis, and a "rate revision" report which combines premiums from policies that were written using a particular set of rates (e.g. rates that were revised on August 1, 1985). The rate revision view of the data was added because the pricing people often used this to judge the results of a particular set of rates.

With these report needs, the data processing people designed the method by which the user would define a segment and select a report, and the best master file structure. The segment defining and report selection was via a series of screens that the user completed.

The master file structure required a compromise. The amount of data required summarized records rather than the originally desired detail records. The record layout is straightforward. It begins with fields containing the segment information and appropriate dates and ends with a variable number of fields containing earned premium and exposure for all past and future months. The reports are then based on straightforward sort/sums on particular fields.

In building the master file, a significant misunderstanding was uncovered. In assigning an inception date to an endorsement (e.g. add a car) for policy period reporting, data processing was planning to use the endorsement's effective date. I had assumed the original policy's effective date would be the one used. I had not been clear enough in my description of the report. This reinforced the need for continual (daily) informal contact between the reserving area and data processing. Fortunately, this was correctable and as it turned out, the only significant problem of its kind in the entire project.

The testing was straightforward since there were existing reports for balancing the calendar and rate revision period data. For the policy effective date report, the testing consisted of internal consistency checks (the difference of two diagonals from a policy period matrix should balance to the calendar period report) and reasonability checks (earnings patterns and premium booking lags).

LOSS PHASE - 1/86 through 1/87

The loss side was significantly more complex on various fronts: more report types, more statistics, more complex master file structure, and less straightforward testing.

The reserving area decided on several report types:

1) Development matrices
   i) accident date
   ii) record date
   iii) record within accident date
   iv) policy effective date
   v) rate revision date

2) Case and IBNR runoff (retrospective reserve tests)

3) Size of loss

As in the premium reports, the loss reports could show monthly, quarterly, semi-annual, or annual data.

We derived twenty-one statistics. Examples would be number closed without payment, number recorded, amount paid, amount reserved.

The structure of the master file is the key to satisfying all these needs. Progressive's claim file recording structure calls for a unique claim number for an accident. For an accident, there are coverage codes and within a coverage, there are claimant numbers. The basic loss unit is called a "feature" and can be thought of as an individual claimant's cost. Each record in the master file contained all the historical information on a particular claimant's cost.

Exhibit I shows an example of the record. The record has a fixed length section at the beginning containing segment and policy information. The remaining portion of the record is variable in length and contains the transaction history of the feature. This sample loss record shows a feature that was first recorded in January of 1987 as an open case reserve (it could have been first recorded as a payment. e.g. small "fast track" payments). The reserve stayed open until it was paid sometime in April and in August, a salvage recovery was processed. There are. of course, dollar amounts associated with these items. The file is "summarized" in the sense that it shows only month-end values for reserves and month totals for payments rather than the individual transactions.

This file was built from separate files containing reserves, loss payments, salvage and subrogation payments, allocated loss adjustment expense payments, and closed without payment transactions. This single file structure is conceptually convenient because it more closely matches the way people think about claims versus the separate transaction file structure.

The building of the master file turned up a number of data problems, which caused some edits to be added to the originating, monthly transaction systems, and reinforced my intention to re-edit the data before it was used to update the master file. In general, data was not "forced", rather used to the extent possible (e.g. a countrywide report could use data that didn't have a state code). An estimate of the number of records omitted was automatically printed on some reports. I have a strong bias against forcing: it hides rather than solves problems.

Testing was a major challenge because of the lack of prior systems and the large number of statistics and report types. This step required the most time ,by far, of any in the project. Data Processing created eight dummy master records, and produced output by hand for every report and every statistic, which the reserving area checked. When the programs were written, the dummy records were processed and the output compared to the manually created output. This process was very long and boring, but worth it as a number of mistakes were caught.

MAINTENANCE AND CHANGES SINCE 12/87

Since 12/87 new transaction types (reinsurance recoverables and recovereds) and new statistics have been added. These were significant enhancements but were all done within the original design which speaks well for the design.

The regular monthly balancing/editing routines continue to catch errors in the transaction systems and have turned out to be helpful in forcing some data quality issues.

LOSS DATA FORMAT

Exhibit 1

* An accident creates a unique claim number, e.g. 453289

* A loss against a particular coverage, e.g. bodily injury, is coded with a "line coverage" code, 1910 (for B.I.)

* A particular plaintiff within a coverage is identified with an "identification" number, e.g. 01

* So a "feature" is a unique combination of claim number, line coverage code, and feature identification code, e.g. 453289 1910 01

Sample record – one feature

Segment/Policy Info	RSF 8701	RSF 8702	RSF 8703	PDL 8704	SAL 8708

APPENDIX

This appendix is a more technical description of the system and was written by Phil Juarez.

I. Overview

The LODESTAR (LOss DEvelopment STatistical Analysis and Reporting) computer system's primary purpose is to act as a collection point for premium and loss data and to provide a facility by which this data can be used for loss reserving and pricing. Conceptually, LODESTAR is a database management system, albeit a primitive one. The "database" is updated monthly and the,"Fourth Generation" reporting mechanism is provided through CICS and batch programs.

LODESTAR was developed using COBOL and Command Level CICS (at the time version 1.5) in an IBM mainframe (MVS) environment. The system consists of over 50 in-house developed programs (30 batch and 20 CICS). The system is logically divided into two sub-systems, Premiums and Losses. Each sub-system has a monthly file update and an on-demand reporting facility.

The cornerstone of LODESTAR is the file structure. All the datasets are sequential tape and/or disk files. The master files have a variable (RECFM=VB) record format. This allows both storage economy and dynamic record growth. The update process simply appends the current month's transactions to the end of the record. The result is a record which contains the complete history of a claimant.

II. Monthly Master File Updates

Balancing to the Accounting Systems

Each LODESTAR sub-system (Premiums and Losses) requires that the transactions generated during the month be added to the appropriate master file. These transactions are created in the source systems (i.e., Premiums, Claims, etc.) and passed to a number of downstream systems including LODESTAR and the General Ledger (MSA) system. Because of problems reconciling the pre-LODESTAR loss reserving systems to our accounting systems, it was a design requirement that this reconciliation occur prior to updating the LODESTAR master files. This is accomplished by reading the actual transaction file and the General Ledger "posting" file and insuring that the two are equal. This automatic balancing occurs prior to the file updating and if an out of balance condition occurs, the program is cancelled and a programmer is called to correct the problem. There have been numerous benefits of the balancing process but the most significant is immeasurable: the company-wide confidence in LODESTAR's

data. From this point the Premium and the Loss updates are significantly different and will be discussed separately.

Premium Master File Update

The Premium system at Progressive is a transaction driven system with no master file. Therefore the data LODESTAR processes the actual New (or renewal) Business, Cancel and Endorsement records. Upon completion of the balancing the New Business records are separated from the Cancels and Endorsements and used to update a "Policy Inception Date" master file.

The Cancel and Endorsement records are then matched to this file to attach a policy inception date to these records. All the records are then merged and summarized to the company, state, product code, coverage code, policy effective date and policy expiration date level. We view this summarization as one level above the policy detail. This summarized transaction file is used to update the LODESTAR Premium Master file.

The summarized transaction records are converted to LODESTAR master file format and merged with the current version of the file. The LODESTAR master record consists of a "fixed" area and a "variable" area. The fixed area consists of the key noted above plus policy inception date, rate revision date, written premium and exposures. The variable area contains the monthly earned premium and exposures.

As noted above, another design requirement was the calculation of the IBNR reserve (by applying factors to the past earned premiums) directly from the LODESTAR premium file. This file structure easily associates the earned premium to the time period for which it was earned and permits direct calculation of the IBNR reserve.

Loss Master File Update

While the LODESTAR premium file gets all its data from one source, the LODESTAR loss file get its data from many sources. Loss data includes reserve, paids, salvage, subrogation, ALAE paid, reinsurance recovered and recoverable. All these sources are balanced against their "posting" files and then converted to LODESTAR master file format. The key for the loss file is company, state, accident year, claim number, coverage code, and claimant number. This basic loss unit is called a "feature". Other information found in the fixed area of the record include the policy number, policy effective and expiration dates, and rate revision date. The variable portion of the record contains a complete loss history of any given claimant.

After the current month's information has been appended to the appropriate record the record is programmatically examined to determine if the feature has reopened or if the transaction is a continuation of the current feature. This dynamic feature analysis also determines if a feature has changed status (e.g. closed without payment) in other ways since the last update.

III. On-Demand Reporting Facility

The ability to select the "segment" (a selected group of companies, states, products, coverages, and limit profiles) was an important design requirement. Fixed or pre-defined aggregation levels were not an acceptable alternative. Another important design requirement was the ability to select statistics (e.g. number of paid features, dollars of paid losses). The solution was a design that incorporated CICS to both edit the selection criteria that the user computed via pre-defined screens and to submit batch jobs to the JES internal reader.

Upon completion of the screens above, a batch job is submitted to generate the desired report(s) at the level of detail requested.

IV. Batch Report Generation

The on-line segment, statistic, and time period selection facility permits the user to select what data he or she wishes to analyze in up to ten different report formats. The request is then translated to a batch job which actually completes the request. The batch job has two fundamental components: extraction of the requested data and reporting of that data.

Extraction is accomplished by reading the master file and comparing each record to each of the up to twenty separate report requests from the on-line. If the record matches one or more of the requests it is flagged to indicate which segment it matches and is passed on to the reporting section. This method has two advantages: the very large master files are only read once and the resulting extract file has no redundant records.

The extract file is input to any or all of the report programs. A report program will perform an internal sort of the extract file, sorting only those records which are flagged for that report. During the sorting process the aggregation levels defined in the on-line are established in the sort-key. Therefore, upon sort completion, a simple control break logic can be utilized and the report can be generated.

The process defined in the preceding paragraph is repeated for each segment requested from the on-line. The extract file is therefore passed for each of these segments. Depending on the request, this can be significant.

V. Report Output

Finally, the user has several choices in output type. The user selects one or a combination of several media when the pre-defined screens (Section III above) are being completed.

The choices are essentially paper, a file for downloading to a PC (for importing into spreadsheet software), or a file that becomes input to analysis routines programmed on the mainframe.

THE IMPACT OF INFLATION ON THE THEORY OF LIFE CONTINGENCIES

Cecilia M. LePere

TITLE: THE IMPACT OF INFLATION ON THE THEORY OF LIFE CONTINGENCIES

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ABSTRACT: Current actuarial notation permits the calculation of annuities given annual benefit amounts that are consistent or that increase annually by a specified dollar amount. This paper, entitled "The Impact of Inflation on the Theory of Life Contingencies," provides a methodology that can be used to calculate the total value of annuities for which benefits are expected to increase annually by a specified percentage rate. The methodology permits the calculation of the value of the annuity on both nominal (undiscounted) and discounted bases.

The Impact of Inflation on the Theory of Life Contingencies

By Cecilia M. LePere

It is often necessary to consider the effect of annual increases in benefit amounts when calculating the value of workers compensation payments expected to be made over a period of time. This situation occurs most frequently when evaluating the cost of workers compensation benefits that will ultimately be paid to persons injured in states that provide for annual increases in indemnity benefits. Other circumstances arise in which it is necessary to approximate the value of future medical benefits that are expected to increase as a result of economic inflation.

The annual increase in indemnity benefits, often called escalation, is commonly calculated as a percentage of the current indemnity benefits an injured worker receives. The amount of the increase is usually determined based on the calculated percentage increase in the average weekly wage of workers in the state of jurisdiction governing the benefits. The increase may be capped at a maximum which is stipulated in the state's workers compensation law.

The annual increase in medical benefits is typically measured by changes in the medical consumer price index. The annual changes in medical benefits are commonly expressed as a percentage increase over the current year's medical benefits.

The intent of this article is to provide a methodology that can be used to calculate the value of the escalated benefits. The formulas are developed in a way that permits the evaluation of the expected costs on both nominal and present value bases.

A life contingency commutation formula is available for situations in which the benefits paid increase by a specified dollar amount for each year the claimant survives. This formula is commonly represented $(Ia)_x$ and denotes the present value of an increasing immediate life annuity payable to a person who is x years of age. The formula assumes an annual benefit of one unit is paid at the end of year one, two units are paid at the end of year two, three units are paid at the end of year three, etc. $(Ia)_x$ has been defined as follows.

$$(Ia)_x = \sum_{t=1}^{\infty} t v^t \, {}_tp_x$$

$$= \sum_{t=0}^{\infty} {}_t|a_x$$

$$= \sum_{t=0}^{\infty} \frac{N_{x+t+1}}{D_x}$$

$$= \frac{S_{x+1}}{D_x} \quad \text{where} \quad S_x = \sum_{t=0}^{\infty} N_{x+t} \qquad (1)$$

Similarly, an n-year temporary increasing annuity can be expressed as follows.

$$(Ia)_{x:\overline{n}|} = \sum_{t=o}^{n-1} t|n-t a_x$$

$$= \sum_{t=o}^{n-1} \frac{N_{x+t+1} - N_{x+n+1}}{D_x}$$

$$= \frac{S_{x+1} - S_{x+n+1} - nN_{x+n+1}}{D_x} \qquad (2)$$

In the formulas referenced, the payments increase at a constant dollar amount equal to one unit each year. However, as discussed previously, there are situations which may occur in which payments are expected to increase at a constant percentage rate rather than by a constant dollar amount.

The annual percentage rate the payments are expected to increase has been defined as the annual rate of escalation. The calculation of the present value of these payments can be simplified through an adjustment in the life contingency formulas previously referenced. The adjustment is made in the portion of the commutation formula that reflects the annual rate of discount for interest. For example,

Assume:

Annual Escalation Percentage Rate = e
Annual Interest Percentage Rate = i
Current Age of Life = x

Present Value of Future Benefits =

$$a_x^e = \sum_{t=1}^{\omega-x-1} v_e^t \, {}_tp_x \qquad \text{where } v_e^t = \left(\frac{1+e}{1+i}\right)^t$$

$$= \sum_{t=0}^{\omega-x-1} \frac{D_{x+t}^e}{D_x^e}$$

$$= \frac{N_x^e}{D_x^e}$$

It is important to point out that, in the case in which benefits are constant over the duration of the claim payments, the escalation percentage equals zero. Therefore, v_e^t in the above formula becomes v^t (i.e. $\left(\frac{1+e}{1+i}\right)^t$ becomes $\left(\frac{1}{1+i}\right)^t$. As a result, the formula (3) above condenses to the form of an immediate life annuity, a_x.

Utilizing this formula simplifies the calculation of the present value of an annuity that increases annually at a constant percentage. A similar procedure can be used to consider a constant percentage of escalation in deferred and temporary annuities as well as in annuities due and continuous annuities. Therefore, this methodology can be utilized to reflect annual changes in the escalation rate as well as the unique pattern of payments for the annuities.

As can be determined from the formulas shown, the discount factor for interest can offset the impact of escalation to some extent. If the rate of interest equals the escalation rate, the effective rate equals zero percent. This means that any increases in payments that are expected as a result of escalation will be totally offset by the interest expected to be earned on the invested funds. For example, if i=6% and e=6%, the effective rate equals 1.06/1.06. The resulting factor of 1.0 implies there is no effective annual increase in cost. Likewise, an escalation rate of 1.06 and an interest rate of 1.035 imply an effective annual increase of 1.06/1.035 or 1.024. Finally, given an escalation rate of 1.060 and an interest rate of 1.070, an effective annual decrease of 1.060/1.070 or .991 is implied.

Commutation formulas have been derived in Table 1 based on the mortality table shown in Table 2. The mortality table has been computed using the U.S. Life Tables for Total Population and are based on data compiled by the U.S. Department of Commerce from the 1969-71 census of the United States. These tables are utilized to calculate the present value of future payments in the following example.

Example:

Claimant's age: 35 years
Annual benefit: $5,200
Interest rate: 3.5%
Escalation rate: 6.0%
Duration of benefits: Life
Benefits are paid at the end of each year.

$$\$5,200 \times a^{e}_{35} = \$5,200 \times \frac{N^{e}_{35}}{D^{e}_{35}}$$

$$= \$5,200 \times \frac{15,315,238}{217,842}$$

$$= \$365,583$$

where; $D^{e}_{35} = v_{e}^{35} \, l_{35}$

$$= \left(\frac{1.060}{1.035}\right)^{35} \times 94,482$$

$$= 217,842$$

and; $N^{e}_{35} = \sum_{t=35}^{110} D^{e}_{t}$

$$= D^{e}_{35} + D^{e}_{36} + D^{e}_{37} + \ldots + D^{e}_{110}$$

$$= 217,842 + 222,639 + 227,504 + \ldots + 0$$

$$= 15,315,238$$

TABLE 1

Commutation Amounts Considering Escalation*

Age	D_x^e	N_x^e	Age	D_x^e	N_x^e	Age	D_x^e	N_x^e
0	100,000	20,532,860	36	222,639	15,097,396	73	313,587	4,047,766
1	100,365	20,432,860	37	227,504	14,874,757	74	306,248	3,734,179
2	102,661	20,332,495	38	232,430	14,647,253	75	297,724	3,427,931
3	105,051	20,229,834	39	237,410	14,414,823	76	287,990	3,130,207
4	107,514	20,124,783	40	242,440	14,177,413	77	277,072	2,842,217
5	110,047	20,017,269	41	247,514	13,934,973	78	265,047	2,565,145
6	112,649	19,907,222	42	252,632	13,687,459	79	252,029	2,300,098
7	115,316	19,794,573	43	257,774	13,434,827	80	238,139	2,048,069
8	118,050	19,679,257	44	262,934	13,177,053	81	223,418	1,809,930
9	120,856	19,561,207	45	268,091	12,914,119	82	207,946	1,586,512
10	123,732	19,440,351	46	273,238	12,646,028	83	191,900	1,378,566
11	126,682	19,316,619	47	278,359	12,372,790	84	175,515	1,186,666
12	129,703	19,189,937	48	283,447	12,094,431	85	158,994	1,011,151
13	132,789	19,060,234	49	288,481	11,810,984	86	142,383	852,157
14	135,934	18,927,445	50	293,447	11,522,503	87	125,778	709,774
15	139,130	18,791,511	51	298,315	11,229,056	88	109,521	583,996
16	142,374	18,652,381	52	303,065	10,930,741	89	94,037	474,475
17	145,666	18,510,007	53	307,668	10,627,676	90	79,660	380,438
18	149,010	18,364,341	54	312,084	10,320,008	91	66,490	300,778
19	152,415	18,215,331	55	316,289	10,007,924	92	54,553	234,288
20	155,887	18,062,916	56	320,245	9,691,635	93	43,932	179,735
21	159,427	17,907,029	57	323,930	9,371,390	94	34,709	135,803
22	163,038	17,747,602	58	327,303	9,047,460	95	26,897	101,094
23	166,724	17,584,564	59	330,344	8,720,157	96	20,447	74,197
24	170,490	17,417,840	60	333,009	8,389,813	97	15,301	53,750
25	174,345	17,247,350	61	335,272	8,056,804	98	11,273	38,449
26	178,294	17,073,005	62	337,090	7,721,532	99	8,200	27,176
27	182,338	16,894,711	63	338,418	7,384,442	100	5,896	18,976
28	186,478	16,712,373	64	339,198	7,046,024	101	4,178	13,080
29	190,707	16,525,895	65	339,380	6,706,826	102	2,932	8,902
30	195,025	16,335,188	66	338,909	6,367,446	103	2,045	5,970
31	199,423	16,140,163	67	337,728	6,028,537	104	1,400	3,925
32	203,908	15,940,740	68	335,790	5,690,809	105	956	2,525
33	208,475	15,736,832	69	333,062	5,355,019	106	653	1,569
34	213,119	15,528,357	70	329,242	5,021,957	107	437	916
35	217,842	15,315,238	71	325,114	4,692,715	108	290	479
			72	319,835	4,367,601	109	189	189
						110	0	0

* Based on the Life Tables for Total Population compiled from the 1969-71 census.

Annual Rate of Interest	3.5%
Annual Rate of Escalation	6.0%

TABLE 2

Mortality Table*

Age	l_x	Age	l_x	Age	l_x
0	100,000	36	94,285	73	54,913
1	97,998	37	94,073	74	52,363
2	97,876	38	93,843	75	49,705
3	97,792	39	93,593	76	46,946
4	97,724	40	93,322	77	44,101
5	97,668	41	93,028	78	41,192
6	97,619	42	92,712	79	38,245
7	97,573	43	92,368	80	35,285
8	97,531	44	91,995	81	32,323
9	97,494	45	91,587	82	29,375
10	97,460	46	91,144	83	26,469
11	97,430	47	90,662	84	23,638
12	97,401	48	90,142	85	20,908
13	97,367	49	89,579	86	18,282
14	97,322	50	88,972	87	15,769
15	97,261	51	88,315	88	13,407
16	97,181	52	87,605	89	11,240
17	97,083	53	86,838	90	9,297
18	96,970	54	86,007	91	7,577
19	96,846	55	85,110	92	6,070
20	96,716	56	84,142	93	4,773
21	96,580	57	83,103	94	3,682
22	96,438	58	81,988	95	2,786
23	96,292	59	80,798	96	2,068
24	96,145	60	79,529	97	1,511
25	96,000	61	78,181	98	1,087
26	95,859	62	76,751	99	772
27	95,721	63	75,236	100	542
28	95,586	64	73,631	101	375
29	95,448	65	71,933	102	257
30	95,307	66	70,139	103	175
31	95,158	67	68,246	104	117
32	95,003	68	66,254	105	78
33	94,840	69	64,166	106	52
34	94,666	70	61,934	107	34
35	94,482	71	59,715	108	22
		72	57,360	109	14
				110	0

* Based on the Life Tables for Total Population compiled from the 1969-71 census as compiled by the U.S. Department of Commerce.

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INJURED WORKER MORTALITY

William R. Gillam

Abstract/Introduction

The paper discusses the NCCI Special Call for Injured Worker Mortality data and the ensuing analysis of that data. The design of the call and the company's ability to supply elements of the call is discussed.

The goal was to test the hypothesis that the mortality of pensioned workers differs significantly from that of the general population. Because of ambiguities in the data, the hypothesis cannot be accepted or rejected. It does appear that, at least for ages below 60, the reported injured worker mortality rate is higher than standard US Life. Between age 60 and 74, the injured worker mortality rate does not differ appreciably from U.S. Life.

The differences in mortality, even if accepted, do not imply significant redundancy or inadequacy of tabular reserves.

INJURED WORKER MORTALITY

Despite the existence of much supposition on the topic, the mortality of injured workers relative to the standard United States Life (USL) Tables has not been well analyzed. Interest waxes in time of deteriorating results, but then wanes as results improve. As if we need more proof that the 1980's represent a prolonged time of less than satisfactory compensation results, here is one more indication: a study of injured worker mortality has been completed.

THE CALL

In 1985, the Actuarial Committee at NCCI resolved to begin such a study with a special call for data. In 1987, the call was submitted to a small group of carriers who agreed to provide such data. In 1988, the call was repeated, but to a larger group of carriers. Submissions were received from 10 carriers in all, most in the second year only.

The specifications for the call and committee sanction for its release were completed in 1986. Data elements, as described below, included several parameters of the claim, to be evaluated at two or more sequential year-end dates.

Exhibit 1 shows the record layout of the call. Report ID, Carrier Code, Claim Number and State would be used for identification. Injury Date and Age at Injury were essential for the study; Pension Date and Sex were desirable, but fortunately not essential, as several carriers did not retain this information in the data files used to answer the call. Type of Benefit code was a simplification of standard NCCI Statistical plan coding. Paid and Incurred amounts of Indemnity and Medical were also not essential, but desirable for corollary studies, and usually easy to capture on company data files. The Reason for Closing field required a choice of only three

codes, so was too simplified to allow much analysis. Permanent Total (PT) claims closed for reasons "Other" than fatality had to be handled carefully.

It would probably have been useful to distinguish Occupational Disease from Trauma cases, as allowed in the last entry, but this information was difficult for most companies to provide. In any case, the vast majority of claims reported were traumatic.

The difficulty in identifying certain claim characteristics was not critical in the following sense. The study would attempt to determine the propriety of applying the standard USL tables to the reserves for PT cases. If we study the mortality experience of a random cross section of PT cases, we measure the applicability of the standard tables to the particular group we want, whatever the profile of that group happens to be.

Workers who qualify for a life pension comprise a very select cohort. The potential for permanent injury is not usually recognized at the time of a serious accident. Certainly, no pension is established if the worker dies or, better, recovers within a short time. Even if the adjuster were able to recognize such a condition at an early stage, it usually takes time to convince the central office of the need to classify a claim as PT for the purpose of data reporting, benefit calculation and reserving.

Initially the Special Call required that the earliest report be at least five years subsequent to the accident date. That was later softened so that any claim recognized as PT could be submitted.

Most of the claims submitted were at least four years old; that is, the actual accident had occurred more than four years before the evaluation dates in the call. Many claims were much more mature than that. We assumed we had an unbiased sample of claims set

up for lifetime reserves.

The call data did not allow the study of mortality rates for all seriously injured workers. Specifically, we were not able to measure the (presumably high) mortality rate of workers who had just been injured. What we could measure is the mortality rate of workers who live long enough after their serious accident to enter the elite group of lifetime pensioners.

THE DATA

We received data from nine carriers, covering three calendar periods beginning 12/31/83 and ending 12/31/86. We believe the data submitted represented an honest attempt to provide an unbiased sample. Unfortunately, inconsistencies in coding necessitated several assumptions described below.

1) Wrong Benefit Type

   Benefit types 0, 5, 6, 7, 8 or 9 appeared over 3,000 claims. We assumed these were regular statistical plan codes for non-serious losses and did not include them in the study. (Interestingly, inclusion of these claims in the study would increase the sample mortality rate)

2) Reason For Closing Omitted

   There were 1,151 reports with the reason for closing field left blank. We assumed them to be open claims.

3) Multiple Deaths and Life After Death

   A few claims which were closed due to death reappeared, usually closed, but occasionally open. We excluded such subsequent reports.

4) Reopened Claims

222 PT claims closed for reasons other than death (code 3) sometimes appear later as open. These are inferred to be open the whole time.

5) Disappearing Claims

Claims appearing as open in one report may fail to appear in any subsequent report. These were treated as though closed for reasons other than death (code 3) in the subsequent report. There were 801 such claims.

6) Holes

286 claims reported as open in one evaluation disappear the next, but reappear later. These are inferred to be open for the missing evaluation. (One claim skipped over two evaluations, and this gap was filled).

7) Contradictory Age Reports

For example, a claimant may have been reported at 12/31/84 to be 52 and to be 54 at 12/31/85. We chose the lower of the two ages. There were 956 such reports.

Because of these choices, we do not have strong confidence in the statistics derived in the study. Nevertheless, the patterns which emerge may be correct. For the purpose of discussion, we treat the results as valid, as well as outline their economic implications.

Mortality Rates

We first attempted to measure life expectancy of PT claimants using usual loss development triangle techniques. On the advice of a Life Actuary with the Travelers Insurance Company, we realized our folly and shifted to the study of mortality rates by age. There may be a lesson in this.

The data was used to produce empirical mortality rates by age as follows:

1) As of the beginning of each year (previous year end), there would be some number of open PT cases for each age of claimant. Date of injury and age of claimant at injury could then be used to determine age of a pensioner as of the evaluation date. We assumed the last birthday was six months before the accident.

For each age, then, there was a sample of claimants who could be followed through the calendar year to the next evaluation.

2) Claims missing or listed as closed for reasons other than fatality at the next year-end evaluation do not represent a full life. Since the exact date of closure is not coded in the call (and apparently difficult to obtain on company files), it was necessary to assume an average mid-year closing. Using this logic, every claim closed for reasons other than fatality would be counted as one-half a life in the denominator of the mortality rate sample and zero fatalities in the numerator. This is a standard life actuarial technique.

3) The total of claims open for a year or closed due to death, plus half of the claims closed for other reasons, is denoted f_x, the lives at age x.

4) For age group x, we denote the number of deaths as d_x. For a given calendar year the sample mortality rate q_x would be the number of fatalities in that group during the year, divided by the number of lives in the same group so $q_x = d_x/f_x$.

5) The call spanned more than a single calendar year; respondents to the call reported claims evaluated at 12/31/83, '84, '85 and '86 (or some subset of those years, depending on available company data). As such, several calendar years' data could be compiled to evaluate empirical mortality rates. It should be apparent that a single claimant reported as living through several year-

end evaluations would be part of the exposure for age x in the first evaluation, x + 1 in the second, and so on. The first evaluation of a claim did not have to be 12/83, but could be 12/84 or 12/85.

Exhibit 2 shows the data and mortality rates based on this procedure. In the fitting described below, we chose to use only the ages with more than 30 lives, which were 23 to 87.

Average Injured Worker Mortality

The mortality rate on the sample ages 23 to 87, is 0.01943. This is 575 deaths over an exposure of 29586.5 lives, and appears in the first line of Exhibit 2.

With the same exposure by age, the U.S. Life expected mortality is 0.01787, as appears in the first lines of Exhibit 3.

Ignoring for a moment the differences in mortality by age, the binomial standard deviation of the sample mortality rate is:

$$\sqrt{\frac{q(1-q)}{n}} = .0008$$

Using this, we see that the U.S. Life mortality is lower than the sample by nearly two standard deviations.

$$\frac{.01787 - 0.01943}{.0008} = -1.95$$

This would indicate that difference in mortality rates between injured workers and U.S. Life is statistically significant.

THE FORCE OF MORTALITY

A smoothing procedure facilitates the comparison of the resulting sample mortality

rates by age to standard. Life actuaries have found that a Makeham curve of the form $M_x = A + BC^x$, where M_x is the force of mortality at age x, provides a good fit to empirical fatality statistics. We fit a Makeham curve to the Injured Worker Mortality data, using a weighted least squares regression.

1) The Makeham force of mortality first must be restated as a mortality rate by age. This is done as follows:

$$Q_x = 1 - e^{-\int_x^{x+1} M_t dt}$$

$$= 1 - e^{-\int_x^{x+1} A+BC^t \, dt}$$

$$= 1 - e^{-\left[A + \frac{B(C-1)\cdot C^x}{\ln C}\right]}$$

2) For each age x, the differences between the sample, q_x, and the theoretical can be calculated and squared. The weighted sum of squares is then

$$F = \Sigma f_x (q_x - Q_x)^2$$

a function of A, B and C.

3) Since neither Q_x nor $\ln Q_x$ is a linear function of x, minimizing the sum of squared differences must be done using techniques of numerical analysis. We used the SAS package NLIN, which uses the gradient method for finding simultaneous zeros of the partial derivative of F with respect to A, B and C.

4) The fitting described in (2) and (3) weights each age group by the number of lives. It also may be reasonable to weight each sample q_x equally. We did this as well and it leads to a slightly lower fitted force of mortality for injured workers, i.e., closer to U.S. Life.

THE FIT

In fitting the Makeham, we chose to use only the ages in which there were at least 30 lives, 23 to 87. The fit resulted in $A=5.314 \times 10^{-3}$, $B=1.483 \times 10^{-5}$, and $C=1.111$, with

rho squared of 94.0%. Exhibit 4-A compares the graph of the mortality rates implied by the fitted curve with the data points.

The standard USL mortality from 1979-81 census data yields an excellent fit to a Makeham curve with parameter A = 7.447×10^{-4}, B = 5.728×10^{-5} , and C = 1.093 with rho squared of 100%. For this fit, we minimized an unweighted sum of squared differences. In most of our analysis, we did not use this latter fit, but used the published values of the commutation function. Exhibit 4-B compares the empirical U.S. Life data with the fitted curve.

SOME CONCLUSIONS

The comparison of the injured worker morality curve with the U.S. Life q_x value in Exhibit 4-C is much more illuminating than a comparison of the raw data points with a curve. The graph shows a mortality rate for injured workers that is slightly higher at ages less than 60, but very slightly lower for the ages 61 to 72.

Is it possible that injured worker mortality is so near standard?

We think it is but it is important to remember the characteristics of the cohort in the study. An injured worker, it must be observed, is healthy enough to have been working in the first place. Such a person not only has demonstrated an ability to survive an accident, but, by the definition of PT status, enjoys an annuity sufficient for lifetime support. The unfortunate worker whose workplace injury results in an immediate death, or one soon enough to preclude the need for a life pension, never enters the study.

A member of this sample population would presumably be resigned to his/her status and under relatively low stress, with the trauma of the original injury well behind. It is also quite probable that older workers may qualify for permanent disability with an injury less severe than that necessary to disable a younger worker. This may in

part account for the favorable mortality of workers around the age of retirement.

THE ISSUE OF RESERVING

One of the motivations for this study was a test of the propriety of using Standard US Life Tables to reserve P.T. cases. We observed -- and rationalized -- slight differences in mortality rates by age among injured workers and the general population.

The mortality found in the study implies that the average life pension on injured workers should be 1.7% lower than on standard. This finding is nominally supported by a weighted average of life pensions using sample distributions of permanently injured workers by age and wage level. The analysis is based on data from the call for Detailed Claim Information, and may be seen in Exhibit 5.

Should action be taken on the possible 1.7% overstatement of reserves for injured workers?

Perhaps, but the issue is more complicated than a simple argument about mortality rates. Pensions for permanently injured workers are subject to multiple decrements. Besides fatality, there may well be other reasons for change in claim status. Such claims often change to Permanent Partial if the worker can resume employment in some other capacity. In fact, he may recover completely, and be taken off the pension rolls. In some states, benefits may terminate after some specified period or maximum amount. In most cases, pensions will terminate, or at least be reduced, upon eligibility of the claimant for Social Security. All these things may reduce the need for a full lifetime reserve.

It should be noted that the death of the injured worker may result in a change of claim status to a benefit for the surviving spouse. This is a significant force upward on the required reserve for the permanently injured worker.

Weighing these considerations to decide whether to reduce reserves 1.7% is unnecessary. The loss development analysis done in regular ratemaking almost always indicates upward reserve development. It would not be appropriate to lower reserves still further.

The above concerns pertaining to multiple decrements may indicate a need for further study of the denouement of P.T. claims. Certainly, the process is far more complicated than that contemplated by simple mortality tables. This study is complete, however, in that the mortality rate of pensioned workers has been determined to be hardly different than standard. It also deflates the argument that company reserving is redundant, as may once have been postulated.

The contention that the mortality rate of injured workers is higher than standard is often used in rate hearings as an argument against the need for rate increases: Don't redundant reserves on pensions of short-lived injured workers overstate losses and hence the need for rate relief? Actuaries know that any systematic aggregate reserve redundancy or deficiency will result in measurable patterns of loss development, which in turn will be compensated for in standard methods used to project future ultimate loss levels. In that sense, then, the argument is already fallacious. Now there is direct evidence that the conjecture of high mortality in these cases is false.

ACKNOWLEDGEMENTS

Alan Reynard, FSA, Travelers Insurance Company, gave us advice of significant value.

Leigh Halliwell, NCCI Senior Actuarial Analyst, performed most of the statistical analysis.

Injured Worker Mortality Study
Record Layout

Field Name	Width	Column(s)	Description
Report ID	2	1-2	Calendar Year of report; 1986
Carrier Code	5	3-7	5-digit insurer code number
Claim #	18	8-25	Alpha - numeric code uniquely defining a claim
State	2	26-27	Numeric postal abbreviation for state of jurisdiction determining benefits
Injury Date	6	28-33	Date injury occurred (in MMDDYY format)
Pension Date	6	34-39	Date identified as a pension case (in MMDDYY format)
Age at Injury	2	40-41	Age on date of injury
Sex	1	42	M = male F = female U = unknown
Type of Benefit	1	43	1 = Death 2 = Permanent Total 3 = Permanent Partial 4 = Temporary Total
Medical Paid	7	44-50	Medical benefits paid (whole dollars) as of report date

Field Name	Width	Column(s)	Description
Medical Incurred	7	51-57	Medical benefits incurred (whole dollars) as of report date
Indemnity Paid	7	58-64	Indemnity benefits paid (whole dollars) as of report date
Indemnity Incurred	7	65-71	Indemnity benefits incurred (whole dollars) as of report date
Reason for Closing	1	72	1 = Open claim 2 = Death of claimant 3 = Other
OD/Trauma Code	1	73	1 = Occupational Disease 2 = Traumatic

EXHIBIT 2

INJURED WORKER MORTALITY TABLE

Age (x)	Lives (fx)	Deaths (dx)	QINJWKR (qx)
	29586.5	575	.01943
23	36.5	0	.00000
24	45.5	0	.00000
25	59.0	1	.01695
26	71.0	0	.00000
27	81.5	0	.00000
28	112.5	1	.00889
29	131.0	2	.01527
30	143.5	1	.00697
31	143.0	1	.00699
32	167.5	1	.00597
33	205.0	1	.00488
34	214.0	2	.00935
35	257.0	0	.00000
36	282.5	2	.00708
37	303.5	2	.00659
38	310.5	1	.00322
39	347.0	3	.00865
40	387.5	4	.01032
41	403.0	3	.00744
42	422.5	2	.00473
43	421.0	1	.00238
44	415.5	5	.01203
45	431.5	3	.00695
46	464.5	3	.00646
47	480.5	2	.00416
48	510.0	5	.00980
49	582.5	5	.00858
50	598.0	3	.00502
51	604.5	9	.01489
52	631.0	5	.00792
53	710.0	9	.01268
54	735.0	7	.00952
55	764.5	10	.01308
56	828.0	11	.01329
57	848.5	8	.00943
58	923.0	8	.00867
59	982.0	10	.01018
60	1001.5	13	.01298
61	1017.5	15	.01474
62	1025.5	9	.00878
63	1036.0	9	.00869
64	1006.5	28	.02782
65	961.5	23	.02392
66	902.0	22	.02439
67	849.5	27	.03178
68	820.0	17	.02073
69	766.0	16	.02089
70	708.5	24	.03387
71	624.0	22	.03526
72	564.5	19	.03366

EXHIBIT 2 (CONT'D)

INJURED WORKER MORTALITY TABLE

Age (x)	Lives (fx)	Deaths (dx)	QINJWKR (qx)
73	511.5	15	.02933
74	442.0	20	.04525
75	383.5	14	.03651
76	305.0	23	.07541
77	263.5	14	.05313
78	248.5	16	.06439
79	202.5	17	.08395
80	201.0	16	.07960
81	170.0	14	.08235
82	156.5	14	.08946
83	128.0	9	.07031
84	99.0	10	.10101
85	63.5	5	.07874
86	41.5	5	.12048
87	34.0	8	.23529

EXHIBIT 3

COMPARISON OF INJURED WORKER AND U.S. LIFE MORTALITIES

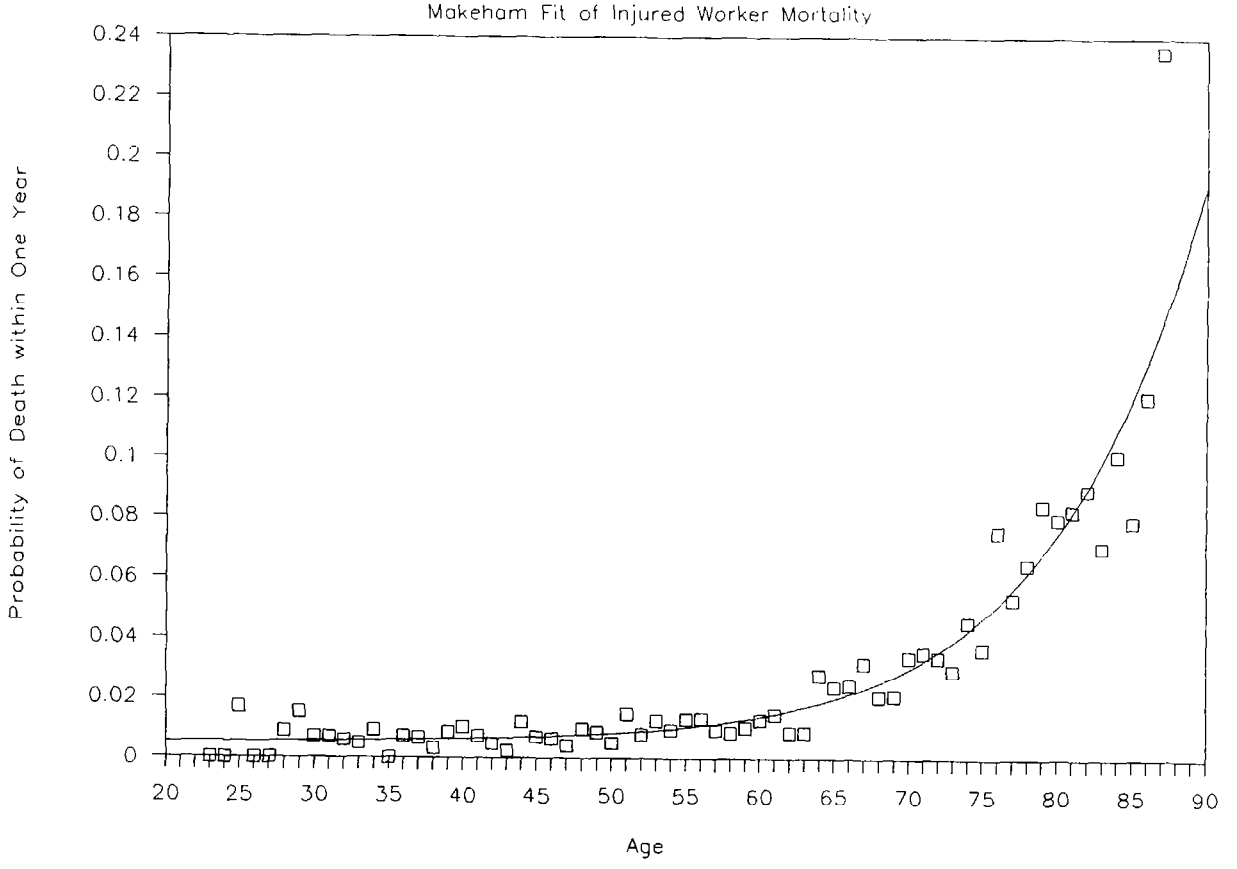
Age (x)	INJWKR (qx)	INJFIT (Qx)	USLIFE
	.01943	.01944	.01787
23	.00000	.00548	.00134
24	.00000	.00550	.00133
25	.01695	.00552	.00132
26	.00000	.00554	.00131
27	.00000	.00557	.00130
28	.00889	.00560	.00130
29	.01527	.00563	.00131
30	.00697	.00567	.00133
31	.00699	.00571	.00134
32	.00597	.00575	.00137
33	.00488	.00580	.00142
34	.00935	.00586	.00150
35	.00000	.00592	.00159
36	.00708	.00599	.00170
37	.00659	.00607	.00183
38	.00322	.00615	.00197
39	.00865	.00625	.00213
40	.01032	.00636	.00232
41	.00744	.00647	.00254
42	.00473	.00660	.00279
43	.00238	.00675	.00306
44	.01203	.00691	.00335
45	.00695	.00709	.00366
46	.00646	.00729	.00401
47	.00416	.00751	.00442
48	.00980	.00775	.00488
49	.00858	.00802	.00538
50	.00502	.00833	.00589
51	.01489	.00866	.00642
52	.00792	.00904	.00699
53	.01268	.00945	.00761
54	.00952	.00991	.00830
55	.01308	.01042	.00902
56	.01329	.01099	.00978
57	.00943	.01162	.01059
58	.00867	.01232	.01151
59	.01018	.01310	.01254
60	.01298	.01396	.01368
61	.01474	.01492	.01493
62	.00878	.01599	.01628
63	.00869	.01717	.01767
64	.02782	.01848	.01911
65	.02392	.01993	.02059
66	.02439	.02155	.02216
67	.03178	.02334	.02389
68	.02073	.02532	.02585
69	.02089	.02752	.02806
70	.03387	.02996	.03052
71	.03526	.03267	.03315
72	.03366	.03567	.03593

EXHIBIT 3 (CONT'D)

COMPARISON OF INJURED WORKER AND U.S. LIFE MORTALITIES

Age (x)	QINJWKR (qx)	QINJFIT (Qx)	QUSLIFE
73	.02933	.03898	.03882
74	.04525	.04266	.04184
75	.03651	.04673	.04507
76	.07541	.05122	.04867
77	.05313	.05620	.05274
78	.06439	.06170	.05742
79	.08395	.06777	.06277
80	.07960	.07447	.06882
81	.08235	.08185	.07552
82	.08946	.09000	.08278
83	.07031	.09896	.09041
84	.10101	.10881	.09842
85	.07874	.11964	.10725
86	.12048	.13151	.11712
87	.23529	.14452	.12717

EXHIBIT 4–A


Makeham Fit of Injured Worker Mortality
Probability of Death within One Year
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
20
25
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35
40
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55
60
65
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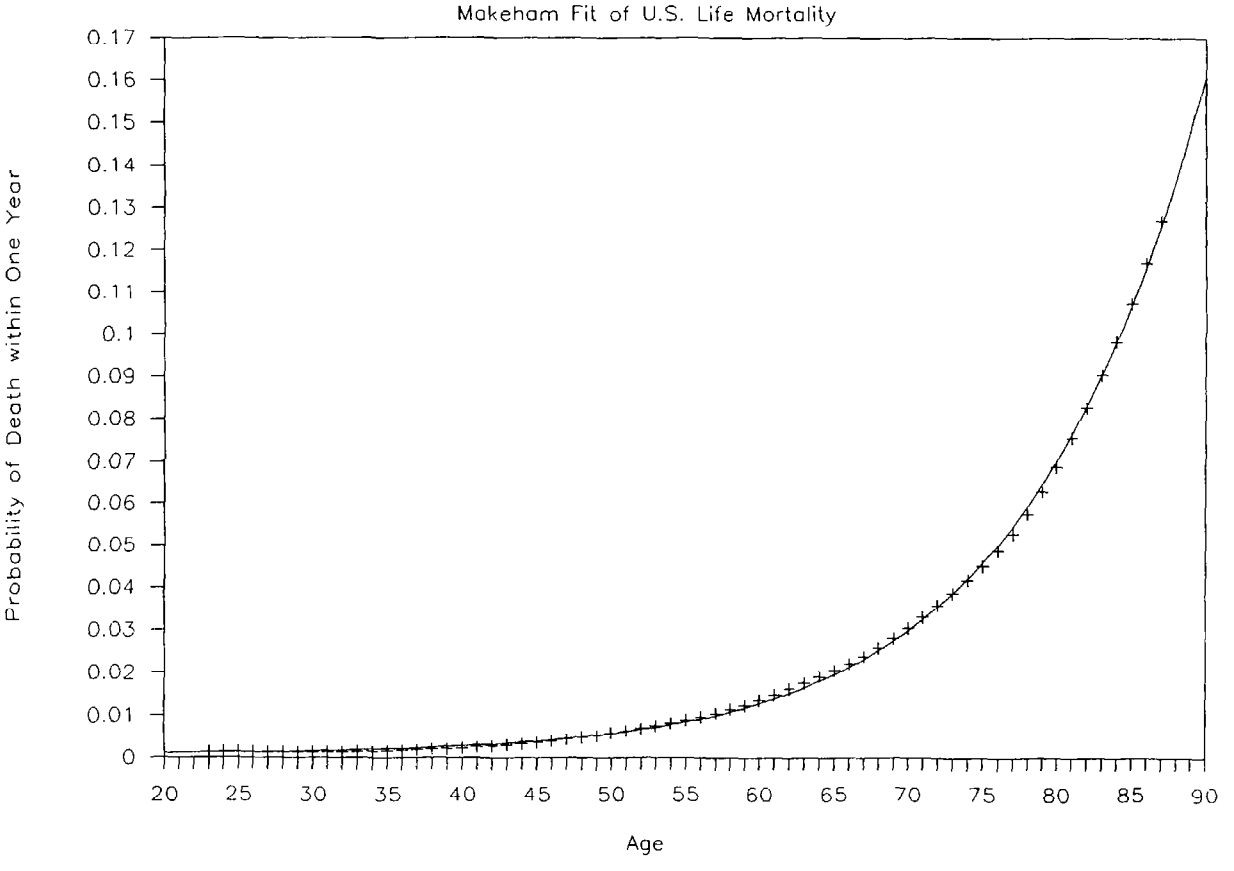
75
80
85
90
Age

EXHIBIT 4-B


Makeham Fit of U.S. Life Mortality
Probability of Death within One Year
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
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Age

EXHIBIT 4–C

Comparison of Mortalities

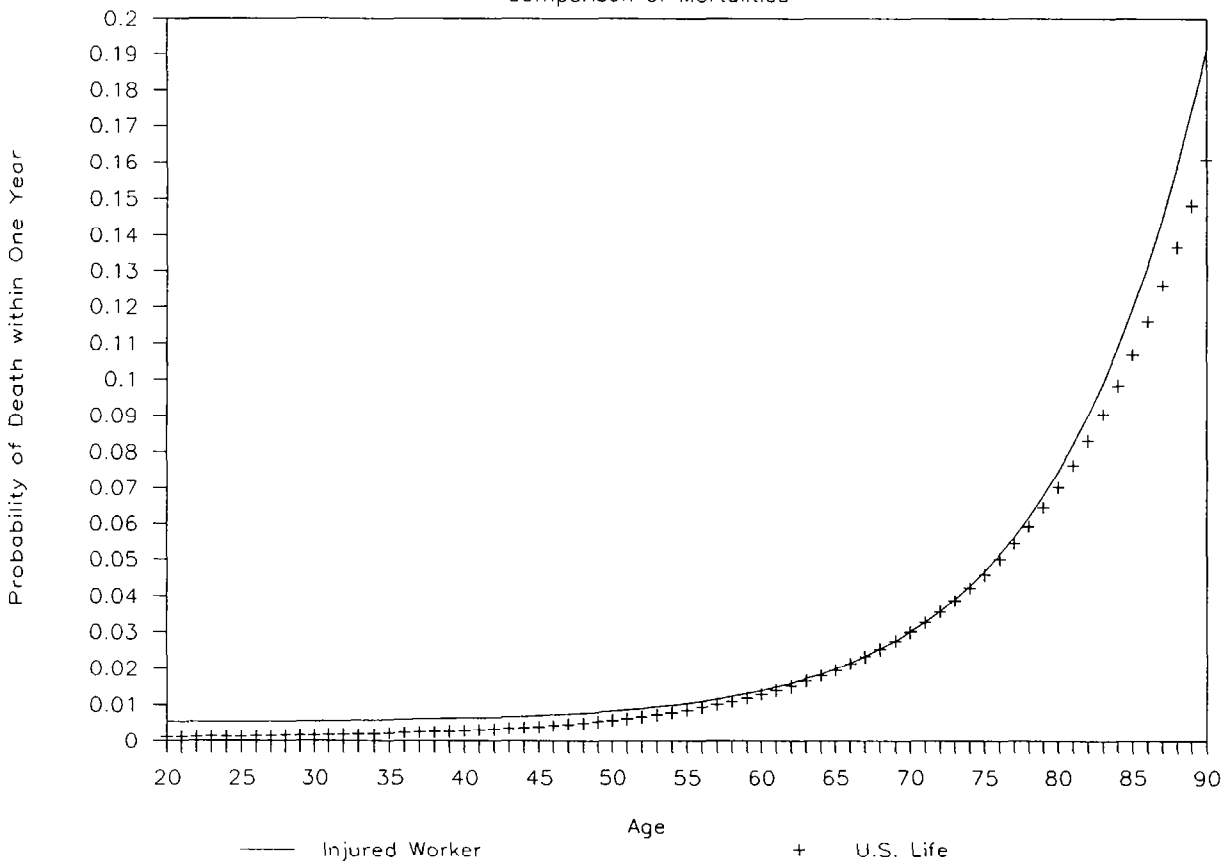


EXHIBIT 5

RESERVES REQUIRED BY U.S. LIFE AND INJURED WORKER MORTALITIES
FOR A SAMPLE OF PENSIONED INJURED WORKERS
(Interest Rate=6.0%)

Age	Injured Workers	Average Annual Benefit	US Life Annuity	Inj Wkr Annuity
21	2	$9,641	15.607	14.782
22	1	$9,360	15.562	14.749
23	9	$9,363	15.515	14.713
24	14	$9,516	15.465	14.676
25	24	$9,219	15.412	14.636
26	34	$9,147	15.355	14.594
27	35	$9,792	15.295	14.549
28	64	$10,117	15.230	14.502
29	65	$10,561	15.162	14.452
30	64	$10,327	15.089	14.398
31	77	$10,365	15.012	14.342
32	89	$10,648	14.931	14.283
33	116	$11,098	14.844	14.220
34	106	$11,635	14.753	14.154
35	136	$11,503	14.658	14.084
36	156	$11,649	14.558	14.011
37	152	$11,767	14.453	13.933
38	148	$11,932	14.343	13.851
39	171	$12,156	14.228	13.765
40	189	$12,862	14.109	13.674
41	197	$12,611	13.984	13.579
42	199	$12,582	13.855	13.478
43	189	$13,045	13.721	13.373
44	194	$13,306	13.582	13.262
45	216	$13,139	13.437	13.146
46	229	$13,571	13.288	13.024
47	222	$13,467	13.134	12.896
48	268	$13,366	12.975	12.763
49	290	$13,785	12.812	12.623
50	258	$13,496	12.644	12.477
51	286	$13,367	12.472	12.325
52	296	$13,419	12.295	12.167
53	336	$13,607	12.113	12.001
54	337	$13,694	11.926	11.829
55	356	$13,631	11.735	11.651
56	387	$13,669	11.538	11.465
57	369	$13,439	11.337	11.273
58	449	$13,426	11.131	11.074
59	449	$13,459	10.920	10.869
60	432	$13,546	10.705	10.656
61	444	$13,433	10.487	10.437
62	464	$13,465	10.266	10.212
63	449	$13,127	10.042	9.981
64	429	$13,078	9.815	9.743
65	384	$12,930	9.584	9.500
66	358	$12,597	9.349	9.251
67	342	$12,347	9.110	8.997
68	351	$12,319	8.866	8.739

EXHIBIT 5 (CONT'D)

RESERVES REQUIRED BY U.S. LIFE AND INJURED WORKER MORTALITIES
FOR A SAMPLE OF PENSIONED INJURED WORKERS
(Interest Rate=6.0%)

Age	Injured Workers	Average Annual Benefit	US Life Annuity	Inj Wkr Annuity
69	288	$11,778	8.620	8.476
70	261	$11,768	8.372	8.209
71	233	$11,406	8.122	7.940
72	201	$11,178	7.872	7.667
73	188	$10,738	7.620	7.392
74	155	$10,464	7.367	7.116
75	126	$10,141	7.111	6.838
76	104	$10,063	6.852	6.561
77	100	$9,678	6.591	6.284
78	95	$9,351	6.329	6.008
79	70	$9,400	6.068	5.734
80	78	$8,634	5.809	5.462
81	59	$8,256	5.556	5.194
82	58	$8,465	5.309	4.930
83	40	$7,869	5.069	4.670
84	21	$7,691	4.836	4.416
85	16	$7,275	4.609	4.167
86	11	$6,804	4.390	3.925
87	14	$7,481	4.181	3.690
88	9	$6,333	3.982	3.463
89	3	$7,041	3.788	3.243
90	3	$6,881	3.599	3.032
91	4	$7,043	3.416	2.829
92	4	$6,555	3.244	2.634
93	1	$6,803	3.086	2.449
95	2	$5,914	2.810	2.105
96	2	$4,994	2.694	1.947
97	1	$5,481	2.591	1.797
99	1	$5,406	2.415	1.525
100	1	$5,323	2.341	1.401
	12,981	$12,563	11.196	11.004

Relative Difference = (Avg Inj Wkr/Avg US Life)-1 = -1.7%

REVIEW OF REPORT OF COMMITTEE ON MORTALITY FOR DISABLED LIVES

Gary G. Venter

Barbara Schill

Jack Barnett

Review of Report of
Committee on Mortality for
Disabled Lives

Abstract

The problem of what mortality tables to use for injured worker pension reserves is not a new one for casualty actuaries. A study of this issue appeared in the 1945 PCAS. We looked at the data from that study using computer intensive non-linear regression to model the ratio of injured worker to standard mortality.

The methodology and some of the conclusions may still be applicable today. In particular, injured worker mortality after some years comes close to standard mortality, and after some age may actually be lower. Because of this, not much credit can be taken on pension case reserves, even though for younger workers initial mortality is much higher than standard.

Some technical issues in non-linear regression are addressed, including a method to adjust for heteroscedasticity and using the information matrix to measure the significance of the parameters.

REVIEW OF REPORT OF COMMITTEE ON MORTALITY FOR DISABLED LIVES

Loss reserves for workers compensation cases in the U.S. now are in the area of $50 billion, much of which is tied up in long term cases. Typically standard mortality is used to reserve these cases, but in serious cases a factor (e.g. 10) is applied to the mortality rates on a judgment basis, as in Snader (1987). Some disabled life tables have been calculated from other benefit systems, involving, for example heart disease or cancer cases, but these are probably not appropriate for injured workers.

Faced for the 25 years since the inception of workers compensation insurance with the need for injured worker mortality tables, the CAS decided to take action, and in 1937 appointed a Committee of Three to investigate the feasibility of undertaking a study. Coincidentally, the Committee of Three came up with three conclusions:

1. Very substantial results could not be expected from the data then available.

2. A start should be made in order to get carriers to keep appropriate records.

3. It was as feasible then as it would be at any later time to do a mortality study based on the statistical system in place.

Thus, working with the National Council on Compensation Insurance, a call for disability data was sent out in October 1938. The data used in the study was for accident years or policy years 1930-1935, depending on how carriers reported, and the first year of disability was excluded from each case. Although the first year after the accident was excluded, the data represented fairly new claimants, who might be expected to display higher mortality than more stabilized cases. The results of the study would thus be most applicable to such cases.

This review looks at the data from that study to see if there are any relationships between disabled worker mortality and standard mortality that might endure to the present. A regression methodology is used to explore this question. As the uniform variance assumption of least squares regression is not met, a method for dealing with this heteroscedasticity is developed. The information matrix from the (non-linear) regression is used to test goodness of fit and to develop prediction intervals.

COMMITTEE REPORT

The report of the committee on mortality for disabled lives produced a mortality table for lives disabled by industrial accidents. The table is based on permanent

total cases and nondismemberment permanent partial cases involving 50% or more disability. In total there were 8,598 life years of exposure with 285 claim terminations. The 285 claim terminations included deaths and the few cases where the injured person recovered. These claim terminations did not include cases where permanent partial disability followed permanent total, the benefit period ended, or a lump sum settlement was made. Since the mortality table in workers compensation is primarily used to determine expected claim size it is appropriate to include terminations due to either death or recovery. An alternative method is a multiple decrement model in which deaths and recoveries are measured separately. However the committee chose to consider both types of terminations together.

In the original study, mortality rates for each age were calculated based on the reported data. For those ages with sparse data, below age 22 and over age 73, the reported mortality rates were weighted with the mortality rates from the 1930 U.S. life tables for white males. The resulting mortality rates for ages 10 to 105 were graduated using the Whittaker-Henderson technique. Mortality tables were then constructed with these mortality rates.

The authors state that the mortality rate for these disabled lives is 144% of that for white males in the 1930 U.S. Life Tables. This was determined by comparing the expected number of deaths in the next year under the disabled workers table of mortality rates versus the U.S. Life Table mortality rates. The expected number of deaths is determined by multiplying the number of lives exposed for each age group by the respective mortality rate and summing for all ages. It is clear from the data, however that this 144% varies dramatically and systematically by age.

RELATIONSHIP BETWEEN DISABLED WORKER MORTALITY AND STANDARD MORTALITY

We projected the mortality rates for disabled workers based on our hypothesis that the ratio, q_d/q_u, between the mortality rate for disabled workers, q_d, and that of the U.S. population, q_u, is a decreasing function of age. This is an alternate method of graduation to the Whittaker-Henderson formula used by the committee. Initially we set the mortality rate of disabled workers equal to a constant plus a power of the mortality rate of the U.S. multiplied by a function of age;

$$q_d = a + q_u^b \times f(\text{age})$$

We found that the constant, a, was insignificant. In all regressions attempted of q_d on q_u and age our estimate of the power of q_u was approximately one. Together these suggest that the ratio of q_d/q_u can be adequately expressed as a function of age.

Let y_t be the ratio of observed disabled worker mortality to U.S. population standard mortality at age t. A fairly simple model was found to fit quite well:

$$y_t = be^{ct} + \varepsilon_t \; ; \qquad \text{with } b = 0.32 \text{ and } c = 84$$

The ratio of the parameter to its estimated standard deviation is 3.72 for b and is 10.83 for c.

Graph 1 shows three regressions of y_t on be^{ct} with the parameter c set equal to 1, 40 and 84. The graph illustrates the importance of c in the model.

In addition, in graph 2 a comparison of the ratio of q_d/q_u to the confidence intervals for the model indicates heteroscedasticity (the variance around the fitted line is not constant over age). The observed q_d/q_u has a much greater variance at younger ages where, on average, q_d/q_u is greater. Therefore rather than assume the constant variance of standard least squares regression it was assumed that errors were normally distributed with mean equal to zero and standard deviation proportional to the mean of the regression. This is referred to as the multiplicative error model and is described further in Appendix 1. The distribution of the error term ε_t is approximated by a normal distribution:

$$\varepsilon_t = y_t - be^{ct} \sim N(0, b^2e^{2ct}\sigma^2) \qquad \text{where } \sigma^2 = \text{constant of proportionality}$$

In Appendix 1 it is shown that this model can be fit by a standard regression with the "dependent variable" set equal to one , and y_t/be^{ct} as the independent variable. Then the parameters b and c are found to be, respectively, 0.35 and 88 which are respectively, 6.86 and 13.08 times the estimated parameter standard deviations. Graph 3 shows the observed data along with the confidence intervals for this multiplicative model. This illustrates the basis for the assumption that the standard deviation of ε_t is proportional to the mean, in that the model confidence intervals more closely approximate the data variations. Table 1 compares the observed y_t and the values from the two fitted models.

To estimate the standard deviations of the parameters for this model we calculated the variance-covariance matrix which is the inverse of the information matrix as described on page 81 of *Loss Distributions* by Robert V. Hogg and Stuart A. Klugman. The calculations of the information matrix and its resulting variance-covariance matrix for both the constant variance and the proportional variance model are described in Appendix 2.

A comparison of mortality rates for 1930 and 1980 from the U.S. Life Tables and the projected mortality rates for disabled workers based on the models is shown in

Table 2. Since the committee used the 1930 U.S. Life Table for white males we used the same 1980 table.

DISCUSSION

The hypothesis that the ratio between the mortality rate for disabled workers versus the population, q_d/q_u, is a decreasing function of age is supported by the data analysis described above.

It is possible that the ratio q_d/q_u is closer to one now than is reflected in the 1930's data. The improvements in mortality of the general population may be heavily influenced by a disproportionately larger improvement in the mortality of disabled people. It will require another study of disabled workers mortality to determine if disabled worker mortality is now closer to standard mortality.

At an advanced age, there is a crossover point at which the mortality rate of disabled workers becomes less than that of the general population (Table 2). With the committee's method this occurs at age 81. With the multiplicative error model the crossover occurs at age 85. It is reasonable to assume that since these disabled workers had recently been in the work force at an advanced age they were healthier than the general population. The permanent injuries received were not necessarily serious enough to increase the mortality of these exceptionally healthy individuals to the level of the general population at that age.

In fact a fairly minor injury may be "permanent" at an older age in that the person may not return to work. This may contribute to the existence of a crossover point since permanent disability benefits supplement retirement income for older workers and could thus discourage return to work. Since on average today's workers retire earlier than they did in the 1930's the crossover point may be earlier now.

Below are the annuity values for certain ages calculated with the 1979-81 U.S. Life Tables and with estimated disabled workers' mortalities based on the proportional variance model. These annuity values contain an interest rate assumption of 3.5% and escalating benefits are assumed to increase at 7% per year.

Lifetime Annuity Values

	U.S. Life Table		Disabled Mortality	
Age	Nonescalating	Escalating	Nonescalating	Escalating
25	22.756	136.298	20.272	111.229
45	17.776	58.464	16.631	52.366
65	11.009	21.442	10.507	20.364
85	4.606	6.117	4.811	6.486

These disabled worker mortalities are created from the general population of permanent total disabled workers and may not apply to the most severely injured workers. As mentioned earlier since the mortality rates are based on recently injured workers they may not be appropriate for claimants who have been disabled for many years. The disabled worker annuity values do not change drastically from those for the general population but they do decrease. However for advanced ages the annuities under the disabled worker mortalities are actually greater than under the U.S. Life Table mortalities.

CONCLUSIONS

1. A model which declines with age seems appropriate for q_d/q_u, the ratio between the mortality rate for disabled workers and that of the U.S. population.

2. At some age this ratio goes below unity and this may now occur at an earlier age.

3. The impact of the disabled mortality rates on the annuity values was moderate then and would probably be even less now.

4. These results may not be applicable to the first year of injury when higher mortality rates are likely or to longer period after injury where mortality rates closer to standard are expected.

Table 1

Age	Ratio of Observed Mortality Rate to 1930 U.S. Standard Mortality Rate	Fitted Ratio from Constant Variance Model (1)	Fitted Ratio from Proportional Variance Model (2)
24	8.2541	10.6254	13.7001
25	9.6604	9.2373	11.8330
26	14.7013	8.1175	10.3362
27	8.0420	7.2020	9.1196
28	2.6410	6.4446	8.1185
29	2.1841	5.8113	7.2855
30	6.3777	5.2764	6.5853
31	5.2512	4.8207	5.9914
32	4.9615	4.4293	5.4833
33	0.0000	4.0907	5.0453
34	8.4568	3.7956	4.6651
35	3.9529	3.5369	4.3329
36	1.1813	3.3088	4.0409
37	2.0036	3.1066	3.7828
38	4.4908	2.9264	3.5536
39	3.2170	2.7652	3.3489
40	2.1517	2.6202	3.1654
41	1.3040	2.4894	3.0002
42	1.2320	2.3709	2.8509
43	2.1564	2.2631	2.7154
44	2.9405	2.1648	2.5922
45	2.8654	2.0749	2.4796
46	1.7136	1.9924	2.3765
47	2.4772	1.9165	2.2818
48	1.5980	1.8464	2.1946
49	2.3456	1.7816	2.1141
50	1.5227	1.7216	2.0396
51	2.8791	1.6658	1.9705
52	1.2276	1.6139	1.9062
53	1.3889	1.5654	1.8464
54	1.3349	1.5201	1.7905
55	1.5800	1.4778	1.7383
56	1.6526	1.4380	1.6894
57	1.6292	1.4006	1.6435
58	1.8961	1.3655	1.6004
59	0.5384	1.3324	1.5598
60	2.1415	1.3012	1.5215
61	1.6078	1.2716	1.4854
62	1.7536	1.2437	1.4513
63	1.3142	1.2172	1.4190
64	0.7567	1.1921	1.3884
65	1.1449	1.1683	1.3594
66	0.9790	1.1457	1.3318
67	1.2446	1.1241	1.3056
68	0.6668	1.1036	1.2806
69	0.7997	1.0840	1.2569
70	0.2978	1.0653	1.2342
71	0.9891	1.0474	1.2126
72	1.5846	1.0304	1.1919
73	0.8659	1.0140	1.1721
74	0.9447	0.9984	1.1532
75	1.3963	0.9834	1.1351
76	0.8882	0.9690	1.1177
77	1.6805	0.9552	1.1010
78	1.1974	0.9419	1.0850
79	0.6338	0.9292	1.0697
80	0.4526	0.9169	1.0549
81	1.3872	0.9051	1.0407
82	1.1605	0.8937	1.0270
83	0.6815	0.8828	1.0138
84	0.3539	0.8722	1.0011
85	1.2400	0.8620	0.9889
86	0.5859	0.8521	0.9770

(1) Y(t)=0.32086e**(84/t)
(2) Y(t)=0.35155e**(87.9074/t)

Table 2

1930

AGE	U.S. Life Table tQx	Disabled Mortality: Raw Data tQx'	Committee tQx''	Fit(REG) tQx'''	Fit(MAX) tQx''''
18					
19					
20					
21					
22					
23					
24	.0037	.0302	.0259	.0389	.0501
25	.0037	.0358	.0255	.0343	.0439
26	.0037	.0551	.0250	.0304	.0388
27	.0038	.0306	.0243	.0274	.0347
28	.0039	.0103	.0236	.0251	.0317
29	.0040	.0088	.0227	.0234	.0293
30	.0041	.0263	.0218	.0218	.0272
31	.0043	.0224	.0209	.0205	.0255
32	.0044	.0219	.0201	.0196	.0242
33	.0046	.0000	.0192	.0189	.0234
34	.0049	.0411	.0185	.0184	.0227
35	.0051	.0202	.0178	.0180	.0221
36	.0053	.0063	.0173	.0177	.0216
37	.0056	.0113	.0169	.0175	.0213
38	.0060	.0268	.0166	.0175	.0212
39	.0064	.0205	.0165	.0176	.0213
40	.0068	.0146	.0166	.0178	.0215
41	.0073	.0095	.0169	.0181	.0218
42	.0078	.0096	.0174	.0184	.0221
43	.0082	.0178	.0180	.0187	.0224
44	.0087	.0257	.0187	.0189	.0227
45	.0093	.0266	.0195	.0193	.0230
46	.0099	.0169	.0204	.0197	.0235
47	.0105	.0261	.0214	.0202	.0240
48	.0112	.0179	.0224	.0207	.0246
49	.0120	.0281	.0234	.0213	.0253
50	.0128	.0195	.0245	.0220	.0261
51	.0136	.0393	.0256	.0227	.0269
52	.0146	.0179	.0268	.0235	.0278
53	.0157	.0217	.0281	.0245	.0289
54	.0169	.0225	.0294	.0256	.0302
55	.0182	.0287	.0308	.0269	.0316
56	.0197	.0325	.0322	.0283	.0332
57	.0212	.0346	.0335	.0298	.0349
58	.0229	.0434	.0347	.0313	.0366
59	.0246	.0132	.0358	.0328	.0384
60	.0264	.0566	.0367	.0344	.0402
61	.0284	.0456	.0376	.0361	.0422
62	.0305	.0535	.0383	.0380	.0443
63	.0330	.0433	.0391	.0401	.0468

1980

AGE	U.S. Life Table tQx	Disabled Mortality: tQx'''	tQx''''
18	.0015	.0515	.0701
19	.0016	.0435	.0585
20	.0017	.0374	.0499
21	.0019	.0326	.0430
22	.0019	.0282	.0369
23	.0019	.0239	.0310
24	.0019	.0201	.0259
25	.0018	.0169	.0217
26	.0018	.0144	.0183
27	.0017	.0124	.0157
28	.0017	.0108	.0136
29	.0017	.0097	.0122
30	.0017	.0088	.0109
31	.0016	.0080	.0099
32	.0017	.0074	.0091
33	.0017	.0069	.0085
34	.0017	.0066	.0082
35	.0018	.0065	.0080
36	.0020	.0065	.0079
37	.0021	.0065	.0079
38	.0022	.0066	.0080
39	.0024	.0066	.0080
40	.0026	.0068	.0083
41	.0029	.0071	.0086
42	.0032	.0075	.0090
43	.0035	.0079	.0094
44	.0038	.0083	.0099
45	.0042	.0087	.0104
46	.0046	.0092	.0110
47	.0051	.0099	.0117
48	.0057	.0106	.0126
49	.0064	.0114	.0135
50	.0071	.0122	.0144
51	.0077	.0129	0153
52	.0085	.0137	.0162
53	.0093	.0146	.0172
54	.0103	.0156	.0184
55	.0112	.0166	.0196
56	.0123	.0176	.0207
57	.0134	.0187	.0220
58	.0146	.0200	.0234
59	.0160	.0214	.0250
60	.0176	.0229	.0268
61	.0193	.0246	.0287
62	.0212	.0264	.0308
63	.0232	.0282	.0329

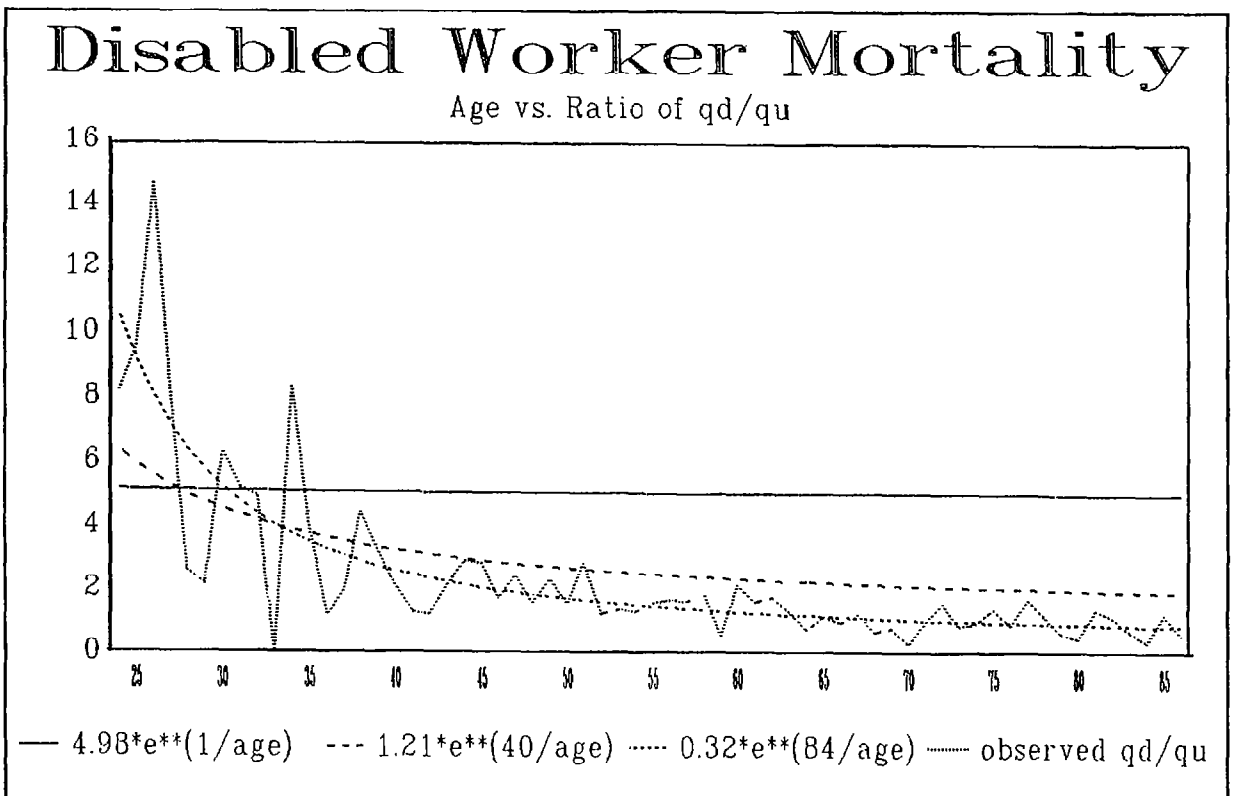
1930

AGE	U.S. Life Table tQx	Disabled Mortality: Raw Data tQx'	Committee tQx''	Fit(REG) tQx'''	Fit(MAX) tQx''''
64	.0357	.0270	.0400	.0425	.0495
65	.0386	.0442	.0412	.0452	.0525
66	.0420	.0411	.0428	.0481	.0559
67	.0456	.0567	.0451	.0512	.0595
68	.0495	.0330	.0481	.0546	.0634
69	.0536	.0429	.0519	.0581	.0674
70	.0580	.0173	.0566	.0617	.0715
71	.0625	.0618	.0621	.0655	.0758
72	.0674	.1068	.0682	.0694	.0803
73	.0727	.0630	.0750	.0737	.0852
74	.0786	.0743	.0822	.0785	.0907
75	.0853	.1190	.0898	.0838	.0968
76	.0927	.0824	.0976	.0899	.1037
77	.1010	.1698	.1056	.0965	.1113
78	.1101	.1319	.1137	.1037	.1195
79	.1199	.0759	.1220	.1114	.1282
80	.1300	.0588	.1305	.1192	.1371
81	.1404	.1948	.1393	.1271	.1461
82	.1512	.1754	.1485	.1361	.1553
83	.1621	.1105	.1581	.1459	.1644
84	.1733	.0613	.1681	.1560	.1735
85	.1847	.2290	.1787	.1662	.1826
86	.1962	.1149	.1899	.1766	.1917
87	.2078		.2019	.1870	.2007
88	.2197		.2146	.1977	.2097
89	.2321		.2283	.2089	.2191
90	.2455		.2429	.2209	.2292
91	.2602		.2587	.2342	.2403
92	.2763		.2757	.2487	.2525
93	.2940		.2941	.2646	.2660
94	.3133		.3140	.2820	.2820
95	.3344		.3356	.3010	.3010
96	.3574		.3589	.3217	.3217
97	.3824		.3841	.3442	.3442
98	.4095		.4113	.3686	.3686
99	.4388		.4406	.3949	.3949
100	.4704		.4720	.4233	.4233
101	.5044		.5057	.4539	.4539
102	.5409		.5417	.4868	.4868
103	.5800		.5799	.5220	.5220
104	.6219		.6204	.5597	.5597
105	.6666		.6666	.5999	.5999
106					
107					
108					
109					

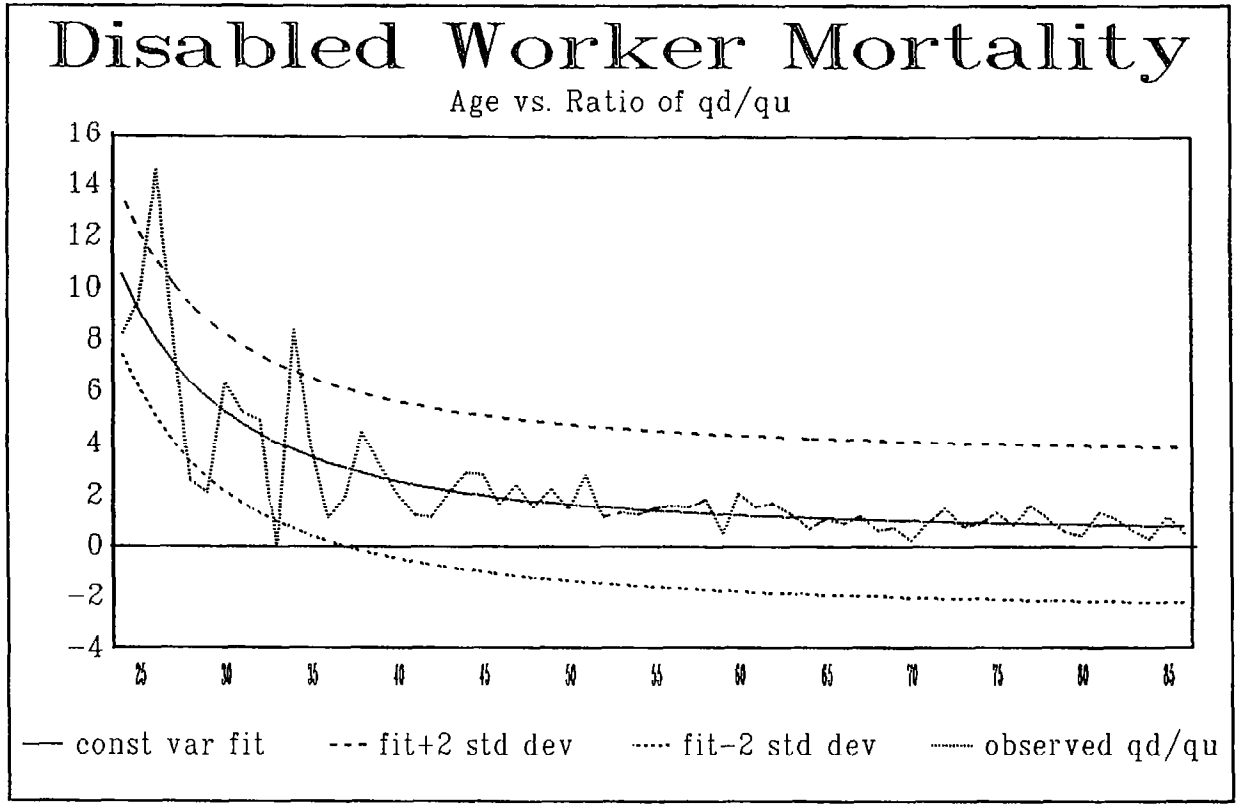
1980

AGE	U.S. Life Table tQx	Disabled Mortality: tQx'''	tQx''''
64	.0252	.0301	.0350
65	.0274	.0320	.0372
66	.0297	.0340	.0395
67	.0322	.0362	.0420
68	.0349	.0386	.0448
69	.0380	.0412	.0478
70	.0415	.0442	.0512
71	.0452	.0473	.0548
72	.0490	.0505	.0584
73	.0529	.0537	.0621
74	.0570	.0569	.0658
75	.0615	.0604	.0698
76	.0664	.0644	.0742
77	.0718	.0686	.0791
78	.0776	.0731	.0842
79	.0839	.0780	.0898
80	.0910	.0834	.0960
81	.0989	.0895	.1029
82	.1073	.0966	.1102
83	.1161	.1045	.1177
84	.1252	.1127	.1254
85	.1351	.1216	.1336
86	.1459	.1313	.1426
87	.1569	.1412	.1515
88	.1677	.1510	.1601
89	.1787	.1609	.1687
90	.1906	.1715	.1779
91	.2039	.1835	.1883
92	.2186	.1968	.1998
93	.2345	.2111	.2122
94	.2506	.2255	.2255
95	.2662	.2396	.2396
96	.2800	.2520	.2520
97	.2931	.2638	.2638
98	.3054	.2749	.2749
99	.3170	.2853	.2853
100	.3278	.2951	.2951
101	.3379	.3041	.3041
102	.3472	.3125	.3125
103	.3559	.3203	.3203
104	.3638	.3275	.3275
105	.3712	.3341	.3341
106	.3779	.3401	.3401
107	.3841	.3457	.3457
108	.3897	.3507	.3507
109	.3949	.3554	.3554

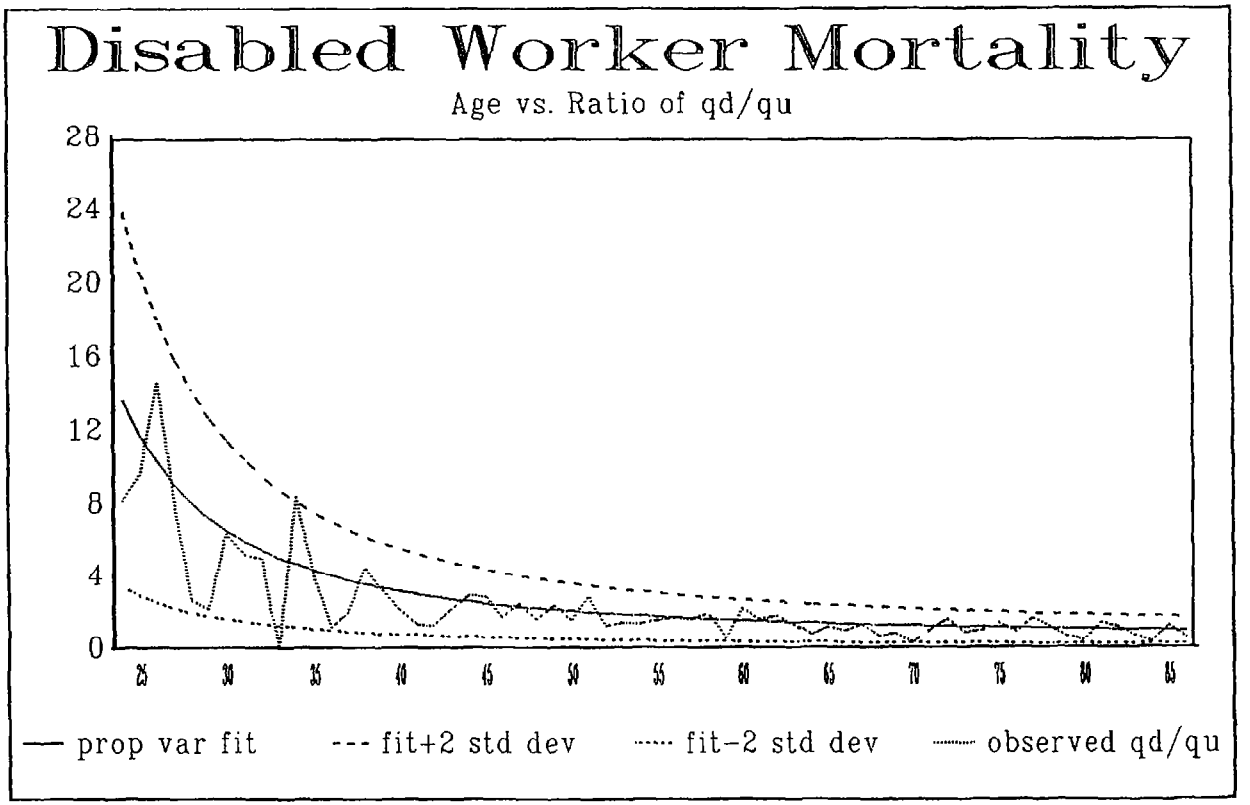
Graph 1


Disabled Worker Mortality
Age vs. Ratio of qd/qu
16
14
12
10
8
6
4
2
0
25
30
35
40
45
50
55
60
65
70
75
80
85
4.98*e**(1/age)
1.21*e**(40/age)
0.32*e**(84/age)
observed qd/qu

Graph 2


Disabled Worker Mortality
Age vs. Ratio of qd/qu
16
14
12
10
8
6
4
2
0
-2
-4
25
30
35
40
45
50
55
60
65
70
75
80
85
const var fit
fit+2 std dev
fit-2 std dev
observed qd/qu

Graph 3


Disabled Worker Mortality
Age vs. Ratio of qd/qu
28
24
20
16
12
8
4
0
25
30
35
40
45
50
55
60
65
70
75
80
85
prop var fit
fit+2 std dev
fit-2 std dev
observed qd/qu

Appendix 1 Regression formulas

Regression with additive error structure

This is the standard least squares regression method.

Model is : $y_t = g(x_{1t}...x_{kt}) + \epsilon_t$

where: y_t is the dependent variable

$x_1...x_k$ are the independent variables

g is the function with parameters to be estimated

ϵ_t is $\sim N(0,\sigma^2)$

The additive error structure is appropriate when it can be assumed that the conditional variance = $var(y_t \mid g(x_{1t}...x_{kt}))$ = constant = σ^2. In other words the variance σ^2 is independent of t. This is an assumption of least square regression referred to as homoscedasticity.

Assuming a normal distribution of the disturbance term ϵ_t
the maximum likelihood estimates for the parameters of g minimize:

$$\sum_t \epsilon_t^2 = \sum_t \left[y_t - g(x_{1t}...x_{kt})\right]^2$$

The regression function used is: $g(x_{1t}) = be^{c/t}$

where $x_{1t} = t$ = age

Our model becomes : $y_t = be^{c/t} + \epsilon_t$

where y_t is the observed ratio of injured worker mortality to standard mortality at age t.

The regression finds b and c which minimize: $\sum_t \left[y_t - be^{c/t}\right]^2$

Appendix 1 Regression Formulas

Regression with multiplicative error structure.

Model is : $y_t = g(x_{1t}...x_{kt})(1+\epsilon_t) = g(x_{1t}...x_{kt}) + \epsilon_t \cdot g(x_{1t}...x_{kt})$

where ϵ_t is $\sim N(0,\sigma^2)$

Thus the disturbance term increases in size with the function.

This multiplicative error structure is appropriate when it can be assumed that the var$\{ y_t \mid g(x_{1t}...x_{kt})\} = g(x_{1t}...x_{kt})^2\sigma^2$ i.e, the variance increases with the square of the function (the conditional mean).

Also, $$\epsilon_t = \frac{y_t - g(x_{1t}...x_{kt})}{g(x_{1t}...x_{kt})} = \frac{y_t}{g(x_{1t}...x_{kt})} - 1$$

This ϵ_t satisfies the assumptions of standard least squares regression, that is : $\epsilon_t \sim N(0,\sigma^2)$, so the maximum likelihood estimates of the parameters of g minimize:

$$\sum_t \left[\frac{y_t}{g(x_{1t}...x_{kt})} - 1 \right]^2$$

An alternative model (which we did not use) is : $y_t = g(x_{1t}...x_{kt}) + \epsilon_t \sqrt{g(x_{1t}...x_{kt})}$

Which requires minimization of : $$\sum_t \left[\frac{y_t}{\sqrt{g(x_{1t}...x_{kt})}} - \sqrt{g(x_{1t}...x_{kt})} \right]^2$$

var$\{ y_t \mid g(x_{1t}...x_{kt})\} = g(x_{1t}...x_{kt})\sigma^2$

Here the variance increases linearly with the conditional mean.

Both of these error structures are examples of heteroscedasticity, a common violation of the assumptions of least squares regression.

A multiplicative model was used and eventually chosen as the model that best "fit" our data .

The regression function used is: $g(x_{1t}) = be^{c/t}$

where $x_{1t} = t$ = age

Our model becomes : $y_t = be^{c/t}(1 + \epsilon_t)$

For this model , the regression minimizes: $\sum_t \left[\frac{y_t}{be^{c/t}} - 1\right]^2$

This is equivalent to minimizing the sum of the squares of the proportional errors.

Appendix 2 Significance of Parameters

Regression can be regarded as fitting a distribution (often a normal distribution) to the error terms ϵ_t by the method of maximum likelihood.

Variances and covariances of the regression parameters can thus be estimated by the inverse of the information matrix as described in *LOSS DISTRIBUTIONS* by Robert V. Hogg - Stuart A. Klugman (Page 81).

If $f(\epsilon;\theta)$ is the density function for the error terms, and θ is a vector listing the parameters to be estimated, the ijth element of the information matrix is:

$$a_{ij}(\theta) = -nE\left[\frac{\partial^2 \ln f(\epsilon;\theta)}{\partial\theta_i\partial\theta_j}\right], \quad \text{Here n is the number of observations.}$$

This is typically estimated by:

$$a_{ij} \approx -\sum_{t=1}^{n}\frac{\partial^2 \ln f(\epsilon_t;\hat{\theta})}{\partial\theta_i\partial\theta_j} = -\frac{\partial^2}{\partial\theta_i\partial\theta_j}\ln\prod_{t=1}^{n} f(\epsilon_t;\hat{\theta})$$

Where $\hat{\theta}$ is the vector of parameter estimates and
ϵ_t = observed deviation from the model for observation t.
Thus the information matrix is estimated by the second partials of the negative loglikelihood.

Additive error structure

For our model: $y_t = be^{c/t} + \epsilon_t$ $\quad \hat{\theta} = \langle b,c,\sigma^2\rangle$ and $f(\epsilon_t;\theta) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\epsilon_t^2/2\sigma^2}$
so that $: \epsilon_t = y_t - be^{c/t}$ $\quad$ Since $\epsilon_t \sim N(0,\sigma^2)$

Thus $\ln f(\epsilon_t;\theta) = -\frac{1}{2}\ln 2\pi - \ln\sigma - \frac{\epsilon_t^2}{2\sigma^2}$

$$= -\tfrac{1}{2}\ln 2\pi - \ln\sigma - \left[y_t - be^{c/t}\right]^2\frac{1}{2\sigma^2} \qquad \text{Since } \epsilon_t = \left[y_t - be^{c/t}\right]$$

Appendix 2 Significance of Parameters

Taking the partial derivatives of $\ln f(\epsilon_t;\theta)$ with respect to b,c and σ^2 (after some algebra) yields the following estimates of the a_{ij} :

$$a_{11} = \frac{1}{\sigma^2}\sum_t e^{2c/t}$$

$$a_{12} = a_{21} = \frac{1}{\sigma^2}\sum_t \frac{e^{c/t}}{t}\left[2be^{c/t} - y_t\right]$$

$$a_{22} = \frac{b}{\sigma^2}\sum_t \frac{e^{c/t}}{t^2}\left[2be^{c/t} - y_t\right]$$

$$a_{13} = a_{31} = \frac{1}{\sigma^4}\sum_t e^{c/t}\left[y_t - be^{c/t}\right] = \frac{1}{\sigma^4}\sum_t e^{c/t}\,\epsilon_t$$

$$a_{23} = a_{32} = \frac{b}{\sigma^4}\sum_t \frac{e^{c/t}}{t}\left[y_t - be^{c/t}\right] = \frac{b}{\sigma^4}\sum_t \frac{e^{c/t}}{t}\,\epsilon_t$$

$$a_{33} = -\frac{n}{2\sigma^4} + \frac{1}{\sigma^6}\sum_t\left[y_t - be^{c/t}\right]^2 = -\frac{n}{2\sigma^4} + \frac{1}{\sigma^6}\sum_t \epsilon_t^2$$

For the data used the sum is from t=24 to t=86.

Appendix 2 Significance of Parameters

For our example the maximum likelihood estimates of the parameters are:

$\hat{b} = .32$, $\hat{c} = 84$ and $\hat{\sigma}^2 = 2.34$ yielding the

Information Matrix:

$$\begin{bmatrix} 2664.4519 & 28.7613 & .9412 \\ 28.7613 & .3271 & .0104 \\ .9412 & .0104 & 5.0397 \end{bmatrix}$$

Taking the matrix inverse gives us the Variance-Covariance Matrix:

$$\begin{bmatrix} .0074 & -.6493 & 0 \\ -.6493 & 60.1556 & -.0028 \\ 0 & -.0028 & .1984 \end{bmatrix}$$

Our final step is to check the significance of our parameters. We do this by observing the ratio of the estimated parameter values to their standard deviations.

Standard error of parameter b : $\sqrt{.0074} = .086$ $.32/.086 = 3.72$

Standard error of parameter c: $\sqrt{60.16} = 7.76$ $84/7.76 = 10.83$

Parameters b and c appear to be significant.

Appendix 2 Significance of Parameters

Multiplicative error structure

$\theta = \langle b,c,\sigma^2 \rangle$

ϵ_t = observed deviation from the model for observation t

Again: $f(\epsilon_t;\theta) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\epsilon_t^2/2\sigma^2}$ and

$$\ln f(\epsilon_t;\theta) = -\tfrac{1}{2}\ln 2\pi - \ln\sigma - \frac{\epsilon_t^2}{2\sigma^2}$$

$$= -\tfrac{1}{2}\ln 2\pi - \ln\sigma - \left[\frac{y_t}{be^{c/t}} - 1\right]^2 \frac{1}{2\sigma^2} \quad \text{,since } \epsilon_t = \left[\frac{y_t}{be^{c/t}} - 1\right]$$

Taking the partial derivatives of $\ln f(\epsilon_t;\theta)$ with respect to b,c and σ^2 yields the following estimates of the a_{ij} :

$$a_{11} = \frac{1}{b^2\sigma^2} \sum_t (\epsilon_t + 1)(3\epsilon_t + 1)$$

$$a_{12} = a_{21} = \frac{1}{b\sigma^2} \sum_t \frac{1}{t} (\epsilon_t + 1)(2\epsilon_t + 1)$$

$$a_{13} = a_{31} = \frac{1}{b\sigma^4} \sum (\epsilon_t + 1)\epsilon_t$$

$$a_{22} = \frac{1}{\sigma^2} \sum_t \frac{1}{t^2} (\epsilon_t + 1)(2\epsilon_t + 1)$$

$$a_{23} = a_{32} = \frac{1}{\sigma^4} \sum \frac{1}{t} (\epsilon_t + 1)\epsilon_t$$

$$a_{33} = \frac{-n}{2\sigma^4} + \frac{1}{\sigma^6} \sum_t \epsilon_t^2$$

Appendix 2 Significance of Parameters

For our example: $\hat{b} = .35$, $\hat{c} = 88$ and $\hat{\sigma}^2 = .15$ yielding the

Information Matrix:

$$\begin{bmatrix} 2953.559 & 20.9673 & 17.3812 \\ 20.9674 & .1709 & .1104 \\ 17.3812 & .1104 & 1348.404 \end{bmatrix}$$

Taking the inverse of this matrix gives us the Variance-Covariance Matrix:

$$\begin{bmatrix} .0026 & -.3218 & 0 \\ -.3218 & 45.3341 & .0004 \\ 0 & .0004 & .0007 \end{bmatrix}$$

Standard error of parameter b : $\sqrt{.0026} = .051$ $.35/.051 = 6.86$

Standard error of parameter c: $\sqrt{45.33} = 6.73$ $88/6.73 = 13.08$

Parameters appear to be significant.

RISK MARGINS FOR DISCOUNTED LOSS RESERVE

Committee on Reserves of the
Casualty Actuarial Society

- - D R A F T - -

June 14, 1990

RISK MARGINS FOR DISCOUNTED LOSS RESERVES

The purpose of this document is to outline the issues surrounding the uncertainty in estimating reserves for losses and loss adjustment expenses for property/casualty insurers (hereinafter labeled "loss reserves") and the appropriateness of presenting this uncertainty in terms of an explicit "risk margin". The particular context is where loss reserves are presented on a present value discounted basis.

This document was prepared by the Committee on Reserves of the Casualty Actuarial Society. The Committee has drawn upon several sources in preparing this document, including "Risk Theoretic Issues in the Discounting of Loss Reserves" by the CAS Committee on Theory of Risk and "Position Paper on the Methodologies and Considerations Regarding Loss Reserve Discounting" by the CAS Committee on Reserves, both published in the Fall 1987 Edition of the CAS Forum.

The Committee takes no position on the advisability of presenting loss reserves on a discounted basis and nothing in this document should be construed to imply otherwise.

I. Historical Perspective

Loss reserves comprise the largest liability item on a property and casualty insurance company's balance sheet. The associated liabilities by their nature are subject to uncertainty, making their exact determination difficult if not impossible. This is especially true of insurers and reinsurers writing long-tail casualty business where claims can remain unpaid for decades.

Traditionally, reserves have been stated on an undiscounted "full value" basis without explicit recognition given to the time value of money. There have been exceptions to this practice. One such example is workers compensation where most states allow some discounting of long term disability and fatal cases; another is the special treatment afforded by some states to limited purpose medical malpractice speciality companies.

Full value reserves have been viewed by many as containing an implicit margin (i.e., the difference between carried full value reserves and the "true" discounted reserves) which protects the balance sheet from unforeseen events. This margin varies in size according to the degree of conservatism used by the reserve analyst in the estimation of the full value reserves.

Full value reserves have historically been understated for the industry as a whole. Under-reserving has played a major role in several insolvencies where the reserve inadequacy has exceeded policyholders surplus by several multiples. There is the concern that, had explicit

loss reserve discounting been permitted - without accompanying changes in financial reporting and regulation - the problem would have been worse. This is particularly disturbing given the current interest in allowing discounting for many purposes. With the passage of the Tax Reform Act of 1986, the IRS now requires discounting for tax purposes. Furthermore, the AICPA is studying the implementation of discounting for GAAP accounting.

The balance of this paper discusses the issues surrounding an explicit margin for adverse deviations in loss reserves that have been discounted to a present value.

II. The Need for Explicit Reserve Margins

Generally, the longer the development tail for a line of business, the more uncertainty in the estimation of its loss liabilities. Thus a correlation exists between investment income opportunity and reserve uncertainty. While this relationship is more accidental than fundamental, it is true that discounting loss reserves removes a substantial, albeit imprecise, reserve margin. It is also true that the act of discounting does nothing to reduce the uncertainty in the underlying liabilities. Thus discounting loss reserves makes the need for an explicit recognition of risk more pronounced.

As mentioned earlier, industry loss reserve estimates have historically been inadequate. Compilations from the 1988 SEC Loss Reserve Disclosures for 58 publicly traded property/casualty companies indicate the following:

Reserve Date	Emerged Reserve Deficiency (as of December 1988)* Dollars (billions)	Percent of Carried Reserve
1978	$ 7.6	22%
1979	6.9	17
1980	6.2	13
1981	6.3	12
1982	8.5	16
1983	12.3	21
1984	15.9	24
1985	13.9	18
1986	7.6	8
1987	2.1	2

(Note that this table reflects actual emerged reserve deficiencies through the 1988 financial statement. Thus, the true ultimate deficiencies may be higher, particularly for the more recent reserve dates.)

There are numerous reasons for these results, including the following: poor reserve estimation techniques; implicit discounting (i.e., use of intentionally optimistic reserving assumptions); indirect discounting (e.g., use of financial reinsurance); unforeseen or extra-contractual liabilities (e.g., asbestosis, agent orange, DES, EIL, triple-trigger theories of liability, judge-made law, etc); "management" of results during underwriting cycles; and uncollectible reinsurance. Regardless of the reasons, it is clear that the theoretical "discount" has provided a much-needed cushion against adverse development.

* Source: 1988 SEC Loss Reserve Disclosures, A Compilation and Analysis of the SEC Disclosure Data, A Tillinghast Publication.

If reserves are discounted, the reserve analyst and others relying on the financial statements can no longer take comfort in an implicit margin or rely on vague notions of "conservatism". In this situation, an explicit allowance for the uncertainty intrinsic to the reserving process is a necessary component in the presentation of the financial condition of an insurance enterprise.

As a practical matter, precedents exist for explicit margins, e.g., the statutory penalties contained in Schedules F and P of the Statutory Annual Statement.

III. Problems with Explicit Reserve Margins

A number of problems and issues need to be understood before an explicit margin for adverse deviations could be included in reserves.

First, practical methods which are easy to use for estimating margins have not been fully developed. One likely reason for this is that interest earnings associated with full value reserves have been viewed as a sufficient implicit margin.

Second, the inclusion of a specific margin may complicate financial statements and make it more difficult for regulators, industry analysts and others to understand them.

Third, many standards of measuring the solvency of a company by use of benchmarks (e.g., IRIS tests) would be complicated if an explicit margin is established in conjunction with discounting loss reserves.

Fourth, the inclusion of a specific margin could distort Annual Statement development schedules (e.g., Schedule P) as well as industry composites of these schedules.

Fifth, the probable lack of uniformity in approach of calculating margins among companies would make comparison of results and performance difficult.

Sixth, the inclusion of a specific margin might not improve the accuracy of the bottom line but simply move the subjectivity, imprecision and conservatism to a different level.

Seventh, unless there were uniformity of approach and recognition of the margin by the various accounting disciplines, the differences that currently exist among them would widen. It is unclear whether GAAP accounting will allow the additional expense item (reserve margin) because of the principle of matching income and outgo. Tax accounting may not allow the margin because it reduces income and, therefore, tax revenues.

These problems are viewed by some as reasons not to include a margin for adverse deviations. However, many of these problems arise equally with respect to loss reserve discounting. Perhaps the solutions to these problems could help the industry focus on the key underlying problem with reserves - uncertainty.

IV. Derivation of Explicit Margins

The theory of estimating reserve margins has not been developed fully and a technical discussion of current quantification methods is beyond the scope of this paper. European actuaries and academicians have conducted research in this area but the work is highly theoretical with limited applications. To date little work has been done on this subject in North America, although papers addressing the issue have recently emerged in the PCAS and CAS Discussion Paper transcripts.

The CAS Committee on Theory of Risk, in their discussion paper "Risk Theoretic Issues in the Discounting of Loss Reserves," has outlined several approaches. These and other potential methods include:

- Empirical study of historical variation in loss development patterns.

- Empirical study of historical reserve deficiencies.

- Confidence interval techniques which use size of loss distributions to establish probability of the actual losses exceeding an indicated level.

- Ruin theory application, which is the basis for solvency regulation in some European jurisdictions. Reserves are established such that the probability of the company's technical insolvency is reduced to a specified level.

- Utility theory. From a utility function and the distribution of aggregate losses, utility theory can be used to compute a "certainty equivalent". The difference between the certainty equivalent and the expected value reserve represents the risk margin.

- The margin set as the difference between the reserve discounted at a risk-related interest rate and reserve discounted at a riskless rate.

- The margin set at a level that a third party would require to commute the reserves.

Regardless of the method used to calculate a reserve margin, the following four issues remain:

First, a reserve margin should distinguish among the following sources of risk:

- Process risk inherent in any stochastic process.

- Parameter risk which includes such items as reinsurance recoverables, changing company management and practices, changing social-economic environment, etc.

- Risk caused by the use of non-optimal reserving techniques.

- Potential for abnormal, unforeseen liabilities such as extra-contractual obligations caused by retroactive legislation and court decisions.

While these last two items are parameter risks, we list them separately to highlight their importance.

Second, the reserve margin should consider the best estimate of the undiscounted reserve and the corresponding discount. This requires the reserve analyst to make an assessment of payment pattern and interest rate risk.

Third, the reserve margin should vary by line of business and maturity. For example, long tail lines of business generally require a larger reserve margin than short tail lines. Similarly, older more mature accident years may require a smaller reserve margin than younger, less mature accident years.

Fourth, the advisability and/or need for a mandated standard calculation approach should be explored. Is there a compelling need for uniformity among companies?

V. Implications for Financial Reporting

The development and isolation of an explicit risk margin raises many questions in accounting for the margin.

- How should the risk margin be booked: as a liability item or a segregated part of surplus?

- Should it be on the balance sheet at all?

- Should there be different methods for accounting for the risk margin under GAAP; SAP, Tax; and Purchase accounting?

A partial list of the arguments for and against booking the risk margin as a liability item, as a surplus item, and as an off balance sheet item are:

AS A LIABILITY ITEM

Arguments for:

- It becomes more affordable since it may result in reduced taxes
- It corresponds with current practice
- Intuitively reasonable to postpone income until it is certain
- It should be considered a real cost of doing business
- It creates a cushion of solvency

Arguments Against:

- Companies are already being taxed on the present value discount of the liability under the Tax Reform Act of 1986 (TRA 1986)
- Some consumer advocates believe that insurers suppress reported profits by artificially inflating reserves
- It fails to match income and expenses
- It fails to fully recognize the time value of money

AS A SEGREGATED SURPLUS ITEM

Arguments For:

- It maintains cushion for solvency if incorporated as segregated surplus
- It encourages unbiased statement of discounted reserves
- It does not add income incentive for understating reserve margin

Arguments Against:

- If earmarked as segregated surplus, it may restrict dividend payments to investors
- It may confuse potential buyers of the net worth of the company if no standard exists on setting the reserve margin

OFF BALANCE SHEET

Arguments For:

- It does not require funding, but enumerates a measure of risk for discounted loss reserves

- There is historical precedent for other items of this native in the statutory blank (e.g., Schedule P discounting disclosure; Schedule D disclosure of market vs. book value of securities)

- It causes the least amount of accounting disruption

Arguments Against:

- Realistically, it results in no change in current practice

Different issues pertain to different accounting contexts, i.e., GAAP, Statutory (SAP), tax and purchase accounting. Each of the different contexts is discussed below:

GAAP ACCOUNTING

The purposed of GAAP accounting is a direct matching of income and expenses. Therefore, if a discounted reserve provides more relevant information, can be calculated with sufficient reliability, and is measurable, then it should replace the use of a full-value reserve. Not all these attributes are met with sufficient reliability since discounted reserves can vary as much or more than full-value reserves. Therefore, there is sufficient reason to incorporate a reserve margin under GAAP accounting. The direct matching of income and expenses may require the reserve margin to be booked as an item of segregated surplus or as an off-balance sheet item if it is not expected to be utilized.

The reserve margin that is utilized as determined by various adequacy testing can require a "true-up" in the current period or an amortization over the remaining life of the asset or liability.

SAP ACCOUNTING

Under SAP Accounting, the reserve margin needs to be considered to fulfill the basic theory underlying such accounting: conservatism. The reserve margin would be considered as an additional buffer against insolvency for any insurer. The most likely way to account for this margin is to earmark it as a reserve account similar to an Mandatory Securities Valuation Reserve (MSVR) in life insurance or as restricted surplus needed to maintain the solidity of an insurer. As restricted surplus, similar to the surplus for loss portfolios

under Regulation 108 in New York, the funds are not available for paying dividends and must be amortized as loss payments are made. Given the conservatism that is the hallmark of SAP reporting, it is critical that reserve margins be considered concurrent with any permission/requirement of discounting.

TAX ACCOUNTING

Under the Tax Reform Act of 1986 (TRA 1986), an explicit risk margin may be considered a contingency reserve and therefore would not be tax deductible. Also under TRA 1986, an insurer that discounts loss reserves, resulting in a discount which is larger than the discount resulting from the IRS methods, would pay taxes based on the higher discount (and income) amount. The introduction of discounting and an explicit risk margin could result in significantly higher tax payments for insurers.

PURCHASE ACCOUNTING

Purchase accounting requires that all values be at fair market value. If full-value financial statement reserves are the starting point, they are re-stated at present value. The reserve margin (consisting of the difference between the full-value and the present value loss reserves) would be required to be discounted at an interest rate equal to a threshold rate of return considered necessary to attract a willing purchaser. This is necessary whether the reserve margin is booked as a liability or surplus item. The mechanics of the calculation require:

- Establishing the interest earned on assets backing the discounted loss reserves on a time line

- Selecting an investment rate to present value the interest earned

- Calculating the present value of the reserve margin

VI. Implications for Reserve Testing

If an explicit reserve margin is incorporated in the balance sheet and reserves are discounted, many reserve tests based on the statutory Annual Statement will not change or require a minimal effort to place the results on a pro-forma basis with previous results. The IRIS Tests and A.M. Best analysis can be adjusted to add the reserve margin to the discounted reserves for most leverage testing.

To maintain Schedule P testing; reserves would have to be stated at full-value without risk margin. This is the method now used for Schedule P even under circumstances where discounting is permitted.

As for the reserve runoff schedule under SEC Form 10K, this schedule shows either statutory results or GAAP results. If statutory results are not at full-value and are used, then there will be an adverse runoff equal to an amount approximating the discount in these reserves. If GAAP results are used, then this schedule is seriously impaired unless a supplementary schedule is provided showing the accretion of interest on discounted loss reserves. This calendar year test would require knowing the interest accreted by report year which can be very vague since

interest rates earned vary from year to year on cash received. To avoid problems in the use and the calculation of the schedule, the statutory results should be incorporated at full-value. Currently, the SEC form already is filled out with distortions due to discounting loss reserves for some lines of business and the inclusion of loss portfolios within reported results.

Similarly in the Canadian P&C 1 and P&C 2, discounted reserves would have to be restated to a full value basis for use in the runoff schedule (formerly Exhibit 34). In addition for the Minimum Asset Test (or the Test of Adequacy of Deposits in Canada in P&C 2), full value reserves should be used when determining the margin required for Unpaid Claims and Unearned Premiums. Use of discounted reserves would understate the required margin.

If discounting reserves is accepted, other testing of results to assure solvency should be established. Under GAAP, the testing of assumptions such as actual versus expected loss payout and the actual versus expected interest earned need to be initiated to "true-up" discounted loss reserve estimates.

In addition to tests of the adequacy of full-value reserves, new tests and criteria would need to be established to measure departures from expectations with respect to:

- assumptions underlying the discounting calculation (interest rate, payout pattern, etc.)

- assumptions underlying the risk margin

VII. Conclusion

1. The purpose of a risk margin should be to enhance reporting of the financial condition of an insurer, including the disclosure and (to the extent possible) quantification of the uncertainty surrounding reported values.

2. In quantifying and disclosing risk margins within the appropriate reporting context, the reserve analyst should consider the following elements of the process:

   - the best-estimate full-value reserve;

   - the amount of discount for anticipated investment income;

   - a provision for stochastic uncertainty (i.e., process risk); and

- a provision for "future unknowables which are virtually certain to occur." (See David Hartman, Centennial address on "Reserving for Liability Claims," June 1989.)

3. The amount of risk margin should be explicit.

4. Uniformity of approach for establishing at least minimum explicit risk margins should be encouraged. Departures from this uniform approach should be disclosed.

5. Further research in the quantification of appropriate risk margins should be encouraged among the Casualty Actuarial Society membership.

In summary, the Committee on Reserves believes that the issues pertaining to explicit reserve risk margins cannot be isolated from those surrounding reserve discounting. Unfortunately, the techniques for quantifying risk margins are not as well advanced. However, we do not believe that this is a valid reason for ignoring or deferring consideration of risk margins.

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STUDY OF INSURANCE COMPANY INSOLVENCIES FROM 1969-87 TO MEASURE THE EFFECTIVENESS OF CASUALTY LOSS RESERVE OPINIONS

American Academy of Actuaries
Committee on Property Liability
Insurance Financial Reporting

AMERICAN ACADEMY OF ACTUARIES

September 28, 1990

To: Insurance Commissioners, Directors & Superintendents
Chief Examiners

Re: **Casualty Loss Reserve Opinions**

The American Academy of Actuaries Committee on Property-Liability Insurance Financial Reporting is pleased to enclose a report on its study of insurance company insolvencies from 1969-87, which seeks to measure the effectiveness of casualty loss reserve opinions. The study commenced in August, 1989 and reflects responses received through June, 1990. The committee especially appreciates the work done by the Chief Examiners in each of the states which responded.

We hope that you will find this report both interesting and useful. The report consists of an executive summary and a more detailed summary. As indicated, the Academy recognizes the importance of the casualty loss reserve opinion requirements and plans to perform additional studies on this topic.

We very much appreciate the cooperation that we received in performing this study. If you have any comments or questions about it, please do not hesitate to write me.

Very truly yours,

David G. Hartman

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Enclosure

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AMERICAN ACADEMY OF ACTUARIES

STUDY OF INSURANCE COMPANY INSOLVENCIES FROM 1969-87 TO MEASURE THE EFFECTIVENESS OF CASUALTY LOSS RESERVE OPINIONS

Prepared by the

AMERICAN ACADEMY OF ACTUARIES
COMMITTEE ON PROPERTY LIABILITY INSURANCE
FINANCIAL REPORTING

September, 1990

1720 I STREET, N.W. 7TH FLOOR WASHINGTON, D.C. 20006 (202) 223-8196

During the last several years there has been growing concern over the threat of widespread economic distress that could result from insolvencies of U.S. property liability insurance companies. The U.S. Congress, the National Association of Insurance Commissioners (NAIC) and insurance company organizations have all discussed this potentially severe problem and initiated studies to identify actions that will reduce the incidence of insolvencies. In order to contribute to the limited base of information on which to formulate sound public policy decisions, last year the American Academy of Actuaries[1] undertook a study of the effectiveness of current casualty loss reserve opinions. This report presents the results and conclusions to date of the Academy's efforts related to this important issue. The Academy recognizes the importance of loss reserve opinion requirements and plans to perform additional studies on this topic.

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[1]The American Academy of Actuaries is an organization of professional actuaries in the U.S. which, among other functions, represents the actuarial profession in areas of public issues and discussions involving actuarial concepts. The Academy was founded in 1965 and now has over 10,000 members.

Study Results

This study was conducted by distributing questionnaires to state insurance departments for each of the 153 companies declared insolvent from 1969 through 1987. This report comments on the 105 questionnaires returned.

The highlights of the committee's findings to date are as follows:

(1) The most commonly cited principle cause of insolvency was "under-reserving". "Under-reserving" was noted in 58% of the insolvencies for which causes were identified. "Mismanagement" was the second most frequently identified cause of insolvency, cited in 41% of the responses. Loss reserve opinions clearly may help reduce the incidence of insolvencies where under-reserving is a potential cause of insolvency. It is less certain that loss reserve opinions can address situations where mismanagement or other factors are the principle cause of insolvency.

(2) Many of the loss reserve opinions for companies subsequently declared insolvent were qualified or conditioned in some manner (4 of 9 cases studied). Since the committee did not review the specific reasons the opinions were qualified and the causes of the subsequent insolvency, we cannot conclude whether or not the opinions for these nine companies were appropriate.

(3) In the majority of insolvencies studied, no loss reserve opinion was rendered (81 of 105 cases). Since most of the insolvencies occurred prior to 1981, loss reserve opinions were not required for Annual Statements filed prior to the declaration of most of the insolvencies studied.

Even if the actual statements of reserve opinions do not clearly help regulators to identify potentially troubled companies, there is anecdotal evidence that opinion requirements lead to improved management actions. Loss reserve opinion requirements and professional responsibilities of actuaries tend to create an environment where actuaries have a significant voice in the financial management of an insurance company. In analyzing reserves, an actuary may find inadequate reserves, inappropriate reinsurance programs, inadequate pricing or a number of other problems which can result in impaired financial condition if not addressed. By communicating such findings before problems become too severe, actuaries can help to promote sound financial management of an insurance company and possibly reduce the chance that an insolvency will occur.

Since many insolvencies are caused by mismanagement, fraud and other factors not typically reviewed in an actuarial analysis, strong loss reserve opinion requirements cannot be expected to prevent all

insolvencies. However, the Committee believes that loss reserve opinions by qualified actuaries contribute to the prevention and early detection of insolvencies of property liability insurance companies.

Background on Loss and LAE Reserves and Reserve Opinions

Reserves for losses[2] and loss adjustment expenses (LAE)[3] together represent by far the largest liability on the balance sheets of property liability insurance companies. At year-end 1989, these reserves comprised two-thirds of the industry's total liabilities and were about double industry surplus.

There is usually substantial uncertainty about loss and LAE liabilities since they represent future costs, often many years away. But reasonable estimates of liabilities are needed as part of the sound management of an insurance company. If a company underestimates loss liabilities, its surplus will be overstated and the reported balance sheet may present a severely distorted picture of the financial health of the company.

Given the importance of accurate estimates of loss and LAE liabilities to the financial integrity of property liability insurance companies, the NAIC in 1981 adopted optional guidelines for loss reserve opinions in the NAIC Fire and Casualty Annual Statement. If adopted

---

[2]Loss reserves are liabilities for future payments to claimants for insured incidents which have already occurred.

[3]Loss adjustment expense reserves are liabilities for the future cost of adjusting or settling insured claims which have already occurred.

by a state, these guidelines specified the format for a signed statement of opinion by a "qualified loss reserve specialist".

The NAIC defined a "qualified loss reserve specialist" as a member in good standing of the American Academy of Actuaries, or a person who otherwise had competency in loss reserve evaluation. This definition easily allowed a non-member of the Academy (including non-actuaries such as Certified Public Accountants or company officers) to self-certify their competency.

The NAIC instructions specified that the opinion must contain a paragraph identifying the specialist, a scope paragraph, an opinion paragraph and additional paragraphs if needed to state a qualification of the opinion. The instructions also noted that "the opinion paragraph should include a sentence which covers at least the points listed in the following illustration:"

> "In my opinion, the amounts carried in the balance sheet on account of the items identified above
>
> (i) are computed in accordance with accepted loss reserving standards and are fairly stated in accordance with sound loss reserving principles.
>
> (ii) are based on factors relevant to policy provisions.
>
> (iii) meet the requirements of the insurance laws of (state of domicile).

(iv) make a good and sufficient provision for all unpaid loss and loss expense obligations of the Company under the terms of its policies and agreements."

For 1989 Annual Statements, twenty-four states required an actuary or qualified loss reserve specialist to provide an opinion on loss reserves for all or some companies. Since larger insurance companies tend to operate in all or nearly all states and several of the nineteen states required opinions for all licensed companies, loss reserve opinion requirements have applied to virtually all large property liability insurance companies.

In June, 1990 the NAIC took action to strengthen loss reserve opinion requirements. For 1990 and subsequent Annual Statements, a loss reserve opinion is mandatory for all companies except those qualifying for specific exemptions, and the opinion must be provided by a qualified actuary. This action by the NAIC is expected to help reduce the incidence of future insolvencies.

MEMBERS OF THE AMERICAN ACADEMY OF ACTUARIES

COMMITTEE ON PROPERTY AND LIABILITY INSURANCE FINANCIAL REPORTING

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AMERICAN ACADEMY OF ACTUARIES
COMMITTEE ON
PROPERTY LIABILITY INSURANCE FINANCIAL REPORTING

Responses to Loss Reserve Opinion Questionnaire Insolvent Companies

In the summer of 1989, the Committee on Property Liability Insurance Financial Reporting (the Committee) of the American Academy of Actuaries (the Academy) began a study of the effectiveness of the current casualty loss reserve opinions.

As part of this project, the Committee requested that chief examiners in the various state insurance departments complete a 12 item questionnaire (Appendix A) for each insurance company declared insolvent from 1969 through 1987.

As of June 18, 1990, questionnaires have been returned for 105 of the 153 companies declared insolvent during this time period. In addition, questionnaires were returned pertaining to four companies that were declared insolvent in 1959, 1962, 1988 and 1989. This report summarizes the results of the 109 questionnaires returned.

The Committee recognizes two constraints within which the study must be conducted. First, there is a limited number of insolvent companies for which loss reserve opinions had been obtained. Second, we are not able to measure the extent to which the requirement for loss reserve opinions may have influenced insurers to avoid insolvencies. Each of these will be discussed in the following paragraphs.

Loss reserve opinions for property/casualty insurance companies were generally not required by state insurance departments until 1981, when the New York Insurance Department began requiring them of all domestic companies. From 1982 through 1989, about 23 other states implemented requirements for loss reserve opinions. In 1990, the National Association of Insurance Commissioners revised the instructions to the Annual Statement to require loss reserve opinions in all states, with limited exceptions.

In the years 1982 through 1987, there were 82 insolvencies; questionnaires were returned in 54 instances. Loss reserve opinions had been required and/or submitted in only 27 of these cases. Because of the relatively small size of the data base, firm inferences can generally not be drawn. However, this study does document the reserve opinions for companies subsequently declared insolvent.

This study is limited to companies that have become insolvent. It does not include identification of insolvencies that were prevented because of the requirement for a loss reserve opinion. In some cases the actuary evaluating the loss reserves may have found reserve inadequacies, thus forcing company management to increase loss reserves in order to obtain an unqualified opinion. In other cases, the actuary may have identified shortcomings, such as inappropriate reinsurance programs, inadequate pricing, improper claims adjustment procedures, and poor underwriting practices that company management was then able to address before these problems resulted in an impaired financial condition. There is anecdotal evidence that suggests insolvencies have been prevented because of the need for a loss reserve opinion, but this is beyond the scope of the Committee's study.

Following is a discussion of each individual question.

Question 1: Name of insolvent company
Question 2: Year company declared insolvent
Question 3: Company's state of domicile

Appendix B displays detailed information regarding questions 1, 2 and 3 for all insolvent companies initially identified in the study. These 153 companies are located in 33 states, Puerto Rico, and the Virgin Islands.

Responses have been received from 24 jurisdictions. These responses pertain to 105 of the 153 companies declared insolvent from 1969 through 1987. Additionally, responses have been received from four companies that became insolvent in 1959, 1962, 1988 and 1989. Among those states from which we have not yet received responses is Texas, in which 11 insolvencies are located.

Exhibit I is a graph of the number of insolvencies, by year, for which we initially solicited responses, and for which responses were received.

In the decade of the 1970's, there were 60 insolvences. From 1980 through 1987, there were 92 insolvencies.

Question 4: Did the insurance department of the domiciliary state have a loss reserve opinion requirement prior to this company being declared insolvent? (Yes/No)

Detailed information pertaining to this question, as well as to questions 5 through 9, are displayed on Exhibit II. Exhibit II provides information on those companies (24) for which a loss reserve opinion was required, as well as for four companies for which loss reserve opinions were provided although not required.

Of the 24 insolvencies for which loss reserve opinions had been required, all occurred in 1982 or later. As noted previously, loss reserve opinions were not generally required prior to 1982.

During the period 1982 through 1987, there were 82 insolvencies. Information on these insolvencies is summarized as follows:

	Opinion Required	Opinion Not Required	Total
Responses received	24	31	55
Responses not received	3*	24*	27
	27	55	82

*Based on the Committee's understanding of state regulations in effect at the time of the insolvency

Thus, about one third of the insolvencies occurred in states where a loss reserve opinion was required.

Question 5: Was a loss reserve opinion rendered to any state on this company prior to its being declared insolvent? (Yes - only once/Yes - more than once/No)

As shown on Exhibit II, opinions were rendered for 24 companies, 20 of which were required opinions and 4 of which were submitted although not required.

Question 6: Did the loss reserve opinion use the recommended language verbatim? (Yes/No)

Of the ten responses to this question, six were "yes" and four "no."

The "recommended language" is that contained in the instructions to the Annual Statement." Qualifying statements are commonly added when considered appropriate, although there are currently no guidelines for the use of qualifying statements. As part of its study, the Committee intends to recommend revisions to the "recommended language." These suggested revisions are expected to include qualifying statements intended to alert regulators to various conditions that may increase the likelihood that loss reserves will not be adequate.

Question 7: Was the loss reserve opinion qualified or conditioned in some manner? (Yes/No)

Of the nine responses to this question, four indicated that the opinions were qualified in some manner whereas five indicated the opinion was not qualified.

As previously noted, this Committee intends to recommend standardized qualifying statements.

Question 8: Was the signer of the opinion a (circle letter of each item that applies):

(a) Member, American Academy of Actuaries (MAAA)
(b) Fellow, Casualty Actuarial Society (FCAS)
(c) Associate, Casualty Actuarial Society (ACAS)
(d) Please specify (e.g. President, Treasurer, Claims Manager, etc.)

We received responses to this question for 20 companies. Using the term "actuary" to mean either a Member of the American Academy of Actuaries or a member of the Casualty Actuarial Society, then 11 of the 20 opinions were signed by actuaries.

For five of these eleven, the response to question 11 indicated that under-reserving was a contributer to the insolvency. For the nine opinions known to have been signed by non-actuaries, only one was apparently associated with under-reserving. This may suggest that companies with loss reserves recognized to be potentially inadequate were more likely to obtain an actuarial opinion.

It was noted in regard to question 7 that four of the opinions were qualified. In all four cases, the signer was an actuary. In only one of these four cases did the response indicate that under-reserving was a cause of the insolvency.

Question 9: Was the signer an employee of the company? (Yes/No)

There were 19 responses to this question. In eleven cases the signer was an employee of the company, and in three of these eleven, an actuary. In eight cases, the signer of the opinion was not an employee of the company, and in seven of these eight, an actuary.

This suggests that when companies obtain a loss reserve opinion from someone outside the company, that person is apt to be an actuary, as defined as a member of the Casualty Actuarial Society or American Academy of Actuaries.

Question 10: What is the approximate size of this insolvency? ($)

For the 81 companies for whom the size of the insolvency was quantified, the insolvency ranged from $4,000 to $1.5 billion (Transit Casualty Insurance Company). Excluding the 20 insolvencies that were for less than $1 million, the median was approximately $10 million and the mean was approximately $55 million. Excluding Transit Casualty, the mean was approximately $31 million.

During the period 1982 through 1987, there were 39 insolvencies greater than $1 million for which we received responses as to the size of the insolvency. The mean value was approximately $80 million.

For those companies for which a loss reserve opinion was required or obtained, the size of the insolvency is shown on Exhibit II.

Question 11: What appears to be the principle cause(s) of this insolvency (e.g., under-reserving, uncollectable reinsurance, fraud, etc.)?

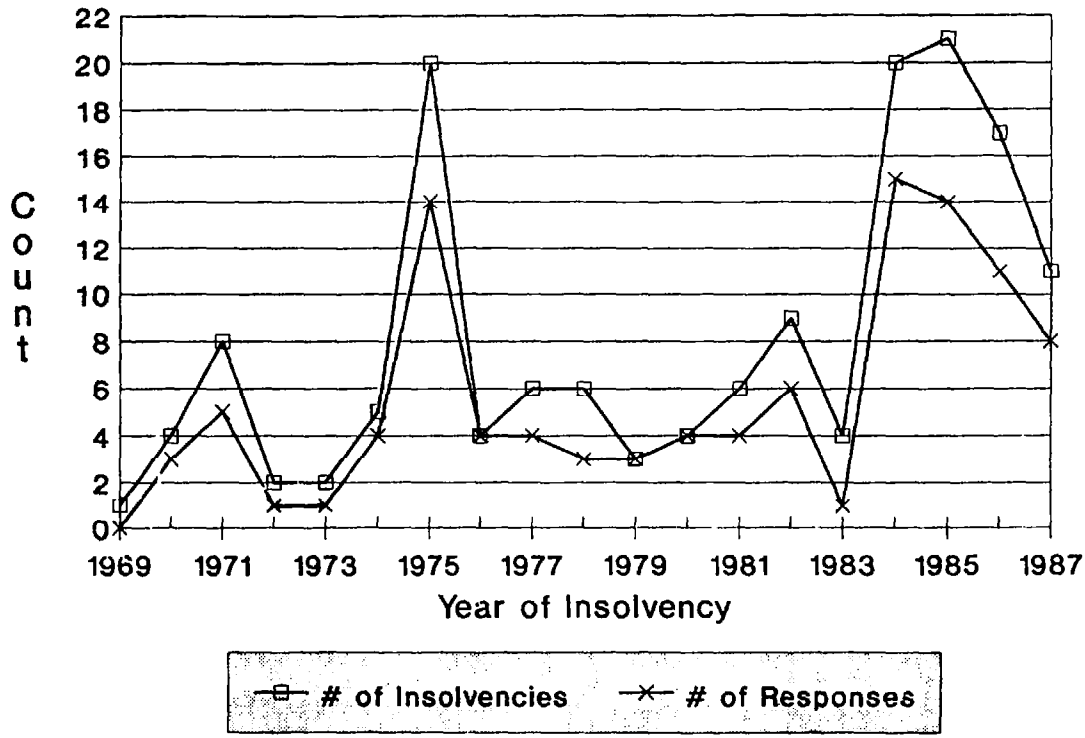
Responses were received for 79 insolvencies. "Under-reserving" was given as the most common response, appearing 46 times as a reason for the insolvency. "Mismanagement" was identified 32 times as a reason. "Poor underwriting," "uncollectable balances," "fraud/theft," "MGA," and "reinsurance" were each identified eight to fifteen times.

For those companies for which a loss reserve opinion was required or obtained, we have shown, on Exhibit I, whether "under-reserving" appeared as a stated reason for the insolvency.

Question 12: What other comments would be helpful for us to have about this insolvency?

Responses to this question were minimal, and they have not been summarized.

Number of Insolvencies/Responses



27-Jun-90

CASUALTY LOSS RESERVE OPINION QUESTIONAIRE

SUMMARY OF INFORMATION FOR COMPANIES FOR WHICH A LOSS RESERVE OPINION WAS REQUIRED OR RENDERED

INSURANCE COMPANY	YEAR OF INSOLVENCY	STATE	QUESTION #4	QUESTION #5	QUESTION #6	QUESTION #7	QUESTION #8	QUESTION #9	QUESTION #10	QUESTION #11 "UNDER-RESERVING"
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10) ($IN MILLIONS)	(11)
EARLY AMERICAN INS. CO.	1985	AL	NO	YES-ONCE		NO	A,C	NO	$60.0	YES
INTERCO UNDERWRITERS EXCHANGE	1983	CA	YES	YES			D	YES		NO
GOLDEN WEST INS. EXCHANGE	1984	CA	YES	YES			D	YES		NO
INDEPENDENT INDEMNITY CO.	1984	CA	YES	YES			D	YES		NO
CAL-FARM INSURANCE CO.	1985	CA	YES	YES			D	YES		NO
S & H INSURANCE CO.	1985	CA	YES	YES			D	YES		NO
HOMELAND INSURANCE COMPANY	1987	CA	YES	YES			D	YES		NO
MISSION INSURANCE CO.	1987	CA	YES	YES			A,C	YES		YES
MISSION NATIONAL INSURANCE CO.	1987	CA	YES	YES			A,C	YES		YES
IOWA NATIONAL MUTUAL INS. CO.	1985	IA	YES	YES-ONCE			D	NO	40.0	YES
SECURITY CASUALTY CO.	1981	IL	NO	YES-ONCE	NO	NO	B	NO		
KENILWORTH INS. CO.	1982	IL	YES	YES-ONCE	NO	NO	D	YES		
MAIN INS. CO.	1982	IL	YES	NO						
HERITAGE INS. CO.	1986	IL	YES	YES-MORE	YES	NO	D	YES		
OPTIMUM INS. CO.	1986	IL	YES	YES-MORE	NO	YES	A,B	NO		
PINE TOP INS. CO.	1987	IL	YES	YES-MORE	YES	YES	A,B	NO		
PRESIDIO INS. CO.	1986	IN	NO	YES-ONCE	YES	YES	B	NO	20.0	YES
PROFESSIONAL MUTUAL INS. CO.	1987	MO	NO	YES-MORE	YES	NO	A	NO	35.0	YES
BEACON INS. CO.	1987	NC	YES							
RENT RITE ADVANTAGE SERVICES	1989	NM	YES	YES-ONCE	NO	YES	A,B	YES	0.7	NO
HORIZON INS. CO.	1984	NY	YES						15.5	YES
IDEAL MUTUAL INS. CO.	1984	NY	YES	YES-MORE					15.5	YES
NASSAU INS. CO.	1984	NY	YES						7.6	YES
AMERICAN CONSUMER INS. CO.	1985	NY	YES	YES-MORE	YES		A,B		32.0	NO
AMERICAN FIDELITY FIRE INS. CO.	1985	NY	YES	YES-MORE	YES		A,B	NO	32.0	NO
UNION INDEMNITY	1985	NY	YES	YES-MORE					138.5	YES
CARRIER CASUALTY CO.	1986	NY	YES	YES-MORE					1.6	YES
MIDLAND INSURANCE CO.	1986	NY	YES	YES-MORE					34.6	YES

American Academy of Actuaries
Committee on Property-Liability Insurance Financial Reporting

Loss Reserve Opinion Questionnaire
Insolvent Companies

1. **Name of Insolvent Company** _____

2. **Year Company Declared Insolvent** _____

3. **Company's State of Domicile** _____

Please circle the appropriate answer to each question:

4. Did the insurance department of the domiciliary state have a loss reserve opinion requirement prior to this company being declared insolvent?

   Yes No

5. Was a loss reserve opinion rendered to any state on this company prior to its being declared insolvent?

   Yes - only once Yes - more than once No

   If the answer to question 5 was "No", skip to question 10.

   If the answer to questions 5 was "Yes", please answer questions 6 through 9 as regards the last opinion rendered prior to the company being declared insolvent.

6. Did the loss reserve opinion use the recommended language verbatim?

   Yes No

7. Was the loss reserve opinion qualified or conditioned in some manner?

   Yes No

   If yes, how?

(over)

Loss Reserve Opinion Questionnaire
Insolvent Companies

8. Was the signer of the opinion a (circle letter of each item that applies):

   a. Member, American Academy of Actuaries (MAAA)
   b. Fellow, Casualty Actuarial Society (FCAS)
   c. Associate, Casualty Actuarial Society (ACAS)
   d. Other (Please specify, e.g., President, Treasurer, Claims Manager, etc.)

9. Was the signer an employee of the company?

   Yes No

10. What is the approximate size of this insolvency?

    $

11. What appears to be the principal cause(s) of this insolvency (e.g., underreserving, uncollectible reinsurance, fraud, etc.)

12. What other comments would be helpful for us to have about this insolvency?

Please print your name

Your telephone number ( )

Please return by September 30, 1989 to:

David G. Hartman
Chairman, AAA COPLIFR
c/o Chubb Group of Insurance Companies
15 Mountain View Road
P. O. Box 1615
Warren, New Jersey 07061-1615

ASSESSMENTS HAVE BEEN MADE BY THE GUARANTY FUNDS TO COVER THE INSOLVENCIES OF THE FOLLOWING COMPANIES:

Company	Declared Insolvent	Domicile
Key Insurance Exchange	1969	California
Fidelity General Insurance Co.	1970	Illinois
Liberty Universal Insurance		Texas
Ohio Valley Insurance Co.		Ohio
Sutton Mutual Insurance Co.		New Hampshire
Citizens Casualty of New York	1971	New York
First American Insurance Co.		Florida
Homeowners Insurance Co.		Illinois
LaSalle National Insurance Co.		Illinois
Los Angeles Insurance Co.		California
Maine Insurance Co.		Maine
Trans Plains Insurance		Texas
United Bonding Co.		Indiana
Maryland National Insurance Co.	1972	Georgia
Metro Casualty Co.		Missouri
Commercial Underwriters	1973	Michigan
First Fire & Casualty Co. of San Antonio, TX		Texas
Gateway Insurance Co.	1974	Pennsylvania
Granite Mutual Insurance Co.		Pennsylvania
Professional Insurance Co.		New York
Rockland Mutual Insurance Co.		Massachusetts
United American Insurers		Iowa
Associated Merchants Mutual Ins. Co.	1975	Massachusetts
Capitol Mutual Fire Insurance Co.		Pennsylvania
Epic Insurance Co.		Arizona
Financial Fire & Casualty Ins. Co.		Florida
Glaco Automobile Insurance Co.		Montana
Guardian Mutual Insurance Co.		Pennsylvania
Interstate Ins. Co. of W. Collingswood		New Jersey
Manufacturers & Wholesalers Indemnity Exchange		Colorado
Medallion/Missouri General Ins. Co.		Missouri
Mobile County Mutual/Mobile Ins. Co.		Texas
National Mutual Insurance Co.		Michigan
Pennsylvania Taximen's Mutual Ins. Co.		Pennsylvania
Resources Insurance Co. of New York		New York
Satellite Insurance Co.		Pennsylvania
Security Fire & Casualty Insurance Co.		South Carolina
State Security Insurance Co.		Pennsylvania
Summit Insurance Co. of New York		New York

Company	Declared Insolvent	Domicile
Transnational Insurance Co.		California
Westgate - California		California
Wisconsin Surety Co.		Wisconsin
Bankers Fire & Casualty Ins. Co.	1976	Florida
Manchester Insurance & Indemnity Co.		Ohio
Southern American Fire Insurance Co.		Florida
Woodland Mutual		Michigan
All-Star Insurance Corporation	1977	Wisconsin
Builders Insurance Co.		Puerto Rico
Empire Mutual Ins. Co./Allcity Ins. Co.		New York
Maryland Indemnity Insurance Co.		Maryland
New York National Insurance Co.		New York
Penn State Mutual Insurance Co.		Pennsylvania
Bankers Mutual Insurance Co.	1978	New York
Commonwealth Insurance Co.		Puerto Rico
Consolidated Mutual Insurance Co.		New York
Consolidated Underwriters		Missouri
Eldorado Insurance Co.		California
Signal/Imperial Insurance Cos.		California
American Reserve Insurance Co.	1979	Rhode Island
Long Island Insurance Co.		New York
Reserve Insurance Co.		Illinois
Atlantic and Gulf States	1980	South Carolina
Concord Mutual Insurance Co.		Pennsylvania
Cosmopolitan Insurance Co.		New York
State Farmers Insurance Co.		Nebraska
Church Layman Mutual Insurance Co.	1981	West Virginia
Eastern Insurance Co.		Florida
Fauquier Mutual Fire Insurance Co.		Virginia
Market Insurance Co.		Illinois
Proprietors Insurance Co.		Ohio
Security Casualty Co.		Illinois
Amherst Insurance Co.	1982	Pennsylvania
Cotton Belt Insurance Co.		Tennessee
Equitable Insurance Exchange, Inc.		Texas
Great Indemnity Insurance Co.		Puerto Rico
Kenilworth Insurance Co.		Illinois
Lloyds of America		Texas (only)
Main Insurance Co.		Illinois

Company	Declared Insolvent	Domicile
Safeguard Mutual Insurance Co.		Pennsylvania
Stuyvesant Mutual Plate Glass Ins. Co.		Pennsylvania
Interco Underwriters Exchange	1983	California
Lincoln Insurance Co. of Puerto Rico		Puerto Rico
Superior Lloyds		Texas (only)
Western Carriers Insurance Exchange		California
Ambassador Insurance Co.	1984	Vermont
Arizona General Insurance Company		Arizona
Aspen Indemnity Corp.		Colorado
Colonial Assurance Co.		Pennsylvania
Dome Insurance Company		Virgin Islands
Excalibur Insurance Co.		Minnesota
Financial Security Insurance Co.		Hawaii
Gibraltar Mutual Ins. Co.		Pennsylvania
Golden West Ins. Exchange		California
Guaranty Insurance Company		Puerto Rico
Gulf American		Florida
Horizon Insurance Company		New York
Ideal Mutual Insurance Company		New York
Independent Indemnity Co.		California
Lawyers Prof. Liability Ins. Co.		Florida
Nassau Insurance Co.		New York (only)
North-West Insurance Company		Oregon
Northeastern Fire Ins. Co. of PA		Pennsylvania
Oklahoma Insurance Logistics Co.		Oklahoma
Universal Casualty Ins. Co.		Florida
American Consumer Insurance Co.	1985	New York
American Fidelity Fire Ins. Co.		New York
Cal-Farm Insurance Co.		California
Columbus Insurance Company		Ohio
Commercial Standard		Texas
Commonwealth Marine		Delaware
Consumers Ins. Group (Kent Ins. Co.)		Florida
Early American		Alabama
Eastern Indemnity		Maryland
Glacier General Assurance Co.		Montana
Guard Casualty & Surety Co.		Indiana
Iowa National Mutual Ins. Co.		Iowa
Pacific American		Delaware
S & H Insurance Co.		California
Southwestern Insurance Co.		Oklahoma
Southwestern National Ins. Co.		Oklahoma
Standard Fire Ins. Co.		Alabama
Temple Mutual Ins. Co.		Pennsylvania
Transit Casualty Co.		Missouri
Union Indemnity		New York
United Employers Ins. Co.		Texas (only)

Company	Declared Insolvent	Domicile
Allied Fidelity	1986	Indiana
American Druggists' Insurance Co.		Ohio
Carrier Casualty Company		New York
Carriers Insurance Company		Iowa
Forestry Industries Ins.		Oregon
Great Global Assurance Company		Arizona
Heritage Insurance Company		Illinois
Intermountain Insurance Company		Montana
Inter-West Insurance Company		Oregon
Lloyds of Louisiana		Louisiana
Merchants & Manufacturers of Cleveland		Ohio
Midland Insurance Company		New York
National Allied Insurance Company		Texas
Optimum Insurance Company		Illinois
Presidio Insurance Company		Indiana
RGAF Underwriters		Florida
Texas Fire and Casualty		Texas
Beacon Insurance Co.	1987	North Carolina
Citizens National Assurance		New Mexico
Enterprise Insurance Co.		California
Holland-America Ins. Co.		Missouri
Homeland Insurance Co.		California
Integrity Insurance Co.		New Jersey
Mission Insurance Co.		California
Mission National Ins. Co.		California
Pine Top Insurance Co.		Illinois
Professional Mutual Ins. Co.		Missouri
Quality Insurance Co.		West Virginia

MARCH 14, 1989 LETTER AND WHITE PAPER ON FLEXIBLE EXAMINATION SYSTEM

Kevin Ryan and
Education Policy Committee

CASUALTY ACTUARIAL SOCIETY

Kevin M. Ryan
President

One Penn Plaza
New York, NY 10119
(212) 560-1010

March 14, 1989

TO: All Members of the Casualty Actuarial Society

RE: Flexible Examination System

The purpose of this letter is to present to you a very important educational issue within the Casualty Actuarial Society and to request your feedback on that issue.

As most of you are aware, the Society of Actuaries has implemented a Flexible Examination System which involves dividing examinations into smaller pieces as well as constructing a system under which some examinations are required and others are elective.

The Education Policy Committee of the CAS was subsequently charged with reviewing this concept and determining whether adoption of a similar examination system would be beneficial to the CAS. After considerable research and deliberation the Committee presented its report to the CAS Board of Directors in the Fall of 1988. The Board of Directors embraced the recommendation in that report by unanimously passing the following motion:

> That the CAS Board endorses the concept of smaller examination units for Parts 4 through 10. It directs the Vice President-Membership to develop a detailed implementation plan and schedule which addresses, at a minimum, all of the additional considerations for implementation itemized in the Education Policy Committee's report plus seeking input from students about this concept.

The Education Policy Committee's White Paper is attached for your review. Inasmuch as this is an extremely important issue for the CAS, we would like to get maximum input from our membership. In order for your input and evaluation to be as informed as possible, I would strongly commend the Education Policy Committee's White Paper to you for a careful reading. Your input is greatly desired and will definitely be utilized as we proceed.

It should be noted that the Board's action requires that the Vice President-Membership present a detailed implementation plan and schedule to the Board for its approval before going forward with any changes to our current system. It further requires that this implementation plan must appropriately address all of the considerations itemized in the Education Policy Committee's report. These appear in the final two pages of the report. The issue that has attracted the most attention thus far is the one of travel time. Please note that travel time is one of the issues highlighted by the Education Policy Committee's report. It is not anyone's intention to implement or revise the examination system in a way that would significantly increase travel time to Fellowship.

The Education Policy Committee has established a Task Force to undertake the additional work necessary to develop an appropriate partitioned examination system plan. Part of this evaluation involves obtaining membership input, and it is felt that a membership mailing represents the most thorough process. As the Board and the Education Policy Committee continue their evaluation, your comments on the subject of exam partitioning will be most welcome. We have set a cut-off date of June 1 for initial comments to be received. Comments should be addressed to:

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34 Street
New York, NY 10119

Please read the White Paper thoroughly and give this matter your attention. We would encourage discussions with other actuaries and students within your company, but we would appreciate it if you would provide us with your personal comments rather than trying to represent other individuals. As part of our evaluation process, we expect to solicit opinions and comments from all of our students in a variety of ways, including a survey. We very much hope to receive your comments in writing by June 1. On behalf of the Board of Directors and the entire CAS, I want to thank you for your attention to this very important matter.

Sincerely,

Kevin M. Ryan, FCAS, MAAA

KMR:mrb
Attachment

CASUALTY ACTUARIAL SOCIETY

FLEXIBLE EDUCATION SYSTEM (FES)

"WHITE PAPER"

This "white paper" addresses the matter of whether or not the CAS should adopt the FES concept throughout its entire examination process. Currently, the FES concept has been accepted for use on parts 1 through 3 and is under consideration for use on part 4.

SCOPE

For purposes of this assignment, the Education Policy Committee (committee) has defined some limits for the scope of our considerations. In general, we limited ourselves to answering the question, "Is FES a better educational process?" We identified seven areas to consider; these criteria formed the totality of our considerations. Two items that we specifically excluded were issues of unification with other actuarial bodies and issues surrounding the Canadian guiding principles (except it was noted that FES was compatible with adding Canadian content to the syllabus).

PROCESS

The concept of a Flexible Education System (FES) involves the following two important features:

1. the exams are offered in smaller units; and

2. the syllabus is re-organized to reflect core material and elective material, with requirements for each.

In developing this "white paper", the committee put a major emphasis on detailed documentation of its decision process. We were faced with a complex decision problem, where the final outcome is not solely dictated by the facts but, perhaps more importantly, by the decision makers' weighting of importance of the various decision criteria and supporting facts in favor of or against FES. We recognized that different conclusions can be reached from the same set of facts, and thus they are available to all recipients of this paper to consider in their own fashion. The recommendation of the committee is based on its weighting of importance of the criteria and supporting facts, and differences of opinion will most likely be addressed in terms of the importance weightings.

The committee agreed that there are weaknesses in the current education and examination process. Through discussion, the committee found that FES would address and help correct some of these; however, this alone is not adequate reason to adopt FES. The committee's view is that other solutions to current problems can be found if FES is not compelling as a better educational system. The reader is reminded here that this paper is not intended to serve as the basis for improving the E & E process, nor is it intended to address directly what changes may be needed in that process.

Misunderstandings often arise when imagining an FES environment. A typical reaction is that the examination process will be harder and it will take longer to pass all the exams. Further insight will reveal that many of these concerns can be handled through controllable results, and the CAS should consider itself resourceful enough to obtain the desired outcome. For example, there is no need to assume that passing percentages will be the same under FES. Difficulty of passing exams and total travel time through the exams are clearly influenced by different pass rates.

DECISION CRITERIA

The committee identified seven decision criteria, the most important being the achievement of the CAS educational objectives, the quality of education and the type of FCAS graduate. The remaining four criteria were split into two categories, very important and somewhat important. The table below summarizes the criteria rankings.

FES DECISION CRITERIA

Most Important	Very Important	Somewhat Important
• Educational Objectives	• Travel Time to FCAS	• Positioning CAS vs. Other Career Options
• Quality of Education	• Administration of Exams	• Employer's Viewpoint
• Type of FCAS Graduate		

The first appendix to this "white paper" includes a page of pros and cons of FES for each of the seven criteria. In some cases an item appears under one heading and, with a "twist", also appears under the opposite heading. These are simply a matter of different perspectives on each issue where the final verdict is still unknown.

EVALUATION OF CRITERIA

I. Educational Objective

The educational objective of the CAS related to this topic is to provide and foster a program of actuarial education leading to fellowship in the CAS including the following:

1. defining the basic areas of knowledge and skills necessary to obtain the competence to practice in the various actuarial specialties;

2. defining standards of educational achievement required for membership in the CAS; and

3. providing a means of measuring educational achievement.

It was also understood by the committee that an educational objective of the CAS was to produce well rounded individuals with a generalist orientation. This is clearly implied by the Syllabus Goals and Objectives currently set forth in the CAS Yearbook. This objective led us to rule out any FES system with specialty tracks.

From the various options which exist when considering an FES system, the committee selected three as the most viable for further consideration. These were an FES with electives (but no specialty tracks), an FES without electives, and no change (no more flexing beyond part 4).

The committee considered each of the three options further. The FES system with electives was not considered as a viable alternative at this time. There was a very strong feeling within the committee that this option would detract from the commonality of education and the broad based, well rounded characteristics of members of the society produced under the current education and examination structure, thus jeopardizing the warrant implied currently by the FCAS designation.

The committee then focused its attention on the two remaining options, namely, an FES system with no electives, and no change (no flexing beyond Part 4). It is recognized that an FES system with no electives is equivalent to partitioning or subdividing the exams as we currently know them.

It is the opinion of the committee that each of the components of the principal educational objective enumerated above is enhanced, perhaps significantly, by the adoption of a well-structured FES system.

First, a more modular approach toward the syllabus and examination structure improves focus and provides clearer and more adequate definition of the basic areas of knowledge and skills necessary to obtain the competence to practice in the various actuarial specialties.

Second, smaller examination units enable the CAS to better define the standards of educational achievement required for membership.

Third, more focused examinations improve the means of measuring educational achievement, in terms of both the depth and breadth of that achievement.

The other criteria used in our evaluation are not associated with codified standards or objectives but are involved primarily with qualitative issues. It is clear from the Appendix that there are several pros and cons under each criteria used by the Committee in its evaluation. None of these individually presented an overwhelming basis for determining whether or not to change the current system. The disadvantages associated with each of these additional criteria would need to be viewed as the key issues to be addressed by any organization considering FES. For reasons cited earlier, disadvantages pertaining to specialty tracks or electives can be excluded from further consideration at this time. Appendix 2 to this "white paper" includes for each criteria a page of pros and cons excluding those relating to the use of electives or specialty tracks.

II. Quality of Education

The committee agreed that the quality of education would likely be enhanced. The use of smaller examination units facilitates the focusing of exams on concepts, the assurance of minimum competence standards, and greater ease in making syllabus changes. It also provides students with more flexibility in selecting their approach toward the exams. It is possible that some currently marginal candidates will be able to pass under FES because of the smaller examination units. It is not clear if this represents a change in the quality of education, however an increase in membership could occur.

III. Type of FCAS Graduate

The type of FCAS graduate under a system of partitioned examinations was a subject of considerable deliberation by the committee. We felt the learned quality of an FCAS may improve due to more focused examination units and assurance of minimum standards in more areas. Alternatively there is some concern that the FCAS graduate may have reduced skills or discipline in the areas of time management, memory capacity, synthesis and ability to isolate important material.

IV. Travel Time

The travel time to Fellowship was another criteria on which the committee spent considerable time. The committee agreed strongly that results under a system of partitioned examinations must be

carefully controlled so as not to materially affect travel time. Since examination units would be smaller, the combination of new units equivalent to one current examination could be more difficult due to the "effective" minimum standards achieved under the new structure. Thus, candidates taking one or two new units may be perceived to have an advantage compared to the candidate taking the equivalent of a full current examination. Also, there was some concern that more candidates might stop at ACAS due to a perceived longer travel time to FCAS. Alternatively, travel time would be reduced for some candidates since the selection of examination units, and their order, is flexible and can be employed by candidates to optimize travel time.

V. Administration of Examinations

The committee agreed that administration of examinations would be more complicated under a structure of partitioned examinations than under the current system. While it is not clear whether this would require additional staffing of either the syllabus or examination committees, record keeping would become more complex, and the costs for committees and exam administration would increase. The use of partitioned examinations facilitates joint sponsorship where desirable, and the attendant sharing of volunteer efforts for syllabus and examination work. The committee agreed that the use of partitioned examinations makes it easier to deal with CIA objectives. Syllabus and examination committee volunteers may also be easier to recruit since more specialization would be permitted. Finally, syllabus transitions should be easier.

VI. Career Positioning

The effect on positioning the CAS versus other career options is a difficult and mostly subjective issue. It is conceivable that the current system offers some recruiting advantage since a system of partitioned exams could appear to have "more" exams and could be more difficult to explain. Alternatively, the partitioned examination process could be perceived as less stressful than under the current system, which would make it attractive (relative to the current system) versus alternative educational programs such as MBA or the Society of Actuaries.

VII. Employer's Viewpoint

The committee recognized that the employers' viewpoint cannot be overlooked. Under a system of partitioned examinations employers may be faced with some additional costs to develop an FCAS, and it will be more difficult to rank or equate students. However, employers can benefit because students can select examination units more relevant to current work and exercise greater flexibility in selecting the study "load". Also, employers may see better educated actuaries due to the improved focus of partitioned examinations.

RECOMMENDATION

As a result of our deliberations, the Education Policy Committee recommends that the CAS adopt a partitioned examination system,

with no electives, for all of its examinations. This recommendation is principally founded on the basis of educational merit, including enhancements in the ability of the CAS to achieve educational objectives and in the quality of education, without affecting materially the type of FCAS graduate produced. The foundation for our recommendation also includes consideration of the additional criteria as discussed above, and where potential disadvantages exist, we believe they can be dealt with through a carefully controlled implementation process, as discussed below.

ADDITIONAL CONSIDERATIONS FOR IMPLEMENTATION

The implementation of a partitioned examination system, including appropriate changes to the syllabus and the examination structure and process, must proceed in a controlled manner. Any potential disadvantages associated with such a system must either be eliminated or minimized in their effect. In particular, the implementation of such a system and all communications regarding that implementation must consider the sensitivities of the existing membership, existing examination candidates and future members of the profession. We would be remiss if we did not emphasize additional considerations identified by the committee in the course of our deliberations.

1. There should be minimal effect due to any new system on candidates succeeding under the current system.

2. Travel time should be affected as little as possible.

3. Effective implementation requires that the syllabus and examination committees be well informed as to the deliberations leading up to the adoption of the new system. Representatives from these committees should be involved directly throughout the implementation process.

4. Employers must be well informed.

5. Performance standards must be established, monitored and evaluated very carefully to assure fair and equitable treatment of all candidates.

6. Consideration must be given to the mode of implementation, i.e., a staged implementation versus all examinations at once.

It is therefore further recommended that implementation plans be codified, with the intended effect in all such areas clearly described and subject to an approval process that includes the Board.

DISCUSSION NOTE

ON THE PROS AND CONS

FULL FES WITH ELECTIVES AND SPECIALTY TRACKS

I. **ACHIEVING CAS EDUCATION OBJECTIVES**

Pros	Cons
1. That an FCAS designation validates knowledge of certain subjects is improved because minimum level of competence is provided in more subjects with FES.	1. Specialty tracks inconsistent with CAS objectives of a common, generalists education.
2. A more modular approach provides a clearer definition of the basic areas of knowledge and skills needed to be an FCAS.	2. The depth of subject knowledge available via FES is not part of CAS objectives.
3. Additional areas of basic actuarial training can be included in syllabus via electives under FES.	3. Reduces homogeneity of FCAS graduates.

II. **QUALITY OF EDUCATION**

Pros	Cons
1. Ability to offer more topics via elective approach.	1. Electives lead to gaps in general knowledge of some members.
2. Testing smaller units allows for better mastery of materials and increases assurance of minimum standards for competence.	2. More marginal performers will be able to pass with this system because taking in smaller pieces.
3. Easier to make syllabus changes and provide up-to-date curriculum.	3. May be more difficult to assure real and perceived fairness and equity to all students because of the different options.
4. Flexibility allows students to select courses and pace education more individually to fit their needs, including job assignments.	4. Potential for loss of synthesis type question via FES.
5. The educational focus of exams on concepts improved with FES.	
6. Alternative educational approaches, possibly superior, exist with a new system.	

III. **TYPE OF FCAS GRADUATE**

Pros	Cons
1. Curriculum will have more capacity to address perspectives other than an insurance company view, i.e., consultants, risk managers.	1. FES reduces required disciplines or skills in several areas: - time management skills (because volume of exam material per session is reduced); - memory requirements reduced; - testing for synthesis of material becomes more limited; - ability to glean important material from non-important material de-emphasized.
2. Retained knowledge and learned quality may be of a higher nature due to broader application of minimum standards to each tested subject.	2. There is some loss of homogeneity of FCAS graduates with electives.

IV. **TRAVEL TIME**

Pros	Cons
1. Travel time could be reduced for some.	1. Travel time to ACAS, FCAS might increase: - exams could become tougher when in smaller parts; - the appearance of 20-30 exams vs. the current 10 may discourage students (and make recruiting more difficult); - taking 3 parts puts a student at a disadvantage to others concentrating on fewer.
2. More examination dates could be offered to benefit travel time: - students set their own pace, select their own exam order; - elective process improves chance of passing on selected topics of interest;	2. More people may stop at ACAS due to many additional exams and travel time.

V. **ADMINISTRATION**

Pros	Cons
1. Use of other organizations exams could reduce staffing needs.	1. May cause additional staffing needs that are a big problem to fill.
2. Facilitates more joint sponsorship of exams with SOA.	2. Record keeping more complex and costly.
3. FES prerequisite to some parts of FEM.	3. Costs for committees and running exams will increase.
4. FES makes it easier to deal with CIA objectives.	
5. Additional part-time volunteers in area of specialties could be easier to obtain.	
6. Transition programs due to syllabus changes easier to do with FES.	

VI. POSITIONING CAS VS. OTHER CAREER OPTIONS

Pros	Cons
1. The exam process is less stressful with FES, particularly with some FEM approaches. For instance, the CAS would improve its attractiveness versus the SOA and MBA.	1. Retaining fewer exams than SOA might be a recruiting advantage for the CAS. 2. FES is a more complex educational system to explain to potential entrants.

VII. EMPLOYERS' VIEWPOINT

Pros	Cons
1. Students can select topics more relevant to current work.	1. More cost to employers to develop an FCAS: - probable increase in needed study time; - any increase in travel time would increase cost.
2. Course load can be varied to fit better with current workload.	2. Reduces homogeneity of FCAS graduates.
3. A better educated actuary may be achieved with FES.	3. Career pathing more complex, with difficulty of clear ranking of students.

Appendix II

DISCUSSION NOTE

ON THE PROS AND CONS

FES WITHOUT ELECTIVES AND SPECIALTY TRACKS

I. **ACHIEVING CAS EDUCATION OBJECTIVES**

Pros	Cons
1. That an FCAS designation validates knowledge of certain subjects is improved because minimum level of competence is proved in more subjects with FES.	1. The depth of subject knowledge available via FES is not part of CAS objectives.
2. A more modular approach provides a clearer definition of the basic areas of knowledge and skills needed to be an FCAS.	

II. QUALITY OF EDUCATION

Pros	Cons
1. Testing smaller units allows for better mastery of materials and increases assurance of minimum standards for competence.	1. More marginal performers will be able to pass with this system because taking in smaller pieces.
2. Easier to make syllabus changes and provide up-to-date curriculum.	2. Potential for loss of synthesis type question via FES.
3. Flexibility allows students to select courses and pace education more individually to fit their needs, including job assignments.	
4. The educational focus of exams onto concepts improved with FES.	
5. Alternative educational approaches, possibly superior, exist with a new system.	

III. TYPE OF FCAS GRADUATE

Pros	Cons
1. Retained knowledge and learned quality may be of a higher nature due to broader application of minimum standards to each tested subject.	1. FES reduces required disciplines or skills in several areas: - time management skills (because volume of exam material per session is reduced); - memory requirements reduced; - testing for synthesis of material becomes more limited; - ability to glean important material from non-important material de-emphasized.

IV. **TRAVEL TIME**

Pros	Cons
1. Travel time could be reduced for some.	1. Travel time to ACAS, FCAS might increase: - exams could become tougher when in smaller parts; - the appearance of 20-30 exams vs. the current 10 may discourage students (and make recruiting more difficult); - taking 3 parts puts a student at a disadvantage to others concentrating on fewer.
2. More examination dates could be offered to benefit travel time: - students set their own pace, select their own exam order;	2. More people may stop at ACAS due to many additional exams and travel time.

V. **ADMINISTRATION**

Pros	Cons
1. Use of other organizations exams could reduce staffing needs.	1. May cause additional staffing needs that are a big problem to fill.
2. Facilitates more joint sponsorship of exams with SOA.	2. Record keeping more complex and costly.
3. FES prerequisite to some parts of FEM.	3. Costs for committees and running exams will increase.
4. FES makes it easier to deal with CIA objectives.	
5. Additional part-time volunteers in area of specialties could be easier to obtain.	
6. Transition programs due to syllabus changes easier to do with FES.	

VI. POSITIONING CAS VS. OTHER CAREER OPTIONS

Pros	Cons
1. The exam process is less stressful with FES, particularly with some FEM approaches. For instance, the CAS would improve its attractiveness versus the SOA and MBA.	1. Retaining fewer exams than SOA might be a recruiting advantage for the CAS.
	2. FES is a more complex educational system to explain to potential entrants.

VII. **EMPLOYERS' VIEWPOINT**

Pros	Cons
1. Students can select topics more relevant to current work.	1. More cost to employers to develop an FCAS: - probable increase in needed study time; - any increase in travel time would increase cost.
2. Course load can be varied to fit better with current workload.	2. Career pathing more complex, with difficulty of clear ranking of students.
3. A better educated actuary may be achieved with FES.	

AUGUST 10, 1989 LETTER REGARDING PARTITIONED EXAMINATION SYSTEM

Michael Toothman

CASUALTY ACTUARIAL SOCIETY

Michael L. Toothman
Vice President-Membership

101 South Hanley
St. Louis, MO 63105-3411
(314) 862-7611

August 10, 1989

TO MEMBERS AND STUDENTS OF THE CASUALTY ACTUARIAL SOCIETY:

The subject of a Partitioned Examination System, and in particular the Board action taken at its September 1988 meeting and the communication to all members dated March 14, 1989, has created a significant amount of feedback and a relatively significant amount of confusion as well. We would like to encourage even more feedback. It is the intention of this letter to reduce or eliminate at least some of the confusion.

There seems to be some confusion that the Board has already adopted a Partitioned Examination System and that we are proceeding with implementation. If that were so, then the requested feedback would be relatively unimportant. NOTHING COULD BE FURTHER FROM THE TRUTH.

The CAS Education Policy Committee was asked to address the issue of whether the CAS should adopt a flexible education system similar at least in some respects to that which has been implemented by the Society of Actuaries. The Education Policy Committee's report was presented to our Board of Directors at its September 1988 meeting. That report, in the form of a "white paper", attempted to present a very objective discussion of the advantages and disadvantages of such a system. At the end of that discussion, the Education Policy Committee presented its recommendation as follows:

> As a result of our deliberations, the Education Policy Committee recommends that the CAS adopt a Partitioned Examination System, with no electives, for all of its examinations. This recommendation is principally founded on the basis of educational merit, including enhancements in the ability of the CAS to achieve educational objectives and in the quality of education, without affecting materially the type of FCAS graduate produced.

Immediately following its recommendation, the Education Policy Committee concluded its report with a section entitled "Additional Considerations for Implementation". In that section, the committee listed six additional considerations, as follows:

1. There should be minimal effect due to any new system on candidates succeeding under the current system.

2. Travel time should be affected as little as possible.

3. Effective implementation requires that the Syllabus and Examination Committees be well informed as to the deliberations leading up to the adoption of the new system. Representatives from these committees should be directly involved throughout the implementation process.

4. Employers must be well informed.

5. Performance standards must be established, monitored, and evaluated very carefully to assure fair and equitable treatment of all candidates.

6. Consideration must be given to the mode of implementation, i.e., a staged implementation versus all examinations at once.

It is therefore further recommended that implementation plans be codified, with the intended effect in all such areas clearly described and subject to an approval process that includes the Board.

The Board of Directors embraced the recommendations of the Education Policy Committee's report by unanimously passing the following motion:

> That the CAS Board endorses the concept of smaller examination units for Parts 4 through 10. It directs the Vice President-Membership to develop a detailed implementation plan and schedule which addresses, at a minimum, all of the additional considerations for implementation itemized in the Education Policy Committee's report plus seeking input from students about this concept.

Please notice that the Board has endorsed the concept of smaller examination units. It has asked the Vice President-Membership to develop a detailed implementation plan which must be presented to the Board for its approval. That implementation plan must satisfactorily address all of the considerations included in the Education Policy Committee's report (and listed above) as well as any other concerns that might be identified as the implementation plan is developed. If those cannot be address to the Board's satisfaction, the Board may very well decide not to proceed with implementation.

Getting input from those currently taking examinations was considered so important to the Board of Directors that it was specifically included in the motion passed by the Board.

Of all the concerns enunciated thus far, travel time (item 2 above) seems to have gotten the most attention. By travel time, we mean the amount of time it takes a candidate to complete all of the examinations. Many people seem to

believe that travel time will be significantly lengthened if a Partitioned Examination System is implemented. Without debating the issue in this letter, suffice it to say that I sense little or no desire on anyone's part to revise our examination system in any way that will lengthen travel time to any material degree for candidates who are succeeding under the current system. We are monitoring the experience of the Society of Actuaries on this issue. At this point, the data available from the small number of exam administrations since the Society of Actuaries revised its system is not conclusive. It appears that average travel time is increasing somewhat, but it may very well be true that that is due to more students staying in the system than were doing so before. Also, our Partitioned Examination Task Force is considering several ideas that could result in shortening travel time, and it is quite anxious to receive any other ideas on this or other related issues from any of you.

To summarize then, implementation of a Partitioned Examination System is not a fait accompli. The input of our members and our students is very much desired and will definitely receive strong consideration as we proceed with this process. The concept of a Partitioned Examination System has been endorsed by the Board because we believe that we can produce even better actuaries under that system. However, we do not anticipate implementation of this system if we cannot satisfactorily address the issues identified by the Education Policy Committee, particularly the issue of travel time.

The Education Policy Committee's White Paper has been mailed to all members of the Casualty Actuarial Society and is currently being mailed to all students currently in our examination system. Feedback from those individuals is very definitely of interest to us. A Partitioned Examination Task Force, reporting to the Education Policy Committee, has been established and is being chaired by Jerry Degerness. That Task Force includes members with past experience on the Syllabus Committee and members with past experience on the Examination Committee. In addition, it includes members who received their Fellowship in the CAS nearly twenty years ago and members who have received their Fellowship much more recently, including one individual who received his Fellowship in Montreal last fall. That group has a very challenging task in front of them. Any input to that process may be sent to Jerry Degerness, to Gus Krause as Chairman of the Education Policy Committee, or to myself.

Also, attached for your information is a copy of the survey currently being mailed to students. If you would like to provide us with your responses to the questions in this survey, please feel free to do so. Your response will definitely be appreciated.

Sincerely yours,

Michael L. Toothman, FCAS, MAAA

/dy

NOVEMBER 2, 1990 LETTER REGARDING PARTITIONED EXAMINATION SYSTEM

Gustave Krause

Attachment 1

One Atlanta Plaza
950 East Paces Ferry Road
Atlanta, GA 30326-1119
404 261-5420
Facsimile: 404 365-1663

Management Consultants
and Actuaries

Tillinghast

[redacted] *a Towers Perrin company*

November 2, 1990

Mr. Michael L. Toothman
Tillinghast
101 South Hanley
St. Louis, Missouri 63105

Dear Mike:

The Education Policy Committee met in New York on October 23, to discuss the issue of exam partitioning and decide upon our recommendations to you at this time.

In light of the work done by the Partitioned Examination Task Force and our ensuing discussion, we ended up with four areas for reaching a decision. These were:

(1) Part 4;
(2) Part 5;
(3) Parts 6 and 7;
(4) The Fellowship exams.

It should be noted here that in our discussion of the above areas, the Education Policy Committee evidenced concern that decisions regarding partitioning must be kept in the context of the overall examination structure and process. In particular, the changes currently underway with respect to Parts 3 and 5 of our Syllabus, coupled with the findings of the Partitioned Examination Task Force regarding the lengthening of travel time over the last decade make the decisions regarding partitioning much more difficult today than might have been the case two years ago. We also recognize that the partitioning issue has heightened the attention to the examination process by students and membership as they have listened to and participated in discussions of this issue over the last eighteen months.

With these items in mind, the Education Policy Committee reached the following position on each of the four items mentioned above:

(1) **PART 4**

The consensus of the Committee is that we should partition Part 4 effective May 1992. The material on this exam is separable, reasonable statistics have been maintained on subpart performance (at least the two subparts as currently configured), and we have agreed to offer the credibility and loss distributions portion of this exam as a freestanding partition in response to requests from the Canadian Institute of Actuaries.

(2) **PART 5**

The Committee was evenly divided (3 Yes, 3 No) as to whether Part 5 should be partitioned in the near future. Some felt that partitioning Part 4 would be a good first step, and others observed that we may not have meaningful statistics on the performance by subpart for this exam for at least a few years. Still others felt that partitioning Part 5 in addition to Part 4 would provide a larger base of data on which to evaluate partitioning in its early years. Also, the material on Part 5 is reasonably separable.

Related to this discussion of Part 5 is the fact that we are currently going through a transition in which some students may lose credit for part of Part 5. Partitioning Part 5 as early as 1992 or 1993 could facilitate avoiding a loss of partial credit for some candidates. This, of course, would require that the transition period and the partitioning occur sequentially.

In any event, we clearly have a divided set of opinions on the issue of partitioning Part 5, and will leave it to the Board to reach a decision on this matter.

(3) **PARTS 6 AND 7**

The consensus was not to plan to partition these exams for the foreseeable future. The overwhelming support for this consensus rests with the fact that ratemaking and reserving are truly the core areas of practice, and substantial testing should be maintained for these subjects.

(4) **FELLOWSHIP EXAMS**

The consensus here was also to defer consideration of partitioning for the foreseeable future. While some, if not most Committee members felt that the subject matter on at least some of these exams was separable, the Committee did not feel that it would be appropriate to actively pursue partitioning these exams at this time.

The Committee also suggests continued study of the potential for partitioning exams beyond the Part 4 level (or Part 5 if the Board decides at this time to plan for partitioning both Parts 4 and 5). However, we feel this should be part of, or adjacent to, a broader, more thorough review of the examination structure and process.

It is clear from discussions within our Committee and with others involved in the educational process that there are a lot of ideas swimming around the heads of many individuals. However, there is no process currently in place which can collect these ideas, analyze them, and synthesize them into one product. The substantial effort that has gone into studying the issue of partitioning over the last two years has surfaced many of these thoughts, and it is clear that while we have a very good educational and examination process, it is not perfect.

We would also recommend that the Board authorize the creation of a database along the lines suggested by the Partitioned Examination Task Force, and that work on the database begin as soon as practical. In the meantime, data on exam performance should be saved, including any past performance statistics that have not yet been discarded. A call on the CAS Office, and past Part Chairman, Vice Chairman, and Chairman of the Exam Committee should be made to determine how much historical information is still available.

In terms of the ongoing consideration of further partitioning, and the possibility of a broader study of the examination structure and process, you or your successor should establish the objectives for such activities. You previously asked each of your Admissions committees to review certain parts of the report from the Task Force on Testing Methods. I believe those responses will provide a meaningful basis for at least some of the objectives of further study, whether it be for partitioning alone or in a broader context

Once again, I would like to express my sincere gratitude to members of the Partitioned Examination Task Force, as well as the members of the Education Policy Committee for their substantial efforts in considering the partitioning issue. We all look forward to the Board of Director's timely and professional disposition of this matter.

Sincerely,

Gus Krause

Gustave A. Krause, FCAS, MAAA
Chairman, Education Policy Committee

GAK:p

cc: Education Policy Committee

NOVEMBER 9, 1990 LETTER REGARDING PARTITIONED EXAMINATION SYSTEM

Michael Toothman

CASUALTY ACTUARIAL SOCIETY

Michael L. Toothman
VP—Admissions

101 South Hanley
St. Louis, Missouri 63105
314-862-7611

DATE: November 9, 1990

TO: CAS Board of Directors

RE: Partitioned Exam Proposal

On September 12, I sent each of you a package of material on Exam Partitioning in preparation for the Board discussion which was held on Tuesday, September 18. Attached to that memorandum were a copy of the Education Policy Committee's White Paper from 1988 as well as a second draft of the report of the Partitioning Examination Task Force. Those two documents are still relevant and hopefully you had the opportunity to review them in preparation for our meeting on Sunday.

I'm attaching to this memorandum the following additional documents for your review:

- As Attachment 1, Gus Krause's letter of November 2 reporting the Education Policy Committee's recommendations on this subject as well as a summary of the discussion held at the Education Policy Committee meeting in New York on October 23.

- As Attachment 2, a draft of an article being prepared for the Actuary, entitled "Exam Performance Under FES". This article reports on the comprehensive analysis of exam statistics performed by the SOA office following their November 1989 exams and represents the most current set of exam statistics that are available within the SOA.

- As Attachment 3, a set of documents reporting results of a survey of SOA students taken about a year ago on the subject of their assessment of the SOA Flexible Education System (FES).

The 1988 White Paper concluded that a partitioned examination system would produce a better educated actuary and that such a system ought to be implemented if several additional areas of concern could be satisfactorily addressed. In the intervening two years, the area of concern that has drawn the greatest attention is travel time. I'm unaware of anyone who has challenged the conclusion that a partitioned system would produce a better educated actuary, though Kevin Ryan and others have made the distinction

between being "well educated" and "well prepared". Some people feel the degree of improvement in the educational process from partitioning would be significant; others believe that the improvement would be slight. Everyone seems to believe that there would be some degree of educational improvement.

The Partitioned Examination Task Force has recommended that Part 4 be partitioned but that no partitioning occur beyond Part 4 at this time and that a systematic study of performance by sub-part take place prior to any additional partitioning. The biggest concerns expressed by the PETF from my reading of the report are the travel time issue and our inability to predict with any high degree of certainty just how various proposals might affect travel time and student behavior. Also, though not expressed in the report, I believe there was a strong concern with proceeding with a system which did not seem to have the support of the students and perhaps not the support of our membership.

As can be seen from Attachment 1, the Education Policy Committee also recommends that we partition Part 4, effective in May 1992. The EPC also recommends that we not partition Parts 6 and 7 and that we defer consideration of partitioning for the Fellowship exams. On Part 5, the Committee was evenly divided. A summary of the EPC discussion on the Part 5 issue appears on Page 2 of Gus' letter.

Attachment 2 provides very interesting information with regard to travel time under FES within the SOA. The summary of this report appears on pages 1 and 2, but I would recommend a review of the entire report. I conclude from this report that <u>average</u> travel time has increased under FES, but that is largely due to the change in the make-up of the candidate population. Students who were successful under the old system are still succeeding under the new system and are not seeing their travel time increase unless they are deliberately choosing to proceed more slowly. The data indicates to me that it is not necessary for candidates to proceed more slowly for defensive reasons. Indeed, the fast track candidates, as well as the average candidates who are reaching Associateship by steady progress in the system, are not being slowed down appreciably by FES. Pass rates have actually been higher under FES. Also, the introduction of this system has not deterred the tremendous increase in the number of students taking the SOA exams. Although the data is not absolutely conclusive, this data in my mind more strongly supports the proposition that candidates succeeding under our current system will not be slowed down by a partitioned system than it would the proposition that currently successful candidates will have their travel time increased by a Partitioned Examination System.

Attachment 3 addresses the question of student reaction to a Partitioned Examination System. SOA students were negative toward FES before it was implemented. It now appears that the SOA student population is positive

towards this system. It is my belief that any significant change to our examination system will produce some anxiety in the student population simply due to the fact that they are comparing the current system that is known to them to an alternative that is not fully known. Students know how to handle the current system and they will learn how to function under a new system. Only after they've gotten use to a new system can their assessment be objective. We have the benefit of being able to measure assessment of SOA students to FES subsequent to implementation, and that assessment is positive.

With regard to the distinction between a well-educated actuary and a well-prepared actuary, I completely agree that our current examination system is producing good actuaries and that these individuals are not good actuaries solely because they have mastered a certain body of academic material but also because they possess certain intangible characteristics that are either necessary to successfully complete our examination process or molded by that process. It is my belief that these candidates would also succeed under a Partitioned Examination System. However, I believe it is also true that many individuals who would be successful actuaries are not successfully completing our entire examination process and that their failure is not due to a lack of intelligence or a lack of certain of the aforementioned intangible qualities. There is no need to make the process difficult purely for the sake of making it difficult. The ability to handle large volumes of material and the ability to manage our time resources well are both important to the success of actuaries. I would contend that leaving Parts 6 and 7 intact would provide an adequate hurdle for the testing of those capabilities. It is not necessary to keep the hurdles artificially high. In fact, if we wish to meet the demand for actuaries over the next decade, it is my belief that we need to increase the probability of success for those capable individuals who have an interest in our profession.

In summary, it is my belief that partitioning in general will improve the education of the students coming through our system and provide increased flexibility for those students so that they may proceed at their own pace. Keeping Parts 6 and 7 intact will provide a sufficient hurdle to assure that successful candidates do possess the various intangible characteristics that we believe are important to the success of an actuary. That is, successful candidates will continue to be well prepared as well as well educated. Partitioning will increase the probability that students will come out college with more examination credits; for these students chronological age at time they attain Fellowship may actually be reduced. Partitioning will not deter students that are being successful under our current system but will make it possible for good candidates who are not succeeding under the current system to obtain membership in the CAS.

For the above reasons, it is my recommendation that the following motions be positively acted upon by the Board of Directors:

1. That the Executive Council be charged with developing a Management Information System that will, at a minimum, allow the CAS to properly assess changes in travel time and exam performance and to manage the entire exam process.

2. That the CAS partition Part 4 into two exams, effective in 1992.

3. That the CAS partition Part 5 into two exams, with the effective date to be either in 1992 or 1993.

4. That the CAS not partition Parts 6 and 7.

5. That the CAS defer any decision with regard to the partitioning of the Fellowship examinations for at least three years so that we can adequately measure the effect of the above changes to the Associateship Syllabus.

I look forward to our meeting on Sunday.

Sincerely yours,

Michael L. Toothman, FCAS, MAAA, FCIA
Vice President - Admission

/dy

cc: Executive Council

Attachments

PARTITIONED EXAM TASK FORCE FINAL REPORT

Partitioned Exam Task Force

PARTITIONED EXAM TASK FORCE

FINAL REPORT

November 9, 1990

Partitioned Examination Task Force Report

This report presents the results of our study of examination partitioning.

The report consists of an Executive Summary followed by detailed discussion of our recommendations, discussion of our conclusions and discussion of the tasks we performed.

Enough detail to serve as a reference for subsequent work which may be based on our efforts is reflected in the Appendixes.

Respectfully submitted,
the PETF:

Jerome A. Degerness, Chairman
Christopher Diamantoukos
Steven F. Goldberg
John J. Kollar
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CONTENTS

	PAGE
TRANSMITTAL LETTER	
EXECUTIVE SUMMARY	1
DISCUSSION OF RECOMMENDATIONS:	
Systematic Study of Performance	6
Collect and Report Demographic Information	9
Partition Part 4	12
Not Partition Beyond Part 4	13
DISCUSSION OF CONCLUSIONS:	
Travel Time is Increasing	14
Body of Knowledge is Growing	15
Efficiency of Learning Materials is Increasing	15
Little information to Describe Performance	16
No Demographic Data on Candidates	16
Other Professions Demographic Data on Candidates	16
Demands on Educational System are More Complex	16
Pressure for Common Areas of Study	17
Waiver Situations	17
Partitioning has Taken Place Before	17
# of Candidates Strains Voluntary Committees	17
DISCUSSION OF PETF TASKS:	
History of the Exam Process	18
Decision Criteria	18
Exam Competency Groups	19
Syllabus Considerations	20
Partitioned Exam Blue-Prints	21
Grading Standards / Minimum Competency	22
Alternative Credit	22
Membership Input	22
Student and Member Survey Results	24
Employer and Recruiting Considerations	26
CAS Data Base	27
Travel Time	31

APPENDIX

CAS OFFICE DATA BASE: 1

- Sample Candidate Record
- Examination Statistics - Snader
  - Packet #1 Summary
  - Packet #2 Details
- Examination Statistics - Diamantoukos

STUDENT AND MEMBER SURVEY 2

- Survey Form
- Results

CAS SYLLABUS MILESTONES, 1960 - 1990 3

TRAVEL TIME 4

CPA CANDIDATE PERFORMANCE 5

- Description of Source - Snader
- List of May 1988 Tabular Reports
- Selected Performance Charts

MEMBER INPUT 6

- Logic to Oppose or Favor and Suggestions
- Synopsis of Member Input - Krause
- Illustrative Examples

Partitioned Exam Task Force (PETF)
FINAL REPORT
November 9, 1990

EXECUTIVE SUMMARY

PETF deliberations have resulted in four recommendations which would require board action and ten observations which merit board attention. These items are set forth in the executive summary and discussion sections. Other recommendations and observations which are within the authority of standing committees are set out in detailed sections of this report. While the PETF unanimously agrees that broad based partitioning is not feasible at the present time and that some segments of the syllabus should remain unchanged in the foreseeable future, history demonstrates that evolutionary changes are necessary and we believe that controlled changes are possible.

In the course of our work, we have held three meetings, conducted analysis of member comments, prepared, administered and analyzed a student survey, prepared a history of the CAS syllabus, generated various public communications, obtained reactions from the Syllabus and Examination Committees and conducted a host of projects internal to the PETF. Our consensus recommendations are that the CAS board of directors should:

1. Require a systematic study of performance by sub-part prior to every partitioning and syllabus reorganization decision (9 yes/0 no).

2. Charge the VP Administration (CAS office) with collecting and reporting demographic information which may be related to exam performance (9 yes/0 no).

3. Subject to the appropriate study, partition part 4 into 4A (interest and life contingencies) and 4B (credibility theory and loss distributions) (7 yes/2 no).

4. Not partition, at this time, beyond part 4 (9 yes/0 no).

Part 4 lends itself to partitioning because the subject matters are distinct and the minimum competency feature instituted in 1989 has required the Examination Committee to scrutinize sub-part performance. Both prospective partitions have been analyzed in much the same way performance for whole exam units is analyzed. We believe that part 4 grading records and analysis provide the basis for systematic study of part 4 performance by the Examination Committee which will confirm that partitioning

can be done in a controlled manner without material effects on ACAS/FCAS quality or travel time. Further, since part 4A subject matter is distinct from that of part 4B, separate administration of the two will not reduce the comprehension, application, analysis, synthesis or evaluation skills required to pass under the 1990 syllabus. One might expect less recall would be required of candidates attempting only one partition, but question construction can be used to test that by bringing in presumed knowledge from prior exams provided the syllabus specifies prerequisites. Also, memory skills are not all exam specific and should be sufficiently tested in a casualty actuarial context so long as the broad areas which generally define casualty actuaries continue as single, larger exams.

It should be noted that the decision to offer part 4B separately starting in 1992 was a major factor in PETF voting. We did not vote absent awareness of that decision, but it was clear from our discussion that recommendation #3 would have been in jeopardy without it and some members would have felt strongly enough to offer a dissenting report.

Prospects to support similar assertions for other exams are not as good for a variety of reasons. While future changes are inevitable, and some are sure to have partitioning features, no other exam has cleanly divided subject matter and a recent history of passing standards based on sub-parts of a whole exam. Therefore, we see no immediate prospects for partitioning beyond part 4 in a controlled manner which addresses all the additional considerations for implementation itemized by the Education Policy Committee in 1988 and the concerns expressed by members and students since March, 1989. Convictions on this issue are strong and diverse enough that some members advocate making recommendation #4 our #1 recommendation.

The forthcoming part 5 two year transition, which moves exposures, coverages, underwriting, marketing and claim functions to 3B and adds part 5B, finance, as a separate subject, temporarily introduces features to part 5 which are similar to the present part 4. However, transition candidates are unique, finance is new subject matter to the Examination Committee and there are no permanent part 5 minimum standards. Further, the PETF is not aware of any current jurisdictional pressure on part 5, or any other exam, similar to that focussed on part 4 by the Canadian Institute of Actuaries and the Society of Actuaries.

From a longer term perspective, the factors which led us to make recommendations #1, #2 and #4 made us inclined to avoid specific recommendations unique to part 5. However, reaction to the first draft of our report requesting specificity generated report drafting correspondence which clearly documents PETF opposition to partitioning part 5. Four PETF members (including the chairman) offer qualified support for partitioning part 5 when the CAS is better prepared to make a good decision. All other PETF members are apposed to partitioning part 5 in the foreseeable future.

A number of perceptions were formed or reinforced in the course of our deliberations. Upon reflection, most do not seem surprising. However, the significance of each is evolving and needs to be thrust into the conscious thought of CAS management and admissions committees.

1. Travel time is increasing.

2. The body of knowledge reflected in the syllabus is growing.

3. Efficiency of learning materials is increasing, but does not compensate for growth in the body of knowledge.

4. The CAS has very little information to describe and track candidates in terms of overall exam success.

5. The CAS has no data on the demographic characteristics of candidates.

6. Some other professions gather and distribute data on demographic characteristics of their examination candidates.

7. Technical and political demands on the CAS educational system are becoming more complex.

8. Expansion, reorganization and transition partitionings have taken place with regularity over the years.

9. There will be continuing pressure for common areas of study which will be redundant between actuarial and possibly other professions. This is born out by the fact that waiver situations are becoming more frequent.

10. Increasing numbers of candidates strain existing voluntary Examination Committees.

In preparation for future changes, admissions committees should concentrate on understanding how growth in the body of knowledge, efficiency of learning materials, difficulty of exams, preparedness of students, employer study programs and other factors, including the demographic features of our student population, influence exam performance. Substantially more sophisticated information is necessary for our Syllabus and Examination Committees to grapple with increasingly complex demands being placed upon them. Natural evolution has generated exam blue-prints, benchmark questions and statistical analysis of exam results. This needs to continue and should be supplemented by demographic information which can be correlated with exam results and exam exit surveys. Then, travel time and other exam format or administration issues can be dealt with more easily by standing committees without task force attention.

So that CAS public constituencies can understand and accept our examination process, pertinent exam performance summaries and analysis should be made available to members, students, employers, educators and prospective students. Some illustrations of how this would facilitate more informed career planning decisions and better exam progress evaluations are as follows:

- Students could use exam statistics broken down by study effort, exam load and pre-exam work experience to make study plans.

- Employers could use exam statistics by type of employer, company study time, monetary incentive, exam load, work experience, undergraduate major, graduate course of study, academic record, type of college or university, and other professional credentials to make recruiting decisions and understand performance.

- Educators and prospective students could use information regarding courses of study and levels of achievement associated with exam and professional success to provide advice and make career decisions.

- An individual CAS member's information needs could emanate from any or all of the foregoing perspectives.

In short, we have found that many activities necessary to consider partitioning are also necessary to sustain vitality in our syllabus and examination system. Some of these activities and the related resources currently are inadequate or missing. The detailed sections of this report describe improvement opportunities and outline a process upon which partitioning and travel time management decisions could be based.

DISCUSSION OF RECOMMENDATIONS:

This section describes our discussions of May 31, 1990, when the recommendations were agreed upon and includes some embellishments realized during the drafting of this report. It does not comment on all our projects, nor does it include all the suggestions we have for the Syllabus and Examination Committees. Those are addressed in the Discussion of PETF Tasks section and the appendixes. Points relating to the "additional considerations for implementation" expressed by the Education Policy Committee in its' 1988 White Paper are denoted by (AC1), (AC2), etc..

RECOMMENDATION # 1: REQUIRE A SYSTEMATIC STUDY OF PERFORMANCE BY SUB-PART PRIOR TO EVERY PARTITIONING AND SYLLABUS REORGANIZATION DECISION.

Exams test candidates' professional skills relative to weighted performance standards. For purposes of discussion, a combination of skills and performance standards will be referred to as emphasis.

When a change in emphasis is made, it is accomplished through modifications to:

- The Syllabus
- Exam Blueprints
- Question Construction
- Performance Standards.

Changes can be controlled in varying degrees depending on what they are and how they are managed. Changes placing new practice areas on the syllabus are less controllable than simple reorganizations or deletions because there is no experience to use as a base. Absent new material, partitioning can be characterized as simple reorganization, so it should be controllable. However, supporting mechanisms must be in place or the control concept has no application.

To control emphasis changes, the admissions committees must be able to compare effort required to pass by similar groups being tested at different times on the same set of skills (AC5). In other words, do a "systematic study" of performance history with respect to the set of skills under consideration.

In a general sense, need for "systematic study" extends to the entire syllabus. Each exam is part of a path leading through associateship to fellowship and minor changes along the way can result in a major change for the process as a whole. Continuing "systematic study" is necessary to ensure that future changes (partitioning or other) will have minimal effect on candidates succeeding under the 1990 syllabus (AC1). Continuing study is also required so that travel time is affected as little as possible by partitioning or other changes (AC2). See Appendix 4.

Questions as to who must do what and when to produce a "systematic study" have different answers depending on circumstances, but the Examination Committee and CAS office would bear most of the burden. The Syllabus Committee and Education Policy Committee would be involved to a lesser extent.

In a partitioning context, the examination committee must isolate and track exam performance at the sub-part level. Records by sub-part should be kept and analyzed for demographic control groups prior to that subpart being administered as a separate unit. For example, part 10 performance on reinsurance for math majors with five years ratemaking experience supported by a company study program who put in 500 study hours should be known so it can be compared to subsequent experience for similar groups of candidates if part 10 reinsurance were to become a separately administered unit or part of another exam.

Further, various skills (recall, comprehension, application, analysis, synthesis and evaluation) are affected in different ways and degrees by partitioning (or combining) exams. For example, less recall is required from candidates attempting only one partition unless there is some change in question construction. To preserve status quo, more presumed knowledge from prior exams or general experience is required. Synthesis would need to be treated in a similar manner. This implies a need for more syllabus precision with regard to prerequisites and sequence of learning.

On the other hand, recall and synthesis skills are not all exam specific and may be sufficiently tested in a casualty actuarial context so long as the broad areas which generally define casualty actuaries continue as single, larger exams. These areas clearly include ratemaking and reserving, but the particulars are a judgement call (see exam competency groups discussion).

Skills, other than recall and synthesis, are more ingrained in specific applications, articles or topic areas. Testing method changes necessary to preserve status quo under partitioning should be less significant for those skills.

Someone must determine that sub-parts being considered for partitioning make sense as cohesive freestanding exam units. Some sub-parts are better prospects than others. For example, most actuaries would agree that life contingencies and credibility theory can be tested separately without losing the cohesive qualities of part 4, but that interest and life contingencies make a logical pair which should remain together. More subtle distinctions, such as would be necessary to separate insurance law from regulation, would require careful attention, probably by the Syllabus Committee.

Periodically, material is added or deleted from the syllabus to meet changing demands for actuarial skills. This generates new practice areas or changes emphasis in existing areas. Absent examination data from other organizations, the only option when new skills are added is to proceed without the demographic analysis described above as has been done in the past.

Analysis of exam performance by units attempted, previous exam performance and pertinent biographical features will need to be a regular part of the Examination Committee routine to ensure that travel time is not being adversely affected (AC2). The SOA has made limited progress in this regard, but their results indicate meaningful information can be obtained via this means. The accounting profession may have done better that either the CAS or SOA.

Members, and particularly students, have expressed concerns that partitioning is just another way to add more to the syllabus and make the exams more difficult. Examples of evidence cited include new syllabus material being added without dropping something old, hours being added to the exams and greater numbers of questions per exam. There should be sufficient Syllabus/Exam Committee coordination (AC3) so that new material or additional questions improve understanding and make exams fairer, rather than materially altering study requirements.

In short, the term "systematic study" contemplates analysis reflecting on:

- Syllabus Content
- Quality and Nature of the Candidates
- Performance Standards (AC5)
- Exam Construction (length, difficulty, emphasis, style, etc.)
- Travel Time Effects
- Confirmation that Parts of Sub-parts under study represent Cohesive Practice Areas

"Systematic study" would require availability of resources such as exam blue-print variance reports from the part chairmen, post exam grading analysis from the Exam Committee, exam exit surveys completed by the candidates and analysis of the foregoing relative to demographic information which should be resident in the CAS office data base.

RECOMMENDATION # 2: CHARGE THE VP ADMINISTRATION (CAS OFFICE) WITH COLLECTING AND REPORTING DEMOGRAPHIC INFORMATION WHICH MAY BE RELATED TO EXAM PERFORMANCE.

Travel time is the dominant issue raised by the concept of smaller examination units and PETF study has demonstrated that travel time has increased over the last ten years or more while the number of separately administered units has increased from eight to twelve (counting 3a, 3B and 3c as separate). There is some evidence the rate of increase has slowed or stopped, but we were not able to confirm that or go beyond speculative explanations of why the historical changes took place. Intensive search for cause and effect relationships demonstrated current information resources do not support basic inquiry.

For example, there is no information which can relate the amount of preparation time invested by successful candidates vs. unsuccessful candidates from one sitting to the next. We have indications from student and member responses to our survey, member letters, SOA analysis and personal experience that some students take a less ambitious approach to the current part 3 than would be the case were it still a single unit. Exam surveys would provide unique informed opinions regarding this issue.

Similarly, there is no information relating academic training or work experience to exam success. Do candidates with ratemaking experience perform better on parts 6 and 9? Do candidates with legal training do better on part 8? Do accounting and MBA backgrounds give an advantage on parts 7 and 10?

Is it possible that innate ability and ambition of individuals attracted to the actuarial profession changes over time? This parameter is more difficult to estimate, but additional insight is likely to be obtained by observing performance indicators such as:

- SAT scores and GRE Scores
- CPA, CPCU, or SOA Exam Accomplishments
- Major Course(s) of Study
- Type of College or University
- Level of Degree
- Grade Point Averages.

Exam surveys would help to obtain opinions regarding clarity, length and fairness of exams. Surveys also could be used to address difficulty, focus on individual sub-parts and make comparisons with prior exams. Of the three to five hundred candidates who write an exam, there are fifty to a hundred people who, at the appointed time, know the material and the recent exams as well or better than anyone else including the Examination Committee. Surveys could distinguish between candidates who used previous exams to practice under exam conditions, those who used them for reference only and those who did not use old exams. Exam preparation effort should be measured in terms of total study time, company study time, study group participation and some measure of pressure from other interests. Survey questions should be exam specific to identify prior training which may give an advantage. Survey content should be determined by the Examination Committee subject to applicable security and privacy constraints.

The Examination Committee should **not** have access to demographic or survey information with respect to current candidates until after grading is complete, pass marks and applicable minimum competency requirements have been determined, and results have been communicated to the candidates. In other words, candidates should continue to pass or fail solely on the merits of their papers. To maintain student confidence in the security and fairness of the process, surveys may have to be distributed in the form of an enclosure mailed out with results rather than being handed out as candidates leave examination sites.

Information made available to various segments of the public could include:

- Analysis relating Other Credentials to Exam Results
- Units Passed vs Units Attempted
- Employment During Exam Preparation Periods
- Runoff of students in the system from various exam levels at each examination date. This would explain what happens to students from various points onward. Survey of dropouts may be useful to understand the reasons why they stopped taking exams; all dropouts should not be surveyed as there is little point in asking someone who failed many exams in a row why no further attempts were made.

The data base could be searched for success indicators which should be useful to career counselors in schools and colleges as well as to students, members and employers. These could be conveyed in the form of demographic profiles for new ACAS's and FCAS's by date of last exam for the respective designations. Travel time measured by number of attempts and chronologically could be analyzed for pertinent demographic groups. One might speculate that pertinent groups include employed by an insurance company, employed by a regulator, employed by a consultant, working academics and full time students among others.

The foregoing is not an exhaustive inventory and there may be some types of information which will be inappropriate or difficult to collect, but it appears the CAS needs to substantially upgrade existing student and member data base resources. This includes establishing the capacity to do professional quality surveys and developing software for analysis and reporting purposes. Admissions committees should have an exam management information system with ad hoc reporting features.

In short, the CAS needs to collect data, record it and develop software to support regular information needs pertaining to:

- Exam Management
- Syllabus Design
- Member Services
- Employer Services (AC4)
- Public Relations

RECOMMENDATION # 3: SUBJECT TO THE APPROPRIATE STUDY, PARTITION PART 4 INTO 4A (INTEREST AND LIFE CONTINGENCIES) AND 4B (CREDIBILITY THEORY AND LOSS DISTRIBUTIONS).

We began our deliberation of this recommendation by recognizing that the CAS board already has agreed to administer a separate part 4B as an elective for the Society of Actuaries starting in 1992 to satisfy Canadian Institute of Actuaries requirements. We concluded there are only two alternatives:

- Partition Part 4
- Offer a Separate 4B Simultaneously with an Unpartitioned Part 4.

We discussed whether exam questions should be different under the simultaneous approach, but concluded there is no justification for that so the issue boiled down to performance measurements. We speculated as to whether or not a 4B pass ratio should be different from a 4b minimum competency standard and, if so, by how much. We discussed the obvious prospect of demand for waivers on Part 4a and 4b when individuals with credit for the SOA interest and life contingencies take and pass 4B. We speculated whether, if partitioning is implemented, pass ratios for the sub-parts should be higher than if the exam continued as a whole.

We debated the considerations contemplated by "systematic study" as that concept can be applied immediately to 4A and 4B. We concluded that all elements are not currently in place, but reasoned that CIA/SOA considerations offset the shortfall.

In the end, the simultaneous exam alternative to partitioning requires more judgment and imposes much more uncertainty and administrative complexity. Recognition of this fact changed some minds and brought our debate to a close. The PETF is not unanimous (7-yes, 2-no) on this recommendation, but members voting no do not feel strongly enough to offer a dissenting report.

RECOMMENDATION # 4: NOT PARTITION, AT THIS TIME, BEYOND PART 4

Our work indicates that CAS educational and testing resources are not sufficiently precise to implement broad based partitioning in a controlled manner. The most apparent evidence is the fact that we can explain only in speculative terms the travel time changes which have taken place over an extended period of years and of which the CAS was largely unaware. Speculation regarding syllabus material, difficulty and length of exams, employer support, student diligence, innate ability of students and the general characteristics of FCAS's does not provide a sound basis for developing a mode of implementation (AC6). If there is to be any further "partitioning" it should be staged so the Syllabus and Examination Committees can do it properly.

Until the CAS can collect and analyze information pertinent to education and testing performance, responsible partitioning of individual exams or syllabus reorganizations is uncertain at best. Given the travel time trend and the growth in our working body of knowledge, it is desirable for the CAS to substitute more factual information and analysis for the intuitive response system which has accommodated changes accumulated since 1914.

We spent a good deal of time discussing the implied warranty that ACAS's and FCAS's have broad based, generally applicable actuarial skills. Frequent comments from members regarding the need to preserve synthesis features on the exams and fear of cheapening the ACAS and FCAS designations further demonstrate the value placed on this warranty. Although the issue was not worked into recommendation form, our consensus was that ratemaking (Part 6) and reserving/accounting (Part 7) should be preserved in much their present form irrespective of how the syllabus might otherwise be rearranged. The synergy argument applies in a similar fashion to advanced ratemaking and individual risk rating (Part 9).

DISCUSSION OF CONCLUSIONS:

A number of perceptions were formed or reinforced in the course of our deliberations. Upon reflection, most do not seem surprising. However, the significance of each is changing and needs to be thrust into the conscious thought of CAS management and admissions committees. Conclusions are set forth in bold type with discussion and reference to appendices where appropriate.

It is clear that **travel time is increasing**. This is born out by review of CAS office records (Appendix 1) and the student survey (Appendix 2). Why this is happening is not so clear. Member letters and survey responses allude to:

- Employer Support (monetary incentives, study time, study materials, etc)
- Job Requirements
- Family Commitments
- More Syllabus Material
- More Hours of Exams
- More Difficult Examinations
- Competition on the Partitioned Part Three
- Candidate Motivation.

However the information necessary to systematically analyze cause and effect is not available and we were not able to answer questions such as:

- Are there identifiable pockets of more and less successful candidates?
- Do predominantly data gathering and programming responsibilities prevent an actuarial emphasis in day-to-day work?
- Does pre-exam academic training of today's candidates compare favorably with candidates of years past?

Most likely, all of these circumstances affect travel time, but the information necessary to separate effects which can be controlled by the CAS from those controlled by employers and candidates themselves is not available. A detailed treatment of the travel time issue is included as Appendix 4.

A cursory review of the syllabus is sufficient to demonstrate **the body of knowledge reflected in the syllabus is growing**. We compared various points in time during the last twenty years and confirmed that the number of separately administered units increased from eight to twelve, examination hours increased per exam and in total, the number of articles per topic area became greater and the degree of sophistication embedded in syllabus material became greater (Appendix 3). The examined body of knowledge probably has expanded even more because there are more FCAS's (over 100 in 1990 compared to 20 or so in the early 70's) writing questions.

A growing body of knowledge is more than a partitioning issue, but absent more precise controls on the tested materials and grading standards, partitioning could foster inadvertent and undetected changes in exam emphasis. Overemphasis on a large area similar to that on life contingencies from 1980 to 1982 is relatively easy to detect and rectify. Detecting and rectifying under or overemphasis on sub-parts requires more precision.

On the other side of the equation we observe that **efficiency of learning materials is increasing, but does not compensate for growth in the body of knowledge**. Prominent illustrations of improvements over the last twenty years are the advances in reserving and individual risk rating materials. At one time, the leading edge on reserving was an article by Tom Tarbel, which did little more than define the term IBNR. Clearly, students can learn faster and with less effort in todays environment. Continuing refinements are fostered through the textbook, papers, CLRS, etc.

Along with the refinements come new areas of application as well as new concepts and new techniques for traditional practice areas. Learning efficiencies will not keep up with this knowledge explosion. On the other hand, it is desirable to have as much in the syllabus as available learning tools can accommodate. This presents the Syllabus Committee with the increasingly difficult job of choosing core material from the available body of knowledge.

Review of CAS office records, information required for exam registration and statistics maintained by the examination committees reveals that the **CAS has very little information to describe and track candidates in terms of overall exam success**. Further, all the information which is captured is not retained and that which is retained is not in a form which can be analyzed together with related information. Except for the fact of passing, virtually all information on parts 1 through 3 is resident only on SOA records. The CAS has only a paper document for each exam registrant which records pass or fail for each exam taken.

In searching for reasons why travel time has changed, we learned the **CAS has no data on the demographic characteristics of candidates**. What little information that is captured on registration forms and surveys is either lost or in a form which can't be related to individual candidate performance. There is no permanent member number, exam number etc. and there is no data base which records information and makes information available in a tractable form. Expanded biographical data capture is necessary to explore the demographics of our member and student populations.

During our analysis, we obtained documents prepared by the National Association of State Boards of Accountancy which provide demographics behind CPA exam results (Appendix 5). Much of the information is similar to that envisioned by the PETF. This demonstrates the CAS should do more to maintain a competitive understanding of its' members and feeder groups because at least **some other professions gather and distribute data on demographic characteristics of their examination candidates**.

New areas of application, more people involved in exam preparation and administration, computer grading of short answer questions, demand for casualty actuarial services outside of North America and increasing use of casualty actuarial techniques by non-actuaries indicate **technical and political demands on the CAS educational system are becoming more complex**. While partitioning may work against simplicity, it does provide flexibility for new situations and transitional periods. Balancing the needs of the CAS with those of the CIA and SOA has become more complex as evidenced by the Canadian part 8, the CIA qualification exam for FCAS's and the move towards more Canadian content throughout the CAS syllabus which will obviate the need for both.

The CAS will be one among many organizations striving to provide learned body services. We should anticipate **there will be continuing pressure for common areas of study which will be redundant between actuarial and possibly other professions**. This is born out by the fact that **waiver situations are becoming more frequent**. Waiver requests will take a quantum leap when SOA students who have credit for their theory of interest and life contingencies begin passing part 4B.

Such circumstances are not new to the CAS. **Expansion, reorganization and transition partitionings have taken place with regularity over the years** (Appendix 3) and it is reasonable to presume this trend will continue.

Partitioning has been considered in various forms (see discussion of the travel time task and Appendix 4), some of which would require more than one annual offering of the same material. While other considerations presently render this a moot point and at the risk of belaboring the obvious, it should be recognized that more offerings would increase demand for exam preparation while **increasing numbers of candidates** already **strain the existing voluntary exam committees.** A full or part time education actuary may be necessary at some point in the foreseeable future.

DISCUSSION OF PETF TASKS:

On May 22, 1989, the PETF laid out a plan which involved many tasks. Each was pursued by a subcommittee and all have been completed in the task force context. However, opportunities for improving CAS exam management which have been identified are beyond task force powers of implementation and those are left to the appropriate CAS bodies to accept, reject, modify and implement.

HISTORY OF THE CAS EXAMINATION PROCESS:

It has been said that those who don't study history are doomed to repeat it. CAS examination history has been highlighted in Francis S. Perryman's "The First Twenty-Five Years" presidential address which appeared in PCAS XXVI, Part I and in Dudly M. Pruitt's "The First Fifty Years" which appeared in PCAS LI. More recently, Bill Gillam's analysis of syllabus changes since 1964 was reported in Stanley M. Hughey's "The First Seventy-Five Years" and Dick Snader prepared "CAS Syllabus Milestones, 1960 - 1990, for the PETF (Appendix 3).

Mr. Gillam used the following words (number of times) in a page and a half of double and triple spaced text: expanded (6), included (4), added (3), moved (1), rearranged (1), incorporated (1) and split (1). Mr. Snader, in his more detailed effort, used some of the same words along with a few of his own: partitioned, introduced, began, increased, became, adopted, transition, incorporated, restructured, combined, ended and dropped. The point here is that a general overview of CAS syllabus history will describe mainly expansion and change while a more detailed scrutiny reveals pruning as well.

It is clear the syllabus moves through time in a dynamic fashion which is likely to continue.

DECISION CRITERIA:

The first PETF task was to study the Education Policy Committee White Paper and review the responsibilities of all CAS standing committees which contribute to the admissions process. With that background, all task force members participated in a decision criteria drafting discussion. Decision criteria from the White Paper formed the starting point and was molded into the items and rankings shown on the next page.

Very Important

- o Quality of Education
- o Educational Objectives
- o Type of FCAS Graduate
- o Travel Time to FCAS
- o Positioning CAS vs. Other Career Options

Important

- o Administration of Exams
- o Coordination within CAS
- o CIA Requirements
- o Employer's Viewpoint
- o College and University Programs
- o Coordination with SOA
- o Competency vs. Proficiency

EXAM COMPETENCY GROUPS:

Exam competency groups are sets of actuarial skills which tend to be thought of as one. The concept is somewhat vague and may be perceived differently from one actuary to the next. However, there are practice concentrations such as ratemaking and reserving which are extensively addressed in the syllabus and tend to be the focus for CAS Statements of Principles and ASB Standards of Practice. Further, there is a strong sentiment among the membership to test synthesis skills and preserve the quality implied by associateship and fellowship designations. In fact, syllabus goals and objectives are made up of statements which include phrases such as:

- o "..develop an expert knowledge of.."
- o "..a broad range of techniques.."
- o "..a broad range of relevant and standard actuarial practice.."

PETF deliberation of this item did not produce anything concrete, but there was a recurring theme observed in comments from CAS members that examination features which most uniquely define casualty actuaries should remain whole. Every PETF member believes ratemaking should continue as one exam at the offered competence levels (basic - 3B, principles - 6 and advanced - 9). There was some difference of opinion on whether reserving and accounting could be split, but the consensus was that premium and loss accounting shouldn't be split from reserving and there is no point in isolating expense accounting somewhere else.

Part 8 has features which go together well, but deal with jurisdictional subject matter which is more the invention of political minds than the application of fundamental actuarial concepts and professional principles. It is subject to the same general educational goals and objectives as the other exams, but must be managed with more deference to political authority.

Exam competency group considerations do not appear to impose significant partitioning constraints on parts 4, 5 and 10 because these exams are made up of distinct sub-parts.

SYLLABUS CONSIDERATIONS:

Syllabus partitioning issues include items such as exam blue-prints, skills distributions, exam standards, growth in the body of knowledge, reasonable travel time, and the efficiency of educational materials.

Exam blue-prints provide the Syllabus Committee's recommended point distribution by subject for an examination. They are guidelines provided to the Examination Committee.

Skills distributions are embedded in blue-prints. They provide guidelines on how the Syllabus Committee intends the Examination Committee to construct questions. This may be an area where the CAS needs professional educators to provide clarity and consistency.

Examination standards are the Examination Committee's interpretation of the Syllabus Committee's intent. These are not complete until the Examination Committee has finalized grading guides on an exam by exam basis. Some variation from one sitting to the next is unavoidable, but inadvertant change should be kept to a minimum.

Our examination system must deal with a growing body of knowledge. We are breaking through the point where contemporary knowledge can no longer be tested. Ten or twenty years ago, a good set of examinations could accommodate all or most of the CAS body of knowledge. At the present time, an effective combination of efficient study materials, syllabus arrangements and exam construction can cover just about everything. However, the stress is beginning to show, and we may soon pass from that circumstance to an era when more is known than can be digested by the individuals who are able and interested in functioning as professional actuaries.

Some areas of the syllabus will grow faster than others. Eventually, different syllabus and exam approaches may be necessary for areas likely to experience more growth. Managing this dynamic will require a process to test growth in the body of knowledge vs. efficiency of available learning materials.

Part of deciding what is a reasonable body of knowledge for the syllabus is related to travel time. Reasonable travel time is that which interested professionals are willing to invest in obtaining skills and credentials. If the time required exceeds that threshold, the system will cease to be used. Since there is some finite (but unknown) limit to what people can learn in a given amount of time, reasonable travel time must, in part, be dictated by the size of our tested body of knowledge. Discussions with the Syllabus Committee indicate balancing the size of the syllabus with efficiency of learning materials is a difficult, time consuming, and subjective task.

New areas of practice and a growing body of knowledge have implications for specialty qualifications and continuing education, but these are beyond the scope of the PETF and were not deliberated.

PARTITIONED EXAM BLUEPRINTS:

A detailed plan for implementation should provide for blueprints specifically developed for any and all new partitions. Given our findings in other areas, this task was not treated with intensity.

GRADING STANDARDS/MINIMUM COMPETENCY:

Partitioning provides mandatory minimum competency features for each separate unit. It gives credit for good performance and allows less punting on material which has not been mastered. It also means that lower standards are necessary on individual partitions to guarantee the same minimum competency over the entire syllabus that exists with larger exam units. A more detailed discussion is included in Appendix 4.

ALTERNATIVE CREDIT:

Smaller units resulting from partitioning would yield closer correlation with offerings of other organizations which provide educational tools and means to obtain various kinds of credentials. Inevitably, that would generate more situations where individuals could reasonably expect to be granted alternative credit.

MEMBERSHIP INPUT:

Over 100 responses to Kevin Ryan's March 14,1989, letter to members presenting the Education Policy Committee's White Paper and asking for comments were received. They raised key issues relating to exam taking, FCAS quality, employer concerns, the CAS and exam administration. A number of ideas and suggestions were offered along with the questions and critiques.

Travel time is the dominant exam-taking issue, but other concerns were identified as well. The travel route to fellowship is at least somewhat unique to each individual. Advantages and disadvantages were identified for taking smaller steps or having the flexibility to take different routes. Stress associated with exam taking and competitive dynamics of small units vs. large units are a concern to many. There is a variety of opinion as to how partitioning may effect motivation. Some are concerned that a large number of units will be a demotivating factor. On the other hand, a smaller, but significant segment of the population believes smaller units may facilitate progress currently constrained by job and other circumstances. Some members believe partitioning would improve clarity and focus of the exams.

Members are very concerned that quality of the FCAS designation be preserved. Some members are concerned that partitioning would allow marginal performers to slip through the system. Others are concerned that smaller units would place less emphasis on the discipline and time management skills necessary to successfully prepare for the current exams. Many members are concerned that smaller units would make it difficult to test synthesis skills.

There is a diversity of opinion regarding memory capacity. Some are concerned that insufficient memory requirements will credential individuals who cannot function well in a competitive business environment, while others criticize the exams for requiring too much rote memory. Generally, members believe the current system to be of high quality and stress that changes (partitioning or other) should be done in a way that preserves quality.

Many members are concerned with the recruiting leverage provided by the examination process relative to MBA, CPCU, CPA and other professional tracks. There is also concern that changes may complicate employers' career programs with regard to study time, exam compensation, record keeping, etc.

Beyond the entry-level stage, members want to maintain effective positioning relative to the Society of Actuaries and the Canadian Institute of Actuaries. International relations will be an increasing concern as political, economic and trade barriers continue to come down.

CAS administrative constraints are a prominent concern as well. There is a limited supply of volunteers to write exams, grade exams, and otherwise support the educational system.

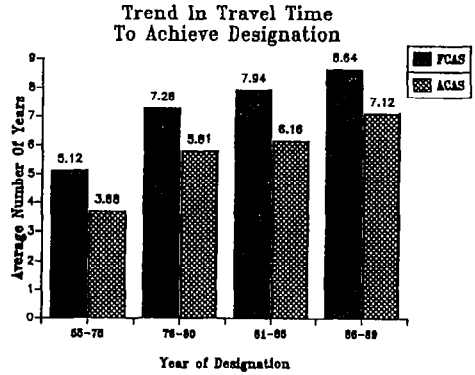
Members suggestions regarding the examination process included the following:

- Test synthesis by drawing on numerous syllabus areas
- Give exams more often
- Use minimum standards on more exams
- Provide electives
- Offer nation specific exams
- Eliminate essay questions

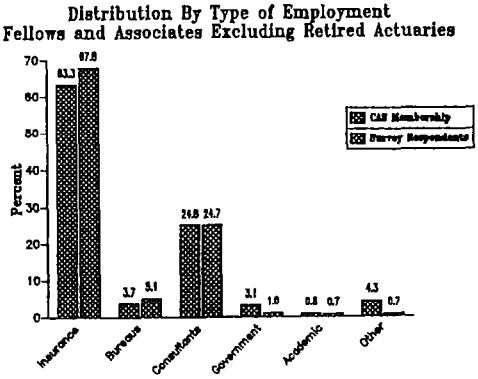
Appendix 6 provides a summary and illustrative samples of the responses.

STUDENT AND MEMBER SURVEY RESULTS:

Surveys mailed to 4,242 individuals generated 704 responses. Associates were most responsive (21%) with the fellows (18%) not far behind. 10% of the students responded. 20% of the overall response was returned by individuals who were not mailed a survey. 50% of the responding fellows received their fellowship between 1985 and 1989. The typical respondent has an undergraduate math degree, works for an insurance company and has 5.6 exams passed. A copy of the survey and summary exhibits are included in Appendix 2



The distribution of respondents by type of employment for fellows and associates excluding individuals who have retired tracks well with the demographics reported in the CAS 1989 Yearbook:



More descriptions of the respondents as a whole are shown in Appendix 2, pages 4 through 10 (A2P4-A2P10).

Generally speaking, respondents were averse to the idea of partitioning. Many feel strongly that it will increase travel time and that the quality of education and actuaries will not be enhanced. Support for the current structure appears to be consistent across designation levels, but fellows appear more conservative than other respondents (See A2P18, A2P34, A2P35, A2P25 and A2P26).

Survey responses were separated between those reporting no more than two attempts on any exam and all others. Interestingly, both groups generally prefer the CAS maintain the current exam structure and not partition parts 5 through 10 (See A2P28 - A2P32).

Motivation was tested by asking respondents whether they **would** achieve fellowship more quickly as well as whether they **could** achieve fellowship more quickly if exams were partitioned (A2P22). There was a marked difference in the amplitude of responses although both queries drew negative feedback. A more neutral, but somewhat indicative response along similar lines was drawn from students who have experience with the partitioned part 3 by asking them if they would have followed a more aggressive study program of the exam had not been partitioned (A2P23).

Attitudes toward exams were explored by asking about the effect on career appeal given complete partitioning vs. selective partitioning and no exams vs. the current structure. Respondents favor exams over no exams, but fewer units over more units (A2P24).

Some demographic exploration was done via the survey. We found that 31% of the respondents who have advanced degrees are fellows and that 20% of the respondents who do not have advanced degrees are fellows (A2P11a). We found that respondents with advanced degrees took fewer attempts to pass the earlier and later exams, but about the same or more attempts to pass exams in the middle of the syllabus (A2P15a&b).

Given the sample size and consistency of responses, these observations have a measure of credibility for the time during which the responses were made. Respondents have conveyed a clear sentiment which is adverse to the general idea of partitioning. On the other hand they embraced the concept of an examination system while allowing that specific features influence the energy level expended while pursuing exams and affect the attractiveness of the profession.

Beyond the immediate conclusions which might be drawn from this survey, analysis of the responses, including the limited demographic information which was captured, hints at information possibilities which could provide understanding of pass ratios, travel time and other examination performance trends.

EMPLOYER AND RECRUITING CONSIDERATIONS:

Partitioning would make it easier for life actuaries, academics and non-actuaries to gain CAS accreditation. This could make it easier for employers of actuaries to develop staff, including specialists. While this may be an advantage to employers, it could change the complexion of the CAS.

Since most academically trained actuaries have a life background, CAS employer interests are best served by keeping the early examinations common for as long as possible. This allows students coming out of school with limited specialty awareness to make career choices without losing the career leverage of credentials obtained in academia. The new part 3B may run counter to this CAS employer interest.

Employers might realize the following advantages from partitioning:

- More associates may achieve fellowship because they are able to pass exams in smaller units more easily.
- More actuaries could satisfy requirements in Canada, the USA and outside North America, thus increasing their value to the company.
- Better matching of study with work.
- More specific education of students.

On the other hand, employers might suffer from the effects of:

- Travel time increases
- Drop-outs from student programs
- Complex administration
- Marginal performers with credentials (this would be the exception, rather than the rule)
- Reduction in synthesis, management, memory, etc.. skills of students succeeding under partitioning.

Respondents to Kevin Ryan's letter with the title of Assistant Vice President and higher were highly negative on partitioning (23 to 2). While these are personal opinions rather than official company positions, they probably are a fair representation of 1989 management attitudes.

Generally speaking, partitioning or other changes which produce better actuaries at lower cost are good for employers. Anything else is neutral or a problem so the key to productive change is being able to understand, choose, control and explain the associated effects.

A tangential observation made during completion of this task was that most academic machinery now in place is geared to life, but experience in Canada (LaValle) demonstrates changes can be affected through commitments of money and staff.

CAS DATA BASE:

The Education Policy Committee White Paper strongly suggests "..results under a system of partitioned examinations must be carefully controlled so as not to materially affect travel time.." To address this issue, we needed to observe travel time experience and proceeded to collect and compile statistics from the CAS office in a PC data base. Observations and conclusions which emerged regarding the data available for our use proved to be as significant as the empirical results.

Findings:

1. Available Data

Very little information is available to describe and track candidates in terms of overall exam success. Information currently maintained (and which was used for PETF analysis) consists of handwritten sheets for each candidate which document exam registration and whether they passed, failed or did not write. A sample CAS office record is included in Appendix 1.

2. Travel Time Trend

We obtained approximately 500 manual records from the CAS office representing all candidates who became Fellows from 1979 to 1988 and transferred them to a PC data base for analysis.

The results (Appendix 1) demonstrate travel time has increased. This conclusion was reached by comparing the average number of years required to complete the exams for those candidates who became fellows between 1979 and 1988 with that of 1984 through 1988 fellows.

	CAS Exams Passed	Number of Candidates	Travel Time in Years
1979-88 Fellows	6	100	4.6
	7	139	5.7
	8	80	8.3
	9	101	8.0
	10	80	8.1
1984-88 Fellows	6	84	4.8
	7	101	5.7
	8	30	10.1
	9	30	10.4
	10	23	10.7

These observations show longer travel times than the survey responses which indicated travel time had increased from 7.9 years to 8.6 years during roughly the same period, but the trend is consistent. The difference in absolute values could mean only motivated individuals responded to the survey and therefore represent a group more likely to do well on exams. It also could mean that relying on memory to fill out a survey isn't the most accurate means to capture historical information or that questions asking for date of first exam, date of associateship and date of fellowship were ambiguous and misinterpreted. The difference was judged to be nuance and not material for task force purposes.

Analysis of travel time experience by individual year of designation indicates increases may have diminished or that growth generated effects have been digested (see Christopher Diamantoukos analysis in Appendix 1.) We did not draw conclusions other than that these types of diagnostics should be a regular part of CAS exam management information.

With respect to why travel time has increased, a probable reason is that total examination hours required for fellowship increased from 33 hours in 1979 to 37 hours in 1987. Other possible explanations include:

- o Expanded Body of Knowledge Covered by the Syllabus
- o Changed Examination Standards
- o Increased Skill Level of Some Candidates leading to Higher Pass Marks.
- o More Marginal Candidates Taking Exams.

The first two items should be analyzed by the Syllabus and Examination Committees, respectively. The other two are addressed below.

3. CAS Demographics

Currently, the CAS does not have demographic information resources which would provide candidate characteristics by degree of examination success. Consequently, we were unable to ascertain whether the student "mix" has been changing. If we had access to information that could indicate how time specific candidate populations are different, some speculation could be removed from the hypothesis offered above.

Further, we believe this lack of information and our inability to explain the apparent change in travel time to ourselves puts the CAS and its stakeholders at a competitive disadvantage relative to other career options. We did not do exhaustive research on demographic information resources of other professions, but did obtain (Appendix 5) an example of reports on CPA candidates published by the National Association of State Board of Accountancy.

Data Base Recommendations:

1. The CAS should institute and maintain a data base which makes it possible to track candidates in terms of overall examination performance. Items which would need to be compiled should include (among others):

- o Exam(s) taken at each sitting
- o Passes and Fails at each sitting
- o Casual vs. serious attempts at each examination

Data should be compiled both retrospectively and prospectively. It may be useful to conduct a survey where historical data is not available in the CAS office.

2. The Syllabus Committee should be asked to review the body of knowledge covered by the syllabus to determine if it has expanded leading to increases in travel time.

3. The CAS Examination Committee should be asked to monitor examination standards over time with respect to both question difficulty and grading. Pre-exam blue-print analysis should be required of the part chairman and exam exit surveys should be obtained from students. This may be an area where the CAS requires assistance from professional educators to interpret results effectively.

Regardless of the approach used, the CAS office should be in a position to maintain a system for recording and compiling results of such studies.

4. The CAS should gather data to be used for understanding demographic characteristics of candidate performance. Results could be used to monitor changes in the student "mix" over time and should be distributed to current members and students as well as potential students and educators.

Examples of data that should be gathered would include (among others):

- Educational Background
- Academic Record
- SAT scores
- Employment History

5. The CAS should increase its capacity to do professional quality surveys.

TRAVEL TIME:

Andre Veilleux and Chris Diamantoukos were a task for within a task force in their analysis of partitioning in conjunction with syllabus and examination features which can be used to control travel time and the nature of fellows emerging from the system. Their work, which is reported in full as Appendix 4, identifies a number of tools which can be used to implement change:

- Pass ratios
- Syllabus content
- Examination length (number of questions and hours)
- Type of question (short answer vs. essay)
- Type of test (open vs. closed book)
- Passing standards (expect better performance on critical material)
- Frequency of offering exams
- Separation of examination units (for example, offer 3B only in February and August while continuing to offer 3a and 3c in May and November)

Three partitioning alternatives to stand alone units were examined using combinations of these tools. It is possible to construct others, but most of the relevant issues probably are revealed by exercising these abstractions. For clarity, "examination unit" refers to an individual examination that is a partition of an "examination group". An "examination group" corresponds to a part in the 1990 syllabus. "Minimum competency" means good enough to get by so long as proficiency is demonstrated by other means. "Minimum proficiency" means professional performance has been demonstrated, a higher standard than minimum competency.

Method A.

1) Overall passing score on exam group or,

2) Minimum competency on all exam units with minimum proficiency on exam unit(s) for which credit is received.

Method B.

1) Minimum proficiency on the exam unit or,

2) Minimum competency on all exam units with overall passing score on exam group.

Method C.

Minimum competency on exam units and an overall passing score which varies by the number of exam units taken.

With respect to quality control, we suggest examination units be subject to partitioned performance analysis, including travel time sensitivity calculations, for some period of time before final partitioning decisions are made.

Finally, measures of travel time can be somewhat ambiguous and it is preferable to use number of attempts over other procedures such as chronological distance from first attempt to last. Also, time to associatship and fellowship should be measured to the date the last exam passed was written, not the date results came out or the first meeting which follows.

DATE	PASSED	FAILED	DID NOT WRITE
May 1977	1, 2		
May 1978	3		4
NOV 1978		5	
May 1979	4		
NOV 1979		7	
NOV 1980	7		
May 1981		6	
NOV 1981	5		
May 1982	6		
May 1983		8	
May 1984	10		
May 1985	8		
Nov. 1985		9	
Nov 1986	9		

Appendix 1

UNITED STATES FIDELITY AND GUARANTY COMPANY
P. O. BOX 1138
BALTIMORE, MARYLAND 21203
301-547-3205
CORPORATE ACTUARIAL DEPARTMENT

RICHARD H. SNADER
VICE PRESIDENT-CORPORATE ACTUARY

September 6, 1989

TO: Members of the CAS Partitioned Exam Task Force

FROM: Richard H. Snader, Vice President-Corporate Actuary

RE: Examination Statistics

The program error described in my 8/22/89 letter has been corrected and the reports recompiled. The reports are arranged in packets as described in my 8/14/89 letter.

Packet #1 - FCAS, 1979-88 in numerical order
Packet #2 - FCAS, 1979-88 sorted by number of CAS administered exams taken
Packet #3 - FCAS, 1984-88 in numerical order
Packet #4 - FCAS, 1984-88 sorted by number of CAS administered exams taken

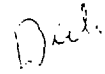
Statistics contained in the packets can be summarized as follows:

Packet #2	No. Recorded Exams	No. of Candidates	Average Travel Time
	6	100	4.6 years
	7	139	5.7
	8	80	8.3
	9	101	8.0
	10	80	8.1

Packet #4	No. Recorded Exams	No. of Candidates	Average Travel Time
	6	84	4.8 years
	7	101	5.7
	8	30	10.1
	9	30	10.4
	10	23	10.7

It appears as if we are getting a false indication from those individuals in packet #4 who took 8 or more CAS administered exams. We appear to be selecting individuals who started long ago but completed their exams only recently. The more typical experience of the recent FCAS would be to take only 6 or 7 CAS administered exams. Those taking 6 CAS exams would most likely have taken Part 4 when it was jointly administered with the SOA and the Joint Board.

Yours truly,



RHS:dmb
Attachments

CC: Gus Krause
Michael Toothman
Education and Testing Methods Task Force

RESULTS ---- Casualty Actuarial Exams

	All Exams		
Total Attempts	6,239		
# Candidates taking more than one Exam	170		
Success Rate	55.5%		
Success Vs # of Attempts	350	out of	631
Total # Multiple Exam Sittings	313		
# Candidates	500		
Exams Not Taken	187		
# Candidates Repeating an Exam	442		
# Repeat Exams	2,287		
Total # Exams	6,239		

SUMMARY

Casualty Actuarial Exams

	Exam # 1	Exam # 2	Exam # 3	Exam # 4	Exam # 5	Exam # 6	Exam # 7	Exam # 8	Exam # 9	Exam # 10	Total Exams	Exams 4 Thru 10 Only
Total Pass	161	216	253	355	463	477	500	498	499	500	3,922	3,292
Total Fail	26	47	55	214	225	228	363	345	454	360	2,317	2,189
Total Exams	187	263	308	569	688	705	863	843	953	860	6,239	5,481
Passing Ratio	86.1%	82.1%	82.1%	62.4%	67.3%	67.7%	57.9%	59.1%	52.4%	58.1%	62.9%	60.1%
Average Attempts	1.2	1.2	1.2	1.6	1.5	1.5	1.7	1.7	1.9	1.7	1.6	1.7
Exams Not Taken: Total Skipped	4	7	9	14	25	19	13	26	34	36	187	167

	Exam # 1	Exam # 2	Exam # 3	Exam # 4	Exam # 5	Exam # 6	Exam # 7	Exam # 8	Exam # 9	Exam # 10
# Passing 1st Time	148	185	209	207	295	291	258	281	242	274
# Passing 2nd Time	9	22	34	110	124	154	163	134	146	142
# Passing 3rd Time	2	7	8	28	37	27	53	53	65	53
# Passing 4th Time		2	2	8	6	5	20	21	23	22
# Passing 5th Time	2			1	1		3	5	15	4
# Passing 6th Time							2	2	4	2
# Passing 7th Time								2	2	2
# Passing 8th Time				1					1	
# Passing 9th Time										
# Passing 10th Time										1
# Passing 11th Time										
# Passing 12th Time									1	
# Passing 13th Time							1			

RESULTS ---- Casualty Actuarial Exams	Exams 4 Thru 10 Only		
Total Attempts	5,481		
# Candidates taking more than one Exam	170		
Success Rate	1		
Success Vs # of Attempts	350	out of	631
Total # Multiple Exam Sittings	313		
# Candidates	500		
Exams Not Taken	167		
# Candidates Repeating an Exam	441		
# Repeat Exams	2,168		
Total # Exams	5,481		

SUMMARY

Casualty Actuarial Exams

	Exam # 4	Exam # 5	Exam # 6	Exam # 7	Exam # 8	Exam # 9	Exam # 10	Exams 4 Thru 10 Only
Total Pass	355	463	477	500	498	499	500	3,292
Total Fail	214	225	228	363	345	454	360	2,189
Total Exams	569	688	705	863	843	953	860	5,481
Passing Ratio	62.4%	67.3%	67.7%	57.9%	59.1%	52.4%	58.1%	60.1%
Average Attempts	1.6	1.5	1.5	1.7	1.7	1.9	1.7	1.7
Exams Not Taken: Total Skipped	14	25	19	13	26	34	36	167

	Exam # 4	Exam # 5	Exam # 6	Exam # 7	Exam # 8	Exam # 9	Exam # 10
# Passing 1st Time	207	295	291	258	281	242	274
# Passing 2nd Time	110	124	154	163	134	146	142
# Passing 3rd Time	28	37	27	53	53	65	53
# Passing 4th Time	8	6	5	20	21	23	22
# Passing 5th Time	1	1		3	5	15	4
# Passing 6th Time				2	2	4	2
# Passing 7th Time					2	2	2
# Passing 8th Time	1					1	
# Passing 9th Time							
# Passing 10th Time							1
# Passing 11th Time							
# Passing 12th Time						1	
# Passing 13th Time				1			

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	# Multiple Exams Passed	# Multiple Exams Failed	Exam 1	Exam 2	Exam 3	Exam 4	Exam 5	Exam 6	Exam 7	Exam 8	Exam 9	Exam 10
	Six Exams																	
	5	6	8.0	1	Nov-88								1	2	4	2	1	1
	3	6	4.0	2	Nov-82								2	2	2	1	1	1
	2	6	3.5	18	May-85								2	1	1	1	1	2
	1	6	4.0	26	May-86								1	2	1	1	1	1
2	3	6	3.5	29	May-84	2	2	2					1	1	1	3	1	2
	4	6	4.5	31	Nov-85								1	2	2	1	2	2
	3	6	4.0	33	Nov-84								1	1	2	1	2	2
	3	6	4.5	43	May-87	1	1	1					2	1	1	2	1	2
		6	2.5	46	May-83								1	1	1	1	1	1
1	2	6	4.0	48	May-84								1	2	1	2	1	1
	4	6	5.0	49	Nov-85								2	2	2	1	2	1
	6	6	8.0	57	May-87							1	1	1	2	2	2	3
	7	6	7.0	60	May-88	1	1	1					3	1	2	4	1	2
		6	2.5	63	May-83								1	1	1	1	1	1
		6	2.5	64	May-85								1	1	1	1	1	1
	4	6	4.0	67	Nov-86	1	1	1					1	1	2	1	3	2
	4	6	4.5	69	May-87								1	2	2	1	2	2
	9	6	7.0	70	Nov-88								2	2	3	1	3	4
		6	2.5	73	Nov-83								1	1	1	1	1	1
	2	6	4.5	94	Nov-86								1	1	2	1	2	1
	5	6	5.5	104	May-87								1	2	2	2	2	2
	2	6	3.5	110	May-85								2	2	1	1	1	1
	2	6	4.5	111	May-85								1	1	1	2	2	1
		6	2.5	120	May-83								1	1	1	1	1	1
	3	6	4.5	123	May-85								1	1	2	2	2	1
	3	6	4.5	125	May-87								2	2	1	1	1	2
1	3	6	4.5	126	May-81	1	1	1					1	2	1	2	1	2
		6	3.0	127	May-85								1	1	1	1	1	1
	5	6	5.0	130	Nov-87	1	1	1					1	1	2	2	3	2
	2	6	4.0	131	Nov-86								1	1	2	1	2	1
	3	6	4.0	150	Nov-84								1	2	3	1	1	1
	4	6	5.0	156	May-87								1	2	2	3	1	1
	11	6	8.0	157	Nov-88								3	2	3	2	3	4
	9	6	9.5	177	Nov-82	1	2					2	2		2	2	6	1
	2	6	4.5	180	Nov-85								1	1	1	1	3	1
	2	6	4.0	183	May-86	1	2						1	2	1	2	1	1
	4	6	4.5	184	May-85								2	1	1	2	2	2
	3	6	4.0	185	Nov-84								1	2	1	1	3	1
	4	6	4.5	187	May-85								1	2	3	1	1	2
	2	6	4.5	190	Nov-85								1	1	3	1	1	1
		6	3.5	192	May-85								1	1	1	1	1	1
	1	6	3.5	205	Nov-86								1	1	2	1	1	1
	3	6	4.5	206	May-85								1	1	1	2	2	2
	1	6	3.5	208	May-86				1					1	1	1	1	2
	6	6	7.5	209	Nov-86							1	1	1	4	2	2	1
	3	6	3.5	210	Nov-84	1	1	1					1	2	2	1	2	1
	1	6	3.5	211	May-86								1	1	1	1	1	2
		6	2.5	222	May-82								1	1	1	1	1	1
		6	2.5	224	Nov-83								1	1	1	1	1	1

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	# Multiple Exams Passed	# Multiple Exams Failed	Exam # 1	Exam # 2	Exam # 3	Exam # 4	Exam # 5	Exam # 6	Exam # 7	Exam # 8	Exam # 9	Exam # 10
	7	6	6.5	226	Nov-87								3	3	2	1	2	2
	3	6	5.0	234	May-86								1	1	2	3	1	1
	1	6	3.0	238	Nov-83								2	1	1	1	1	1
	3	6	5.5	245	May-87								2	3	1	1	1	1
	7	6	6.0	246	Nov-87								2	2	3	2	2	2
	6	6	6.0	263	May-88								3	3	1	3	1	1
	3	6	4.0	264	Nov-85								2	2	2	1	1	1
	1	6	3.0	266	Nov-85								1	1	2	1	1	1
		6	2.5	272	May-83								1	1	1	1	1	1
	3	6	4.5	273	May-86								1	1	1	2	1	3
	5	6	4.5	288	May-85	1		2					1	3	2	1	2	2
	2	6	4.5	293	May-86								1	2	1	2	1	1
		6	2.5	296	Nov-84								1	1	1	1	1	1
1	1	6	3.5	301	May-84								2	1	1	1	1	1
3	2	6	5.0	313	May-84								1	2	1	1	2	1
	4	6	5.0	315	Nov-86								2	2	2	1	2	1
3	4	6	5.5	317	May-79							2		1	1	1	3	2
2	2	6	5.5	321	May-88								1	1	2	1	2	1
1	2	6	3.5	328	May-84	1	1	1					1	1	1	1	2	2
		6	2.5	333	May-86								1	1	1	1	1	1
	3	6	4.5	338	Nov-85								1	2	2	1	2	1
	1	6	3.5	346	May-85								1	1	1	2	1	1
		6	2.5	347	May-86								1	1	1	1	1	1
	1	6	3.0	353	Nov-84								2	1	1	1	1	1
		6	2.5	354	May-84								1	1	1	1	1	1
	5	6	5.0	358	May-87								3	3	1	2	1	1
	6	6	5.5	362	Nov-87								2	2	3	1	1	3
5		6	5.5	364	May-84								1	1	1	1	1	1
	6	6	6.5	366	May-88								1	2	3	2	2	2
	4	6	5.5	378	Nov-86	1	1	1					1	1	2	2	3	1
	2	6	3.5	384	May-86								2	1	1	2	1	1
	6	6	5.5	396	Nov-87								3	2	1	2	2	2
	3	6	4.5	399	Nov-86								1	2	2	1	2	1
		6	2.5	400	Nov-83								1	1	1	1	1	1
	12	6	9.5	403	Nov-87							2	4	2	2	4	3	1
	11	6	9.0	418	May-87							2	3	2	2	2	3	3
	1	6	3.5	420	May-83								1	2	1	1	1	1
	2	6	3.5	421	May-85								1	1	1	1	2	2
	1	6	3.0	429	Nov-84								1	1	1	1	2	1
	8	6	6.5	436	May-86								1	2	3	4	3	1
1	1	6	3.5	438	May-84								1	2	1	1	1	1
	8	6	7.0	439	May-88								4	2	1	3	1	3
	9	6	9.0	443	Nov-87								3	2	3	2	3	2
	8	6	6.5	451	May-88								2	3	2	2	3	2
	7	6	7.5	465	Nov-88								1	2	3	1	3	3
	1	6	3.5	467	May-82								1	1	1	2	1	1
	5	6	6.0	470	May-86								1	2	2	3	1	2
	5	6	5.0	476	Nov-85								1	2	2	2	3	1
	2	6	4.0	477	Nov-84								2	1	1	1	2	1
	6	6	3.5	484	May-82	4	4	4					3	2	2	2	1	2

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	# Multiple Exams Passed	# Multiple Exams Failed	Exam 1	# Exam 2	# Exam 3	# Exam 4	# Exam 5	# Exam 6	# Exam 7	# Exam 8	# Exam 9	# Exam 10
	5	6	6.0	491	May-88								1	1	3	2	2	2
20	331	600	4.6	100		17	18	16	1			10	142	151	163	152	164	148
	Seven Exams																	
	1	7	4.0	3	Nov-86							1	1	1	2	1	1	1
1	13	7	10.0	5	May-79	6	2	10	1	2	2	2	1		1	3	3	5
	5	7	5.0	6	Nov-85							1	1	1	4	1	2	2
	5	7	5.5	7	May-88							1	1	2	3	3	1	1
		7	3.0	10	May-87							1	1	1	1	1	1	1
		7	3.5	12	May-80							1	1	1	1	1	1	1
2	5	7	7.5	15	May-81						1	2		2	1	3	1	2
2	2	7	5.0	19	May-84							1	1	2	1	2	1	1
	7	7	8.5	28	May-87	1	1	1	1				3	2	1	3	2	2
	3	7	4.0	34	Nov-84	1	2					1	2	1	2	2	1	1
	1	7	4.5	38	May-88							2	1	1	1	1	1	1
		7	3.0	40	Nov-83						1		1	1	1	1	1	1
4	1	7	5.5	44	May-84				1				1	2	1	1	1	1
	1	7	3.0	45	May-88	1	1	1				1	1	1	1	2	1	1
		7	3.0	47	Nov-83						1		1	1	1	1	1	1
10	11	7	13.0	52	May-84	1	1	1			2	3	3		1	2	4	3
1	10	7	8.5	53	May-84							2	1	1	1	1	7	4
	5	7	6.0	54	Nov-87							1	1	2	2	2	3	1
	7	7	6.5	59	May-85	1	2				1	1	1	1	1	2	4	3
	1	7	3.0	65	Nov-84							1	2	1	1	1	1	1
		7	3.0	68	May-82							1	1	1	1	1	1	1
		7	3.5	72	May-85							1	1	1	1	1	1	1
	2	7	4.5	80	May-83							1	1	1	1	1	2	2
		7	3.0	82	Nov-85							1	1	1	1	1	1	1
	1	7	3.5	83	May-82							1	1	1	2	1	1	1
	1	7	5.5	85	Nov-83				1				1	1	1	1	2	1
		7	3.0	87	May-87							1	1	1	1	1	1	1
	1	7	3.5	90	May-88							1	1	1	2	1	1	1
	11	7	8.5	92	May-80	3	3	3			1	3	3		2	3	3	3
		7	3.0	93	May-88							1	1	1	1	1	1	1
	1	7	3.5	95	May-88							1	1	1	2	1	1	1
	3	7	5.5	100	May-80						1	3		1	1	1	1	2
	3	7	5.0	105	May-87							1	1	1	1	2	2	2
	6	7	6.5	106	Nov-88							2	2	1	2	1	3	2
	7	7	10.0	107	May-88							3	1	1	4	3	1	1
2	6	7	9.0	109	May-80						1	1	2	2	2	2	1	2
	1	7	4.5	112	May-87							1	2	1	1	1	1	1
	9	7	9.5	121	May-86	2	1	3				3	2	1	1	4	1	4
2	7	7	8.5	128	Nov-86						1	1	3	2	1	2	3	1
	3	7	4.5	140	May-88							1	1	1	3	1	1	2
		7	3.0	141	May-80							1	1	1	1	1	1	1
	7	7	5.5	145	May-87	4	3	5				1	2	4	2	3	1	1
		7	4.5	161	May-83					1			1	1	1	1	1	1
	4	7	6.5	163	May-88							1	3	2	2	1	1	1
	7	7	6.5	168	May-85	2	2	2		1			2	3	4	2	1	1

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	Passed	Failed	Exam 1	Exam 2	Exam 3	Exam 4	Exam 5	Exam 6	Exam 7	Exam 8	Exam 9	Exam 10
		7	3.0	172	May-88							1	1	1	1	1	1	1
	3	7	5.0	173	May-88							2	1	1	2	1	2	1
	2	7	4.0	175	Nov-86							2	1	1	2	1	1	1
	6	7	7.5	176	May-88							1	2	2	2	2	2	2
	4	7	5.0	178	May-88							3	2	1	2	1	1	1
	3	7	4.5	181	May-82	2	2	2				1	1	1	1	3	1	2
	1	7	4.0	189	May-88							2	1	1	1	1	1	1
	1	7	6.5	193	May-79	1	2					1	1	1	1	1	2	1
1	5	7	6.0	196	May-84							2	1	2	2	2	2	1
	2	7	2.5	197	May-80	3	4	2				1	1	2	1	2	1	1
	2	7	4.5	203	May-86							1	1	1	2	2	1	1
	4	7	7.5	215	May-86	1	1	1	1				1	1	2	1	2	3
5	7	7	9.0	217	May-84							2	1	2	1	1	4	3
2	4	7	9.5	218	Nov-82					2	1	1			2	2		3
		7	3.5	221	May-87							1	1	1	1	1	1	1
	8	7	8.5	223	Nov-81						2	1		2	4	1	2	3
		7	3.0	227	May-88							1	1	1	1	1	1	1
	6	7	7.0	229	Nov-87							1	3	1	4	2	1	1
1	9	7	7.5	230	Nov-86	1	2					2	3	2	1	1	3	4
	1	7	3.5	235	Nov-86							1	1	1	2	1	1	1
	4	7	6.5	239	May-82						1	1	1	2	1	2	2	1
	4	7	5.5	242	May-86							2	1	2	2	1	2	1
	4	7	5.0	243	May-88	1	2					1	2	2	1	2	1	2
4	9	7	10.0	244	May-84	1		2				1	1	3	1	2	4	4
		7	3.0	248	May-88							1	1	1	1	1	1	1
	1	7	3.5	252	Nov-81							1	1	1	1	1	2	1
	4	7	4.5	259	May-81							2	1	2	1	1	2	2
	2	7	5.0	261	May-83							1	1	1	1	3	1	1
	1	7	3.5	267	May-86							1	1	1	1	2	1	1
		7	6.0	275	May-84				1				1	1	1	1	1	1
	1	7	4.0	281	May-81	2	4					1	1	1	1	2	1	1
	6	7	5.0	282	Nov-87	3	3	3				1	2	2	3	1	2	2
		7	5.5	283	Nov-83				1				1	1	1	1	1	1
	10	7	8.5	284	May-86							1	4	2	1	5	3	1
	5	7	7.0	285	Nov-85					1			1	2	2	1	3	2
1	4	7	9.5	287	Nov-88							1	2	1	2	1	1	3
	2	7	4.5	291	May-86							2	2	1	1	1	1	1
	4	7	6.5	299	May-85					1			1	1	3	2	1	2
	1	7	3.5	300	May-86							1	1	2	1	1	1	1
		7	3.0	307	May-88							1	1	1	1	1	1	1
1	1	7	4.0	309	May-82	1	2					1	1	1	1	2	1	1
	1	7	3.5	310	May-87							1	2	1	1	1	1	1
	13	7	9.5	312	Nov-85	2	2	2				1	1	3	1	1	8	5
	3	7	5.0	322	May-88							2	1	2	2	1	1	1
	4	7	5.5	325	May-88							1	1	2	1	3	2	1
		7	3.0	335	May-79							1	1	1	1	1	1	1
3	2	7	5.5	336	May-84					1			2	1	1	1	1	2
1	9	7	12.5	337	Nov-84	1	1	1			1	2	3		2	1	3	4
	7	7	7.0	339	Nov-88							1	1	2	3	2	3	2
	2	7	4.0	345	Nov-80							1	1	1	2	1	2	1

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	# Multiple Exams Passed	# Multiple Exams Failed	Exam 1	Exam 2	Exam 3	Exam 4	Exam 5	Exam 6	Exam 7	Exam 8	Exam 9	Exam 10	#
	3	7	4.5	349	May-88							1	1	1	2	2	2	1	
	2	7	4.0	352	May-82							1	1	1	2	1	1	2	
	10	7	13.5	360	May-87						1	2		1	4	3	2	4	
	1	7	4.0	363	May-81							1	1	2	1	1	1	1	
	2	7	4.5	369	May-87							1	1	2	1	2	1	1	
	10	7	9.5	371	May-82	1	1	1			1	2	2	1	3	3	3	2	
	2	7	4.0	373	May-88							1	1	1	2	1	1	2	
	6	7	9.5	376	May-88				1				2	3	1	2	2	2	
1	5	7	8.5	387	May-88							1	2	2	2	2	1	2	
2	2	7	6.0	389	May-84							1	2	1	1	2	1	1	
	1	7	8.0	394	May-86				1				1	1	1	1	1	2	
	6	7	6.5	395	May-85							1	2	1	1	2	3	3	
	2	7	4.5	398	May-87							2	1	1	1	2	1	1	
		7	3.0	406	May-87							1	1	1	1	1	1	1	
	4	7	5.0	408	Nov-87							2	1	1	2	1	2	2	
	6	7	7.0	411	May-80						1	2	1	1	1	2	2	3	
	2	7	6.5	412	Nov-88							1	1	2	2	1	1	1	
	2	7	4.5	415	May-87							1	1	1	2	2	1	1	
	7	7	5.5	417	Nov-85	2	1	3				1	3	1	4	2	1	2	
	4	7	6.0	422	May-87							3	2	2	1	1	1	1	
		7	4.5	423	May-83					1			1	1	1	1	1	1	
		7	3.0	431	May-86							1	1	1	1	1	1	1	
		7	3.0	437	Nov-85							1	1	1	1	1	1	1	
	2	7	5.0	441	May-88							1	2	1	1	1	1	2	
1	8	7	8.0	445	Nov-79	4	3	5			2	2	2	1	3		4	1	
	5	7	5.5	447	May-88							2	3	1	1	1	1	3	
	3	7	4.5	448	May-87							1	1	2	1	1	2	2	
	1	7	4.0	452	Nov-87							1	1	1	2	1	1	1	
	2	7	4.5	453	Nov-87							1	2	1	2	1	1	1	
1		7	3.5	454	May-84							1	1	1	1	1	1	1	
	3	7	5.0	455	May-88							3	1	1	1	1	2	1	
	4	7	7.5	459	May-88							3	1	1	2	1	2	1	
	4	7	10.5	460	May-87				1				2	1	1	3	2	1	
	1	7	3.5	461	May-87							1	2	1	1	1	1	1	
	9	7	9.0	475	Nov-81						1	2	1	1	2	3	3	3	
	4	7	2.5	479	May-87	5	6	4				2	1	1	2	1	2	2	
1	4	7	5.0	480	May-84	1	1	1				1	2	2	2	1	1	2	
	5	7	9.5	481	May-88				1				1	2	2	3	2	1	
	1	7	5.5	485	Nov-88							1	1	1	1	1	2	1	
	7	7	10.5	486	May-87				1				2	2	3	3	1	2	
	2	7	4.0	495	May-82							1	2	2	1	1	1	1	
	1	7	3.0	496	May-82	1	2					1	1	2	1	1	1	1	
3	9	7	16.0	497	Nov-82	1	1	1	2	4			2	1	2	1	2	2	
	2	7	4.0	499	May-87							1	2	2	1	1	1	1	
52	484	973	5.7	139		56	58	54	14	14	23	162	189	183	217	211	223	221	
Eight Exams																			
	7	8	8.5	8	May-86					1		2	1	3	2	2	3	1	
	6	8	9.5	11	May-87					1		4	2	1	3	1	1	1	

Casualty Actuarial Exams

Not Taken	Failed	Passed	Years	Candidate #	Completion Date	Multiple Exams Taken	Passed	Failed	Exam 1	Exam 2	Exam 3	Exam 4	Exam 5	Exam 6	Exam 7	Exam 8	Exam 9	Exam 10
	3	8	6.0	17	Nov-79					1	1	1		2	2	1	2	1
	9	8	9.0	21	May-82					2	1	1	1	2	1	2	3	4
	7	8	13.0	25	Nov-81					2	1	1	1	1	3	1	4	1
1	5	8	8.0	37	Nov-84				1			1	1	1	2	3	3	1
	1	8	4.5	39	May-83						1	1	1	1	1	2	1	1
2	11	8	8.5	50	May-80	3	1	5		2	3	2	1		1	4	2	4
	1	8	4.0	66	Nov-82						1	1	1	1	2	1	1	1
2	5	8	7.0	75	May-84					1		2	1	1	1	1	3	3
	3	8	12.0	76	May-86				1	1			1	1	2	1	2	2
	3	8	5.0	78	Nov-81						1	1	1	1	1	1	3	2
	7	8	7.5	81	May-80					1	1	2	2		2	2	2	3
	4	8	9.0	98	Nov-85				1	1			1	1	4	1	1	2
	8	8	8.0	108	May-85						1	2	3	1	2	2	2	3
1	1	8	3.5	116	May-81	1	2			1	1	1	1	1	1	1	1	1
	5	8	6.5	118	Nov-79					1	1	2		1	1	1	4	2
3	7	8	13.0	129	Nov-86						2	4		2	1	1	3	2
	1	8	4.5	132	May-82						1	1	1	1	1	1	1	2
	24	8	15.5	137	Nov-88	4	5	3	1	1	1	1		3	3		12	10
	7	8	9.5	138	May-88				1			1	2	2	2	3	1	3
1	10	8	9.5	146	Nov-82					1	2	2	1	1	2	1	5	3
	6	8	7.0	147	May-83						1	1	1	1	2	3	3	2
	1	8	4.0	162	Nov-82						1	1	1	1	2	1	1	1
1	4	8	6.0	164	Nov-82					1	1	1	1	1	3	1	2	1
	12	8	9.5	169	May-82	1	1	1		2	2	2		2	2	2	4	4
	5	8	11.0	170	Nov-88				1	1			2	1	2	1	2	3
	3	8	7.0	171	May-85						1	2	1	1	3	1	1	1
1	22	8	17.0	174	Nov-86	6	1	11	1	2	4	1	1	2	13	1	4	1
	7	8	8.0	179	May-85						1	1	1	2	1	3	4	2
	7	8	8.0	198	Nov-81					1	1	1	1	1	2	3	4	1
	5	8	6.0	207	May-82						1	2	1	1	2	2	2	2
	2	8	8.0	231	May-86				1	1			1	1	1	1	2	2
	2	8	5.0	237	Nov-81						1	2	1	1	1	1	2	1
	8	8	10.0	247	May-83					1	1		2	2	2	3	2	3
	8	8	8.0	249	May-83	1	2				1	2	2	1	1	4	3	2
	2	8	4.5	250	May-82						1	1	1	1	2	1	1	2
	10	8	12.0	255	Nov-88				1			2	5	2	2	2	2	2
	11	8	11.5	260	Nov-80				1	1	2	2	2	1	3	1	4	2
	3	8	4.5	270	Nov-80	2	3	1			1	1	1	1	3	1	2	1
	2	8	7.0	279	Nov-82				1			1	2	1	2	1	1	1
	7	8	7.5	280	May-86	1	1	1		1		1	2	2	2	4	2	1
5	15	8	12.5	289	May-83	3		6	2		2	8	3	3	2	1	1	1
	5	8	6.5	294	May-82						1	1	2	1	1	4	2	1
	8	8	7.5	298	May-79	1	1	1	1	2	2	2		2	2	2	2	1
	2	8	8.0	304	May-79	1	2		1			1	1	1	1	2	1	2
	7	8	11.0	311	Nov-87				1		1		3	2	2	3	2	1
	6	8	10.0	314	May-88					1		1	3	1	2	2	2	2
	14	8	9.5	327	May-82	4	3	5		1	2	3	2	1	3	6	3	1
		8	6.5	331	May-82						1	1	1	1	1	1	1	1
	15	8	11.0	340	Nov-82	2	1	3		1	2	2	3	1	5	3	3	3
8	7	8	10.0	341	May-84	2	1	3		1		2	1	3	1	4	1	2

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	Passed	Failed	Exam 1	Exam 2	Exam 3	Exam 4	Exam 5	Exam 6	Exam 7	Exam 8	Exam 9	Exam 10
	6	8	7.5	343	Nov-81				1	1	1			2	2	1	3	3
	10	8	8.5	348	Nov-86	1		2			1	2	3	1	3	1	3	4
	2	8	6.5	350	Nov-83				1	1			1	2	2	1	1	1
	6	8	8.0	355	May-82						2	1	2	1	1	2	2	3
1	2	8	5.0	356	May-82						1	1	1	1	1	1	2	2
1	17	8	16.5	359	Nov-86	1	1	1	1		3	2	1	2	6	1	3	6
		8	4.0	379	May-81						1	1	1	1	1	1	1	1
	9	8	10.5	380	Nov-88						1	2	2	1	2	2	6	1
	11	8	12.0	381	Nov-80				1		1	2	2	3	4	2	1	3
	4	8	9.0	382	May-87				1			2	1	2	1	2	2	1
1	8	8	6.5	385	May-82	3	2	4			1	1	2	2	1	4	2	3
	3	8	7.5	388	May-79				1	1		1		2	2	1	1	2
	7	8	12.0	402	May-87				1	1			3	1	1	4	2	2
	2	8	8.5	414	May-86				1	1			1	1	1	2	2	1
1	5	8	6.0	424	May-79	1	1	1		1	1	1	1	1	1	4	1	2
	6	8	9.5	425	May-87	2	3	1	1	1			1	1	3	3	1	3
3	3	8	6.5	426	May-84						1	2	1	1	2	1	2	1
1	3	8	11.5	430	Nov-82					1	1	1	1	1	1	1	3	1
	12	8	10.0	458	May-82	1	1	1		1	1	2	2	4	5	1	1	3
	4	8	5.5	462	May-82	1	1	1			1	3	2	1	2	1	1	1
	8	8	10.0	466	Nov-87					1	1		2	1	3	2	3	3
	8	8	7.0	468	May-82	1	1	1			1	2	3	3	2	1	2	2
	14	8	9.5	472	May-81	5	4	7			2	2	2	4	1	4	1	6
	3	8	6.5	483	Nov-80					1	1	1		1	1	1	3	2
	5	8	6.0	489	Nov-83	1	2				1	1	1	2	2	1	3	2
	10	8	11.5	493	May-88	1	1	1	1	1		1	1	2	3	3	2	4
		8	5.0	494	Nov-82				1	1			1	1	1	1	1	1
	4	8	5.0	498	Nov-82	1	2				1	1	1	1	2	2	3	1
33	513	640	8.3	80		51	43	60	27	47	74	110	110	116	168	149	184	168
	Nine Exams																	
	10	9	12.5	4	May-83	1	2		1	1	2	1	2	2	1	1	4	4
	2	9	11.5	13	May-86				1	1	1		1	1	1	1	2	2
	4	9	10.5	22	Nov-85					1	1	1	1	1	3	2	2	1
1	1	9	5.5	23	Nov-79					1	1	1	1	1	2	1	1	1
	4	9	7.0	24	May-83	1	1	1	1		1	2	2	1	2	2	1	1
	4	9	8.0	36	May-79	1	3		1	1	1	1	1		3	4	1	
2	3	9	6.5	42	May-84					1	1	1	2	1	1	2	2	1
	3	9	5.5	51	May-83					1	1	1	2	1	2	2	1	1
	2	9	6.5	61	May-83					1	1	1	1	2	2	1	1	1
		9	5.0	62	May-81				1		1	1	1	1	1	1	1	1
	7	9	8.0	74	May-81	3	4	2	1	1		2	1	2	1	3	2	3
3	17	9	13.5	77	Nov-84	5	3	7	1	2	3	3	2	1	4	3	5	2
	13	9	9.5	91	May-81					3	3	4	1	3	2	1	3	2
	9	9	10.5	96	May-81	1		2	1	1	2	2	1		2	5		4
		9	4.0	103	May-81	1	2			1	1	1	1	1	1	1	1	1
	9	9	15.5	113	May-88	1	2		1	1	2	2		2	5	1	1	3
	2	9	3.5	114	Nov-79	3	5	1		1	1	1	1	1	2	1	1	2
	3	9	9.0	115	Nov-83				1		1	1	1	2	1	1	2	2

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	Passed	Failed	Exam 1	# Exam 2	# Exam 3	# Exam 4	# Exam 5	# Exam 6	# Exam 7	# Exam 8	# Exam 9	# Exam 10
	5	9	7.5	117	May-82					1	1	1	2	1	1	3	2	2
	13	9	12.0	133	Nov-86	2	1	3		1	2	3	1	1	3	1	7	3
1	10	9	9.0	134	May-82	3	2	4		2	2	4	2	2	1	3	1	2
	4	9	8.5	136	Nov-84					1	1	1	2	1	1	1	4	1
	1	9	5.0	139	May-82					1	1	1	1	1	1	1	1	2
1	19	9	16.5	144	May-87				1	1	1	3	2		3	6	6	5
	1	9	4.5	148	May-79					1	1	1	2	1	1	1	1	1
	7	9	8.5	149	May-86					1	1	2	2	2	1	1	2	4
	1	9	6.5	151	May-82					1	1	1	2	1	1	1	1	1
	8	9	8.0	152	Nov-84	2		4	1		1	2	2	2	3	2	2	2
1	6	9	8.5	153	May-80					2	2	2	2	2	2	1	1	1
3	5	9	8.0	154	May-84					1	1	2	2	1	1	1	2	3
	3	9	6.5	158	May-82	1	2			1	1	1	1	1	2	3	1	1
1	1	9	4.0	159	Nov-79	2	4			1	1	1	1	1	1	1	1	2
	9	9	10.0	160	May-87	2	1	3		1	1	1	2	2	2	5	2	2
	8	9	7.0	165	May-79	3	4	2		1	1	2	2	1	2	1	3	4
	5	9	9.5	182	Nov-81				1	2	1		2		3	2	1	2
	9	9	10.5	186	May-87				1	1	1	1	1	2	2	3	3	3
	2	9	7.0	191	May-82				1		1	1	1	2	1	1	1	2
		9	4.5	194	May-81					1	1	1	1	1	1	1	1	1
1	3	9	6.0	199	May-79	2	4		1	1	1	1	1		2	2	2	1
		9	4.0	201	May-80					1	1	1	1	1	1	1	1	1
1	23	9	10.5	212	May-81	11	7	15	1	3	3	2	3		6	3	4	7
1	5	9	7.0	219	Nov-81	1	1	1		1	1	2	1	2	2	1	2	2
	1	9	7.0	225	May-85	1	2		1	1		1	1	2	1	1	1	1
	1	9	5.5	232	May-79					1	1	1	1	1	1	1	1	2
	2	9	4.5	233	May-81	1	2			1	1	1	1	1	1	2	2	1
	6	9	8.0	236	Nov-83					1	1	2	1	1	1	1	5	2
	9	9	11.5	240	May-86	1	2			1	1	2	4	2	1	4	2	1
	10	9	9.5	241	Nov-83					1	1	2		1	4	2	5	3
	3	9	6.5	251	May-81	1	1	1	1		1	1	2	2	1	1	2	1
	6	9	6.5	253	Nov-79	1	1	1	1	1	1	1		2	3	1	3	2
	3	9	7.0	256	Nov-80				1	1	1	1		1	1	1	4	1
	2	9	3.5	262	May-79	3	5	1		1	1	1	1	1	2	2	1	1
	1	9	4.5	265	May-81				1		1	1	1	1	2	1	1	1
	11	9	7.5	271	Nov-81	5	4	6	1		2	3	2	1	4	1	4	2
	6	9	6.5	276	May-80	1	1	1		1	2	2	1	3	1	1	2	2
	3	9	5.0	286	May-81	1	2			1	1	2	1	1	1	1	2	2
1	4	9	6.0	290	May-80	1	2		1	1	1	2		2	1	1	2	2
	6	9	4.0	292	May-79	5	5	6		1	1	1	1	2	3	2	2	2
1	7	9	7.5	295	May-80	2	1	3	1	3	2	2	1	1	2	2	1	1
1	9	9	9.5	305	May-80				1	2	2	2		2	2	1	2	4
1	13	9	12.5	308	Nov-80	3	4	2	2	1	2	1	2	3	2	1	5	3
	4	9	11.0	318	May-80				1	1	1	1		2	2	2	1	2
	10	9	12.5	320	Nov-88				1	1	1		2	3	1	2	6	2
	1	9	6.0	324	May-83					1	1	2	1	1	1	1	1	1
	5	9	7.5	326	May-83	1	2		1	1	1		1	3	2	2	2	1
3	6	9	11.0	329	Nov-85	1	2		1	1		2	2	2	1	2	2	2
1	11	9	14.5	330	May-87	1	2		1	1	1	2		2	2	4	4	3
1	4	9	7.5	334	May-85					1	1	2	1	2	1	2	2	1

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	Passed	Failed	Exam 1	# Exam 2	# Exam 3	# Exam 4	# Exam 5	# Exam 6	# Exam 7	# Exam 8	# Exam 9	# Exam 10	#
2	8	9	9.0	342	May-84				1		1	1	2	2	4	2	1	3	
	2	9	6.5	344	May-83					1	1	2	1	2	1	1	1	1	
2	11	9	6.5	351	Nov-79	4	2	6	1	2	1	3	2	2	4	1	1	3	
5	13	9	12.0	367	May-84	2	3	1	1	1	1	3	2		2	4	5	3	
	8	9	9.5	368	Nov-85					1	1	2	2	1	4	2	2	2	
	7	9	8.5	370	May-86				1		1	1	2	2	1	2	3	3	
2	5	9	9.0	377	May-81	2	3	1		1	1	2	2	2	2	1	1	2	
	3	9	4.5	383	May-79	3	4	2		1	1	1	1	1	1	2	2	2	
	6	9	6.5	386	Nov-79	1	2			2	1	2	1	1	1	1	3	3	
	5	9	7.5	390	Nov-80				1	1	1	1		2	4	1	2	1	
	4	9	6.0	391	Nov-84	1	2			1	1	1	1	2	2	1	3	1	
1	8	9	6.0	392	May-80	5	4	7	1	1	2	1		3	2	3	2	2	
	9	9	8.0	393	Nov-79	1		2		3	3	3	2	2	2	1	1	1	
	10	9	10.0	401	May-83				1	1	1	1	1	2	2	2	3	5	
	3	9	9.0	404	May-81	2	4			1	1	1	2	1	1	2	1	2	
	13	9	12.0	416	May-83				3	1	1	2		1	3	1	3	7	
1	14	9	11.5	427	Nov-84					2	1	2	3	2	2	5	4	2	
	10	9	9.5	433	May-84					1	1	1	1	1	3	5	4	2	
1	5	9	9.0	444	May-82	1	2		1	1	1		1	3	1	2	3	1	
	10	9	11.5	449	May-87				1	1	1	1	2	2	3	3	3	2	
1	9	9	11.5	456	May-87	1	1	1	1	1		1	3	1	1	4	5	1	
4	6	9	8.5	457	May-84	1	1	1		1	1	2	2	2	1	2	2	2	
		9	4.5	463	May-81					1	1	1	1	1	1	1	1	1	
	3	9	6.5	464	May-79				1	1	1	1		2	1	1	2	2	
	1	9	5.0	469	Nov-83					1	1	1	1	2	1	1	1	1	
	1	9	5.5	473	May-82					1	1	1	1	1	1	2	1	1	
	9	9	11.0	474	Nov-82	1	1	1	1	1	1	2	3	1	2	2	4	1	
	5	9	7.5	478	May-82					1	1	1	1	1	2	3	2	2	
	2	9	4.0	487	Nov-82	2	3	1	1	1		1	1	1	1	1	2	2	
	11	9	12.0	490	Nov-86					1	1	3	3	2	3	2	4	1	
	1	9	4.0	492	Nov-80	1	2			1	1	1	1	1	2	1	1	1	
	7	9	7.0	500	May-80	2	1	3		1	1	3	1	1	2	3	2	2	
	6	9	7.5	501	May-83	2	1	3		1	2	2	1	2	1	1	1	4	
44	600	909	8.0	101		107	122	95	49	107	117	152	135	148	188	187	224	202	
	Ten Exams																		
	1	10	12.5	9	Nov-87				1	1	1	1	1	1	1	1	2	1	
	8	10	8.5	14	Nov-86	1	2		1	1	1	2	1	4	1	1	5	1	
1	1	10	5.5	16	May-82	1	2		1	1	1	1	1	1	1	1	2	1	
1	8	10	7.5	20	May-79	2	2	2	2	3	1	4	1	1	1	2	2	1	
	2	10	5.0	27	May-80	1	2		1	1	1	1	1	1	2	1	1	2	
1	3	10	7.5	30	May-83				1	1	1	1	1	1	1	1	2	3	
	6	10	8.5	32	Nov-84	1	2		1	1	1	1	2	2	2	2	3	1	
	4	10	8.5	35	May-83				1	1	1	2	2	1	1	3	1	1	
	14	10	12.0	41	Nov-82	3	2	4	5	2	1	4	4		2	2	3	1	
1		10	4.0	55	May-79	3	6		1	1	1	1	1	1	1	1	1	1	
	1	10	6.0	56	Nov-80				1	1	1	1	1	1	2	1	1	1	
	6	10	10.0	58	May-82				1	1	2	3	3	1	1	1	2	1	
1	4	10	10.0	71	Nov-87				1	1	1	1	2	1	3	2	1	1	

Casualty Actuarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	# Multiple Exams Passed	# Multiple Exams Failed	Exam 1	Exam 2	Exam 3	Exam 4	Exam 5	Exam 6	Exam 7	Exam 8	Exam 9	Exam 10
	Six Exams																	
	5	6	8.0	1	Nov-88								1	2	4	2	1	1
	3	6	4.0	2	Nov-82								2	2	2	1	1	1
	2	6	3.5	18	May-85								2	1	1	1	1	2
	1	6	4.0	26	May-86								1	2	1	1	1	1
2	3	6	3.5	29	May-84	2	2	2					1	1	1	3	1	2
	4	6	4.5	31	Nov-85								1	2	2	1	2	2
	3	6	4.0	33	Nov-84								1	1	2	1	2	2
	3	6	4.5	43	May-87	1	1	1					2	1	1	2	1	2
		6	2.5	46	May-83								1	1	1	1	1	1
1	2	6	4.0	48	May-84								1	2	1	2	1	1
	4	6	5.0	49	Nov-85								2	2	2	1	2	1
	6	6	8.0	57	May-87							1	1	1	2	2	2	3
	7	6	7.0	60	May-88	1	1	1					3	1	2	4	1	2
		6	2.5	63	May-83								1	1	1	1	1	1
		6	2.5	64	May-85								1	1	1	1	1	1
	4	6	4.0	67	Nov-86	1	1	1					1	1	2	1	3	2
	4	6	4.5	69	May-87								1	2	2	1	2	2
	9	6	7.0	70	Nov-88								2	2	3	1	3	4
		6	2.5	73	Nov-83								1	1	1	1	1	1
	2	6	4.5	94	Nov-86								1	1	2	1	2	1
	5	6	5.5	104	May-87								1	2	2	2	2	2
	2	6	3.5	110	May-85								2	2	1	1	1	1
	2	6	4.5	111	May-85								1	1	1	2	2	1
		6	2.5	120	May-83								1	1	1	1	1	1
	3	6	4.5	123	May-85								1	1	2	2	2	1
	3	6	4.5	125	May-87								2	2	1	1	1	2
1	3	6	4.5	126	May-81	1	1	1					1	2	1	2	1	2
		6	3.0	127	May-85								1	1	1	1	1	1
	5	6	5.0	130	Nov-87	1	1	1					1	1	2	2	3	2
	2	6	4.0	131	Nov-86								1	1	2	1	2	1
	3	6	4.0	150	Nov-84								1	2	3	1	1	1
	4	6	5.0	156	May-87								1	2	2	3	1	1
	11	6	8.0	157	Nov-88								3	2	3	2	3	4
	9	6	9.5	177	Nov-82	1	2					2	2		2	2	6	1
	2	6	4.5	180	Nov-85								1	1	1	1	3	1
	2	6	4.0	183	May-86	1	2						1	2	1	2	1	1
	4	6	4.5	184	May-85								2	1	1	2	2	2
	3	6	4.0	185	Nov-84								1	2	1	1	3	1
	4	6	4.5	187	May-85								1	2	3	1	1	2
	2	6	4.5	190	Nov-85								1	1	3	1	1	1
		6	3.5	192	May-85								1	1	1	1	1	1
	1	6	3.5	205	Nov-86								1	1	2	1	1	1
	3	6	4.5	206	May-85								1	1	1	2	2	2
	1	6	3.5	208	May-86				1					1	1	1	1	2
	6	6	7.5	209	Nov-86							1	1	1	4	2	2	1
	3	6	3.5	210	Nov-84	1	1	1					1	2	2	1	2	1
	1	6	3.5	211	May-86								1	1	1	1	1	2
		6	2.5	222	May-82								1	1	1	1	1	1
		6	2.5	224	Nov-83								1	1	1	1	1	1

Casualty Actoarial Exams

# Not Taken	# Failed	# Passed	# Years	Candidate #	Completion Date	# Multiple Exams Taken	# Multiple Exams Passed	# Multiple Exams Failed	Exam 1	#Exam 2	#Exam 3	#Exam 4	#Exam 5	#Exam 6	#Exam 7	#Exam 8	#Exam 9	#Exam 10
6		10	7.5	407	May-84				1	1	1	1	1	1	1	1	1	1
	7	10	11.5	409	May-85				1	1	1	2	3	1	2	4	1	1
	7	10	8.5	410	May-84	2	4		1	1	1	2	2	2	1	1	3	3
	4	10	7.5	413	May-85				1	1	1	1	2	2	1	2	2	1
	1	10	5.0	419	May-81	2	4		1	1	1	1	1	2	1	1	1	1
	6	10	7.0	428	May-82	1	1	1	1	1	1	2	1	1	2	1	4	2
	2	10	6.0	432	May-80				1	1	1	2	1	1	1	2	1	1
	3	10	6.0	434	May-79	1		2	2	2	1	2		1	1	1	1	2
	4	10	8.5	435	Nov-83	1	2		1	1	1	3	1	1	1	1	2	2
	3	10	9.0	440	Nov-82	1	2		1	1	1	1	1	1	3	1	2	1
	3	10	10.0	442	May-80				1	1	1	2	1	1	2	2	1	1
	9	10	12.0	450	May-86				1	1	1	1	2	2	3	3	2	3
		10	6.5	471	Nov-79	1	2		1	1	1	1	1	1	1	1	1	1
	4	10	7.0	482	May-82	2	4		1	1	1	1	1	1	1	4	2	1
1	3	10	7.5	488	May-79				1	2	1	2	1	1	1	1	2	1
38	389	800	8.1	80		82	109	56	96	95	94	135	112	107	127	144	158	121

CIGNA Property and Casualty Companies

1600 Arch Street
Philadelphia, PA 19103
(215) 523-4000

Appendix 1

CIGNA

September 26, 1989

RECEIVED
OCT 05 1989
CORPORATE ACTUARIAL
DEPARTMENT

Richard H. Snader
Vice President–Corporate Actuary
United States Fidelity and Guaranty Company
P. O. Box 1138
Baltimore, Maryland 21203

RE: Examination Statistics

Dear Dick:

I have reviewed the revised Examination Statistics that were attached to your letter of September 6th and created a different analysis of empirical Travel Times. My focus was on the number of examination sittings beyond Part 3 required to obtain Fellowship. This seemed to be the basic agreed upon definition formulated at the PETF meeting this past May 22nd. The analysis is attached and hopefully I have not made any mechanical errors.

The final column represents an estimate of the number of sittings sought for. As indicated, it is the sum of the average sittings per candidate/Fellow past Part 4 plus the average number of sittings for Part 4 per candidate only for those candidates that passed Part 4 of the CAS administered examination as indicated in your packet #3.

My reaction to the "trend" is that Travel Time has not changed materially over the past few years. Based on your comment on the "false indication" caused by individuals who started long ago, it may also be the case that a final steady-state candidate population has not been obtained. That is to say, there is an "age mix" bias that exists over time that may be causing some of the trends that we are witnessing.

Upon further reflection, I came to the conclusion that the lack of a strong trend in Travel Time as measured by examination sittings is to be expected. This is a direct result of some stability in the passing ratio, i.e. the conventional 40% passing ratio that has been referred to elsewhere and observed over time. Hence, if the probability of passing examinations has not changed much over time, then, all other things being equal, the expected number of sittings to pass the examinations (Travel Time) will also remain about the same.

This further lead me to consider how Travel Time might be measured under a partitioned system and compared to today's Travel Time. I considered the simple example where an examination part is partitioned into two examination units. If each exam unit sitting is equivalent to one-half of an examination part sitting (a fairly reasonable assumption to allow the comparison of Travel Time) and passing ratios by exam unit are independent of each other and remain unchanged from that of the examination part, then Travel Time will remain unchanged. One can calculate the expected number of sittings based on units or parts several ways and always come up with "no change".

This realization was a bit unnerving. I realized that there must be cases that undergo increases in Travel Time while others show decreases. For example, some candidates that pass the examination part in one sitting will require at least 1 1/2 sittings when two units are substituted. Some candidates that fail to pass the examination part the first time will however pass one of the exam units and some of these candidates will continue on to pass the complementary exam unit where they would not pass the examination part today.

There is one important facet of this analysis that cannot be overlooked that may make the before and after comparisons less valid. The "no change" conclusion holds true if we are indeed speaking of the same population of candidates. For example, the comparison is not technically correct if some candidates never finally pass the examination part but proceed to pass the two equivalent examination units after partitioning.

Furthermore, those candidates that do pass the two units rather than the single part will have exhibited a passing grade in each unit: it is no longer possible to "average out" subject areas of an examination part and pass it in the aggregate. This forces a greater knowledge of the syllabus for successful candidates.

There are further situations that can be considered but the bottom line is that theoretical projections must be tempered by the importance attached to the various groups of CAS candidates. There will be both positive and negative dislocations and it will be up to the PETF to decide which results are more important than others in reaching its final recommendations. The Consideration that addresses today's successful candidates is an example of a more important area to reflect upon.

Very truly yours,

Christopher Diamantoukos, FCAS

CD/dc

cc: Partitioned Examination Task Force

84 Fellows	All Exams	Parts 1-3	Part 4	Excluding Parts 1-3	Excluding Parts 1-4	Travel Time Including Part 4
Passed	402	54	34	348	314	
Failed	254					
Sittings	656	69	55	587	532	
Candidates	53					
Avg. Travel	12.38		1.62	11.08	10.04	11.66

85 Fellows	All Exams	Parts 1-3	Part 4	Excluding Parts 1-3	Excluding Parts 1-4	Travel Time Including Part 4
Passed	340	37	22	303	281	
Failed	217					
Sittings	557	43	34	514	480	
Candidates	47					
Avg. Travel	11.85		1.55	10.94	10.21	11.76

86 Fellows	All Exams	Parts 1-3	Part 4	Excluding Parts 1-3	Excluding Parts 1-4	Travel Time Including Part 4
Passed	421	53	32	368	336	
Failed	287					
Sittings	708	61	54	647	593	
Candidates	57					
Avg. Travel	12.42		1.69	11.35	10.40	12.09

87 Fellows	All Exams	Parts 1-3	Part 4	Excluding Parts 1-3	Excluding Parts 1-4	Travel Time Including Part 4
Passed	410	39	37	371	334	
Failed	298					
Sittings	708	39	53	669	616	
Candidates	57					
Avg. Travel	12.42		1.43	11.74	10.81	12.24

88 Fellows	All Exams	Parts 1-3	Part 4	Excluding Parts 1-3	Excluding Parts 1-4	Travel Time Including Part 4
Passed	378	19	39	359	320	
Failed	267					
Sittings	645	20	56	625	569	
Candidates	54					
Avg. Travel	11.94		1.44	11.57	10.54	11.98

	A	B	A1	B1		
6	33	16	46	3	49	49
6	27	24	40	11	51	51
7	27	19	34	12	46	46
7	31	19	41	9	50	50
7	28	16	36	8	44	44
8	28	16	36	8	44	44
8	15	37	27	25	52	52
8	8	20	15	13	28	28
9	10	8	11	7	18	18
9	22	28	37	13	50	50
9	11	22	15	18	33	33
10	5	8	9	4	13	13

	A	B	A1	B1	Total
6	60	40	86	14	100
7	86	54	111	29	140
8	51	73	78	46	124
9	43	58	63	38	101
10	5	8	9	4	13
Total	245	233	347	131	478

	A	B	A1	B1	Total
6	60.0%	40.0%	86.0%	14.0%	100.0%
7	61.4%	38.6%	79.3%	20.7%	100.0%
8	41.1%	58.9%	62.9%	37.1%	100.0%
9	42.6%	57.4%	62.4%	37.6%	100.0%
10	38.5%	61.5%	69.2%	30.8%	100.0%
Total	51.3%	48.7%	72.6%	27.4%	100.0%

Appendix 2

If you have read the CAS "white paper", please answer the following. If not, skip to Question 4.

1. In the CAS "white paper", the concept of smaller exam units was set forth. Do you agree that future actuaries will be better served with respect to the considerations listed below if partitioned units replace the current exam structure?

	1 Strongly Agree	2	3	4	5 Strongly Disagree
a. Obtaining the knowledge and skills that are basic to the actuarial profession.	[ ]	[ ]	[ ]	[ ]	[ ]
b. Defining the educational achievements required for membership in the CAS.	[ ]	[ ]	[ ]	[ ]	[ ]
c. Providing a means of measuring educational achievements.	[ ]	[ ]	[ ]	[ ]	[ ]
d. Positioning of the actuarial profession relative to other career options.	[ ]	[ ]	[ ]	[ ]	[ ]

2. Please indicate whether you agree or disagree with the following points:

	1 Strongly Agree	2	3	4	5 Strongly Disagree
a. Testing practical applications is more important than testing conceptual understanding.	[ ]	[ ]	[ ]	[ ]	[ ]
b. Associates should be encouraged to attain their FCAS designation.	[ ]	[ ]	[ ]	[ ]	[ ]

2. (continued)

c. The current exam structure would serve students better if each exam were offered once a year with sittings in February, May, August and November.	[ ]	[ ]	[ ]	[ ]	[ ]
d. A partitioned exam structure would serve students better than the current system of May and November exams if each partition were offered once a year with sittings in February, May, August and November.	[ ]	[ ]	[ ]	[ ]	[ ]
e. If the exams are partitioned, it is desirable to have the option of taking full parts or partitioned subsets.	[ ]	[ ]	[ ]	[ ]	[ ]

3. Please indicate whether you agree or disagree with the following points:

	1 Strongly Agree	2	3	4	5 Strongly Disagree
a. The CAS should maintain the current structure of exam administration.	[ ]	[ ]	[ ]	[ ]	[ ]
b. The CAS should partition all of parts 5-10.	[ ]	[ ]	[ ]	[ ]	[ ]
c. If partitioning is done, at least some of the current exams should be left intact.	[ ]	[ ]	[ ]	[ ]	[ ]
d. Students would achieve fellowship more quickly if exams were partitioned.	[ ]	[ ]	[ ]	[ ]	[ ]
e. Students could achieve fellowship more quickly if exams were partitioned.	[ ]	[ ]	[ ]	[ ]	[ ]

4. If you have taken the partitioned Part 3 (Course 120, Course 130 or Course 135), please indicate whether you agree or disagree with the following statements:

	1 Strongly Agree	2	3	4	5 Strongly Disagree
a. Partitioning of Part 3 helped me to complete it more quickly.	[ ]	[ ]	[ ]	[ ]	[ ]
b. Partitioning of Part 3 helped me to learn the material better.	[ ]	[ ]	[ ]	[ ]	[ ]
c. I would have followed a more aggressive Part 3 study program if it had not been partitioned.	[ ]	[ ]	[ ]	[ ]	[ ]

5. Please indicate whether you agree or disagree with the following statements:

	1 Strongly Agree	2	3	4	5 Strongly Disagree
a. Partitioning of the CAS exams would be beneficial to students.	[ ]	[ ]	[ ]	[ ]	[ ]
b. The existence of completely partitioned exams will encourage me to continue pursuing an actuarial career.	[ ]	[ ]	[ ]	[ ]	[ ]
c. The existence of selectively partitioned exams will encourage me to continue pursuing an actuarial career.	[ ]	[ ]	[ ]	[ ]	[ ]
d. The present exam structure encourages me to continue pursuing an actuarial career.	[ ]	[ ]	[ ]	[ ]	[ ]
e. Absence of an exam qualification feature would make the actuarial profession less attractive.	[ ]	[ ]	[ ]	[ ]	[ ]

5. (continued)

   f. More students would achieve Associateship if exams were partitioned. [ ] [ ] [ ] [ ] [ ]

   g. More students would achieve Fellowship if exams were partitioned. [ ] [ ] [ ] [ ] [ ]

6. Please indicate the number of times you have taken each exam:

Partitioned Exams	Non Partitioned Exams
_____ Course 120	_____ CAS Part 1
_____ Course 130	_____ CAS Part 2
_____ Course 135	_____ CAS Part 3
	_____ CAS Part 4
	_____ CAS Part 5
	_____ CAS Part 6
	_____ CAS Part 7
	_____ CAS Part 8
	_____ CAS Part 9
	_____ CAS Part 10

7. Which exams have you passed? (Please check all that apply)

Partitioned Exams	Non Partitioned Exams
_____ Course 120	_____ CAS Part 1
_____ Course 130	_____ CAS Part 2
_____ Course 135	_____ CAS Part 3
	_____ CAS Part 4
	_____ CAS Part 5
	_____ CAS Part 6
	_____ CAS Part 7
	_____ CAS Part 8
	_____ CAS Part 9
	_____ CAS Part 10

8. In which year did you pass your first exam? 19_____

9. If ACAS, year of associateship? 19_____

10. If FCAS, year of fellowship? 19_____

11. Which of the following most closely describes your employment status?

    [ ] Insurance Company
    [ ] Consulting Firm
    [ ] Regulatory Agency
    [ ] Bureau or Association
    [ ] Other (Please specify)_____

12. Please indicate your highest level of education: (Check the one which is most appropriate)

    [ ] Less Than a Bachelor's Degree (BA or BS)
    [ ] Bachelor's Degree (BA or BS)
    [ ] Bachelor's Degree Plus Some Graduate Work
    [ ] Master's Degree
    [ ] Working on an advanced degree beyond Master's
    [ ] Other Advanced Degree (Please specify)_____

13. If you have a Bachelor's or higher college degree, please indicate the area(s) of each of your degrees: (Check all that apply)

    [ ] Mathematics
    [ ] Statistics
    [ ] Computer Science
    [ ] Economics/Finance
    [ ] Other (Please specify)_____

14. If you would like to provide us with any other comments about partitioning of CAS exams, please do so in the space provided below or include a separate letter with your response.

THANK YOU FOR HELPING US WITH THIS SURVEY

PLEASE MAIL THE COMPLETED QUESTIONNAIRE TO THE

CAS PARTITIONED EXAM TASK-FORCE
C/O CASUALTY ACTUARIAL SOCIETY
ONE PENN PLAZA
250 WEST 34TH STREET
NEW YORK, NEW YORK 10119

CAS
Partitioned Exam Survey
Results
December 1989

19 DEC 1989 2:04 PM BY PI.26616

CENTRAL GRAPHICS

OUTLINE

- Response Rate
- Distribution of Respondents
- Travel Time
- Responses to Survey Questions
- Comments
- Summary

RESPONSE RATE

- 16.6% Overall Response Rate.
- Response Rate by Designation Group:

Group	Surveys Mailed	Number Of Responses	Response Rate
Fellows	923	164	17.8%
Associates	619	132	21.3
CAS Students	2700	267	9.9
Other Students	0	141	-
Total	4242	704	16.6%

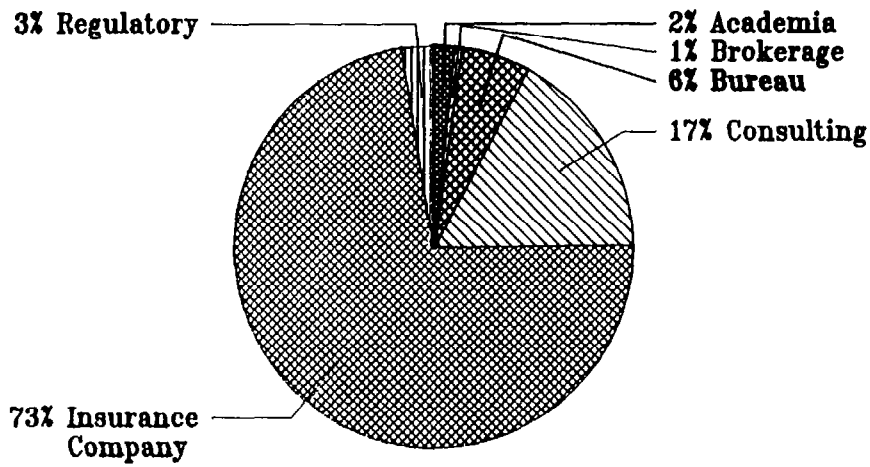
- 20% of the surveys were sent in by people who were not mailed a survey.
- 50% of the Fellows responding received their fellowship between 1985 and 1989. (81)

DISTRIBUTION OF RESPONDENTS

- By Type of Employment, All Respondents Combined.
- By Type of Employment, FCAS/ACAS population compared to Credentialed Respondents.
- By Designation Level.
- By Partitioned vs. Nonpartitioned Part 3, Students Only.
- By Number of Exams Passed.
- Typical Respondent.
- Group 'A'* vs Group 'B'

* A Group 'A' respondent is someone who took no more than 2 attempts to pass any exam.

Distribution By Type Of Employment
All Respondents Combined



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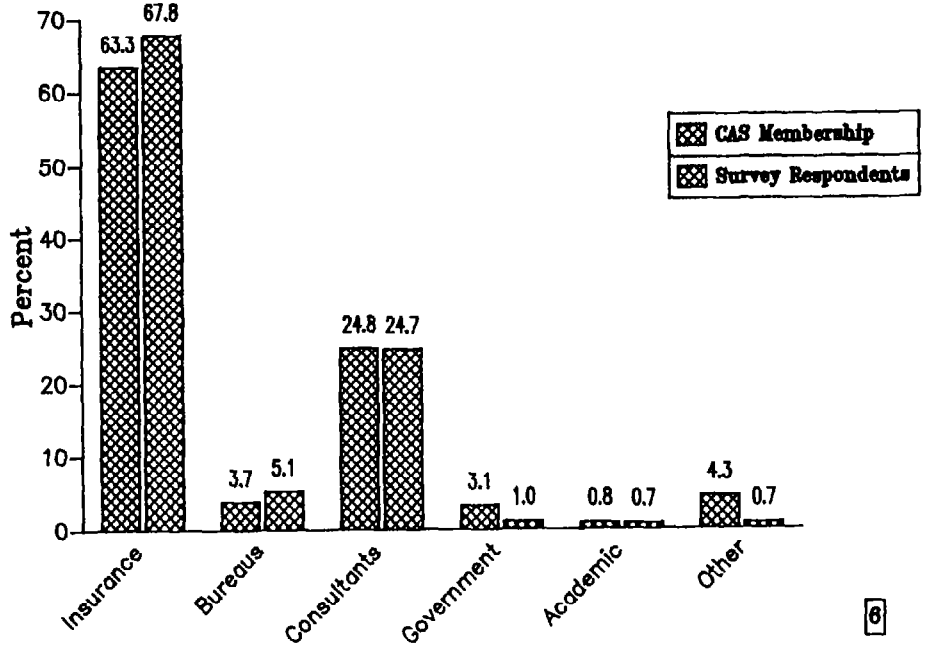
Distribution By Type of Employment
Fellows and Associates Excluding Retired Actuaries



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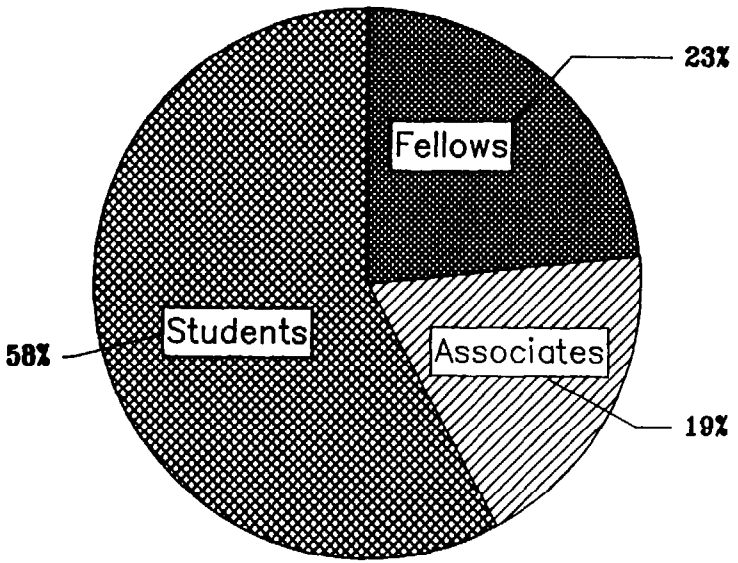
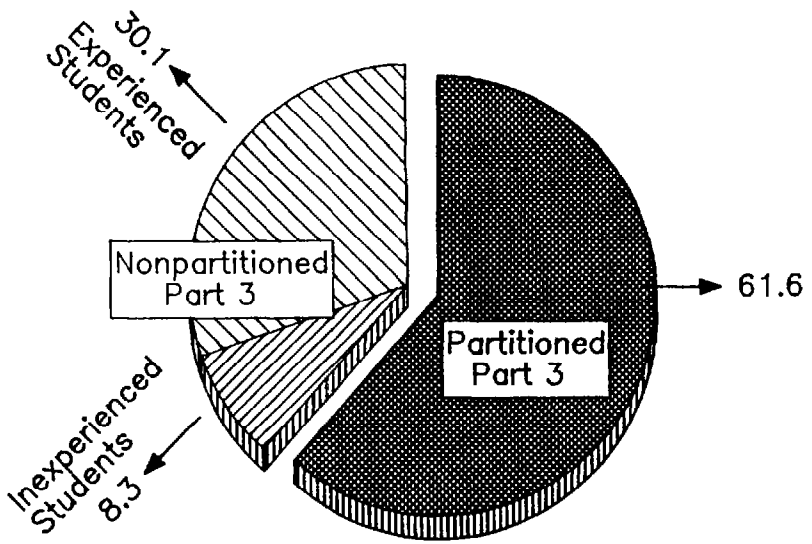
CENTRAL GRAPHICS

Distribution By Designation Level

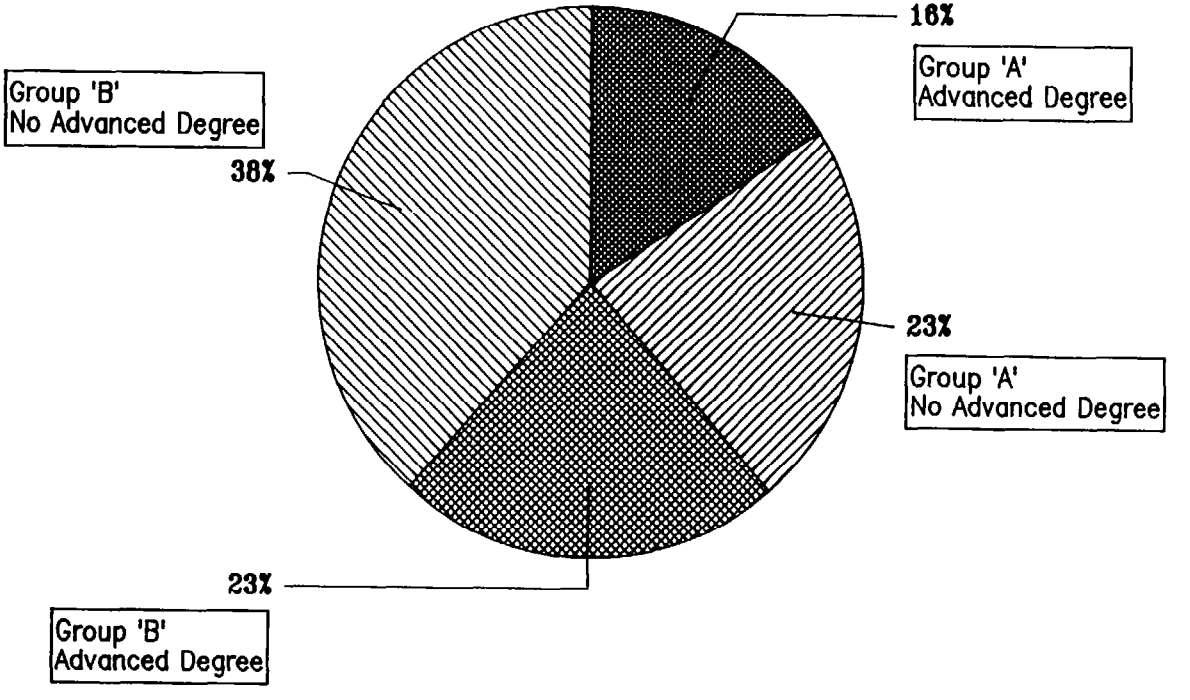


Distribution Of Students



Note: Only six Associates and no Fellows have taken part 3 as a partitioned exam.

Distribution Of Credentialed Actuaries By Education Levels and Travel Rate



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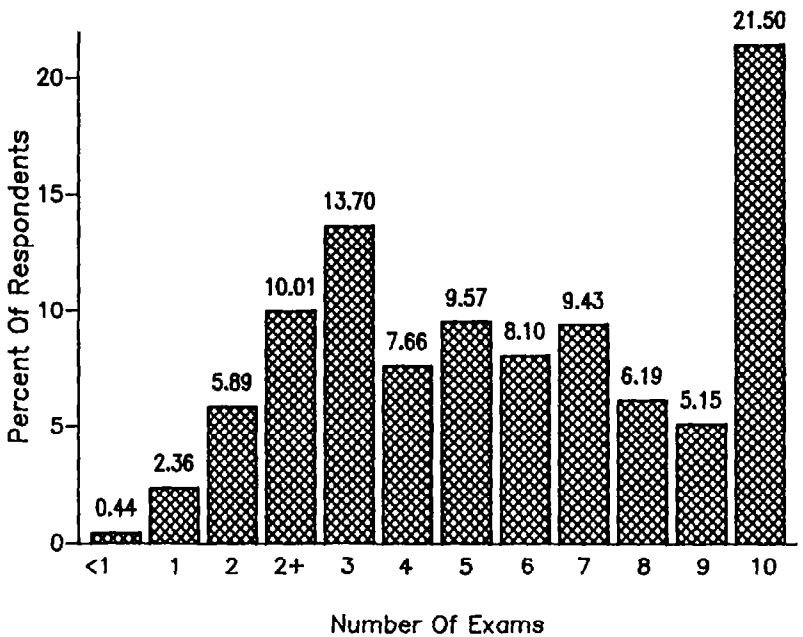
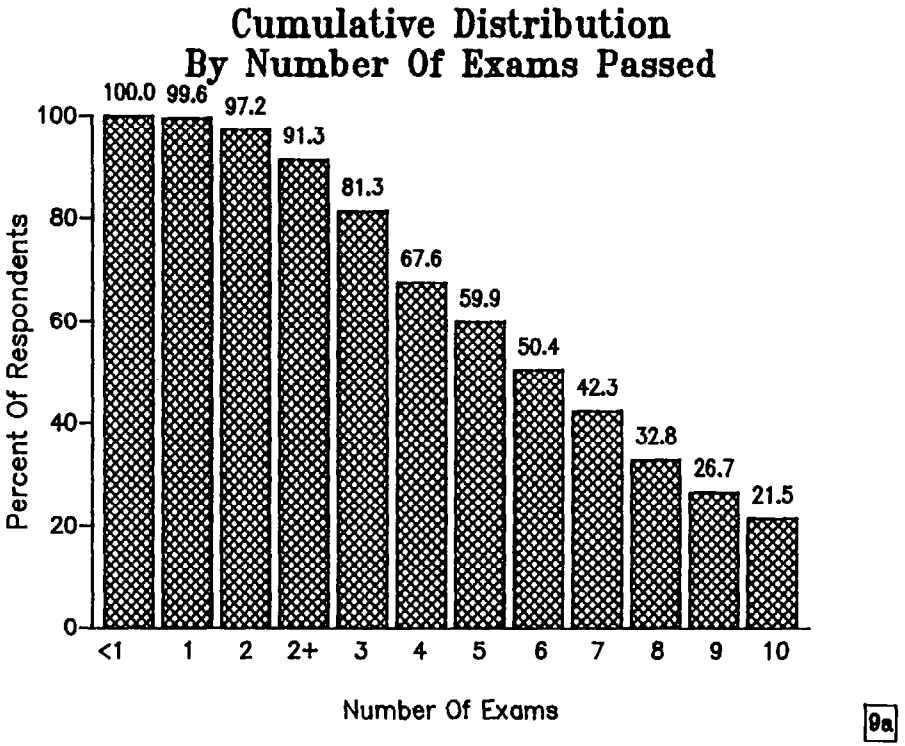
Absolute Distribution By Number Of Exams Passed

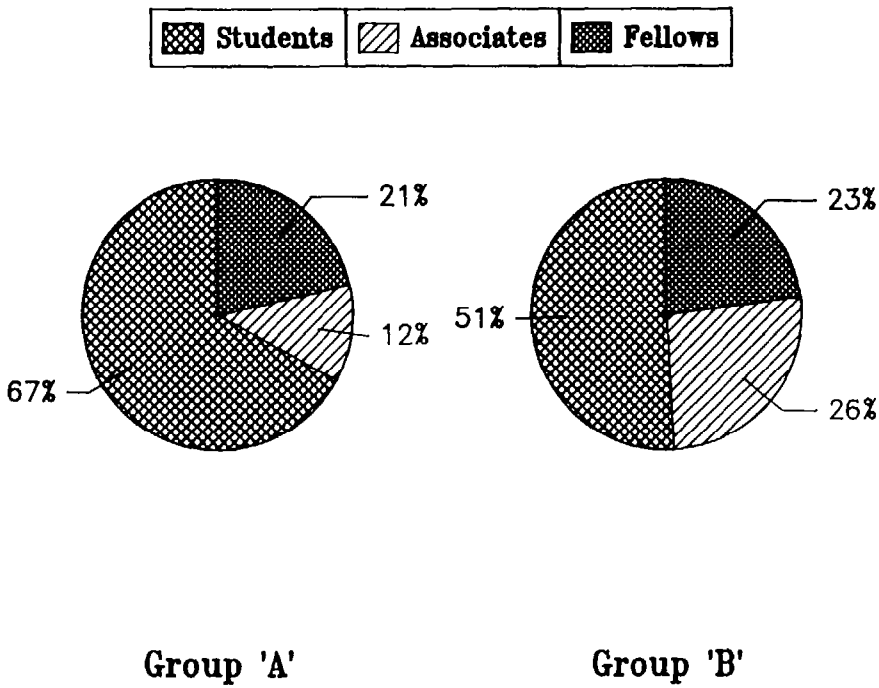




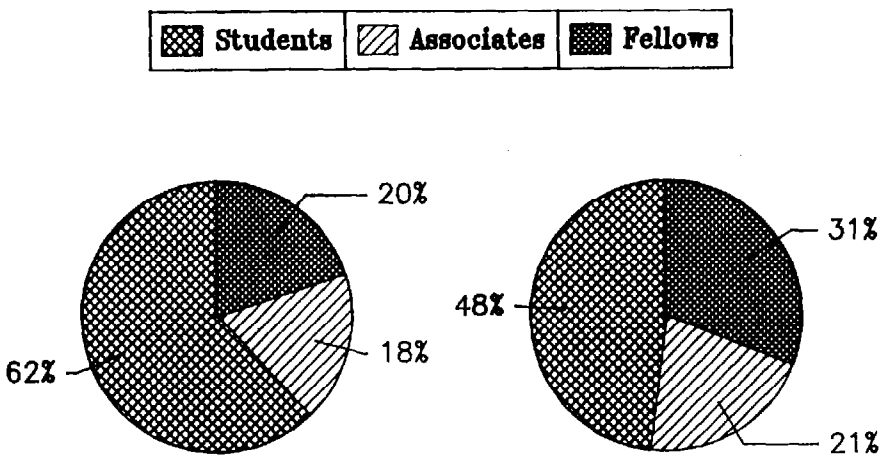
Profile Of The "Typical" Respondent

- 84.0% Have Math or Actuarial Degrees
- 67.4% Do Not Have Advanced Degrees
- 73.0% Work for an Insurance Company
- 5.6 Average Exams Passed

Distribution Of Group 'A' And Group 'B' By Designation Level



Distribution Of Academic Degrees By Designation Level



No Advanced Degree **Advanced Degree**

11a

22 NOV 1989 10:44 AM BY PL26616 CENTRAL GRAPHICS

Percent of Group 'A' and Group 'B'

	Group 'A'	Group 'B'
Fellows (81–85)	50.0	50.0
Fellows (86–89)	40.6	59.4
Associates (86–89)*	29.0	71.0

* Associates of 86–89 are the Fellows of 90–95

Note: Numbers in Parentheses are Years of Designation

TRAVEL TIME

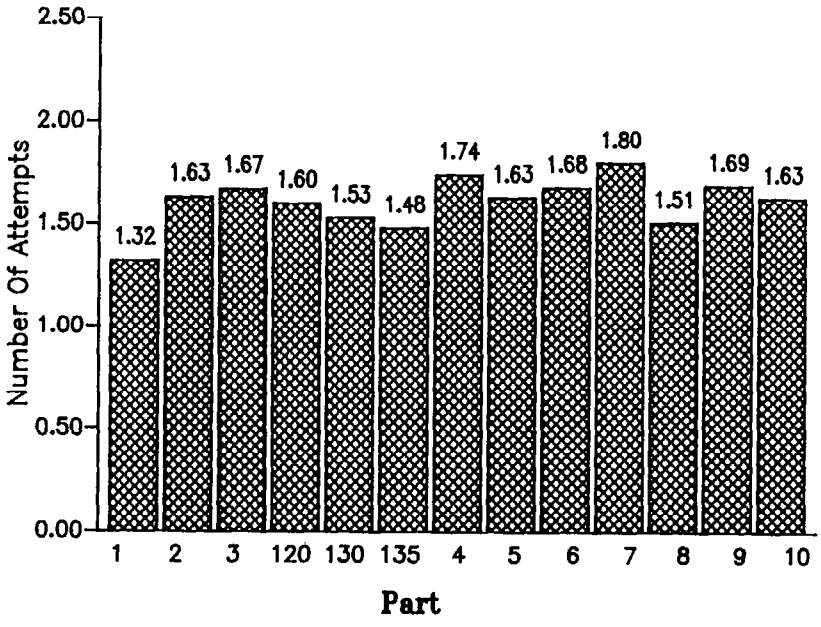
* Average Number of Attempts to Pass Exams.

  All Respondents Combined
  Group 'A' vs Group 'B'

* Percent Passing Exams on First Attempt.

* Trend in Travel Time to Achieve Designation.

Average Number of Attempts to Pass Each Exam
All Respondents Combined



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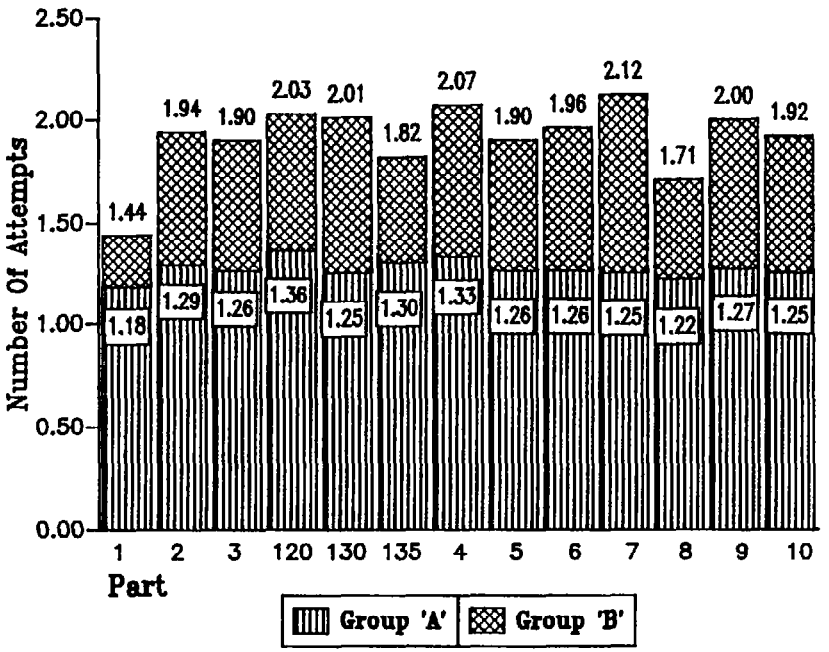
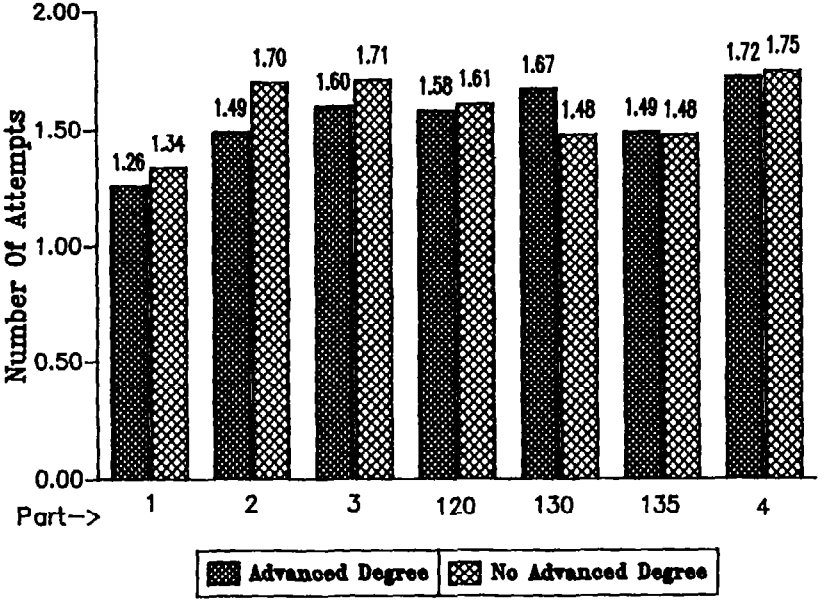
Average Number Of Attempts To Pass Exams
Group 'A' vs Group 'B'

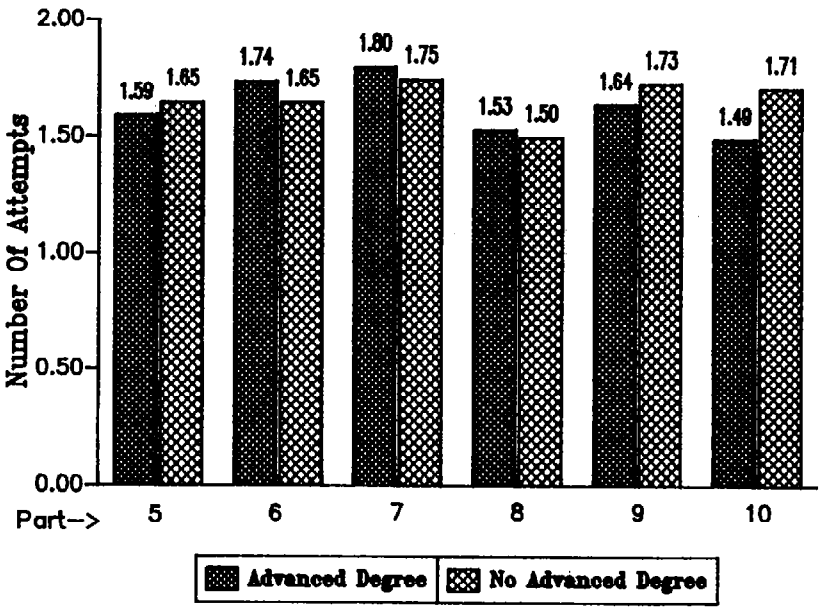


Average Number Of Attempts To Pass Exams
Advanced Degrees vs No Advanced Degrees
- Early Exams -



15a

Average Number Of Attempts To Pass Exams
Advanced Degrees vs No Advanced Degrees
- Later Exams -



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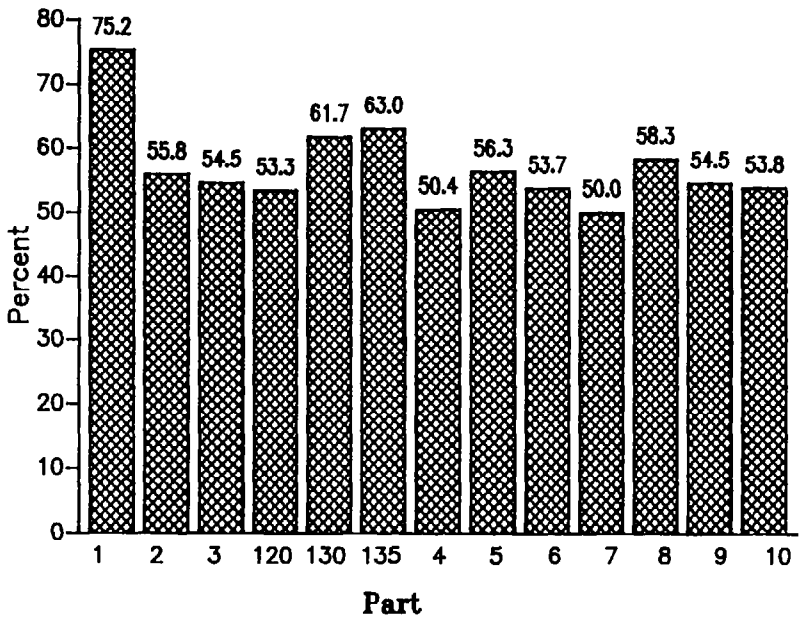
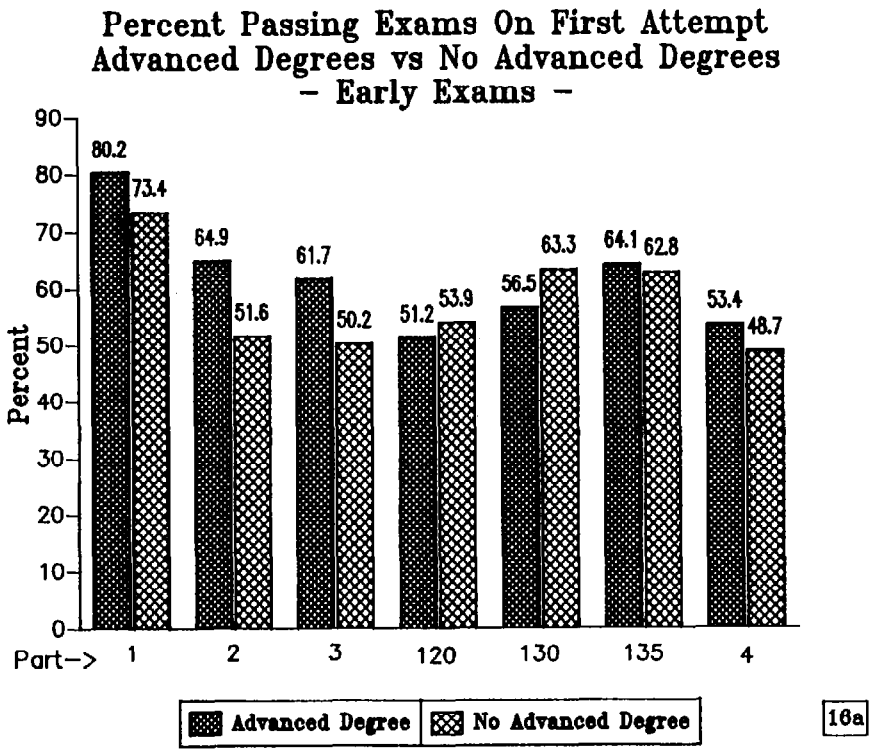
CENTRAL GRAPHICS

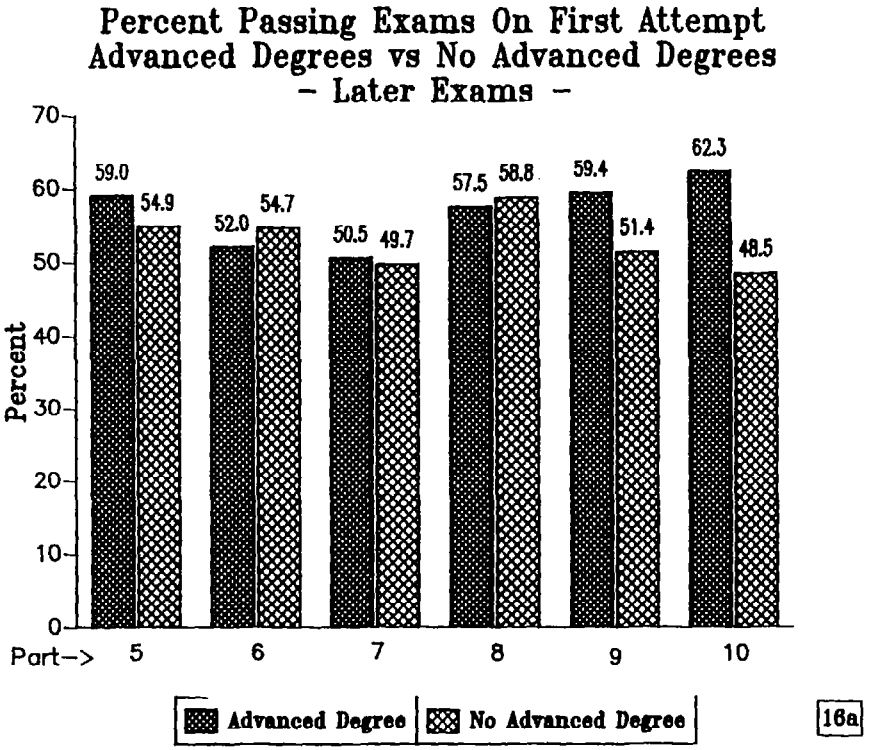
Percent Passing Exams On First Attempt



16

22 NOV 1999 10:39 AM BY PL26616 CENTRAL GRAPHICS


Percent Passing Exams On First Attempt
Advanced Degrees vs No Advanced Degrees
– Early Exams –
Percent
90
80
70
60
50
40
30
20
10
0
80.2
73.4
64.9
51.6
61.7
50.2
51.2
53.9
56.5
63.3
64.1
62.8
53.4
48.7
Part-> 1
2
3
120
130
135
4
Advanced Degree
No Advanced Degree
16a



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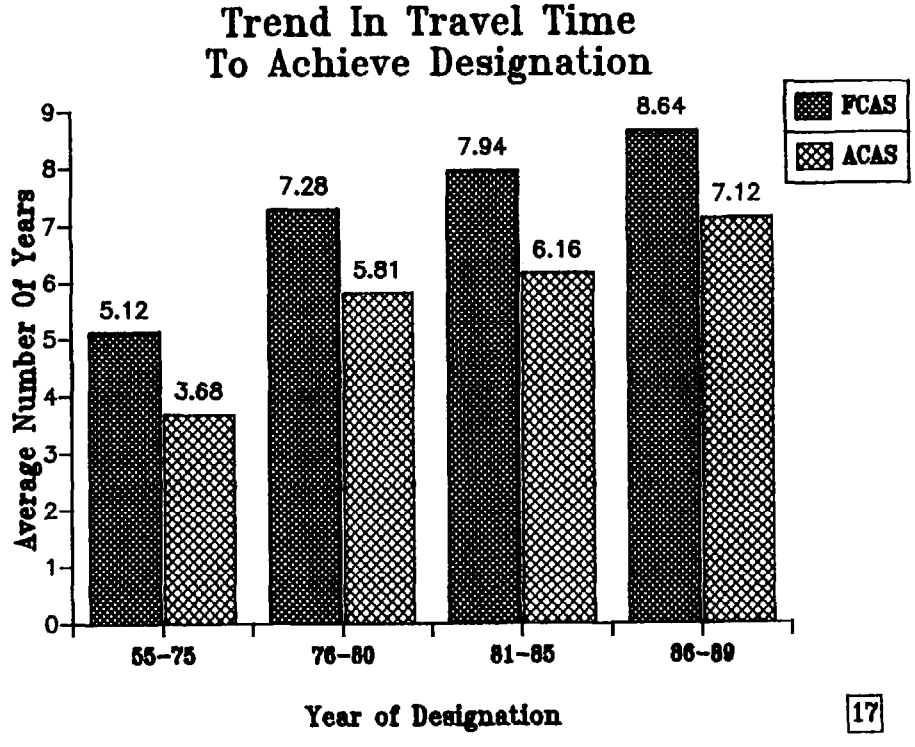
CENTRAL GRAPHICS



SUMMARY OF RESPONSES
ALL RESPONDENTS COMBINED

- Respondents support maintaining current structure, and are against partitioning Parts 5 - 10.

- Generally, respondents are consistent in their responses regardless of designation level and experience with partitioning Part 3.

- Partitioning will make the Actuarial Profession less attractive relative to Other Career Fields.

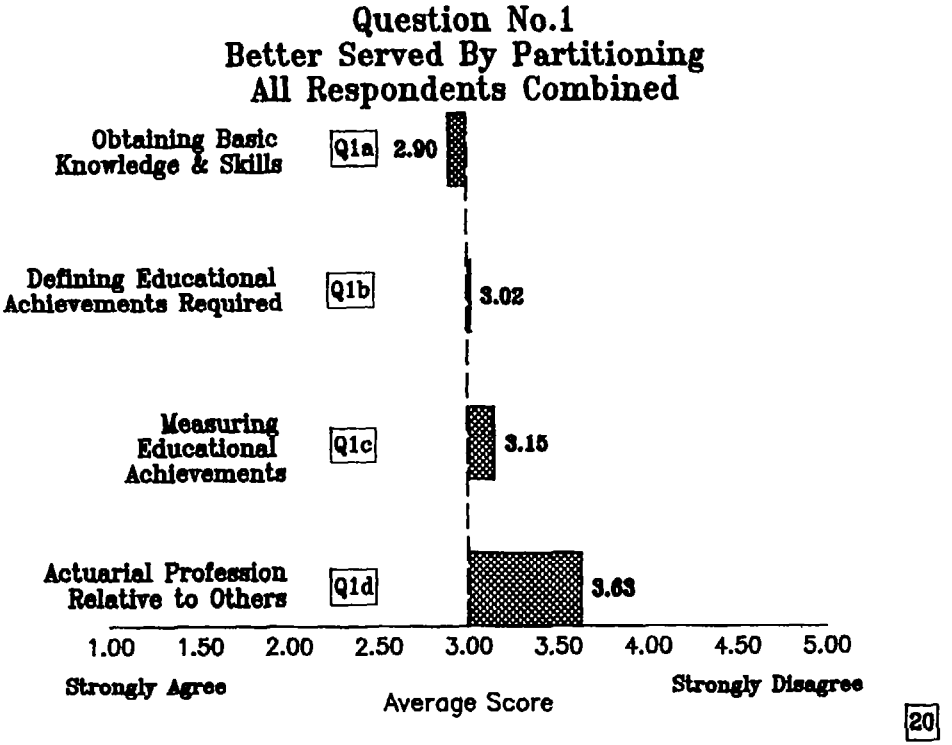
- Travel Time will be increased if exams are partitioned - supported by experience with partitioned Part 3.

- Partitioning will discourage students from pursuing the Actuarial Profession.

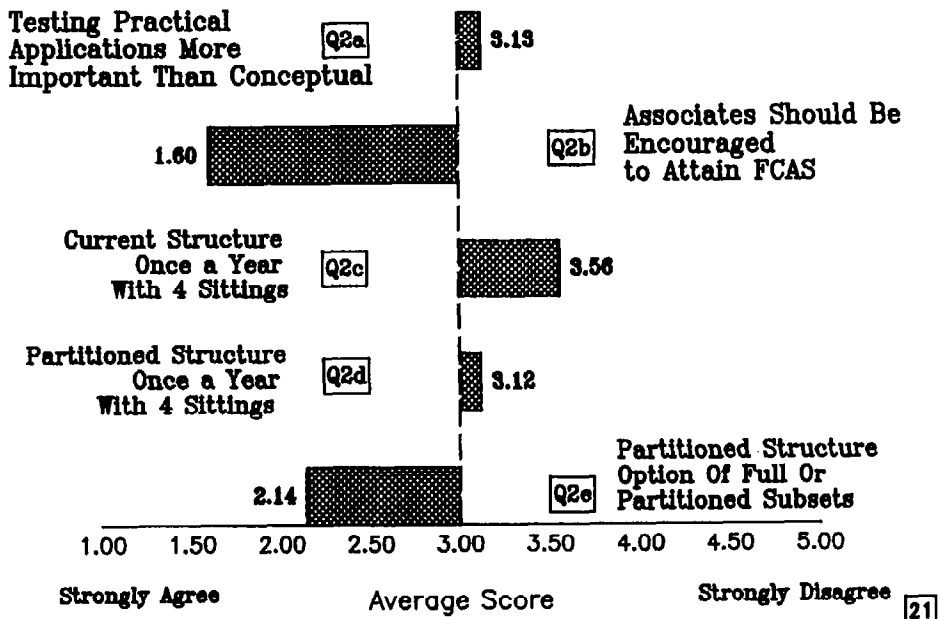
- Students should be encouraged to achieve FCAS, but fewer would if exams are partitioned.

RESPONSES TO SURVEY QUESTIONS

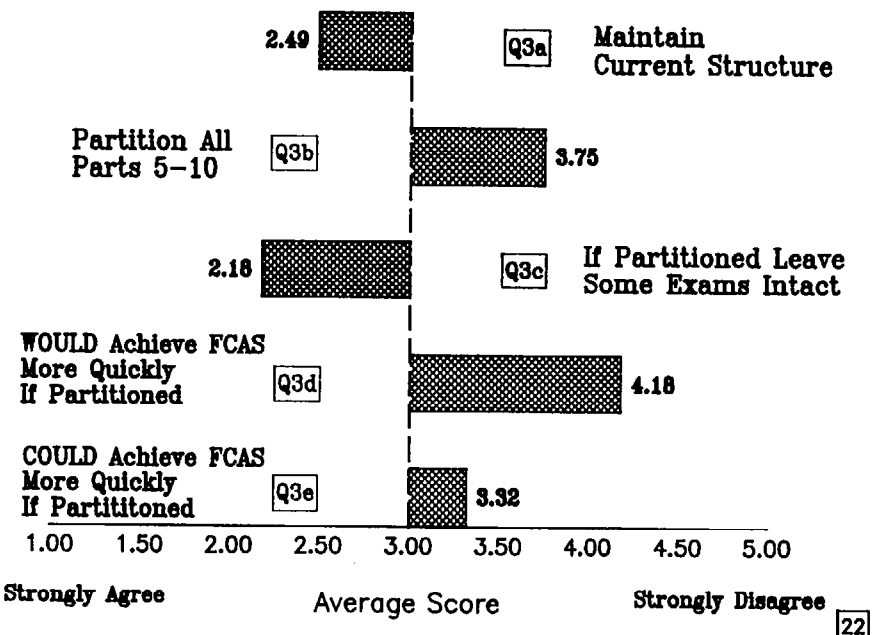
- **All Respondents Combined.**
- **Key Questions by Designation Level.**
- **Key Questions by Group 'A' and Group 'B'.**



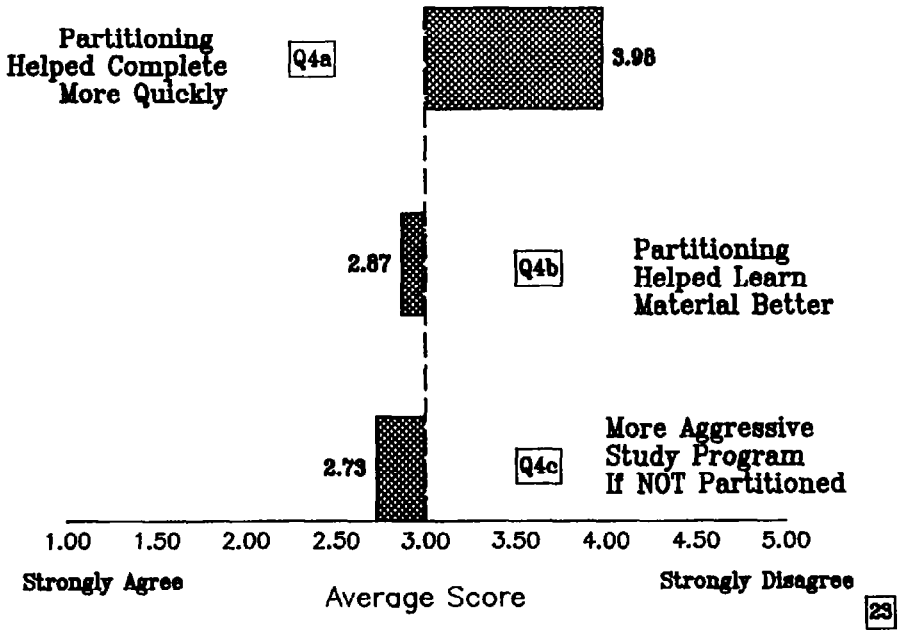
Question No. 2
All Respondents Combined



Question No. 3
All Respondents Combined



Question No. 4
Partitioned Part 3 Students



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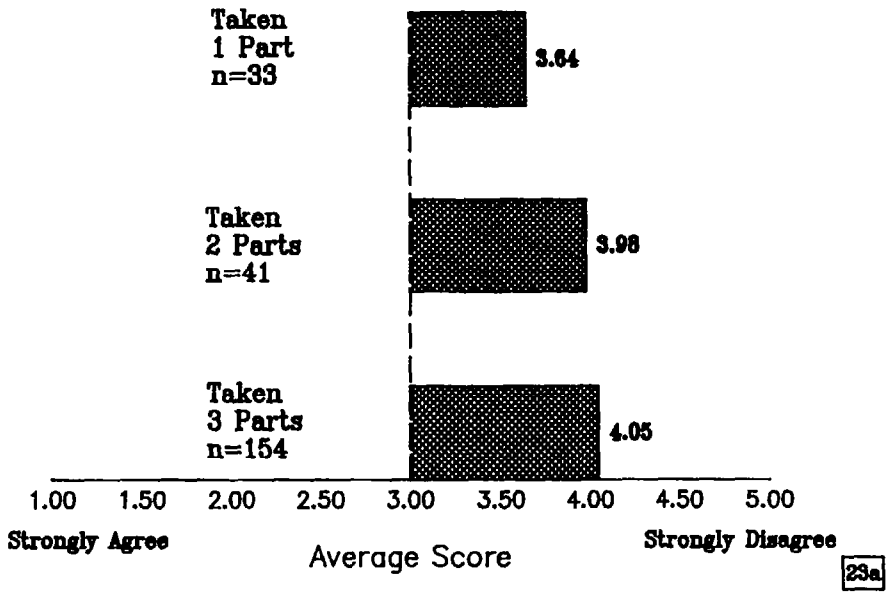
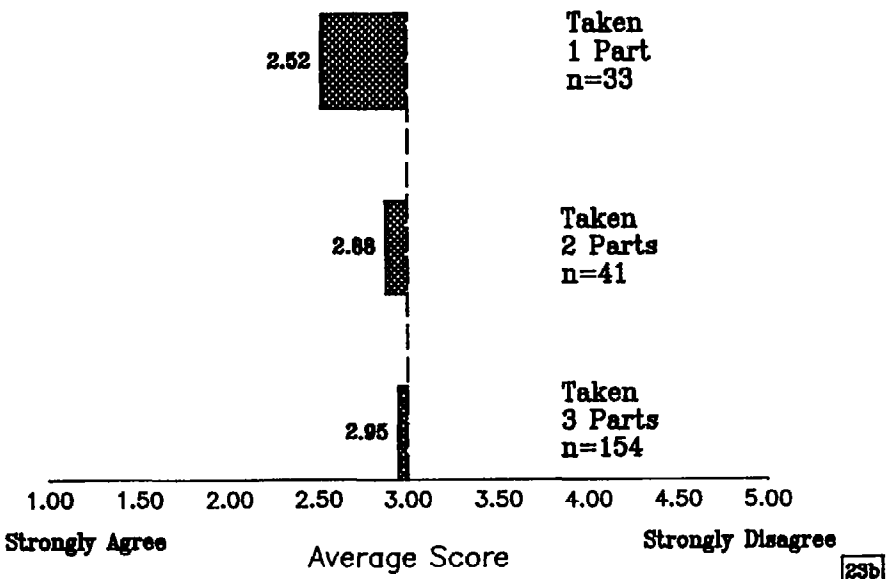
Question No. 4A
Partitioned Part 3 Students
Partitioned Helped Complete More Quickly



Question No. 4B
Partitioned Part 3 Students
Partitioned Helped Learn Material Better



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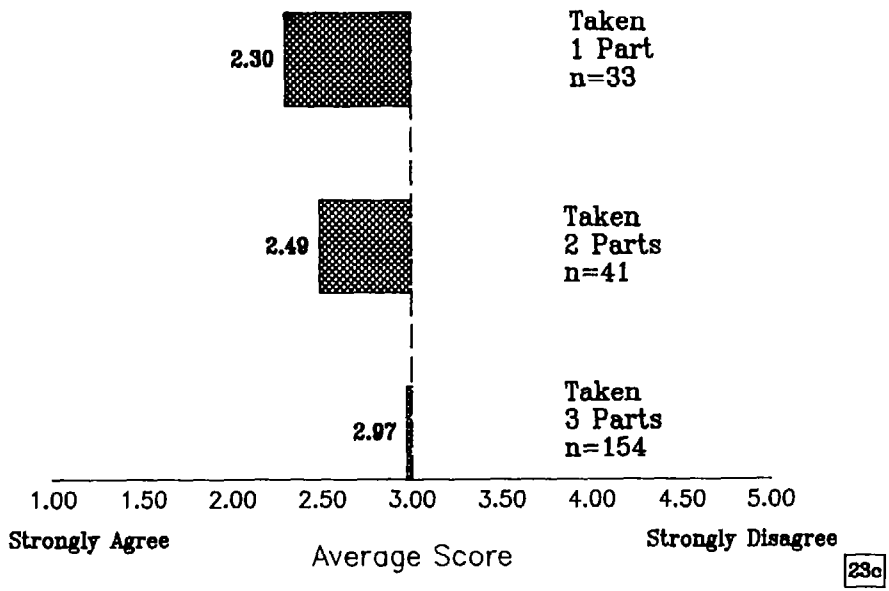
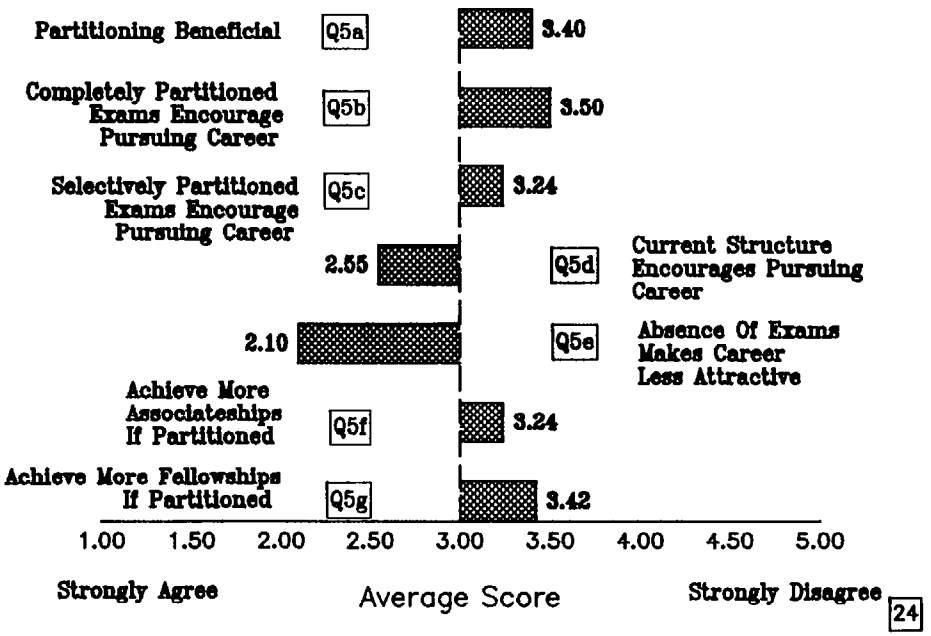
Question No. 4C
Partitioned Part 3 Students
More Aggressive Study Program If Not Partitioned



Question No. 5
All Respondents Combined



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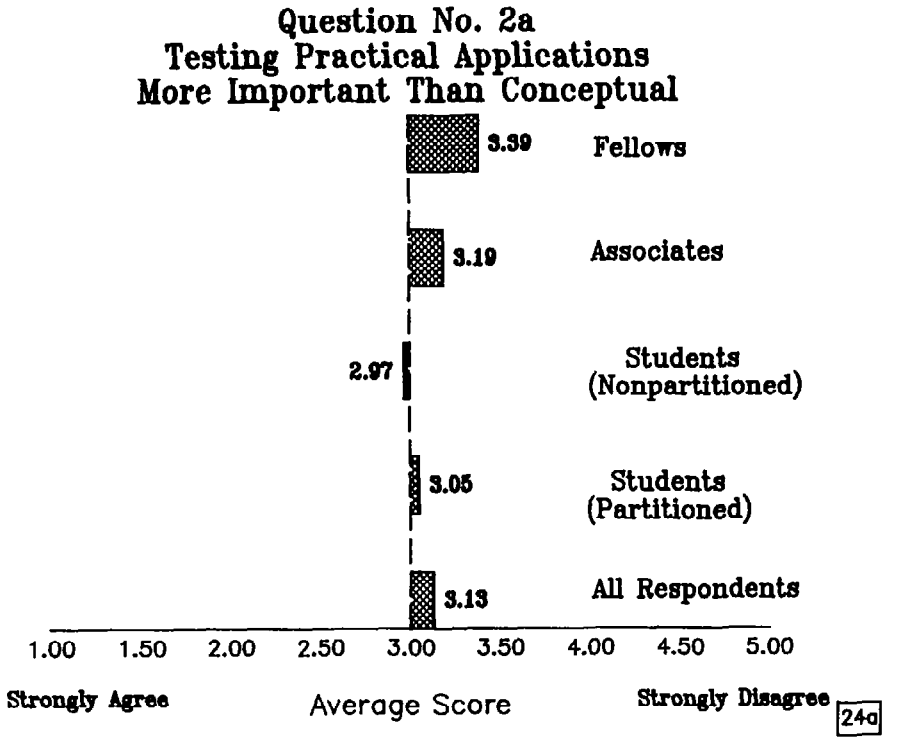

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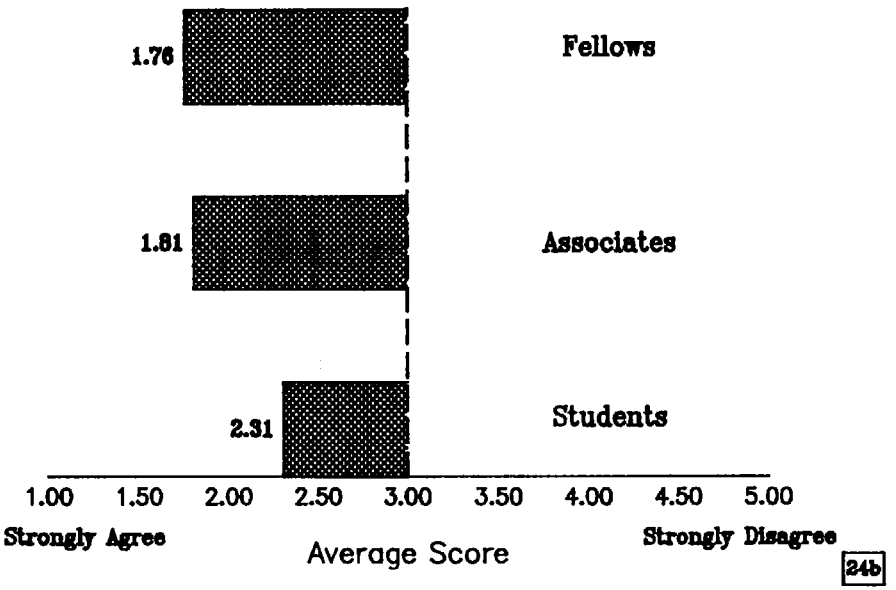
CENTRAL GRAPHICS

Question No. 5e
Absence of Exams Makes Career Less Attractive



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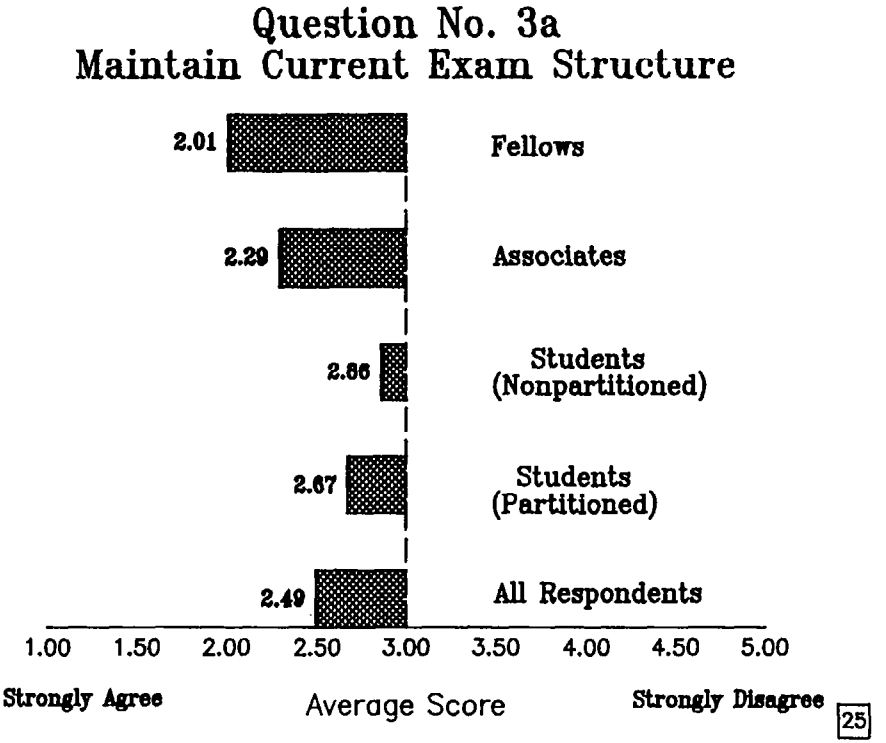
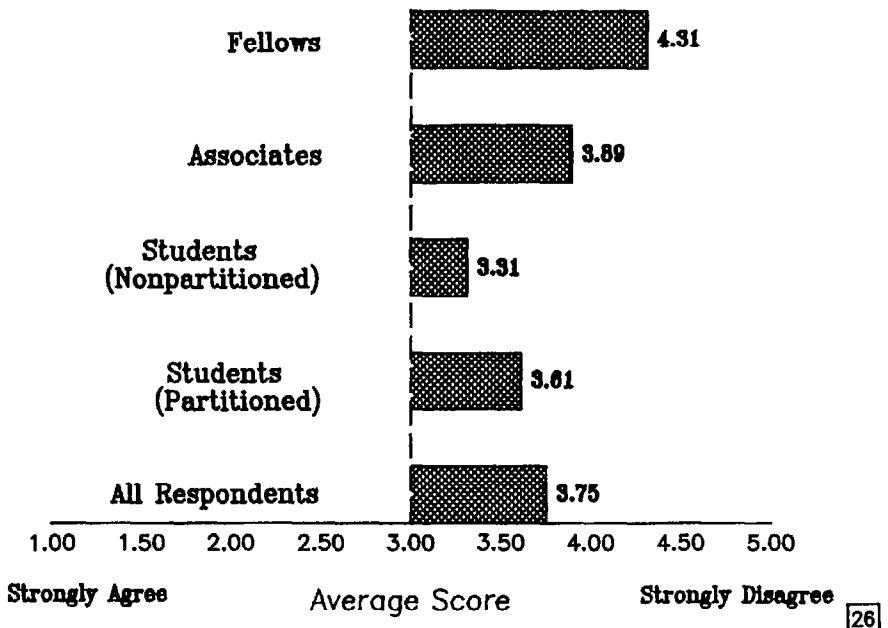


Question No. 3b
Partition All Of Parts 5–10



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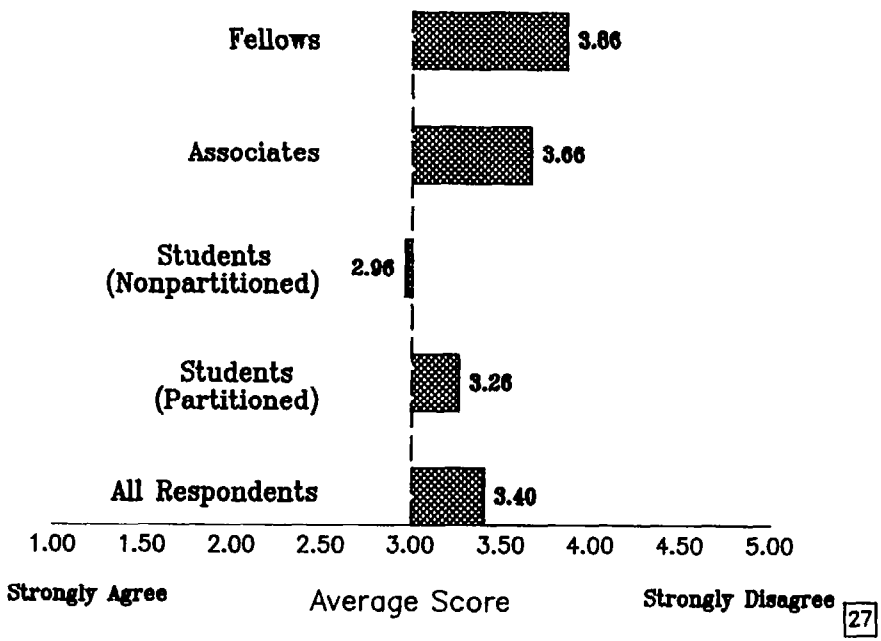
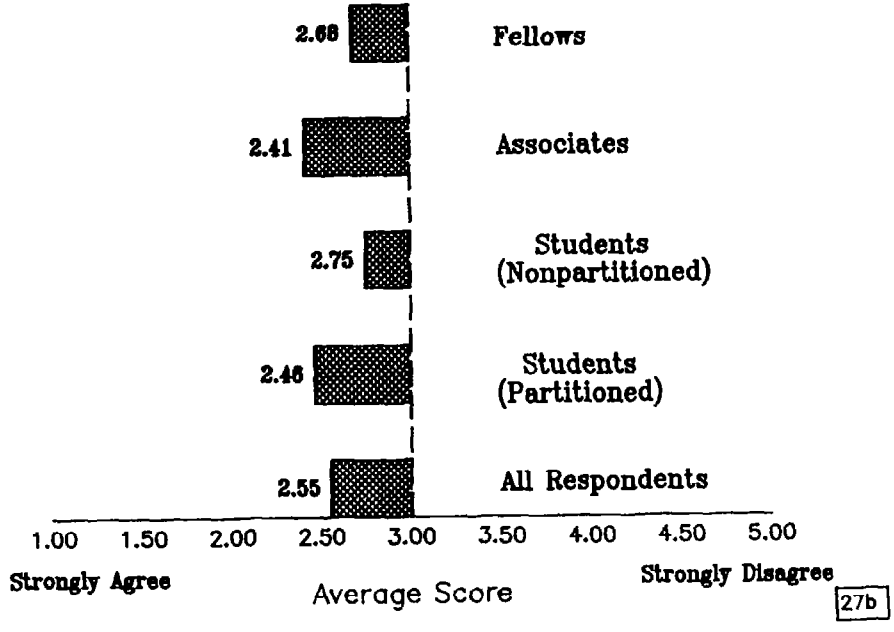
20 DEC 1989 1:13 PM BY PL26616 CENTRAL GRAPHICS

Question No. 5a
Partitioning of Exams Beneficial To Students



Question No. 5d
Present Exam Structure Encourages Pursuing Career



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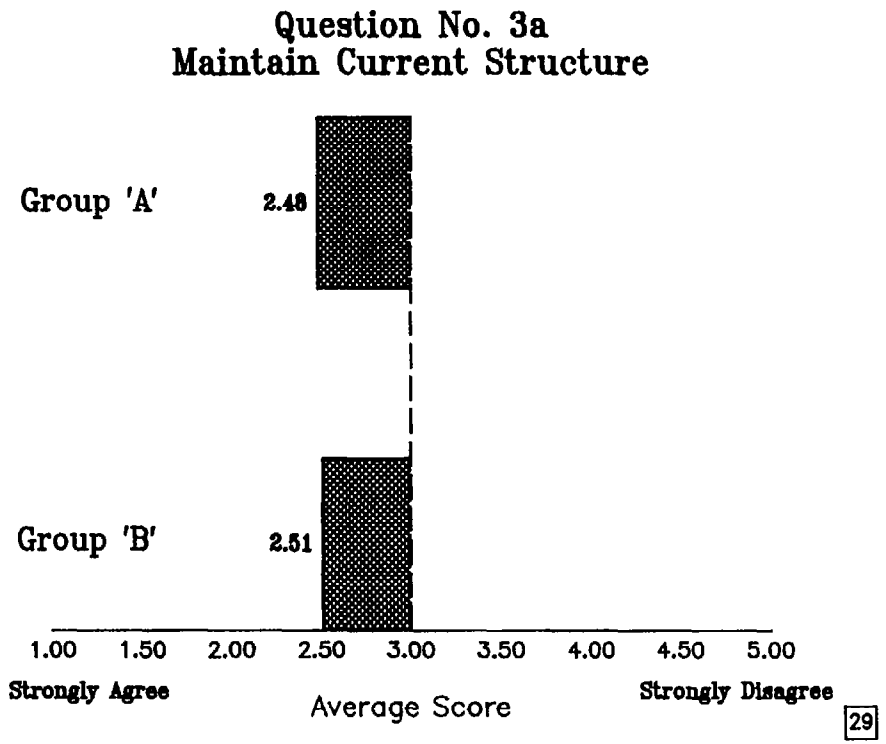
CENTRAL GRAPHICS

SUMMARY OF RESPONSES
Group 'A' vs Group 'B'

Group 'A' and Group 'B' concur on their opinions regarding the exam structure.

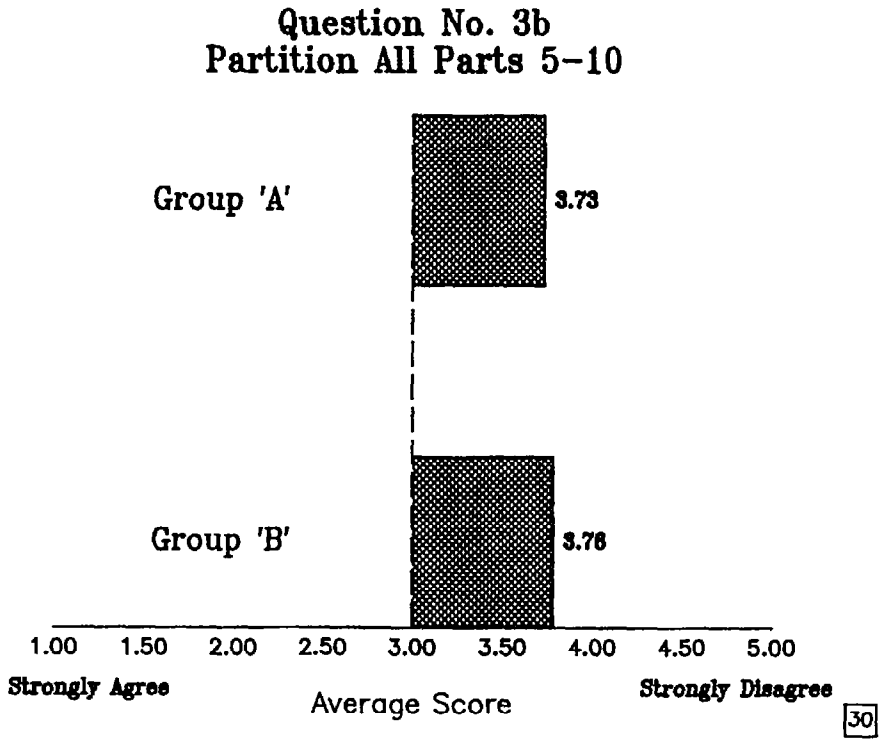
- **The CAS should maintain current structure.**
- **The CAS should not partition all of Parts 5 - 10.**



Question No. 3a
Maintain Current Structure

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Grp A	Nbr	101	74	47	55	30
	Prct	32.9 %	24.1%	15.3%	17.9%	9.8 %
Grp B	Nbr	103	76	61	61	28
	Prct	31.3 %	23.1%	18.5%	18.5%	8.5 %

29a



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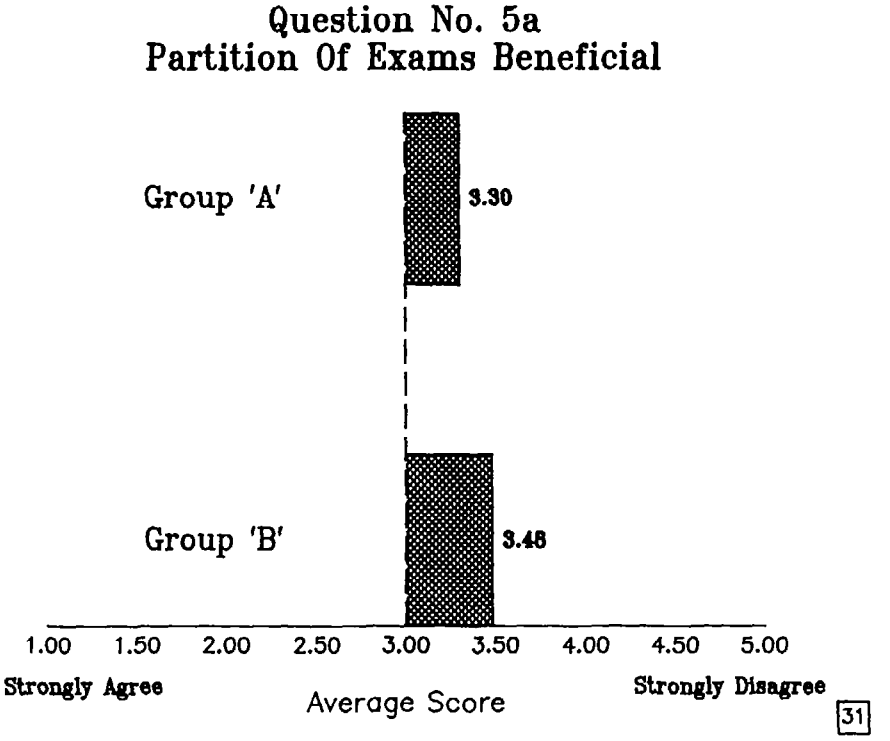
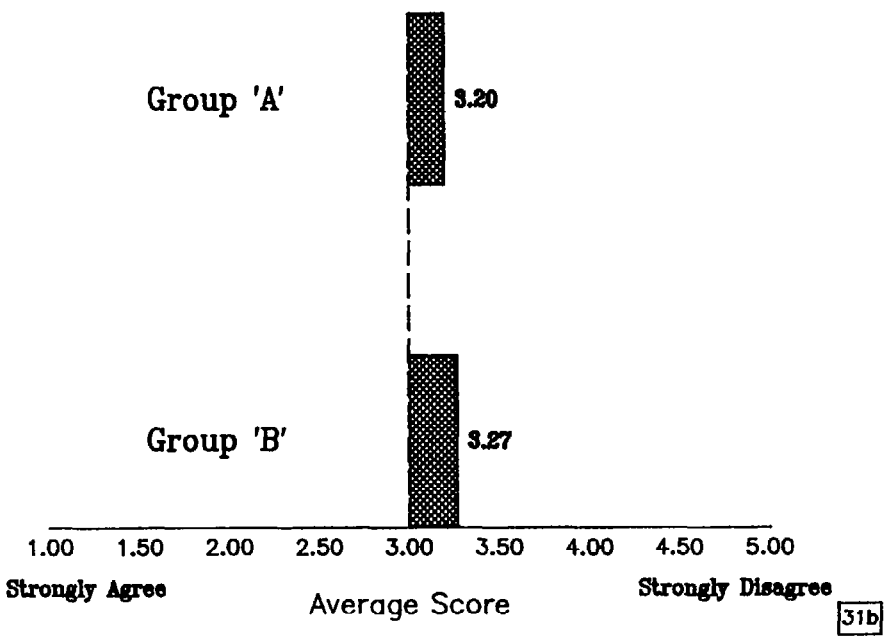
CENTRAL GRAPHICS


Question No. 5a
Partition Of Exams Beneficial
Group 'A'
3.30
Group 'B'
3.46
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Strongly Agree
Average Score
Strongly Disagree
31

Question No. 5c
Selective Partitioning Would Encourage Me



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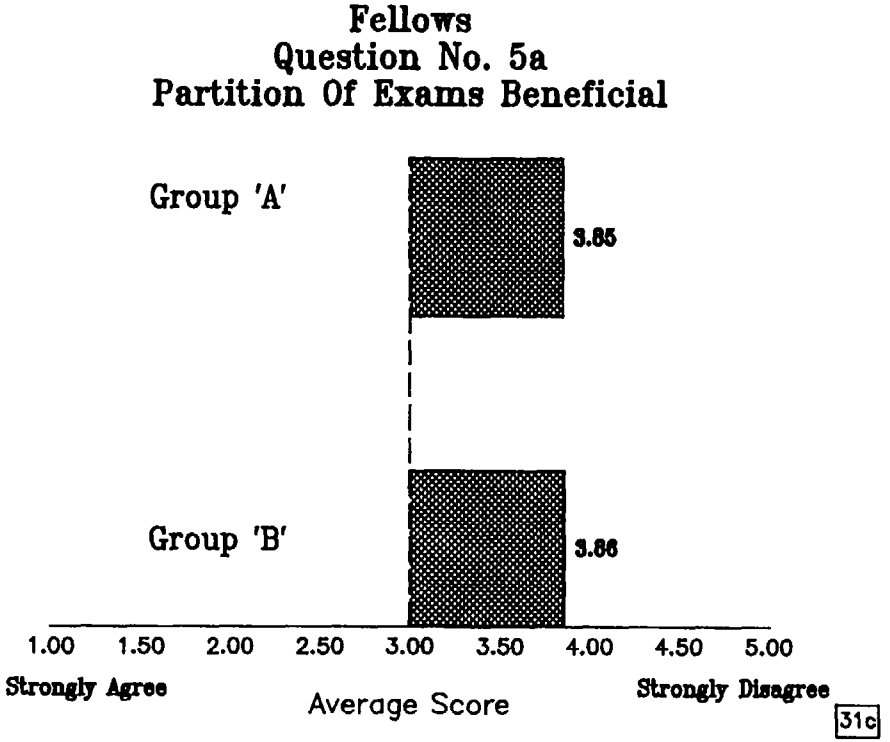
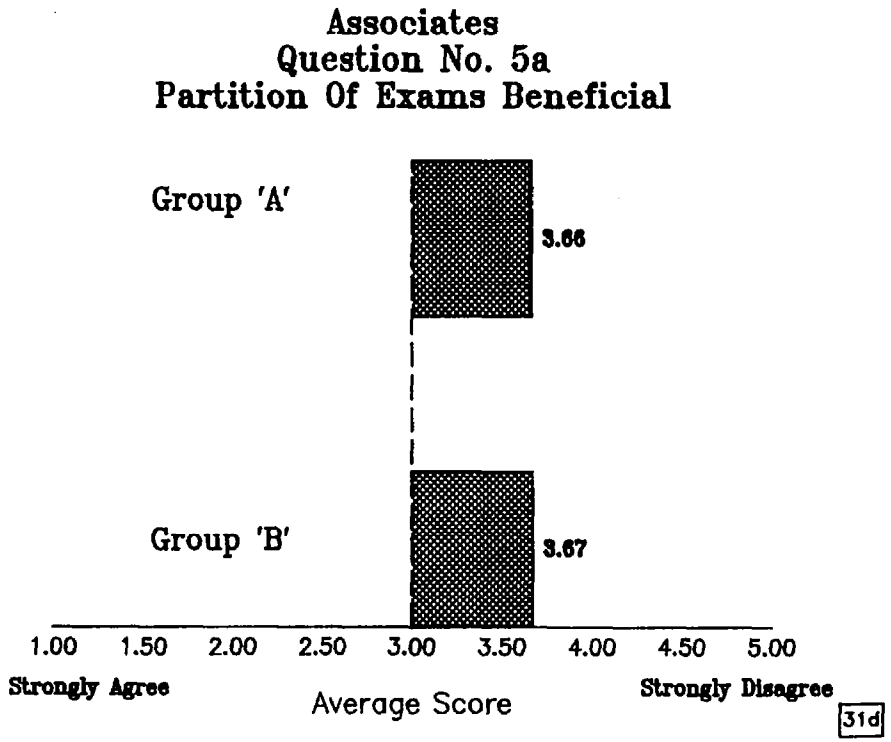
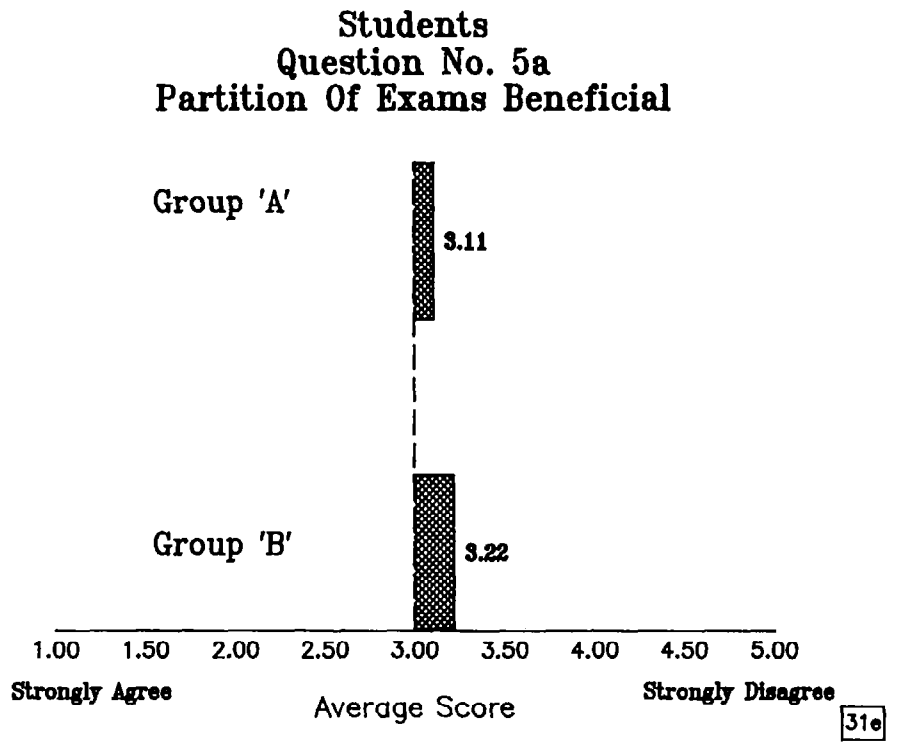
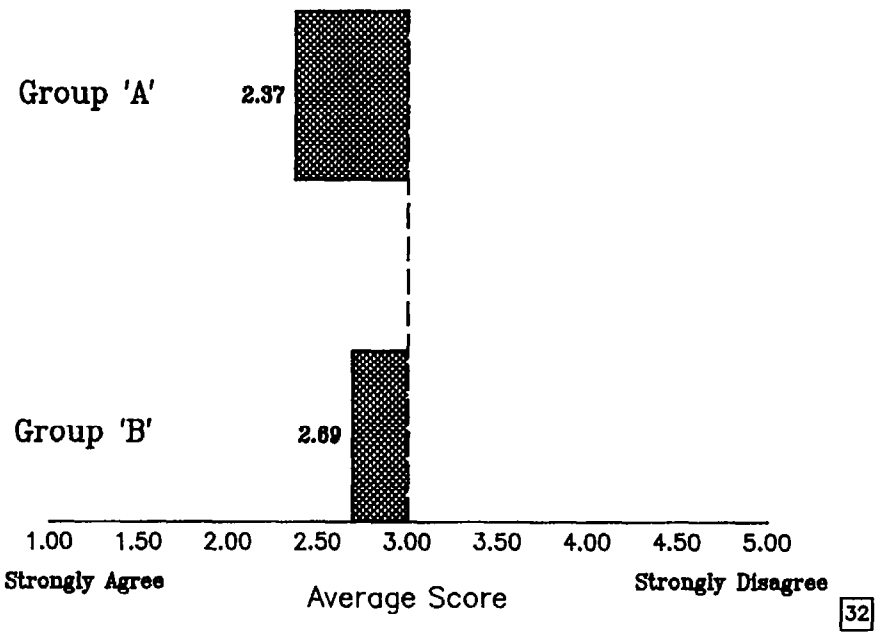






Question No. 5d
Present Exam Structure Encourages Me



32

22 NOV 1989 10:58 AM BY PL26616

CENTRAL GRAPHICS

COMMENTS

- 354 out of 704 respondents wrote comments. Comments represent the viewpoints of approximately half the respondents.

- Comment results are consistent across designation level and experience with partitioned Part 3.

TOP TEN COMMENTS

1. Partitioning will increase travel time. (88)
2. Quality of education and Actuaries will not be enhanced or will be reduced. (52)
3. Offer each exam biannually. (52)
4. Students will be discouraged from entering profession or discouraged from taking exams or leave the profession altogether. (50)
5. Because of negative experience with partitioned Part 3, I am against partitioning. (47)
6. Students who opt to sit for a whole exam will be handicapped against those who will just sit for one part of an exam. (44)
7. Partitioning makes it more difficult to stress synthesis and integration of knowledge. (31)
8. Keep the exams as they are, but improve the content and design. (25)
9. I strongly disagree with partitioning. (20)
10. Exams should be offered 3 to 4 times per year. (20)

Note: The figures in parenthesis indicate the number of times the comment appeared in the survey.

SUMMARY

- 16.6% Response Rate.
- Even without Partitioning, Travel Time is Increasing.
- Respondents are "Pro" Maintaining Current Structure.
- Respondents are Against Partitioning Parts 5 - 10.
- Respondents support current structure regardless of designation level.

CAS SYLLABUS MILESTONES

1960 - 1990

CAS Syllabus Milestones

Ancient History

- Prior to 1960 the CAS maintained a completely separate eight exam syllabus. Exams were given annually in May.
- There was no General Mathematics exam. Part 1 covered Probability and Statistics as separate topics. Part 2a covered Life Insurance Mathematics; 2b covered Principles of Insurance, Economics and Investments. Parts 1 and 2 were partitioned into four separate sub parts.
- Other exam topic arrangements were quite similar to exams given through the 10 exam syllabus of 1975, but there was no partitioning beyond Part 2.
- The last two examinations could be waived by "presenting an original thesis on an approved subject relating to insurance". This was known as the "paper route". The paper route was discontinued in 1962.

Joint Administration

- A three hour General Mathematics exam was introduced in 1960.
- Parts 2 and 3 corresponded to ancient Parts 1 and 2. Part 2 was partitioned until 1963. Part 3 was partitioned until 1969.
- In 1962 the CAS began joint administration of Part 1 with the SOA.
- In 1966 joint administration of both Parts 1 and 2 began.

The Eight Exam Syllabus

- From 1966 to 1968 the CAS administered a syllabus of eight three hour exams including jointly administered Parts 1 and 2. Exams were given annually in May.
- Four exams were required for ACAS.
- Parts 1 and 2 were multiple choice; the remaining exams were essay type.
- Part 3 was "partitioned". Parts 3a and 3b could be taken and passed separately.
    - Part 3a was called Elementary Life Insurance Mathematics. This was not a very rigorous examination. The textbook was very elementary.

- Part 3b was called General Principles of Insurance, Insurance Economics and Investments.

. Ratemaking was one half of a three hour exam. The other half was Insurance Coverages and Policy Forms.

The Nine Exam Syllabus

. From 1969 to 1974 the CAS administered a nine exam syllabus consisting of 7 three hour exams and 2 two hour exams. Total exam hours were increased from 24 to 25. Exams were given in May and November.

. Five exams were required for ACAS.

. Part 3 became a separate two hour exam covering Compound Interest and Life Contingencies. This exam corresponded to Part 3a of the eight exam syllabus.

. Part 4 covered (a) Economics and Risk Theory and (b) Insurance Coverages and Policy Forms. Part 4 corresponded to Parts 3b and 4a of the eight exam syllabus.

. Under the new syllabus, new Parts 4a and 4b could be taken separately during a brief transition period.

. Part 5 covered (a) Ratemaking and (b) Insurance Statistics and Data Processing. Part 5 corresponded to 4b and 8a of the eight exam syllabus.

. New Part 6, the "law" exam, was previously Part 5 and the new Part 7, the "reserve" exam, was previously Part 6.

. Part 8 became a separate two hour exam covering Individual Risk Rating. Previously it was Part 7a of the eight exam syllabus.

. Part 9 covered Advanced Insurance Problems which were previously covered under Part 7b (Underwriting and Administration) and 8b (Advanced Ratemaking).

. Summarizing, the nine exam syllabus was little more than a rearrangement of the eight exam syllabus with one half hour of testing added to the Life Contingencies and Individual Risk Rating topics.

The Ten Exam Syllabus

- The current exam syllabus was effective beginning with the 1975 examinations. It initially consisted of ten exams, nine of which were three hours in length and one was four hours in length, for a total of 31 hours.

- Seven exams are required for ACAS. At the time the 10 exam syllabus was adopted, there was considerable sentiment in favor of an experience requirement. The seven exam ACAS requirement was viewed as a proxy for the experience requirement.

- The principal change was the addition of Part 3 covering Numerical Analysis and Theory of Interest, which was jointly administered with the SOA.

- Life Contingencies was separated from Theory of Interest and became section (a) of Part 4. Section (b) was new material covering Operations Research and Data Processing. The Jordan text for life contingencies was introduced at this time.

- Old Part 4 became Part 5, old Part 5 became Part 6, old Part 6 became Part 7, and old Part 7 became Part 8.

- Advanced Ratemaking was combined with Individual Risk rating to form Part 9.

- Part 10 consisted of Insurance Company Operations, Reinsurance and Current Topics.

- During a brief transition period Parts 4a, 4b, 9a and 9b could be taken and passed separately.

- In 1979 Parts 6 and 7 were increased to four hours.

- Forecasting was added to Part 10 in 1978, and Part 10 was increased to four hours in 1982.

- Summarizing, SOA Part 3 was incorporated into the CAS syllabus; new material was added on Operations Research; and testing time was expanded for other topics.

The Enrolled Actuaries Experiment

- Part 4 was a jointly sponsored exam from 1980 to 1982. The sponsors were the CAS, the SOA and the Joint Board for Enrollment of Actuaries.

- In order to comply with the Joint Board's enrollment requirements, the SOA was forced to restructure its syllabus and offer a more elementary exam on interest

and life contingencies. This event presented an opportunity for joint CAS sponsorship; and apparently motivated by ecumenical spirit, the CAS agreed to the arrangement.

- As a result, Theory of Interest and Life Contingencies were combined in Part 4, which became a four hour exam. Operations Research was moved to Part 3, and combined with Numerical Analysis and Applied Statistics. Operations Research was a new topic for the SOA; Applied Statistics was a new topic for both the CAS and SOA.

- Because of low pass ratios imposed on both the CAS and SOA by the Joint Board and because of overemphasis on life contingency and pension topics not considered useful to casualty actuaries, the CAS ended its joint sponsorship of Part 4 in 1983.

- In 1983 Credibility Theory was added to CAS Part 4. Part 3, which is still jointly sponsored, was increased to four hours.

The Canadian Connection

- A specific Canadian section was introduced into Part 8 in 1987, making it necessary for candidates to specify at the time of application whether they were sitting for the US or Canadian version.

- In 1988 Part 8 was increased to four hours.

- In 1989 the separate Canadian Part 8 was dropped in favor of increased Canadian content throughout the syllabus.

Modern Times

- Part 3 was partitioned in 1987.

- In 1990 Operations Research will no longer be required by the CAS. In its place a new exam (Part 3B), Introduction to Property and Casualty Insurance will be given.

- Also in 1990 Insurance Coverages, etc. will no longer be tested in Part 5. Instead a section on Finance will be added as Part 5B. Part 5A will be Economics and Risk Theory. Part 5 will be partitioned during a transition period lasting through 1991.

- The syllabus now requires 37 hours of testing.

1988 SYLLABUS OF EXAMINATIONS

Part	Time Allowed	Subjects
		Associateship Examinations
1*	3 hours	Calculus and Linear Algebra
2*	3 hours	Probability and Statistics
3a*	1½ hours	Applied Statistical Methods
3b*	1½ hours	Operations Research
3c*	1 hour	Numerical Methods
4	4 hours	Interest and Life Contingencies; Credibility Theory and Loss Distributions
5	3 hours	Principles of Economics; Theory of Risk and Insurance; Insurance Exposures and Coverages; Underwriting, Marketing and Claim Functions
6	4 hours	Principles of Ratemaking and Data for Ratemaking
7	4 hours	Premium, Loss, and Expense Reserves; Insurance Accounting, Expense Analysis, and Published Financial Information
		Fellowship Examinations
8**	4 hours	Insurance Law and Statutory Insurance; Regulation and Regulatory Issues
9	4 hours	Advanced Ratemaking; Individual Risk Rating; Excess Rating
10	4 hours	Financial Operations of Insurance Companies; Reinsurance; Forecasting; Valuation Topics

*Jointly administered with the Society of Actuaries

** Candidates must specify the United States or Canadian specialty at the time of application.

1980 SYLLABUS OF EXAMINATIONS

Associateship Examinations

Part	Time Allowed	Subjects
1*	3 hours	General Mathematics
2*	3 hours	Probability and Statistics
3*	3 hours	Numerical Methods and Operations Research
4**	3 hours	a) Theory of Interest
		b) Introduction to Life Contingencies
5	3 hours	Principles of Economics, Theory of Risk and Insurance, Policy Forms and Coverages, Underwriting and Marketing
6	4 hours	Principles of Ratemaking and Data for Ratemaking
7	4 hours	Insurance Accounting and Expense Analysis, Premium, Loss, and Expense Reserves

Fellowship Examinations

8	3 hours	Insurance Law, Supervision and Regulation, and Statutory Insurance
9	4 hours	Advanced Ratemaking and Individual Risk Rating
10	3 hours	Financial Operations of Insurance Companies, Reinsurance and Excess Rating, Forecasting, and Current Events and Issues

*Jointly administered with the Society of Actuaries

**Jointly administered with the Society of Actuaries, the American Society of Pension Actuaries and the Joint Board for the Enrollment of Actuaries.

5

SYLLABUS OF EXAMINATIONS

(Effective with 1975 Examinations)

Part		Subject
1		General Mathematics*
2		Probability and Statistics*
3		Numerical Analysis and Theory of Interest*
4	(a)	Life Contingencies
	(b)	Operations Research, Decision Theory, Data Processing
5		Principles of Economics, Theory of Risk and Insurance
		Forms, Coverages, Underwriting, Product Design, Marketing
6		Principles of Ratemaking and Insurance Statistics
7		Insurance Accounting and Expense Analysis
		Premium, Loss, and Expense Reserves
8		Insurance Law; Supervision and Regulation
		Statutory Insurances
9	(a)	Advanced Ratemaking
	(b)	Individual Risk Rating
10		Operations of Insurance Companies, Reinsurance,
		Topics of Current Interest

* Jointly administered with the Society of Actuaries

1967

4

SYLLABUS OF EXAMINATIONS

ASSOCIATESHIP

Part	Section	Subject
1		General Mathematics.
2		Probability and Statistics.
3	(a)	Elementary Life Insurance Mathematics.
	(b)	General Principles of Insurance; Insurance Economics and Investments.
4	(a)	Insurance Coverages and Policy Forms.
	(b)	General Principles of Ratemaking.

FELLOWSHIP

5	(a)	Insurance Law; Supervision, Regulation and Taxation.
	(b)	Statutory Insurances.
6	(a)	Premium, Loss and Expense Reserves.
	(b)	Insurance Accounting and Expense Analysis.
7	(a)	Individual Risk Rating.
	(b)	Problems in Underwriting and Administration.
8	(a)	Insurance Statistics and Machine Methods.
	(b)	Advanced Problems in Ratemaking.

1970

SYLLABUS OF EXAMINATIONS

(Effective with 1969 Examinations)

ASSOCIATESHIP

Part	Time Allowed	Subject
1	3 hours	General Mathematics (jointly sponsored with the Society of Actuaries)
2	3 hours	Probability and Statistics (jointly sponsored with the Society of Actuaries)
3	2 hours	Compound Interest and Life Contingencies
4	3 hours	(a) Principles of Economics: Theory of Risk and Insurance (b) Insurance Coverages and Policy Forms
5	3 hours	(a) Principles of Ratemaking (b) Insurance Statistics and Data Processing

FELLOWSHIP

6	3 hours	(a) Insurance Law; Supervision, Regulation, and Taxation (b) Statutory Insurances
7	3 hours	(a) Insurance Accounting and Expense Analysis (b) Premium, Loss, and Expense Reserves
8	2 hours	Individual Risk Rating
9	3 hours	Advanced Insurance Problems

Beginning May 1970: Parts 1, 2, 3, 5, 7, 9.

Beginning November 1969
Parts 1, 2, 4a, 4b, 6, 8. However, beginning with May 1970 Part 4 must be taken in its entirety & any previous credit for 4a or 4b automatically expires.

1970
Appendix 3

SYLLABUS OF EXAMINATIONS

(Effective with 1969 Examinations)

ASSOCIATESHIP

Part	Time Allowed	Subject
1	3 hours	General Mathematics (jointly sponsored with the Society of Actuaries)
2	3 hours	Probability and Statistics (jointly sponsored with the Society of Actuaries)
3	2 hours	Compound Interest and Life Contingencies
4	3 hours	(a) Principles of Economics: Theory of Risk and Insurance (b) Insurance Coverages and Policy Forms
5	3 hours	(a) Principles of Ratemaking (b) Insurance Statistics and Data Processing

FELLOWSHIP

6	3 hours	(a) Insurance Law; Supervision, Regulation, and Taxation (b) Statutory Insurances
7	3 hours	(a) Insurance Accounting and Expense Analysis (b) Premium, Loss, and Expense Reserves
8	2 hours	Individual Risk Rating
9	3 hours	Advanced Insurance Problems

TRAVEL TIME

I. INTRODUCTION

Travel Time is one of the additional considerations emphasized by the EPC in its White Paper. The intent of the EPC is to eliminate or minimize any potential disadvantages that a partitioned examination system might have on these considerations: "the intended effect in all such areas" are to be "clearly described". There is one specific consideration addressing Travel Time:

> Travel time should be affected as little as possible.

There is also a consideration that implicitly relates to Travel Time:

> There should be minimal effect due to any new system on candidates succeeding under the current system.

This consideration would also focus on the effects the transition to a partitioned examination system will have on candidates successful under the current system.

In addressing the Travel Time considerations in Section II, several different issues will be examined. These issues bear on certain qualities of the examination system that will be affected by partitioned examinations and the resultant effects on various types of CAS candidates. They are important attributes to consider when evaluating an examination process under a partitioned structure. This discussion will be followed in Section III by a presentation of changes to the examination system and implementation methods that would likely affect Travel Time. The evaluation of these items against the White Paper Criteria as prioritized by the Task Force then follows in Section IV before a final concluding section (Section V).

For the sake of clarity, a few initial remarks are in order. When speaking of partitioned examination units, the term "examination unit" will be used to refer to an individual "stand alone" examination that is a partition of an "examination group". An examination group, in turn, is meant to basically correspond to a single examination Part in today's environment.

In the discussions surrounding current successful candidates, no judgment is made as to what would constitute successful candidates in the future, with or without partitioned examinations. Given the discussions addressing the future of the actuarial profession, there is a distinct possibility that tomorrow's successful candidate, when spoken of in the same light as today's successful candidate, may possess certain attributes and exam passing qualities that may very well be unlike today's. Furthermore, their exam performance may also differ with respect to the frequency with which exams are passed or the number of exams sat for over a period of time. For comparison purposes, the evaluation of exam performance may need to translate exam units under a partitioned system to a basis equivalent to today's examination parts. Hence, the pace at which todays's successful candidate progresses through the examination parts is the focal point of all comments in this regard.

Finally, a working definition of Travel Time is needed. In this report it is defined as the number of separate examination sittings beyond Part 3 required by a candidate to attain fellowship in the CAS. Travel Time may be further defined by the context in which it is used, e.g. the average Travel Time for all 1988 Fellows.

II. TRAVEL TIME ISSUES

CURRENT SUCCESSFUL CANDIDATES

All other things being equal, partitioned examinations at first glance might be expected to increase the number of sittings, and therefore Travel Time, of today's successful candidates. If an otherwise successful candidate is required to compete at the same level as today for passing an examination unit, then the increase in the number of separate exam units may leave the candidate passing some but not all the units that are equivalent to one of today's examinations.

It is our a priori judgement that partitioning would increase the travel time of currently successful candidates. This effect is expected because the candidates would have to display competency at a finer level of examination. As such the "subsidization" intrinsic in today's process, wherein a strength in one area of the syllabus can buttress a weakness in another area of the syllabus, will be reduced. This is difficult to measure empirically without sampling and evaluating by way of illustration the performance of all candidates in the sections of a given examination as it now stands. The sections of today's examinations represent the most readily available means of recasting them on a partitioned basis.

In order to better analyze this issue, it may be necessary to record candidates' scores on some partitioned basis for a period of time before a strict partitioned examination system is actually implemented.

LESS SUCCESSFUL CANDIDATES

A less successful candidate may require several sittings in order to pass an examination part. On the surface it would appear that partitioned exams might allow the candidate to pass an examination unit in an area in which the candidate is strong and thereby provide the candidate with at least some progress at any one sitting. Subsequent sittings would require that the candidate only pass those remaining exam units that have not yet been passed. All other things being

equal, some such candidates will likely pass the equivalent of one of today's examinations in fewer sittings. Some of these candidates may progress further along in the examination process and complete the examinations given the the measure of success offered by partitioned exams. For candidates in this category seeking to strike an effective balance between study and work commitments, partitioning offers additional alternatives.

NEW ENTRANTS AND MARGINAL PERFORMERS

In the future under a partitioned examination system, there will be some new entrants into the examination process as a direct result of partitioned examinations. These candidates would not have entered the examination process under the current system but are attracted by a partitioned system. The opportunity will exist to sit for smaller examination units vis-a-vis today's examinations. These candidates may continue taking exam units over a long period of time so long as they experience some success. Inclusion of this group may result in an apparent Travel Time increase.

There is another group of candidates whose decision to enter the examination process will not be affected by the partitioning issue. This group represents marginal performers who are not able to make significant progress under the current system. It must be considered that such candidates may not remain in the examination process as long under today's environment.

While precise identification of these groups will not be possible, their existence must be recognized in order to make reasonable and consistent assessments of exam performance when evaluating Travel Time effects.

COMPETITION

Exam strategies will undergo change under a partitioned examination system. Each candidate will pursue his/her best strategy given his/her strengths, weaknesses, performance history, ambition, and study budget. The level of preparedness for an individual exam unit will likely increase

relative to the level that exists today for an examination. This will result in increased competition from candidates concentrating on one or two partitioned exams as opposed to the equivalent full examination today.

To the extent that successful candidates perform poorly on some section of one of today's examination parts, partitioning would result in the additional accumulation of candidates that correspond to this group who are weak in a given exam unit. This would result in a less competitive situation for stronger candidates, all other things being equal. The redefined notion of competition at the exam unit level may be more acute, or pronounced, than competition at the 1989 examination part level. Put another way, the greater variability in performance by candidates at the exam unit level must be recognized.

If examination units under a partitoned system are meant to stand alone, both as to their actual offering (sittings) and recognition for successful completion, then it becomes necessary to discrimate among candidates at this more refined level. Establishing a competitive performance standard at the examination unit level, somehow equivalent to that which exists today at the examination part, requires striking a balance between the forces working to increase and decrease competition.

EQUITY

Performance standards are meant to assure "fair and equitable treatment of all candidates" under a partitioned examination system as specified by another consideration in the EPC White Paper. It would seem that an inequity is created in the evaluation of candidates under a partitioned examination system if some candidates are concentrating on only some of the exam parts within an examination group while others focus on the entire examination group. To some extent one could argue that this situation exists today. However, the disparity among candidates as to the total number of exam units written during one examination period will increase under partitioning over today's levels. Partitioning will create an environment where stability in the fair and

equitable treatment of candidates at the exam unit level will undergo disruption and where that equity will be more difficult to maintain once it is "achieved".

Since partitioning, at the minimum, affords the recognition of "minimum competency" at the exam unit level, there is an additional measure of equity at the examination group level that can be considered. Equivalency of equity at the exam group level and equity at the 1989 examination part level may be desired.

There is a close relationship between equity and competition as further discussions will point out. Partitioning must strike a balance between inequities at the examination group (1989 part) level, associated with surges in competition, and increased focus on equity at the exam unit level, associated with minimum competency standards.

III. CHANGES TO THE EXAMINATION PROCESS AND IMPLEMENTATION METHODS

In Section II we illustrated the effects that partitioning might have on the students taking the exams. In this Section we list those changes we can make, either to the way exams are given or to the way the exams are structured, to control those effects.

A. Changes to the Examination Process

1. Passing Ratios

A direct influence on Travel Time that relates to the issue of performance standards is afforded by Passing Ratios. This represents the percentage of all candidates that are successful in passing a given exam. It can be fine tuned to exclude ineffective candidates who fail to achieve a "minimum grade", less than fifty percent of the passing grade. The passing grade controls the passing ratio.

All other things being equal, it is obvious that an increase in passing ratios will produce more successful candidates per examination or examination unit and, in the long run, it will decrease Travel Time.

2. Examination content

The amount of subject matter to be tested directly affects the study time needed to pass an examination. Increasing the volume of material tested per examination hour, or increasing the volume in the aggregate, can be construed to increase Travel Time. With partitioning, it would seem less onerous to add material to the examinations. There would therefore be enhanced opportunities to increase "Travel Time" as measured by material contained in the syllabus.

3. **Examination Length as Measured by the Number of Questions**

A smaller number of questions within an examination or examination unit can make it more difficult to accurately discriminate among candidates. This may cause some candidates to fall into a marginal group if they just miss a passing grade because the evaluation afforded by the question mix was not sharp enough. Erring on the conservative side, i.e. passing fewer candidates than more candidates, penalizes those candidates in the marginal group.

4. **Examination Length as Measured by Examination Hours**

If the number of questions were not altered for an examination today, then increasing the amount of time with which to write the exam will reduce stress on candidates and allow them to perform closer to a true representation of their abilities. Discrimination would be enhanced and perhaps Travel Time reduced for some candidates.

A further variation is to also increase the number of questions with or without increasing the amount of time given for writing the examination. This should also improve discrimination but will have less influence on the stress element.

5. **Essay Questions**

More essay questions will force the greater assimilation of several subjects and concepts even at the examination unit level. Although grading could become somewhat more subjective, the opportunity to provide greater discrimination exists. This in turn can decrease Travel Time.

6. **Open Book Examinations**

This might be an alternative for the less critical exam units or for those exam units that cover a vast amount of material.

7. **Varying Examination Passing Standards**

As a further variation on the minimum competency and proficiency standards introduced earlier, it may be feasible to reduce the degree of competency or proficiency required on some exam parts and perhaps increase them on others. Less critical exam units, such as economics, might carry lower competency or proficiency standards than the more critical exam units, such as ratemaking or reserving. Changes in competency level requirements can be used to affect Travel Time.

8. **Frequency of Offering Examinations**

At some time in the mid-seventies during the transition to new standards for Associateship, some CAS examinations were offered twice a year. The increased opportunity to pass an examination provides a method where Travel Time per se may not be affected but the total elapsed calendar time to fellowship can be reduced for some candidates. It is conceivable that there could be more than two examination cycles a year.

9. **Separation of Examination Units**

It may be possible to alter the frequency with which exam units are offered in the future while still maintaining the annual examination part cycle that exists today. This would entail offering all exam units for a given examination group within a six month period while splitting the exam units of a given examination group between two, maybe even three, sittings. Exams would take place more frequently, say every three months. All candidates would be competing for the same exam unit without regard to other units within an examination group. For example, an examination partitioned into two exam units would result in one exam unit being offered in February and the other in May. This approach would maintain the same total examination

hours between an exam group under partitioning and the equivalent 1989 examination part. It also affords the opportunity whereby candidates are provided equivalent preparation and study time which reduces competitive inequities introduced by offering all exam units of an exam group at the same time.

B. **Implementation Methods: Competency and Minimum Performance**

There are several partitioned examination implementation Methods that are worthy of discussion. They present themselves when the effects on a less than perfect candidate presented earlier are considered more carefully. Suppose that an examination group is offered in several exam units. For each unit there are minimum competency and proficiency performance possibilities, the latter requiring a higher empirical exam grade. Further, the examination group is assigned an overall passing grade developed from the grades of the individual exam units. A candidate would earn credit for an examination group and all its units by attaining an overall examination passing grade. A candidate could also earn credit for an exam unit by attaining minimum competency grades on all units and a proficient grade on the exam units(s) for which credit is given. Partially successful candidates would still need to take the full examination group in order to pass the other exam units, but the candidate would need only maintain minimum competency grades on those exam units already earned.

Transition rules would need to be devised so that a student is <u>not</u> penalized if exam units within an examination group are exchanged for others or if an exam unit passed by the student is dropped from the syllabus altogether. For example, if a student passes one exam unit in an examination group but that exam unit is subsequently replaced by another, then the student starts anew with the examination group. If the exam unit the student passed is moved to an examination group that the student has already gained credit for, then the student

is penalized in that no benefit was gained from having passed that exam unit. Similar invisible penalties can be incurred under the current system when subject matter is moved from one part of the syllabus to another.

Another possible Method would be to provide credit for an exam unit if the candidate obtains a proficient grade on that exam unit or provide credit for the entire examination group if the candidate achieves a minimum competency grade on all exam units at the same time that an overall passing grade is achieved. If any exam units are passed, then the student may obtain at future exam sittings a proficient grade on those exam units of the examination group that remain to be passed in order to obtain credit for them. Exam units could be taken individually and therefore stand on their own as independent "examinations". It may be possible that under this Method a student may feel it is to his/her advantage to take the entire examination group all over to obtain an overall passing score rather than what may be perceived as the more difficult to obtain proficient scores on the remaining exam units.

Yet a third variation would require minimum competency grades for individual exam units and an overall grade which would vary inversely with the number of exam units taken. For example, if a candidate sat for units A, B, C, and D, then the overall grade needed for passing might be 55% compared to 60% if only units A and B were written. Minimum competency for all exam units is implied by the overall grade so no credit would be received if the overall grade was below the passing grade even though the candidate did very well (proficient grade) on one exam unit.

IV. EVALUATION OF METHODS AND CHANGES

A. Overview

In the previous section, changes to the current examination process and a series of implementation methods for a partitioned examination system having some bearing on travel time, were presented. To assist in the evaluation and comparison of these various items, they are summarized below:

1. Changes to Examination Process:

The first seven types of changes are presented as methods that have some influence in the way students' knowledge are tested. The last two are presented as methods that can influence students' exam behaviors.

1) Passing Ratios

2) Examination content

3) Examination Length as Measured by the Number of Questions

4) Examination Length as Measured by Examination Hours

5) Essay Questions

6) Open Book Examinations

7) Varying Examination Passing Standards

8) Frequency of Offering Examinations

9) Separation of Examination Units

2. Implementation Methods:

The three approaches outlined below represent alternatives to stand alone exam units. They are

meant to suggest alternative ways to measure standards of achievement. Their descriptions indicate the basis upon which credit for an examination unit is given.

Method A

1) Overall passing score on exam group or,

2) Minimum competency on all exam units with minimum proficiency on exam unit(s) for which credit is received.

Method B

1) Minimum proficiency on the exam unit or,

2) Minimum competency on all exam units with overall passing score on exam group.

Method C

Minimum competency on exam units and an overall passing score which varies by the number of exam units taken.

There are three broad methods of "offering" examinations in smaller units. An evaluation must be made as to the suitability of alternatives to letting each exam unit stand on its own as being in the spirit of the intent of the EPC with respect to PES. The three broad methods are:

1) Offer exam unit sittings but provide credit only on an examination group basis once all units have been passed.

2) Offer credit for smaller exam units but require that the overall score on all exam units in an exam group written at the same sitting affect obtaining that credit.

3) Offer both sittings and credit at the exam unit basis. Examination groups are essentially irrelevant except when designating ACAS or Student status.

The last method listed is that which everyone seems to be thinking about. Under such a method it seems very difficult to satisfy the intended resolution of the Travel Time issue vis-a-vis today's standards.

The three implementation Methods offer alternatives to the third level above. Each of them involve the use of different focal points regarding the issues of competition and equity.

B. Changes to Examination Process

1. Introduction

As illustrated in the previous section, each of the Methods have, in their own way, a direct bearing on Travel Time. In assessing the various Methods, the actions for each which result in increased versus reduced Travel Time are identified. These need to be compared with the Decision Criteria that have been identified as critical by the PETF. Where a significant impact results on other criteria, those criteria are also discussed.

2. Discussion of Changes

1) Passing Ratios

Everything else being equal, increasing passing ratios (or reducing passing grades) would decrease Travel Time.

Such an action runs couter to the Educational Objectives, as it allows for lower standards of educational achievement. It also infers a different type of FCAS, potentially allowing for marginal candidates to acquire the coveted professional designation.

Quality of Education should not be affected by this change. The administration of examination should also not be materially affected.

2) Examination Content

Increasing the amount of subject matter to be tested could be seen as increasing Travel Time. Conversely, streamlining or reducing current exam material for a given exam unit could effectively decrease Travel Time.

However, in an attempt to streamline the exam material for smaller exam units, there is a risk that there will not be a sufficient amount of subject matter remaining to fairly measure educational achievement. This risk is even more so if some exam material is actually dropped from the syllabus. Such actions certainly run counter to the Educational Objectives criterion.

Quality of Education should not be affected too much to the extent that critical pieces of subject matter are retained. Dropping some of those critical syllabus items without replacing them with material of similar import might result in a lower Quality of Education.

By streamlining exam material, there is a potential that FCAS graduates will ultimately lack certain skills or discipline in the areas of time management, memory capacity, synthesis and the ability to isolate important material.

3) Examination Length as Measured by the Number of Questions

A larger number of questions within an examination allows for better discrimination among candidates. To the extent that one increases the number of questions, the margin

of error in accurately assessing passing and failing performances will decrease. This is even more important for smaller exam units where the number of questions tend to be small.

With smaller exam units, one should strive to have a higher ratio of questions to the amount of subject matter in order to avoid an increase in Travel Time. In this way it may be possible to improve the way educational achievement is measured, thus responding to the Educational Objectives in a positive manner.

The Quality of Education and Type of FCAS criteria should not be affected by increasing the number of questions. The increased number of questions would translate into an increase in the administration of the exams.

4) Examination Length as Measured by Examination Hours

Allowing more time to answer the same number of questions, everything else being equal, also results in an improvement in the discrimination characteristics of an exam.

Increasing the exam length implies a change in the standard of educational achievement. To the extent that today's standard is to measure the ability of the candidates to perform well within a certain time constraint, any increase in time allowed would run counter to the current Educational Objectives.

Similarly, the Type of FCAS emerging in the future may change. The Quality of Education should not be affected. There should be no effect on the administration of the exams.

5) Essay Questions

Restricting exams to essay type questions also results in an improvement in the area of discrimination. Eliminating quick multiple choice "trap" questions will force candidates to concentrate more on the subject matter itself. This obviously results in a slight deviation from current standards of educational achievement which should be regarded as a positive outcome.

The Type of FCAS might also be different, but again it should be seen as a positive outcome. Quality of education should not be affected. Exam administration would increase as a result of the extra demand placed on fairly correcting these essay type questions.

6) Open Book Examinations

This is not anticipated as having any material impact on Educational Objectives or Quality of Education. It can affect the Type of FCAS as it focuses on the synthesis and application of subject material. Administration will be more difficult in the areas of creating questions for examinations and grading.

7) Varying Examination Passing Standards

One way to limit increases in travel time as a result of Partitioning would be to allow for varying passing scores on the various exam units. A higher level of competency would be required on units considered critical. Those would be the exams testing basic areas of knowledge and skill necessary to obtain the competence to practice in the various actuarial specialties. Two examples of such basic areas would involve exam units testing ratemaking and reserving techniques. A lower standard would

be required on units involving complementary knowledge. Subjects such as Economics, Finance, Policy forms and Coverage, etc. would seem to be areas where one need only assert minimum competency.

Although varying passing standards explicitly results in a change in the way we measure educational achievement, it makes it easier to focus on one of the fundamental CAS principles of fostering a program of actuarial education. Hence the current Educational Objectives could still be preserved under some system of varying passing grades.

Similarly, it is reasonable to believe that the Type of FCAS would be different as a result of these changes because of the way achievement would be measured. Again, this outcome should not necessarily be interpreted in a negative way. A better Type of FCAS may very well emerge!

Quality of Education should not be affected by this change. The Administration of Examinations should also not be materially affected.

8) Frequency of Offering Examination

This type of change, even though it does not reduce the number of sittings to completion, allows candidates to perform at a faster pace. Under such a scheme, exam units beyond what is today Part 3 would be offered more than once a year.

This type of change does not have any bearing on the Educational Objectives, Quality of Education or Type of FCAS criteria. It would add a significant burden to exam administration

and could seriously injure the ability to adequately staff the Examination Committee on a volunteer basis.

9) Separation of Examination Units

This change entails spreading out the units within an exam group over the entire exam cycle. The elapsed time between successive units could be established based on the volume of material or based on the expected number of study hours needed to prepare for each unit. Travel time by itself is not affected under such a scheme, but it does reduce the competitive inequities that arise from a partitioned examination process.

This type of change does not have any bearing on the Education Objectives, Quality of Education or Type of FCAS. It does however have some bearing on the administration of the exams. It would appear that even though the work within an exam committee could be subdivided into parts, the sum of the workloads involved with all the subdivisions might be more than the workload of administering a single exam group sitting. For each unit within the cycle, some work might be duplicated and some of the resources might also grow thin. This may be most pronounced when an exam cycle is split into more than two sittings.

3. Synopsis of Changes to Examination Process

Each of the changes was discussed in comparison to the Critical Decision Criteria. These changes are not mutually exclusive with respect to implementation, which means that they can be used with one another. For example, spreading out the exam cycle could be used in conjunction with frequency of exam offering. Exam cycles could be offered twice a year, combining the advantages of the two schemes. This could however compound the problem of the administration of the exams.

Some of the changes were weighed against the increased administration of exams, even though this was not identified as a Critical Decision Criteria. To the extent that some degree of computerization is achieved, administration of exams might be less of a concern in certain respects. A computerized student data base would certainly help administration.

C. **Implementation Methods**

1. Introduction

In this second part, different approaches of measuring the standard achievement on partitioned exam groups are compared to the simple case of having a single standard for a stand alone exam unit. In other words, should we recognize different standards for candidates writing more than one unit within a exam group? The goal is to reduce if not eliminate the competitive inequities that could arise with exam partitioning.

These Methods also attempt to resolve the philosophy implicit in the examination process as to equity at the examination group, equivalent to a 1989 examination part, and equity at the partitioned examination unit level. They also address how offering examination group (examination parts in 1989) in smaller (exam) units can be incorporated into a partitioned examination method.

2. Discussion of Each Method

Method A

Under Method A, a candidate would get credit for all the units within an exam group by achieving an overall passing score. If a candidate does not obtain the overall passing score, he or she can earn credit for a single unit if there is minimum competency on all units and a minimum proficiency on that

particular exam unit. The candidate would have to write all units again to get credit on remaining units but would be required only to show minimum competency for the particular unit for which partial credit was obtained.

The main advantage of this approach is that it totally eliminates competitive inequities at the exam group level. Under this approach everyone has to write all the units of an exam group within the exam cycle. This approach also retains the feature of testing the candidate's ability to synthesize a large volume of exam material. It also has the advantage over Method C of establishing only one overall passing score.

On the other hand, aside from being hard to explain, the Method might not be easily understood by the students at large. It might also have the undesireable feature from the student's perspective of eliminating the advantage of partitioning altogether since the candidate is required to write all units of an exam group within the exam cycle. Moreover, this approach is not flexible in that it does not easily allow for deletion of certain units and addition of new ones. It does not allow for a candidate outside the CAS, such as an SOA student or a future candidate pursuing an FCIA designation that must gain credit for both SOA and CAS examinations, to write only some smaller number of units and obtain credit toward their own professional designation. It also shares the disadvantages with the other two Methods of having many performance standards to administer.

This Method attempts to provide equity at the exam group level while providing for competition at the exam unit level. Competition at the exam unit level is expected

to be sharper hence the use of a proficiency score at that level.

Method B

Under Method B, a candidate would get credit for all the units within an exam group by achieving an overall passing score and minimum competency on all exam units. If a candidate does not obtain the overall passing score, he or she can get full credit on a single unit by demonstrating minimum proficiency on that particular exam unit. In addition, the student can sit for selected units only and obtain credit by achieving proficient scores.

This approach has the advantage of reducing competitive inequities. It has the advantage over Method A of allowing for credit on single units. It also has the advantage over Method A of allowing the candidates to write only certain units as opposed to all. It has the advantage over Method C of requiring only one passing score.

Like Method A, it also has the disadvantage of having many performance standards to administer. Finally, even though it does reduce some of the competitive inequities, it does not fully eliminate them. It maintains equity to an extent at the examination group level, equivalent to a 1989 examination part, and adds the ability to obtain credit on a partitioned basis. The introduction of the equity issue when exam units are written alone distinguishes it from Method A.

Method C

Under Method C, a candidate would get credit for all the exam units within an exam group by achieving an overall passing score and

achieving a minimum competency score on each unit. However the overall passing score would vary inversely with the number of units the candidate elects to write.

This Method also reduces the competitive inequities although it does not fully eliminate them. It has the advantage over the other Methods of not having to establish a minimum competency standard when more than one unit is written. If only one unit is written, the passing score reduces to the proficiency standard.

It has the disadvantage relative to Methods A and B of having to establish more than one passing score.

This Method attempts to establish equity based on the number of exam units written. Technically, each combination presents its own standard. Contrast this Method with an extreme example today where a candidate passes an examination part by obtaining perfect scores on two (Sections A and B) out of three sections and no points on the third (Section C).

Under this Method, the same candidate sitting for units A and C might fail (assuming an overall score of 50% is failing) but would pass unit B. This indicates that this Method may need to employ overall passing grades lower than todays. It also indicates the potential for enhanced performance needed in the future to obtain the equivalent exam progress today.

3. **Synopsis of Implementation Methods**

The focus of these Methods are an alternative to having each exam unit stand on its own. To let each exam unit stand on its own, the CAS must address the likelihood of greater variability in candidates'

scores when compared to examination part scores today. If the same standards as today are applied to individual exam units, then the Travel Time of candidates under such a partitioned examination system will likely increase once a steady-state has been achieved. In order to avoid this undesirable increase in Travel Time, either educational standards must be relaxed or a reorientation of equity and competition is needed away from the individual exam unit level.

D. **Concluding Remarks**

The first part of this section covered avenues available to a Partitioned Examination System to help reduce or at least maintain current Travel Time.

The second part of this section covered alternative approaches to measure standards of achievement under a Partitioned Examination System. Each were presented as an improvement to the stand alone exam in the are of reducing competitive inequities.

As a final analysis one can try to combine some of the changes to the examination process with one of the implementation Methods described in the second part to produce the most desirable scenario under a Partitioned Examination System.

V. CONCLUSIONS AND RECOMMENDATIONS

In a steady-state environment, after the effects of the transition to a new examination system have disappeared, it is expected that the variability of candidates' performance at the exam unit level will be more variable than that at the 1989 examination part level. This means that without moving away from applying today's standards to exam units in the future, an increase in Travel Time cannot be prevented, and a significant increase is likely at that.

The question of equity occurs both at the exam unit level and the exam group level. An underlying philosophy as to how to offer examinations in smaller units must be established before these questions can be answered. Once resolved, the attention then turns to competition and its affects on Travel Time.

Some combination of changes to the examination process, perhaps employing an alternative to letting each exam unit stand alone, is necessary in order to preserve Travel Time at a level commensurate with that which exists today. When the variability of candidates' performance at a level below that of 1989 examination parts is considered, it is apparent that fairly significant changes must be made in the examination process if Travel Time is to be affected as little as possible.

Appendix 5

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CORPORATE ACTUARIAL DEPARTMENT

RICHARD H. SNADER
VICE PRESIDENT-CORPORATE ACTUARY

January 29, 1990

Mr. Stephen P. D'Arcy
Assistant Professor
Department of Finance
University of Illinois
460 Commerce West
1206 West Sixth Street
Champaign, IL 61820

Dear Steve:

As I mentioned to you on the telephone the other day, a question has been raised regarding the accuracy of the pass ratio and travel time I provided you for CPA candidates.

It turns out that CPA pass ratios are much different from the ones I quoted. A publication called "CPA Candidate Performance on the Uniform CPA Examination" published by the National Association of State Boards of Accountancy (NASBA) provides a wealth of information.

As you may know the CPA exams consist of four different subjects that are tested in one sitting. There are two sittings each year. The four subjects are Theory, Practice, Auditing and Business Law. The NASBA publication distinguishes between first time candidates and repeat candidates. The relevant statistics are as follows:

Pass Ratios

	All Exams	At Least One Exam
First Time	20%	50%
Repeat	27-30%	55%
All	25%	53%

Our report recommends collecting background information on candidates. The type of information contained in this publication might be a good model for the CAS to follow. A portion of their exhibits are attached. I can send the entire book to the appropriate person in the CAS if someone will just tell me who that person is.

Yours truly,

RHS:dmb
Attachment

cc: Jerry Degerness
PETF (w/o exhibits)
Education & Testing Methods TF (w/o exhibits)
Michael Toothman

MAY 1988
TABULAR REPORTS

1 Performance of First-time Candidates by State
2 Performance of Repeat Candidates by State
3 Performance of Candidates by Highest Level of Education Achieved
4 Performance of First-time Candidates by Major
5 Performance of First-time Candidates by Overall Grade Point Average
6 Performance of First-time Candidates by Semester Hours of Accounting
7 Performance of Candidates by Accounting Experience
8 Performance of First-time Candidates by SAT and ACT Scores
9 Performance of Candidates by Number of Subjects Taken
10 Performance of Candidates by Subject
11 Performance of Candidates by Supplementary Study
12A Performance of First-time Candidates without Advanced Degrees by School
12B Performance of First-time Candidates with Advanced Degrees by School
12C Performance of Repeat Candidates without Advanced Degrees by School
12D Performance of Repeat Candidates with Advanced Degrees by School
School Index (Total candidates for each college and university—identified as Report 14)

Chart 4
Passing Rates of First-time Candidates by Subject

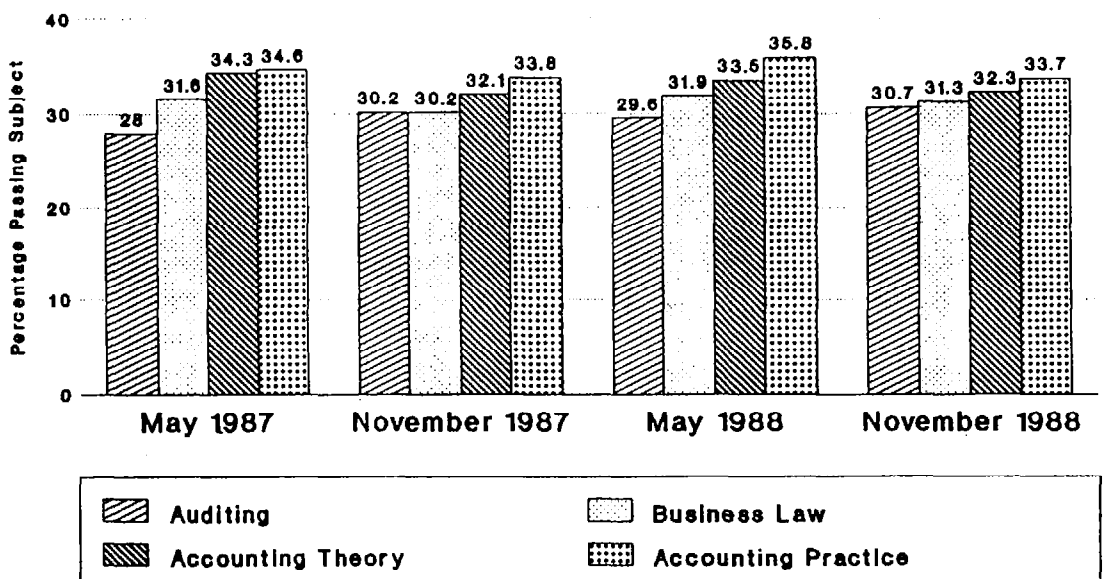


Chart 5
Passing Rates of Repeat Candidates by Subject

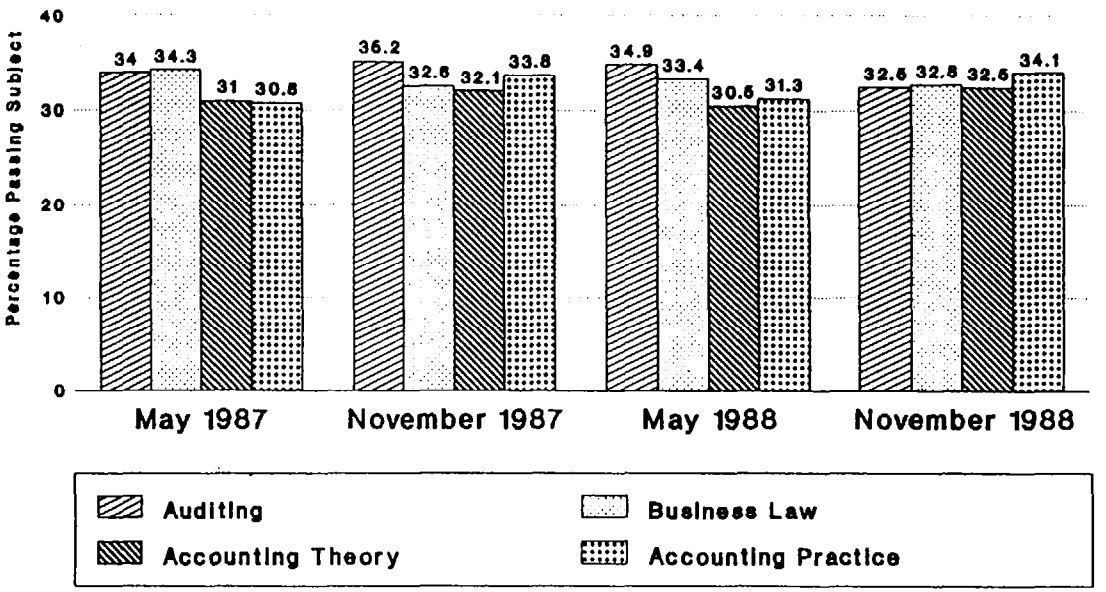


Chart 7
Passing Rates of First-time Candidates by Examination

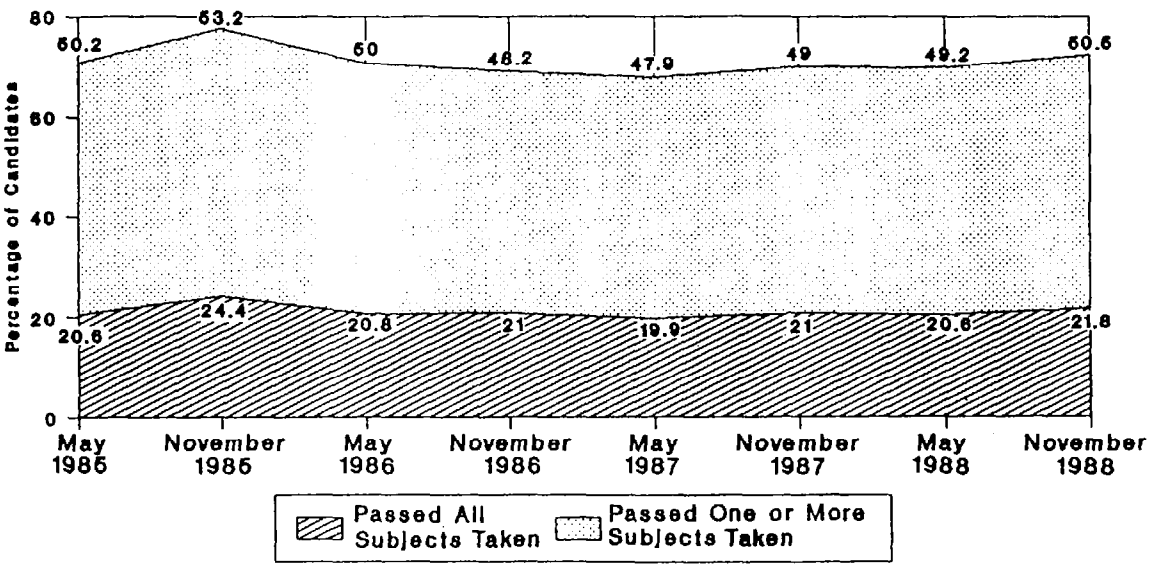


Chart 9
Percentage Passing Each Subject by Number of Sittings May 1988

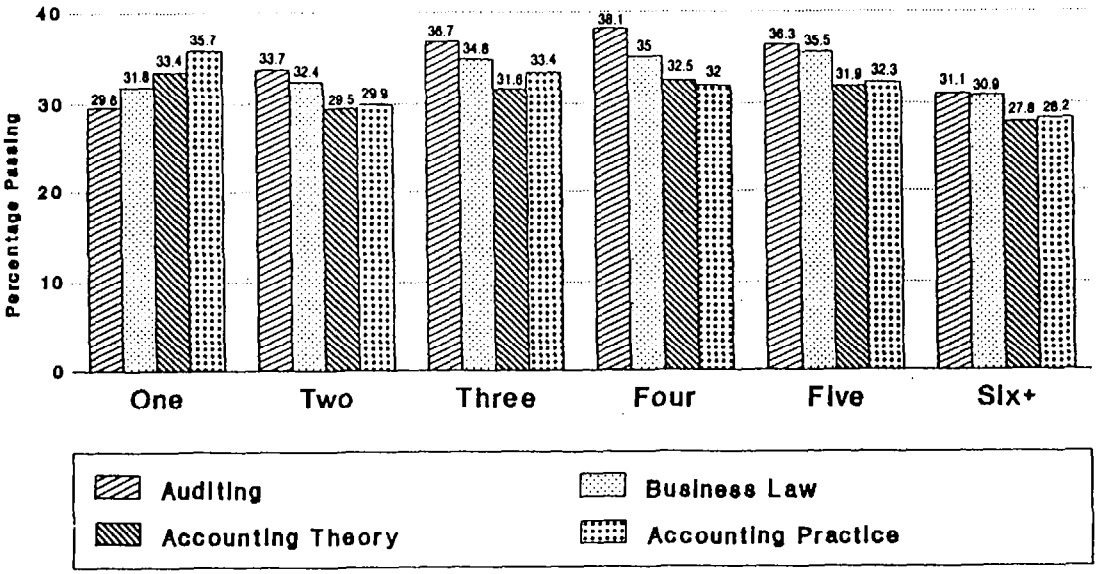
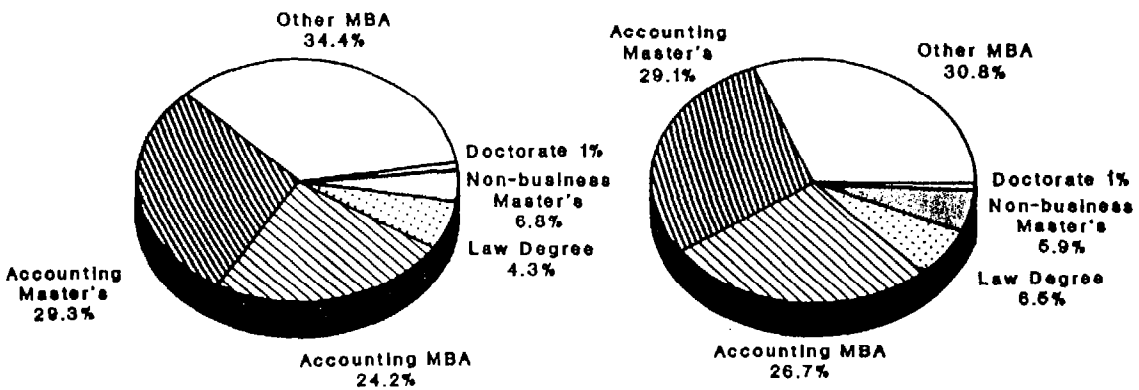


Chart 11
Percentage of Types of Advanced Degrees of First-time Candidates



May 1988 November 1988

Chart 13
Success by Educational Level of First-time Candidates

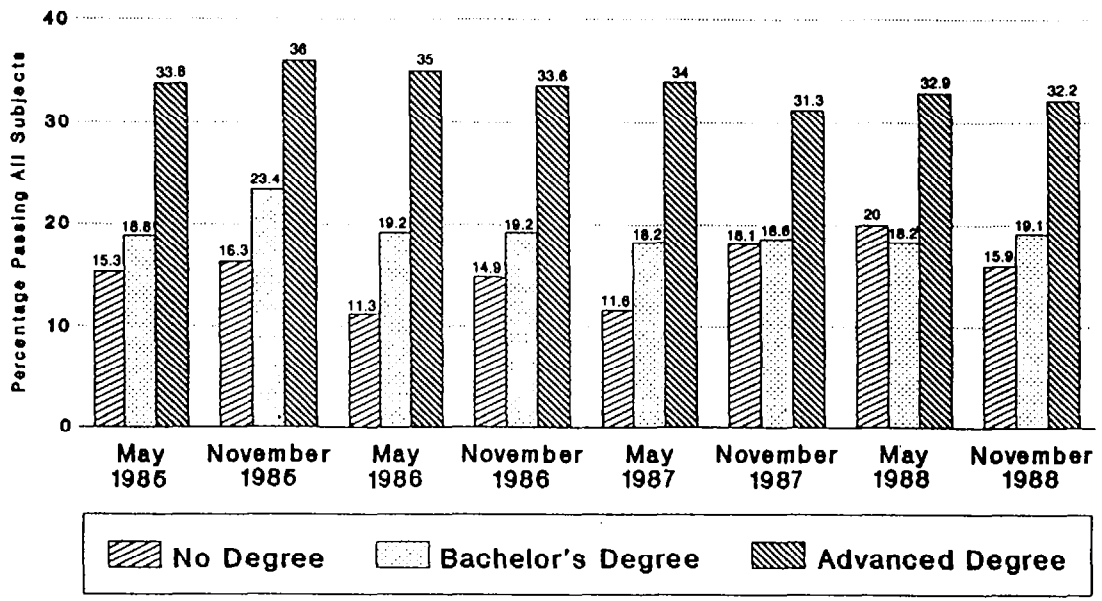


Chart 15
Success by Hours of Undergraduate Accounting Study of First-time Candidates

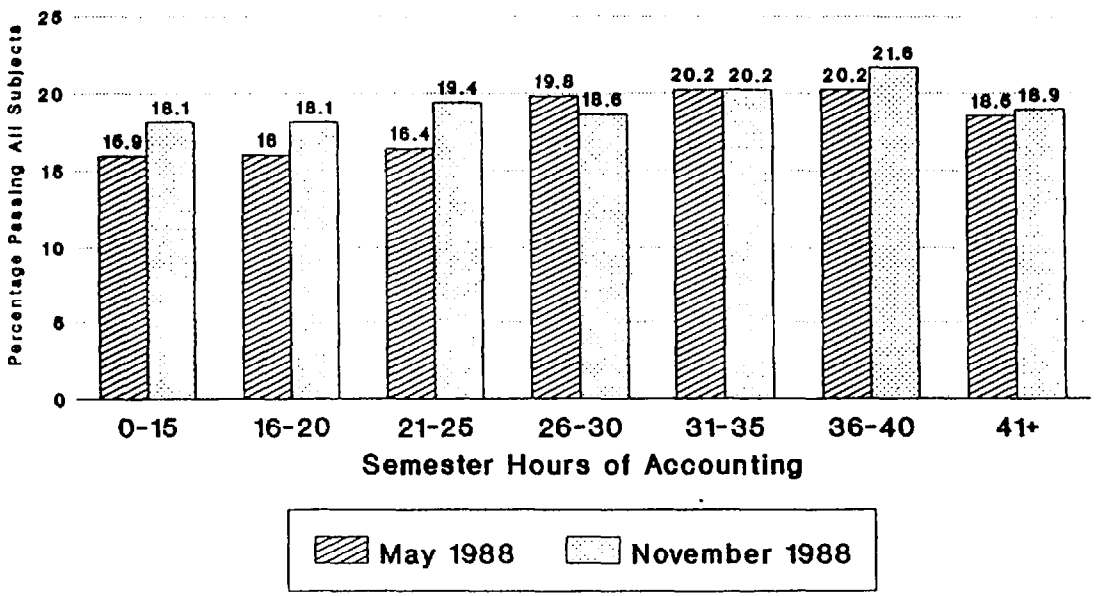


Chart 19
Success by Undergraduate Grade Point Average

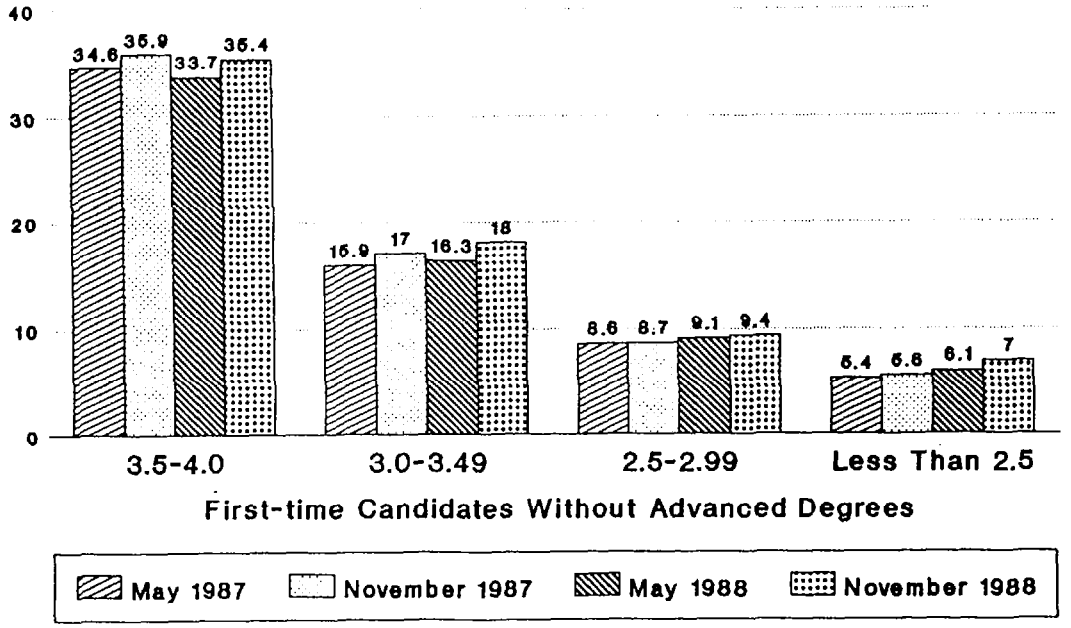


Chart 20
Success by Graduate Grade Point Average

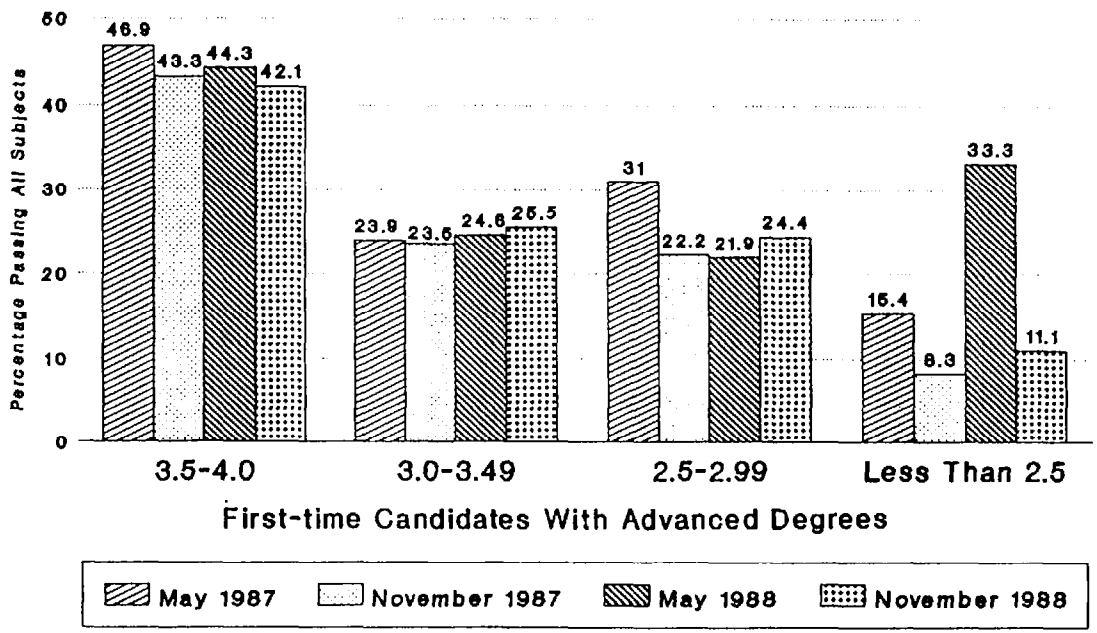


Chart 23
Success by Accounting Experience

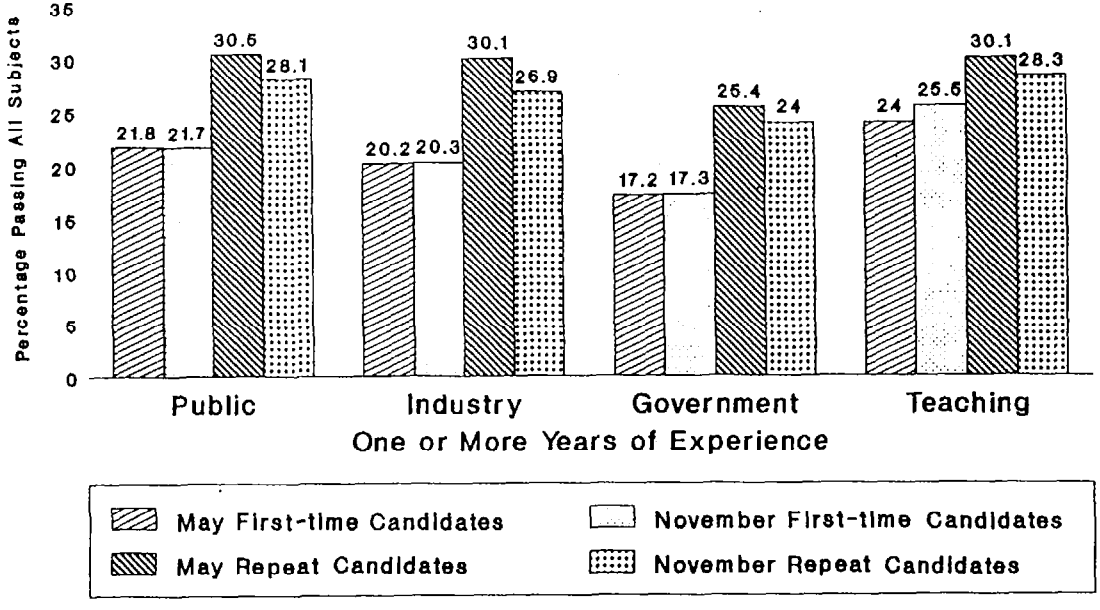


Chart 26
Success by SAT Verbal Scores of First-time Candidates

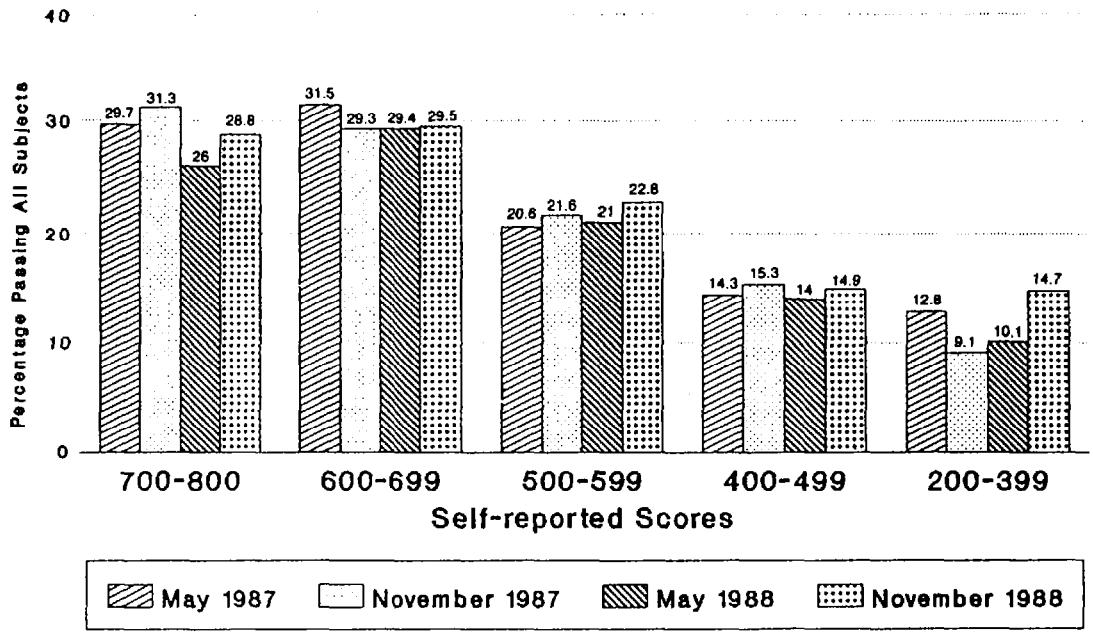


Chart 27
Success by SAT Mathematics Scores of First-time Candidates

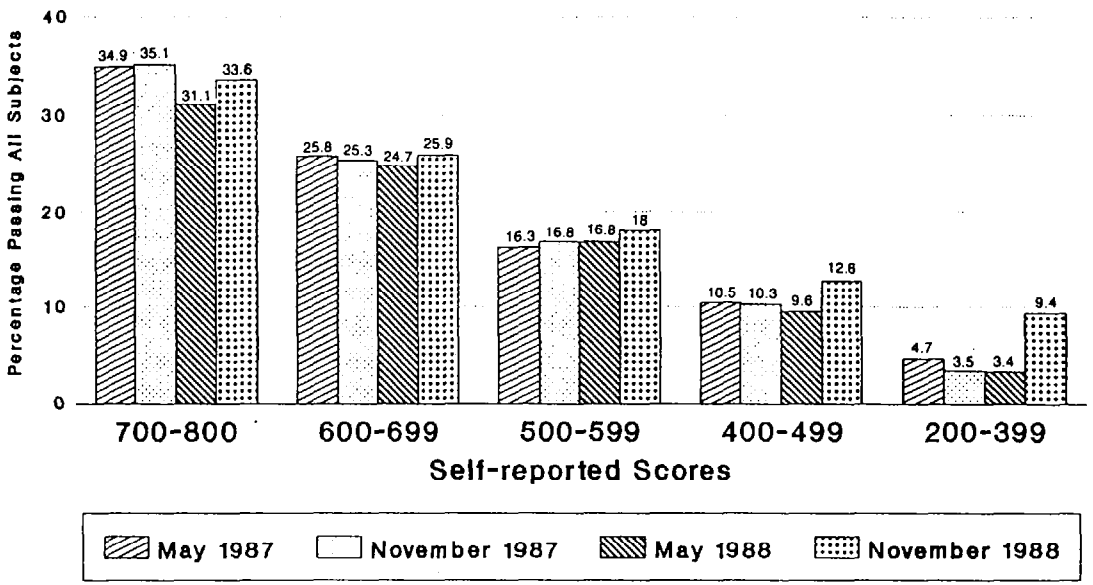


Chart 30
Success by ACT Verbal Scores of First-time Candidates

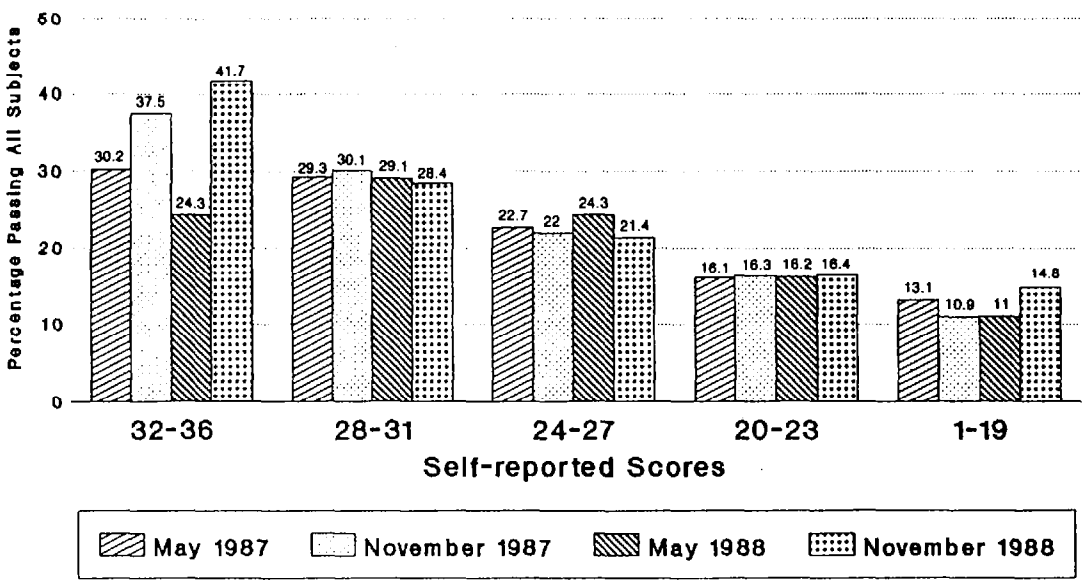


Chart 31
Success by ACT Mathematics Scores of First-time Candidates

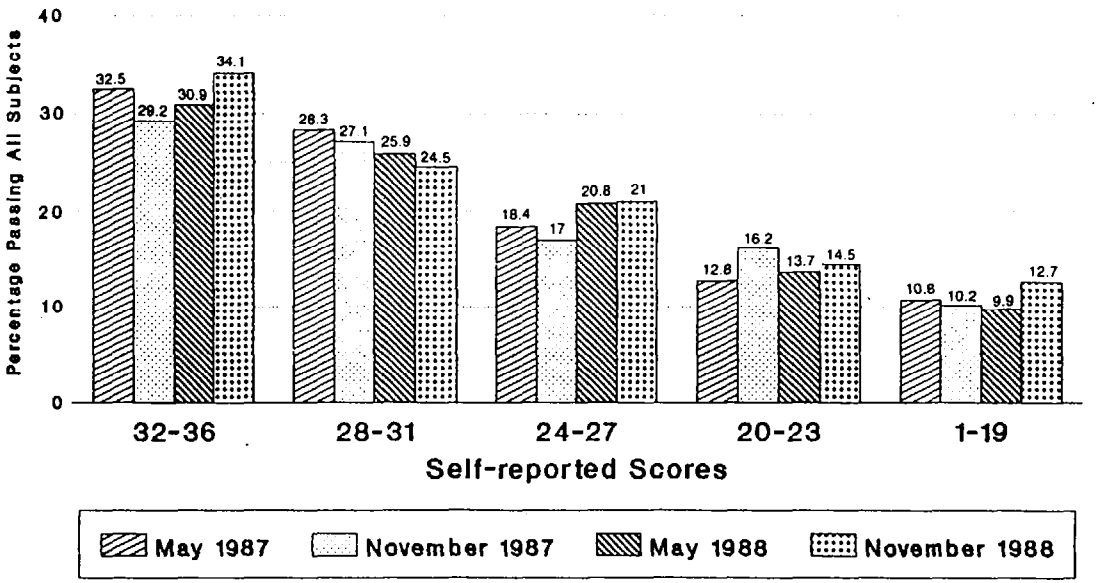


Chart 35
Passing Rates of Candidates Relative to Coaching Course Preparation

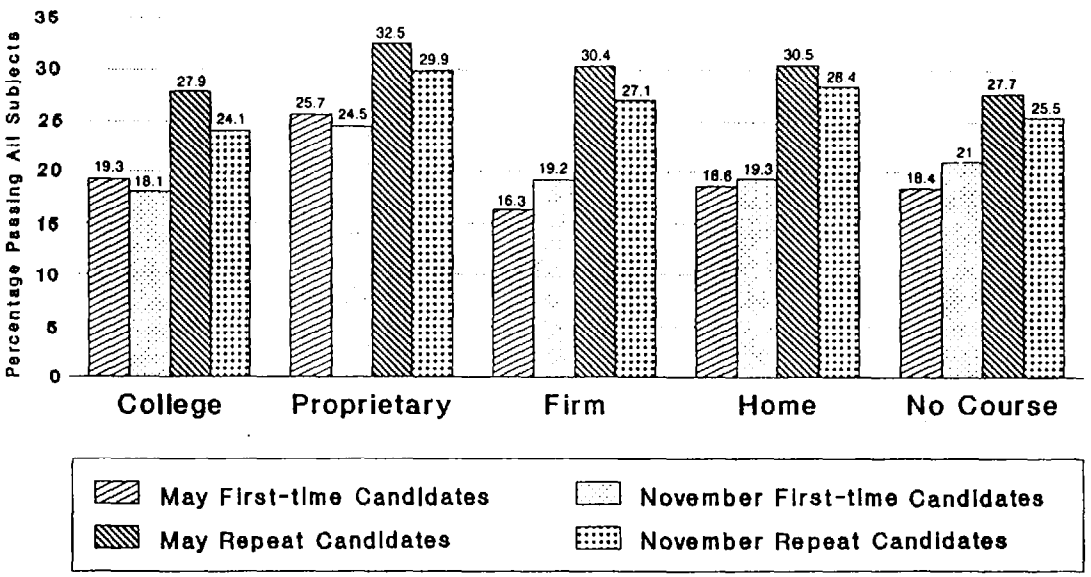
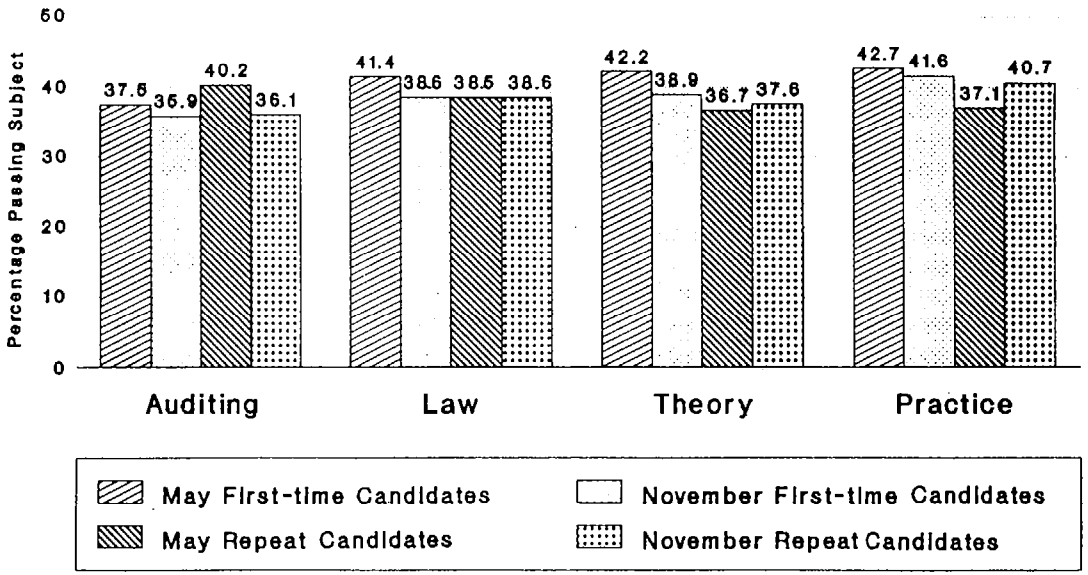


Chart 36
Passing Rates by Subject of Candidates Who Took Proprietary Coaching Courses



MEMBERSHIP INPUT

Members Opposed Because:

1. Travel time concerns
2. Recruiting will be compromised
3. Synthesis skills not tested
4. Minimum standards don't require partitions
5. Cheaper FCAS
6. Credibility of scoring
7. Administration
8. Effect on employers
9. Lets in marginal performers
10. "One part" competitive pressure
11. Stress would increase
12. Emotional reasoning
13. Motivation - terminal ACAS
14. Memory would not be tested
15. CAS/SOA distinction would be vague
16. Current system is good
17. Time management would not be tested
18. Project management would not be tested
19. Less discipline would be required

Members In Favor Because:

1. Flexibility
2. Emotional reasoning
3. Small steps can be taken
4. Specialty tracks would be feasible
5. Travel time will improve
6. Clarity will improve
7. Synthesis can be preserved

Suggestions From Members:

1. Test synthesis skills by reflecting concepts from other parts of the syllabus
2. Give exams more often
3. Provide electives
4. Make exams nation specific
5. Eliminate essay questions

PARTITIONED EXAMS

JUNE 20, 1989 SYNOPSIS OF MEMBER INPUT

PREPARED FOR TASK FORCE BY GUS KRAUSE

		Appraisal
1.	Opposed. Travel time issue. Recruiting would suffer.	2
2.	Unconventional comments. Really skirts the partitioning issue. Has some other ideas unrelated to our task force mission. Questions whether current exams accomplish enough.	
	Adds nothing to what we have.	1
3.	In favor. Presents a rational argument for specialty tracks at some future point in time.	2
4.		

In favor. Personal view dominant - he is a long-time associate. Highlights the choice for many as "small steps or none at all." 2

5.

Would favor if we can deal with travel time and "one part" competitive pressure. 2

6.

Opposed. Increased travel time. Uses part 3 as example. Strong opinion that partitioning will drive more people out of (or away from) the system. Nothing new, but strong opinion voiced. 2

7.

Opposed. As employer, travel time a real issue. ACAS could become a more frequent "terminal point."* Takes issue with the possibility of more marginal performers getting through. Favors requiring time and project management, discipline, memory

and synthesis skills. 3

*This point needs our clear attention.

8.

Favors. Would have personally traded some travel time for flexibility. As an employer, likes ability for partitions to track better with work assignments. 2

9.

Thinks FES is a done deal. (next membership mailing should clarify.) N/A

10.

Opposed. Thinks ability to more precisely test competence is not a significant benefit. Questions whether flexibility is real or perceived, with arguments and examples which are not very convincing. Travel time issue. If exams are partitioned, suggests that each part be truly independent, i.e., not 4a, 4b; Suggests capping exam time to two hours

and offering more frequently.

Opposition seems emotional due to extensive comments about how to partition. 2

11.

Opposed. Thinks primary benefit of partitioning would be to support electives and specialty tracks. Does not favor sacrificing synthesis for topical depth. His students are unanimously opposed. 3

12.

Favors (I think). Has broad criticisms of current E&E system. 2

13.

Opposes (I think). Partitioning will further stereotype the actuary. 2

14.

Opposed. Take wait and see approach,

i.e., learn more from SOA experiment. May cheapen the FCAS designation. Will be administratively more difficult and current process is less than perfect (typo's, lost exams, etc.). Prefers minimum standards. Sees difficulty with recruiting. 3

15.

Opposed. Travel time, e.g., part 3. Points out an overwhelming majority of people in San Antonio favored minimum standards (i.e., 5*) to partitioning.* 2

*This can and should be documented.

16.

Opposed. Students have not indicated a preference for SOA system. Current system works very well; standards are tight enough. Partitioning may drive candidates away. Travel time; part 3 example. Clearly opposes any FES or FEM change. Offers many comments on

an annotated White Paper Appendix II-a. 3

17.

Opposed. Concern about competition, e.g., candidates writing one partition only. Travel time issue. Recruiting issue in terms of attractiveness. 2

18.

Opposed. Thinks 20 to 30 exams will discourage many potential candidates. Travel time issue. Competing issue, i.e., candidates taking only one part. Blurs distinction between CAS and SOA. 2

19.

Opposed. Was in favor due to flexibility, but major concern about travel time. Uses part 3 as example. Concern about fewer questions, thus lower credibility of statistics for a given partition. Concern about career attractiveness. Staffing committees a

problem. Worried about whether our action is a response to SOA threat to offer casualty exams. 3

20.

Opposed. Will drive candidates away. Travel time issue; uses part 3 as example. 2

21.

Opposed. Prefers current system with minimum standards. Thinks member input represents our "going through the motions." Suggests a membership vote. 2

22.

Favors. Will allow people to better balance personal, work and exams commitments. Thinks travel time will increase because we will require candidates to know the material in more depth. Number of people sitting for higher level exams could be quite low, with grading implications, i.e., distri-

bution would not be smooth. 2

23.

Opposed. FES could only be used with electives. Current system does not lack focus. Uses part 3 as evidence of increased travel time. Thinks candidates would attempt less than whole exam equivalent. Recruiting more difficult. 2

24.

Favors. Presents Canadian concerns; really doesn't say much else. Canadian concerns transcend our work for the most part. 3

25.

Opposed. Loss of synthesis is major concern. 2

26.

Opposed. Will sacrifices synthesis. Uses part 3 as travel time example.

Most CAS exams don't provide natural partitions. Adverse impact on recruiting. 2

27.

No strong feeling. Concerned about losing "advanced degree" image of ACAS and FCAS. 2

28.

No opinion. Concern about travel time. Uses part 3 as example. 2

29.

Opposed. Loss of synthesis is fatal flaw. Convinced that travel time will increase. Thinks there will be more stress, not less, under a partitioned system. 2

30.

Opposed. Should remove obsolete and irrelevant readings from current

35.

Favors. Thinks students like partitioning. Partitioning would stabilize productivity of students near exam time. New subject matter could mean more exams rather than more severe exams. Partitioning would place more emphasis on learning than on passing. Synthesis would be hurt; suggests the possibility of a given reading on more than one partition. Favors more frequent testing. Thinks there will be a tendency to let partitions get bigger in terms of syllabus size. 3

36.

Opposed. Strongly favors current process; even suggests recombining part 3. Concern about travel time; part 3 example. 2

37.

Opposed. Favors current system with minimum standards. Travel time; part 3 example. Concerned about quality of

FCAS. 2

38.

Opposed. Current system achieves educational objectives. Concern about loss of synthesis. Travel time; part 3 example. More people will stop at ACAS. Concern about quality of FCAS. 3

39.

Oppose. Travel time increase. Lost credits when syllabus changes. 1

40.

No opinion. Indicates that partitioning unnecessary unless long-term goal is to have electives. 2

41.

Opposed. CAS today has a significant recruiting advantage over SOA. Not convinced that FES/FEM is working for SOA. Wants to know how matter will be

decided. Will students vote?* 2

*No.

42.

Opposed. Favors for getting Canadian content in via nation specific parts. Recruiting is hampered. Synthesis is lost. Travel time; part 3 example. 2

43.

Favors. Important to offer exams more than twice a year, to benefit travel time and give students greater flexibility. Suggests eliminating essay questions to ease administrative burden. 2

44.

No opinion.* Travel time is an issue but he does <u>not</u> sense a level of unrest with life students. Administrative burden will be formidable. 2

*Probably favors, hard to tell.

45.

No opinion. Notes on copy of White Paper pages. 1

46.

Opposed. Favors minimum standards. Synthesis is very important. Travel time will increase. Single partition takers have advantage. Lowering passing standards contrary to goal of improving quality of education. Increased administrative burden and cost. Employers would need to restructure actuarial exam programs. Recruiting is harder. 3

47.

Opposed. Travel time main concern. Uses part 3 example. Those good at synthesis and large volumes of material would be losers. Questions fairness of evaluations based on 12-15 questions. FCAS graduate will be weakened. 2

48.

Opposed. Should evaluate all current weaknesses. Doesn't agree that procedural changes would be easier under a partitioned system. Concern about transitions. Travel time control is inconsistent with more focused exams. Thinks partitioned exam system would be more stressful. 2

49.

Opposed. Studying smaller units is diametrically opposed to producing well rounded, generalist actuaries. States current average time to FCAS is 8-10 years; must not be increased. Cites part 3 example. Makes recruiting difficult. Suggests vote. 2

50.

Opposed. Partitioning will produce technocrats vs. generalists. Gives naive mathematical travel time presenta-

tion. CAS work problems are fundamentally different from SOA, requiring synthesis. 2

51.

Opposed. Cites Fireman's Fund petition. Travel time. Competitive advantage of taking one part. Cites SOA part 3 results. 2

52.

Favors. Cites competitive issue on one vs. more than one part. This in turn leads to taking fewer parts and increased travel time. Relaxing standards. Lengthened travel time results in some who lose incentive to get FCAS because of attained job position.

53.

Opposed. If effort and travel time are unaffected, the same educational result should be obtained. Recruiting and company

programs adversely affected. Exam loads may be reduced to compete, thus increasing travel time despite all CAS efforts. 3

54.

Favors. Give more often. Some current exams have a hodgepodge of material. 2

55.

Oppose. Watch SOA longer. Use minimum standards. Quality of FCAS a concern. 2

56.

Opposes. Emphasizes need for synthesis. Comprehensive type exams good for professional designation. Minimum standards may be sufficient. Travel time could be significantly lengthened. Focus on weaknesses of current system would be better exercise. 2

57.

Favors, but insists on electives.

Thinks CAS must move toward specialists to avoid "jack of all trades, master of none". Very few synthesis questions on current exams. 3

58.

(Based on meeting with his students).

(Must read. List too long to paraphrase) 3

59.

Favorable. SOA has done a poor job. Part 3 has increased travel time. Synthesis and time management skills are useful. Currently, more study time is needed for parts 4 and 5 than 1, 2 or 3. Work responsibilities cut into study time; partitioning lets one "chip away". 3

Task force should read.

60.

Oppose. Quality of education would suffer. Long-term retention would decrease. Travel time concern. His understanding is that this proposal is to enable consulting firms to get their students through.* Proposes alternative (probably unrealistic). 1

*Maybe someone should ask where this understanding came from.

61.

Opposed. Thinks partitioning is change for the sake of change. Criticizes most points in the White Paper. Suggests interviewing some life students. 2

62.

Opposed. Will drive candidates away from profession. Loss of synthesis is a concern. Questions better educational process. Exams can become too small. Would need to offer more frequently. Marginal candidates almost

certain to get through. Degrades the FCAS designation. Employers' nightmare. 2

63.

Opposed. Will accelerate the increase in syllabus material, number and length of exams. Impossible to test everything. 2

Comments from students attached.

(task force should read) 3

64.

Opposed. Smaller units are worse selectors; the luck factor increases a lot. Prefers broad range of talent to perseverance. Concern about travel time in terms of employer investment. Cost increase should get more attention. Stronger syllabus is needed now. Partitioning will result in weaker society. 2

65.

Opposed. Will lower quality of FCAS.

Travel time. He thinks SOA has been unsuccessful. Synthesis important. Smaller number of questions inadequate to test candidate. He says SOA members feel quality of education is lower and travel time is longer.*

*We should follow up on this.

66.

Favors. Main concern is travel time. Need incentive to have students take an appropriate load. Suggests an alternative which is roughly equivalent to imposing minimum standards. 2

67.

Opposed. Had experience with SOA exams. Felt shorter exams created time pressure unlike longer exams. 2

68.

Opposed. Must evaluate strengths and

weaknesses of current system. Employer concerns; time, expense. Career less attractive vs. accounting, e.g. ACAS may not pursue FCAS. Suggests membership vote. 2

69.

Opposed. Travel time will increase. Employer's investment will increase. Synthesis questions would not be used. Stress will increase. Exams more related to work is not valid.

70.

Opposed. Current structure is effective. Travel time. Partitioned exams may promote memorization rather than creative thinking. Prefers minimum standards. May be more appropriate for fellowship exams - less time available due to other commitments. Frequency of giving exams would need to increase. 3

71. This is a petition <u>not</u> in favor. Signed by a number of Fellows,

Associates and Students. N/A

72.

Opposed. Major issue is travel time. Says Life actuaries have confirmed increase in travel time.* Not convinced that education can (or should) be improved. Raises several specific questions. 2

*Task force may want to follow up.

73.

Opposed. Travel time. 2

74.

Opposed. Travel time issue. Recruiting hampered. Fewer questions increases randomness. 2

75.

No opinion. What has SOA learned? Concern about partitioned exams

becoming larger and larger. Doesn't see how syllabus changes are facilitated by partitioning. Concern about loss of synthesis. More frequent exams means constant studying. Place more emphasis on continuing education. 2

March 23, 1989

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34 Street
New York, NY 10119

Dear Sirs:

I favor the move to a flexible education system. The pros provided in the white paper far outweigh the cons cited.

I'm not certain that we should dismiss the possibility of eventually having specialty tracks. I did not find the evaluation provided persuasive in either direction. It would seem to me that "commonality of education" and a generalist orientation could be achieved by the time an individual has completed equivalent of seven or eight exams under today's syllabus. The ability to specialize via the last one or two exams might enhance our pool of future actuaries, rather than diminish it.

There is a lot to be said for transitioning from where we are to FES without electives. Once we've had experience under this system, we could then reevaluate whether or not it does represent our best approach to the future.

Thanks very much for the opportunity to provide this input. Let me know if I can be of further help to you.

Sincerely,

March 23, 1989

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34th Street
New York, NY 10119

Re: Flexible Examination System

Gentlemen:

I read with great interest the "White Paper" with regard to the Flexible Education System.

I am now 41 years old and have been an Associate of the Casualty Actuarial Society for 17 years. In part, I see my failure to complete my Fellowship as a lack of personal commitment. But I also see it as a matter of shifting priorities. By the time I was close to completing my Fellowship, choices had begun to arise between family responsibilities, work responsibilities and study for exams. In the end, study lost out. The irony is that the material on the exam I am missing is the material that I use everyday in my consulting practice. Unfortunately, there still is not time in my life to prepare adequately for Part 9 if taken as a whole.

I see FES as presenting the possibility of completing my Fellowship while reducing to some extent the strain from other forces competing for my time. For me, I see the choice as taking smaller steps or making no progress. I cannot find 400-500 hours to adequately prepare for all of Part 9. I could find 200 hours twice to take it in pieces.

Also, I don't believe that I am alone in this position. I think there are probably a number of long-time Associates in the CAS that have stopped at that level only because other commitments, many of them work-related, have left inadaquate time to properly prepare for exams. These are not necessarily "marginal" students. I think that marginal people tend to get weeded out well before Associateship is reached. A case could be made that some of these people may be among our most talented - people whose work performance was sufficiently impressive that they were given exceptional responsibility very early in their careers. To the detriment of their examination performance.

Isn't the CAS better served by encouraging people to proceed in small steps toward Fellowship rather than getting to a point where they decide that no further progress is the best choice?

March 27, 1989

Appendix 6

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34th Street
New York, New York 10119

Dear Sirs:

I strongly oppose partitioning exams 4 through 10 into smaller units.

The major reason I oppose the change is that I believe that it would increase travel time to Fellowship, and thus discourage potential actuaries.

I think the current situation with Part 3 is a good example. In my company, many students choose to sit for only one or two parts of Part 3. Thus, at best it takes two sittings to pass all of Part 3. It frequently takes longer than that, and only the bravest student is willing to take Part 4 when he still has part of Part 3 remaining.

The White Paper suggests two ways to avoid an increase in travel time. I find both ways unsatisfactory. The first suggestion is to increase the pass ratio. Given students' risk-averse nature, we would have to increase pass ratios to unacceptably high levels to convince them to take more than two small exams at a time. Thus we would end up devaluing the worth of the exams.

The second suggestion is to increase the frequency of examination dates. This one is a better solution, but also has negatives. The biggest negative is the burden on the people who make up and grade the exams. In order to relieve this burden, I believe they would end up putting more and more multiple choice questions on the exams. This would result in lower quality exams.

Currently, the exam process is a long road, and a great deal of commitment is required in order to achieve Fellowship. Many capable people drop out of the actuarial program since they are not willing to make the commitment to the exam process. The proposed system will encourage even more people to leave the program.

If The CAS approves the smaller exams, we shall end up with fewer accredited actuaries. This will cause companies to use more non-accredited actuaries for actuarial tasks, thus there will be less commonality among people doing actuarial work. Also, The CAS's importance will shrink as the number of non-accredited actuaries increases.

I appreciate what The CAS is trying to do. However this would end up in weakening The CAS, and should not be implemented.

Very Truly Yours,

March 27, 1989

Appendix 6

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34th Street
New York, NY 10119

Dear Sir:

I read the very thoughtful and well written Task Force paper on the propsed FES and related matters. I compliment the Committee on developing an apparently comprehensive list of "pros" and "cons".

After thinking about the "pros" and "cons", I feel the "cons" totally overwhelm the "pros" and, therefore, I would argue against the proposal.

In my mind, the principal dispositive issues are:

- As an employer, the prospects of increased (travel) times and costs (Appendix I-g.) are a clear "no-sale".

- As an FCAS, I am very much opposed to any changes which might increase the likelihood of the ACAS being a more frequent terminal point (Appendix I-d.).

- As a professional, I believe the prospect that having "more marginal performers able to pass with this system because of taking it in smaller pieces" (from Appendix II-b) is, in and of itself, a compelling reason to keep our current system.

- As a businessman, I believe that the examination process requiring - as it currently does - time and project management, discipline, memory and synthesis skills - helps to develop well rounded managers and executives (Appendic I-c).

In sum, there may be lots of ways we can improve our educational process and our professionals, but in my view, FES isn't one of them.

Sincerely,

March 27, 1989

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 W. 34th Street
New York, NY 10119

Dear Sir or Madam;

I would like to comment favorably on the proposed flexible examination system. I think splitting up unrelated topics will make some exams, Part 4 in particular, easier to deal with. I like the flexibility and time commitment decisions being left up to the student. While a student, I would have appreciated the option to trade a longer travel time for less personal sacrifice and time commitment per sitting.

As an employer, having the students take examinations in an order which relates to their work assignments should prove beneficial.

Regards,

March 27, 1989

Partitioned Examination Task Force
c\o Casualty Actuarial Society
One Penn Plaza
250 West 34 Street
New York, NY 10119

Dear Sirs:

The FES material mailed to members on March 14, 1989 reads as if the decision has in effect already been made to move to an FES system. The input being sought now from member and students appears to be not on the subject of IF FES but HOW FES. Am I interpreting the status of this properly?

Sincerly,

March 24, 1989

Appendix 6

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34th Stret
New York, New York 10119

Re: **FLEXIBLE EXAMINATION SYSTEM**

Gentlemen:

Thank you for providing the opportunity to give input regarding the proposed Flexible Examination System under consideration by the CAS.

Personally, I do not endorse the direction as outlined, i.e., FES without electives and specialty tracks. It would seem to me that the primary benefit of a partitioned system would be to allow for tracks and elections. The other benefits are secondary, and of questionable value in comparison to the confusion and complexity that will follow this move.

I should also state that I do not support an FES with tracks. Our field is still sufficiently focused to allow for a generalist approach. This is one of the strengths of our current system, and is widely appreciated by employers and co-workers.

The current system encourages a synthesis of various subject matter when dealing wth a particular problem. This is more than an educational nicety; it is a fact of everyday life for the practicing Casualty Actuary, and probably more so than for the other actuarial

disciplines. This approach is particularly valuable for the exams beyond Part 5. I would not want to see this aspect of our exam system sacrificed for the sake of topical "depth". If we go that way, I believe we will end up with people more technically knowledgeable in narrow areas, but less resourceful and innovative in coping with the manifold problems facing us today.

As an aside, I polled the students in my area, and they were unanimously opposed. They pointed out that this system will result in each student taking one subpart at a time, thereby lengthening the travel time to completion.

Finally, I would recommend that the Committee use every available forum to gather membership input. A general session discussion at the next CAS meeting might be useful, given the importance of this whole matter.

Sincerely,

March 31, 1989

Casualty Actuarial Society
One Penn Plaza
New York, New York 10119

Attention: Partitioned Examination Task Force

This is to respond to Kevin Ryan's March 14, 1989 mailing on Flexible Examination System (FES).

In brief my "vote" is nay.

As a member of the CAS, as well as being a member of the Syllabus Committee, I have been following with much interest the movement towards FES (and FEM) for the past several years awaiting a compelling argument for such change. Thus far I haven't found one.

To resurrect one of my favorite, overused, sayings: "If it ain't broke, don't fix it".

I am personally involved in the hiring of upwards of 15 or 20 entry level actuaries each year. I have yet to hear of a potential student volunteering that the SOA approach is better. From personal observation, I think we do have a problem in some cases attracting an MBA oriented graduate to the more arcane actuarial educational system. On the other hand, I believe the average competence of FCAS's in the insurance industry far surpasses that of MBA's. I would fault some FCAS for being not sufficiently aggressive or not sufficiently decisive as compared to some high caliber MBA's. Even so, I think the FCAS's know insurance much better than MBA's who work in insurance. As long as we keep the FCAS accessible and meaningful, I am not sure there is much more we can do to attract MBA's. It is not unreasonable that a person have both an FCAS and an MBA.

My point is that our current system works VERY WELL. While it may have weaknesses I don't see FES as an overall improvement.

To the extent the designers of FES see it as a tightening of educational standards, I am inclined to react that standards are already tight enough.

I am also quite concerned that we will be more likely to drive candidates away when we describe a series of 25 or 35 examinations.

While I haven't attempted to prove it, my perception is that the breaking apart of part 3 into courses 120, 130, 135 has increased "travel time" through part 3 at my company, which has many examination takers. This splitting of part 3 has not produced measurably better actuaries.

The one advantage I see to FES is that it will be easier to add or drop a subject from the syllabus. In the past, it has always been a very involved process with partial credits, partial exams and the like. Even so, some of this same problem will persist with limited carryovers of credits for discontinued parts.

Accommodating the needs of the CIA is useful if it does not totally rearrange how the CAS does things. I keep thinking of one man one vote and wondering if we shouldn't pay as much attention to states or state groups having populations equal to Canada's population.

Since with but one or two exceptions I disagree that the so called "pros" are in fact pros, I have very briefly annotated Appendix II in the pro column to provide you with more insight into my beliefs. I have not commented on Appendix I because it was not the recommended alternative. If some of my annotations are repetitious, so also are the pros.

To say it again: "If it ain't broke, don't fix it". FES is something we don't need. FEM is something else we don't need.

Sincerely,

April 5, 1989

Appendix 6

Partitioned Exam Task Force
CAS
One Penn Plaza
250 West 34th Street
New York, New York 10119

Dear Sirs:

I have read your recommendation for FES and wish to comment on several issues that the report raises. First, I agree with the decision to break down the exams. Among the three options I also agree that the FES without specialization is the superior alternative. I believe that this will allow more flexibility and less stress throughout the exam process.

I feel that the change will affect one's chances of achieving fellowship depending on their current status. One who is currently at the associate level, with increased job responsibilities and family demands, may not have the time necessary to prepare for a full exam. However, they may be able to prepare for a subset of those examinations. As you noted, this would also allow more marginal candidates to eventually receive fellowship in the CAS. Conversely, those who are in the early stages of the exam process may be discouraged if travel time increases significantly. Therefore, there may be a jump in fellowship early on, but a decline after an extended period of time.

I do not believe that travel time will remain the same as it is now. I cannot conceive of a system by which the students will be required to know the material in greater detail and, yet, get through in the same time. I do grant that higher pass ratios and more frequent exam offerings would help to alleviate this problem. However, more detail implies more time studying which, in turn, would lead to longer travel time.

The increase in exam offerings, combined with more numerous exams, may pose another problem which the report did not seem to address. Currently, the number of candidates sitting for upper level exams is very low. If the exams are split up, the number taking any exam could become even smaller. How would this affect the grading process on those exams? Certainly it could become difficult to observe any clear distribution in the results which would create problems in establishing a pass mark.

Thank you for allowing my input. As a student in the CAS, I certainly have a great interest in any changes which will be made. Because of the great impact which implementation of the report will have on students, I request that future correspondence be sent to students as well as fellows and associates. This is true for syllabus as well. Any changes in the syllabus affect students more than fellows, as they are no longer sitting for the exams.

Sincerely,

April 6, 1989

Partitioned Exam Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34 Street,
New York, NY 10119
U.S.A.

Appendix 6

Dear Task Force,

Thank you for this opportunity to respond to your report. Please be clear that these comments are mine and mine alone. They do no reflect the opinion of the University nor the Canadian Institute of Actuaries.

I am pleased that you call yourself the "Partitioned Exam" Task Force and not the "Flexible Education" Task Force, since you exclude the possibility of a flexible education system, full blown. I believe that that may be a weakness in the long run. The reason I say this is Canadian based. I think you would be well advised to have some Nation-specific material. For example, Canada does not really have a private Workers Comp. industry, so many Canadians cringe at the level of W.C. material in the syllabus. At the same time, the C.I.A. wants to be sure that all new F.C.I.A.'s/F.C.A.S.'s have shown knowledge of relevant Canadian material. Can that be shown if at least 50% of the material on any exam is American? Finally the C.I.A. is requesting some "life" material for future F.C.I.A.'s/F.C.A.S.'s. Are you going to ask all future F.C.A.S.'s to meet this requirement or will the F.C.I.A.'s/F.C.A.S.'s have to sit an extra exam?

On the same point, at the University today, Course 140 (Society of Actuaries exam on Compound Interest) is the second exam our students sit. Having passed this exam very early on, they then feel a loss if they enter the C.A.S. system with no cross-credit. This may be a factor in discouraging our students (many) in becoming C.A.S. candidates. So let's allow for cross-credit for the Society of Actuaries Course 140 - please!! I am sure other campuses note the same effect.

. . 2

Under disadvantages to Flex Ed., you list: " may be more difficult to assure real and perceived fairness and equity to all students because of different options." That has to be one of the most unactuarial statements I have ever seen. We are trained to be able to evaluate equity within and amongst different options. Are we admitting (and publicizing) our inability to do this most basic of actuarial practices?

Under administrative disadvantages you list cost. Yes, exam fees may rise, but the costs are fully supported within the exam fee structure, so is this a notable obstacle?

I do agree with your advantages (same page - Appendix I-e); namely:

2. Facilitates more joint sponsorship of exams with S of A (a laudable goal)
4. FES makes it easier to deal with CIA objectives (is this not essential?)

In general, I appreciate the hard work done to produce this document and feel that it is a step in the right direction.

While some of my comments are slightly off topic, I hope they will assist you in your further discussion.

Yours most sincerely,

Appendix 6

April 24, 1989

Casualty Actuarial Society
One Penn Plaza
250 West 34th Street
New York, NY 10119

Re: Splitting the Upper Level Exams

Dear Secretary:

I am in favor of splitting the CAS exams, albeit with some reservations. The following considerations seemed the most important to me:

1. The students I polled generally liked the idea.

2. If after 2-5 years it turns out to have been a mistake, then the old system can be reinstituted fairly easily.

3. Each of the current exams, in my opinion, is roughly equivalent to two graduate-level, self-study courses in which the grade depends solely on an "in-class" final exam. Few, if any, serious programs of graduate study operate this way. There is usually a test or project for each major section.

4. As exam time nears, students become progressively less productive at work. Split exams could alleviate this "productivity variance."

5. Over time, new subjects have been added to the exams much faster than old subjects have been dropped. With split exams, new subjects would probably result in more exams rather than more severe exams.

6. There is no reason why optional, longer exams could not be added to a split-exam syllabus to qualify people as specialists in certain areas. The current syllabus properly concentrates on a generalist education. The typical company actuary is becoming more of a specialist as the years go on, in my opinion. In-depth education in specialty areas can be accommodated under a split or non-split system for the core exams.

7. Split exams will make it easier for the student to match up his work-related educational needs with his off-hours educational activities. A need or interest in, say, reinsurance pricing may not coincide with any work projects involving time series models. A split exam system could lead to more emphasis on the learning, less on the passing.

My reservations are these:

1. Students sometimes look at exams as hoops you jump through for a reward. Once you jump through a hoop, you forget it and run to the next hoop. Split exams might reinforce the propensity to study strictly for the sake of passing.

2. The sections of one exam tend to inter-relate. They explain and clarify each other. Split exams might obscure this or destroy its value to the student. There is no reason, however, why a particular exam article cannot be required for two or three exams.

3. The "productivity variance" problem will probably stay with us, if syllabus subjects continue to be tested at annual intervals. Split exams simply increase the pressure on somebody who wants to reach Fellowship before the age of forty. (O.K., then, thirty.) The student will attempt to pass more exams each sitting, in order to get through the same volume of material in the same span of time. Consequently, I would like to see more frequent testing of syllabus topics under a split exam system. I wonder how the CAS can pull this off.

4. There will be a real temptation to let the smaller, split exams get bigger over time. How can you exclude that important new article? It's not such a long syllabus list, really... And it's only one little, additional article... And it is important...

Sincerely,

May 16, 1989

Appendix 6

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34th Street
New York, NY 10119

Dear Colleagues:

After reviewing the pros and cons of the partitioned education system carefully, I have come to the conclusion that we probably ought not to change our testing methods at this time. The potential gains appear limited, there is some risk of making things worse, and the amount of work to change the system is quite heavy.

My concerns about switching to PES are:

1) Two major changes that the Society of Actuaries expects partitioned exams to facilitate are having alternative exam tracks and giving credit for college courses (FEM). In contrast, the Casualty Actuarial Society has chosen against these routes.

2) Ultimately, what the student learns depends upon preparation effort. A goal of PES is to leave travel time unaffected. Therefore, we would be aiming for the same amount of effort by the student. I would expect approximately the same educational result.

3) The split into partitioned exams may cause unexpected difficulties with recruitment, company promotion and raise practices, or examination committee staffing.

4) Ultimately, the travel time could be affected despite our best efforts. Students may become accustomed to taking what amounts to a fraction of a current examination. Other students may have to reduce their exam load in order to compete with those who specialize and take the exams in small units.

5) The widespread opposition to PES expressed by the membership might make conversion more difficult.

In the long run, I have no doubt that the CAS has the ability to switch to partitioned examinations. One way or another, all the problems that come up can be solved. However, the amount of effort to cope with all the different problems in subdividing the examinations may not produce enough benefit to justify the effort.

Sincerely,

May 19, 1989

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
210 West 34 Street
New York, NY 10119

As an exam coordinator, part of my responsibilities include motivating students to pass exams, facilitating exam success through the student program policy and monitoring exam results.

When the CAS asked for comments on the FES I decided to meet with our students to see how they felt about the potential change in exam structure.

Naturally, my response as student coordinator would be incomplete without the current perception of the attitude of our students.

The next two pages present the major discussion points and findings from our meeting.

OPINIONS ON THE FLEXIBLE EXAM SYSTEM

The Casualty Actuarial students at Insurance Companies had an opportunity to get together to discuss the March 14, 1989 white paper concerning the Flexible Examination System. Although we understand that each student will have an opportunity to express their view, we thought that our overall perception might be presented in this format (in no way do we wish to preclude our students right to participate in your future opinion gathering!).

On the positive side we found:

1) May make it easier for an ACAS to get to FCAS.

2) If the workload is unusually heavy, the student can adapt their studying to the exams.

3) People can obtain credit for part of an exam instead of getting no credit.

4) For those students not currently in the Actuarial program, it would be easier to get some credits.

5) Focus on pieces that relate to the current work environment.

On the negative side of this issue were:

1) Our Life Student Coordinators think it takes longer and is harder to pass the exams. What statistics can CAS supply about Part 3 before and after the switch into parts?

2) There is a strong belief that travel time will, in fact,be extended. How will travel time be monitored so as to not "substantially increase" it?

3) Where will we find enough people to fill out the exam committees? If the exams are more focused, who will make up the creative questions to differentiate among students? Who will grade the answers? Will the existence of more exams mean more (or all) multiple choice questions?

4) While the Unification Issue is supposed to be ignored, some students believe that issue is why the FES is being discussed in the first place. If so, why isn't the life side going back to the ten exams format?

5) When all is said and done, what do we gain? The thought among most individuals is that an FCAS knows quite a lot of information and that this new procedure doesn't add to that.

As you have most likely noted, most of the negatives are in question form. Other unanswered questions include:

1) Will the pass ratio stay the same, go up or go down? How will this affect the quality? Will passing be based on demonstrating a command of the subject matter, irrespective of the resulting pass ratio?

2) How often will exams be given? Quarterly? What exams?

3) How will the various parts be broken? Will all exams be converted simultaneously? What will be the impact on the overall size of the syllabus?

4) Will one have to become an ACAS (whatever that will mean) to certify loss reserves, or will passing the loss reserving section(s) be enough?

Concerning the survey of students that CAS wants to do, we have the following thoughts:

1) Do not send out these surveys when students are expecting exam results. In the past, several mailings have come to students who were awaiting their results. The usual reaction to these mailings has been negative and such a mailing would, most likely, yield a bias.

2) Do not try to get opinions immediately before or after exams are given. Students do not want to think about such an important topic as FES nearby their exams.

There is a concern among some individuals that FES is already in concrete and that it doesn't really matter what is written or said by those in opposition to this concept. It would be helpful if CAS would publish the results of the surveys (members and students).

We had a show of hands at the end of our session regarding the implementation of FES:

2	For
10	Undecided
20	Against

As an exam coordinator, I am concerned about the unanswered questions. Multiple exam dates may or may not be a problem-depending on their frequency - for administration purposes (not to mention record-keeping). I am also worried about transition if we do go to FES.

I believe the main concern that I have (and others share this) is what do we get out of going to FES?

Partitioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34 Street
New York, NY 10119

To: CAS Board and the Education Policy Committee

Re: **Flexible Education System**

As a CAS student working for Insurance Company and as the Vice President of Education for a local Actuarial Society, I would like to provide you with my comments regarding the White Paper on the Flexible Education System (FES). (I have also studied the pros and cons provided to members of the Casualty Society.) Overall, I am in favor of the idea of FES program, but careful construction of this system and a thorough review of membership input are crucial to the success of FES! I personally feel that the Society of Actuaries has done a poor job of implementing their FES and ignored many of the membership's comments, much less the students' comments. The Casualty Society could probably learn from the SOA's blunders and, it is my fevered hope, avoid them with their own development of FES!!

I took Part 3 the first time it was split into 3 separate "courses", 120, 130, and 135. I was fortunate to pass all three sections at once, but I thought it was ludicrous to test my knowledge of Numerical Analysis material with only ten questions. Travel time has increased for many of our students who took or are taking the SOA Part 3 "courses" under the new system. Most of the students at do not pass all three sections at once, particularly since it is too tempting to study for only one or two sections. And I do think it is useful for a student to learn the time management and synthesis skills necessary to pass an actuarial exam.

However, my above reflections do not mean that I am not in favor of the partitioning of exams. I am in favor of it! As a student who has been struggling with Part 4 and Part 5 for the last two years, I can see a real cause for splitting up these exams, particularly now that minimum standards are imposed on Part 4. (Granted, a somewhat self-centered cause, but valid nonetheless.) There appears to be a greater amount of material (and it is not generally taught at any universities) on these exams than on the lower level exams. Students always seem to need to increase their total study time to pass CAS exams over Parts 1-3. I would recommend splitting Part 4 into two subparts (four parts or three parts would be ridiculous!), Life Contingencies and Interest, and Credibility and Loss Distributions. Part 5 could be split into

Economics and Risk Theory as one subpart and Policy Forms and Insurance Operations as the other. Do you have any idea how frustrating it can be to study diligently for 4 months and come out with nothing to show for it? At least this way students could "chip away" at the exams and at least come out with "something", a piece of the current exam, if not all of the exam. My responsibilities at work have, needless to say, increased substantially since I was a Parts 1-3 student, and it is more difficult to find those study hours essential for passing the exams. But I would stand a much better chance of being able to knock down a subpart than all of the exam sections at once. Our ("our" meaning) pass ratios on Parts 4 and 5 have been relatively poor as well. This is where most of our students, myself included, get "hung up". I do not think it was necessary for the SOA to split their exams into as many subparts as they have, but I do think Parts 4 and 5 are well-suited for partitioning and would not increase travel time substantially, if at all. (Has anyone at the CAS conducted surveys to find out how many students sitting for Parts 4 and 5 are first-time takers, second-time takers, third-time takers, etc.? Only on rare occasions have I seen a student pass Part 4 on the first try.) As for Parts 6 through 10, I really do not know enough about these exams to tell you whether they would be well-suited for partitioning.

The SOA recently has offered an Applied Statistics intensive seminar for elective credit. However, the enrollment is limited, and many companies and consulting firms were not informed of this seminar in advance. I feel it is discriminatory to limit enrollment and to require that participants have passed course 120 in the last two sittings. EVERY student should have an equal chance to earn credits towards Associateship or Fellowship level. Certainly, restricting enrollment of a seminar and only making one seminar available (located in the Midwest and nowhere else), does not provide this! Besides, what is the criteria for "passing" these seminars? The big advantage of using exams to test for knowledge of syllabus material is that is a very objective and fair way of deciding who knows the material well enough to get credit for it. At least it is when compared to other methods, such as intensive seminars and college classes, etc.

Frankly, I do not feel that FES will significantly increase the quality of education. And it will increase the number of administration problems for both companies and the CAS, I am sure. However, it may allow people to specialize in the areas most applicable to their work, if elective exams were offered anyway. I am disappointed that the committee felt that the "FES system with electives was not considered as a viable alternative at this time." I concur with the committee's opinion that Actuaries should get the same broad-based background in mathematics, economics, ratemaking, and accounting, etc., but at the Fellowship level I feel that it may be more beneficial to offer more specialized elective subjects. (Maybe topics such as Econometrics as it applies to commercial insurance ratemaking?) Of course, it probably would be more difficult to find qualified CAS volunteers to grade these exams. Perhaps papers should be allowed as elective options for Fellowship credit on specialized topics.

I recommend that FES be adopted for Parts 4 and 5 as I have prescribed above. As for other considered changes, I do not have specific recommendations other than I implore you to consider these changes very

carefully and review the flaws already seen, in my opinion, with the SOA's Flexible Education System.

Sincerely,

May 23, 1989

Appendix 6

Partioned Examination Task Force
c/o Casualty Actuarial Society
One Penn Plaza
250 West 34 Street
New York, NY 10119

To: Task Force Members

Re: Flexible Examination System

Kevin Ryan, in his March 14 letter to the CAS membership, asked that comments and opinions on this proposal be directed to the Task Force.

My reaction to the proposed plan is a negative one. I don't believe the change is necessary or desirable. In recent years, the amount of syllabus material, as well as the number of exams and their length, have been increased significantly. This proposal will simply accelerate that process. Despite your Task Force's intention - and that of the Board's - in my judgment, that outcome is inevitable.

And to what avail? Certainly, the syllabus material and exams need to be kept up-to-date. But it is also impossible to test on everything. New ideas and tools are generally founded on older ones. As this new knowledge comes along, is it necessary to continue to test the old? (A case in point: Is the Part 1 exam still needed?) True, this new knowledge tends to increase exponentially; but increasing the study material and time proportionately is not the answer.

Reactionary that I am, I'd probably prefer to go back to the eight 3 hour exam set up. No doubt that's unrealistic. But I do think we could do a better job within the present framework - both in terms of present and future needs - by developing syllabus materials and exams which emphasize concepts and general approaches rather than specifics and technical minutiae.

So, let's stay with the present plan, and try to improve upon it.

For whatever they may be worth, attached are some comments from several of our students (past and present).

Thank you for your attention.

Sincerely,

COMMENTS FROM STUDENTS RE PROPOSED FLEXIBLE EXAMINATION SYSTEM:

1. I see a more complicated, harder to administer system that will produce little if any benefit. In the long run, I think this would make the exam process even more difficult than it already is. Exams will be harder and will invariably end up covering a lot more material than it does now. I am not in favor of this change.

2. My initial reaction to this system is favorable. I think that shorter, more numerous exams will tend to promote greater learning and understanding of the material. With the large amount of material to know for the current exams, I feel it's easy to just memorize what you know will be on the exam for sure, without totally understanding some of the concepts. With so much material to cover, you must learn it fast and move on. To some extent, I think the new system would reduce this problem.

   The cons listed on Appendix I-d I think are valid concerns. Exams would probably be tougher, and those students taking an entire exam (e.g. 4 parts) would probably be at a disadvantage to those taking just one or two parts. The CAS has control over the former, but probably not the latter.

   One final concern I have is cost. The white paper indicates that administrative costs would likely increase under FES. I feel the exams are already too expensive. I would hope that the CAS would do everything possible to efficiently administer the exams and keep costs reasonable.

   Overall, it sounds like a good change.

3. Here are my comments about the new flexible exam structure (FES). If FES goes in as presented in theory, then I'm neutral. However, I have the following fears:

   - Will each subpart increase in difficulty year after year such that the study time per "whole exam" will increase? If so, then it seems travel time will increase.

   - Will students taking several parts be at a disadvantage against those who specialize on one at a time? If so, then it seems all will start to specialize and travel time will increase.

   Concerning the goals, is education really that high of a priority? Obviously, I haven't taken but half the exams so maybe the higher exams do help for our job here. But so far, the exams appear to be mostly a filtering process.

COMMENTS FROM STUDENTS RE PROPOSED FLEXIBLE EXAMINATION SYSTEM:

4. My main concern is travel time to fellowship. I can't believe that this won't increase your time to obtain fellowship. I also believe the person who wants to pass all of say Part 5 will likely be at a disadvantage with the student who's only taking the first part. If I thought they were going to segment the exam and be more standardized in the questions they asked, I'd probably say OK. If they offer the exams three times a year versus two, how soon will we get the results? A week before registration is due for the next exam? Will they really segment the exams and not add more material?

   Bottom line is they want to control supply - and the exams are already doing a good job of that.

5. The first few years under the FES would probably work as expected. The exams would be more focused and students would gain a better understanding of each topic. But, eventually the original intent would be lost, and there would become 20 exams that take 20 years to pass. The difficulty and length of each exam would gradually increase and the percent of students passing each exam would again become 25-30%. This will not make it easier to get through the exams. I am definitely opposed to this!

6. I am against splitting the current exam system into the FES. The following are my concerns:

   1) The travel time would be increased.

   2) Splitting the exams and adding material without deleting any material would add to study time.

   3) I do not like the possibility (ultimately) of 20 four hour exams.

   4) Specialization of material could make it harder to pass exams. (Part 4 in the past was taken with life actuaries). For example, reserve material, by itself, taken with actuaries who work on reserves only.

   5) Five to ten questions on an exam would not be a good representation of ability to understand the material. This would have a tendency to push exam scores closer together.

COMMENTS FROM STUDENTS RE PROPOSED FLEXIBLE EXAMINATION SYSTEM:

7. This concept can only increase the amount of time that will be required to prepare for each exam; and, more than likely, the amount of time required to pass the exams.

   The FES adds a requirement of minimum proficiency in each piece of an exam. This is a greater requirement than at present. In addition, fracturing the exams into pieces will foster more specialization to "pass" each part. Consider Part 7 - if the exam is split into a Reserving Exam and an Annual Statement Exam, we will have to compete separately against actuaries who do reserving as their function and against actuaries who put together the annual statement. This will be much tougher than competing against the same actuaries on both pieces combined. Thus, because of actuarial specialization, the knowledge necessary to pass individual pieces of an exam will increase. Needless to say, the actuary who takes both parts of the Part 7 exam will need to know considerably more detail to pass the exam than is necessary now.

   The greatest danger in the FES program is what happens in the future. As the pieces become more competitive, the exams will need to be expanded in scope, detail, or length. Each piece will become an exam requiring sufficient study to preclude adequate preparation for another piece. Isn't this breaking up of exams the way new exams are born?

   If the CAS wants to improve the education of the actuary, this will do it. The cost will be greater travel time, regardless of what the committee may say. Let's be honest, CAS, this new program will make it tougher to pass each exam and require more time to do it.

8. If administered well, it appears that the pros and cons were fairly well itemized.

   There appears to be recognition expressed in the White Paper that, generally, more "study time" will be required of the student - this even under the premise that the exams are not made more "difficult" as they become more focused. That would seem to necessarily translate into more "travel time". I'm possibly influenced somewhat by my personal standing, but I don't see that the pros presented outweight the cons.

   Additionally, two general areas are not being given proper consideration, in my opinion. The two are, admittedly, related.

COMMENTS FROM STUDENTS RE PROPOSED FLEXIBLE EXAMINATION SYSTEM:

(Cont'd) 8. (A) SPECIALIZATION - even if those persons administering the exams in the future understand and implement the intentions underlying the current thinking and the change to FES, the FES approach must lead to specialization. Each part (subpart) is destined to eventually have some people (students) who are concentrating heavily on that part (only). Given the competition and minimum standards, that must lead to a similar type of competition as we have now, but for 20-30 exams (subparts) instead of ten. The white paper does not leave me to believe that this is anyone's intention, although perhaps it is.

(B) Each exam (subpart) would become 15-20 questions and be tested for 60-90 minutes. Professional educators will tell you (and it should come as no surprise to any of us) that the fewer areas that are explored on an exam, the more random the results can become. They don't say it that way, but what they mean, e.g. is that in giving a final exam, if you ask 100 questions and test for 5 hours, you will do a better job of ranking students than if you ask 10 questions and test for 30 minutes. At the extreme, if you ask only one true/false question, the "best" student might happen to miss that topic, or he/she might punch a # on the calculator wrong , and come up with the wrong answer and a FAILING grade. The "worst" student might get lucky and you might hit the one area he/she knows.

On balance, I cannot possibly imagine that the subdivision into parts could be a good thing.

9. I just have one main question about all of this: Is the CAS more concerned about the quality of background of the on-board Fellows or the Fellows-in-process? If the concern is only about those in process, perhaps the splitting of exams makes some sense in theory. In actual practice, however, a battery of tests makes more sense since a synthesis is what is required on the job. Perhaps one battery for associate, and a second for Fellow.

If, on the other hand, the concern is for on-board Fellows, continuing education in some form is the answer. The true scholar constantly upgrades his/her knowledge. Others who consider the exam process a means to an end will probably not upgrade themselves. With time, they become out of date. To my mind, continung education ought to be considered. Realistically, though, the continuing education concept won't catch on because the on-board Fellows as a whole would never agree to it.

All things considered, people who finish the exam series today have a more broad knowledge of the actuarial profession than those who finished 25 years ago. To split the exams into smaller parts has the potential to achieve greater knowledge in more areas, but it is questionable if the finshed product would be any better at synthesizing information than finishers of the current exam series. I think attention ought to be directed to making the current exams more valid and standardized, and to establishing a meaningful continuing education policy.

DECEMBER 24, 1990 LETTER REGARDING PARTITIONED EXAMINATION SYSTEM

Charles Bryan

CASUALTY ACTUARIAL SOCIETY

Charles A. Bryan
President

277 Park Avenue
30th Floor
New York, NY 10172
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December 24, 1990

TO: Members and Persons Pursuing Actuarial Designations of the Casualty Actuarial Society

RE: **Recent Board Decisions Regarding A Partitioned Examination System**

A Partitioned Examination System has been the focus of considerable study and discussion within the CAS over the last three years. Such a system has been the subject of two formal communications to our members during 1989 and the subject of study for a special task force. A request for membership and student input has resulted in many letters and in discussions at CAS meetings and meetings of regional affiliates. We are grateful for the amount of membership involvement that we have had on this subject.

At its November 11 meeting in New Orleans, the CAS Board of Directors received the final report of the Partitioned Examination Task Force and the recommendation of the Education Policy Committee and the Vice President-Admissions. The Board then took several actions to decide future policy on partitioning. The Board's decisions were first announced to the membership during the business session on Monday, November 12, in New Orleans. Since many of you may be unaware of these actions, this letter details the various steps leading to the Board's November actions and reports these actions to you.

September 1988 Board Action

The CAS Education Policy Committee was asked to address the issue of whether the CAS should adopt a Flexible Education System, similar in some respects to that implemented by the Society of Actuaries. The Education Policy Committee report was presented to the Board of Directors at its September, 1988 meeting. That "White Paper" report presented an objective discussion of the advantages and disadvantages of a partitioned system. The entire "White Paper" was provided to the membership as an attachment to the President's letter of March 14, 1989. At the end of its report, the Education Policy Committee made the following recommendation:

> As a result of our deliberations, the Education Policy Committee recommends that the CAS adopt a Partitioned Examination System, with no electives, for all of its examinations. This recommendation is principally founded on the basis of educational merit, including enhancements in the

ability of the CAS to achieve educational objectives and in the quality of education, without affecting materially the type of FCAS graduate produced.

The Education Policy Committee report concluded with a section entitled "Additional Considerations for Implementation." In that section, the committee listed six additional considerations:

1. There should be minimal effect due to any new system on candidates succeeding under the current system.

2. Travel time should be affected as little as possible.

3. Effective implementation requires that the Syllabus and Examination Committees be well informed as to the deliberations leading up to the adoption of the new system. Representatives from these committees should be directly involved throughout the implementation process.

4. Employers must be well informed.

5. Performance standards must be established, monitored, and evaluated very carefully to assure fair and equitable treatment of all candidates.

6. Consideration must be given to the mode of implementation, i.e., a staged implementation versus all examinations at once.

It is therefore further recommended that implementation plans be codified, with the intended effect in all such areas clearly described and subject to an approval process that includes the Board.

The Board of Directors adopted the recommendations of the Education Policy Committee's report by unanimously passing the following motions:

That the CAS Board endorses the concept of smaller examination units for Parts 4 through 10. It directs the Vice President-Membership to develop a detailed implementation plan and schedule which addresses, at a minimum, all of the additional considerations for implementation itemized in the Education Policy Committee's report plus seeking input from students about this concept.

1989 Activity

Subsequent to the 1988 Board action, the Partitioned Examination Task Force, chaired by Jerry Degerness, was created to determine whether an implementation plan could be developed which satisfactorily addressed the various additional considerations itemized by the Education Policy Committee. In addition, input was sought from our membership and students, via the President's letter to the membership of March 14, 1989; the VP-Admissions's letter to the membership of August 10, 1989; a student survey conducted by

the Partitioned Examination Task Force; and numerous presentations and discussion sessions at CAS and regional affiliate meetings.

In addition to Jerry Degerness, the Partitioned Examination Task Force was staffed by eight hardworking individuals representative of a significant cross-section of the CAS, by type of work, length of CAS membership, and geography. The Task Force's assignment proved even more demanding than originally anticipated, and the individuals on this Task Force have all contributed significantly to the Task Force and the Casualty Actuarial Society. They deserve our heartfelt thanks and appreciation.

Partitioned Examination Task Force Recommendations

We anticipate publishing the final report of the Partitioned Examination Task Force in an upcoming issue of the Actuarial Forum. The Board considered a draft of this report at its September, 1990 meeting. An oral presentation of the PETF recommendations was also made at that meeting and substantive and lengthy discussion took place. The recommendations of the PETF were:

1. Require systematic study of performance by sub-part prior to every partitioning and Syllabus reorganization decision.

2. Charge the Vice President-Administration (CAS office) with collecting and reporting demographic information which may be related to exam performance.

3. Subject to the appropriate study, partition Part 4 into 4A (interest and life contingencies) and 4B (credibility theory and loss distributions).

4. Not partition, at this time, beyond Part 4.

Education Policy Committee Recommendations

The Education Policy Committee considered the PETF recommendations at its October 23 meeting. The recommendations of the Education Policy Committee were:

1. Partition Part 4 effective in May of 1992.

2. On part 5, the committee was evenly divided (3 yes, 3 no) as to whether Part 5 should be partitioned in the near future.

3. Not partition Parts 6 and 7 for the foreseeable future.

4. Defer consideration of partitioning the Fellowship exams for the foreseeable future.

5. The committee also suggested continued study of the potential for partitioning of exams beyond the Part 4 and Part 5 level but felt that

such study should be part of a broader review of the examination process and structure.

6. Finally, the committee recommended that the Board authorize the creation of a database along the lines suggested by the Partitioned Examination Task Force and that work on the database begin as soon as practical.

Vice President-Admissions Recommendations

The Vice President-Admissions presented the Board with the report of the PETF, the recommendations of the Education Policy Committee and a letter that provided the Board with an analysis of the various advantages and disadvantages of a partitioned system. It was his recommendation that the following motions be positively acted upon by the Board of Directors:

1. That the Executive Council be charged with developing a Management Information System that will, at a minimum, allow the CAS to properly assess changes in travel time and exam performance and to manage the entire exam process.

2. That the CAS partition Part 4 into two pieces, effective in 1992.

3. That the CAS partition Part 5 into two pieces, with the effective date to be either in 1992 or 1993.

4. That the CAS not partition Parts 6 and 7.

5. That the CAS defer any decision with regard to the partitioning of the Fellowship examinations for at least three years so that we can adequately measure the effect of the above changes to the Associateship Syllabus.

Board Action

Between the September and November Board meetings, Board members exchanged with each other, in writing, their own feelings on this very important subject. Substantial discussion and debate took place at the November 11 Board Meeting. The Board placed great weight on the advantages of a better capability to keep the syllabus current and to improve the educational system for casualty actuaries. The Board decisions may be summarized as follows:

- Part 4 will be partitioned effective May of 1992.

- Parts 5 will be partitioned effective November of 1993.

- Both Parts 4 and 5 will be given twice a year beginning with the exam session when the exam is first partitioned. Part 4 will be

given twice a year beginning in May of 1992 and Part 5 will be given twice a year beginning with the November 1993 exam.

- Parts 6 and 7 will not be partitioned.
- Consideration of partitioning for the Fellowship exams will be deferred for a least three years.
- The transition rule currently in place for Part 5 will be extended for one year through 1992. Since Part 5 will then be partitioned beginning with the 1993 administration, any individual who currently has credit for one of the two pieces of Part 5 will no longer have the possibility of losing that credit if the other half of the exam is not passed by the end of the transition period.

As clarification to the above items, Part 4 will be partitioned into two pieces: 4A will cover life contingencies and compound interest; 4B will cover credibility and loss distributions. Part 5 will be partitioned into two pieces: 5A will cover economics and risk theory; 5B will cover finance.

The need to develop a comprehensive Management Information System was deemed so obvious that no motion was considered necessary. This objective is included in the Executive Council Goals for 1991.

In the interest of full disclosure, it is our intention to publish the original report of the Education Policy Committee, the report of the PETF and the letters containing the most recent recommendations of the Education Policy Committee and the Vice President-Admissions in a forthcoming issue of the Actuarial Forum. For those of you who wish further information on this subject, we recommend those items to you.

All of us who participated in the discussions concerning partitioning examinations appreciate that not everyone agrees with the decision to partition examinations 4 and 5. However, there were strong and convincing arguments presented that indicated partitioning these examinations would improve the educational system. Consistent with its responsibilities, the Board chose to base its decision on what it believed to be in the best interests of both our present and future members. I believe that our members, after reviewing all the available material and deliberations, will agree that both the process and the decision were consistent with the fine traditions of our Society.

Sincerely yours,

Charles A. Bryan
President
Casualty Actuarial Society

THE ECONOMIC THEORY OF RISK AND INSURANCE (REPRINT)

Allan H. Willet
(Introduction by Glenn Meyers)

Risk Theory in 1901

From time to time, the Committee on the Theory of Risk will be reprinting classic papers (or in this case a book) on risk theory. What follows is the committee's first submission of this series.

This book, The Economic Theory of Risk and Insurance by Allan Willett, was originally published in 1901. It was reprinted in 1951 by the S.S. Huebner Foundation for Insurance Education. As stated in the forward of the reprint "its true significance lies ... in the continuous recognition that its contents have received from insurance educators and economists." This continues to be the case.

I first read this book in 1975. It was then part of the CAS Exam Syllabus. As I reexamine this book, I realize its significant influence in my thinking on such topics as parameter risk, risk loads and the role of insurance in a free market economy.

Glenn Meyers

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THE ECONOMIC THEORY OF RISK AND INSURANCE

by

ALLAN H. WILLETT, Ph.D.

Published for

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THE S. S. HUEBNER FOUNDATION FOR INSURANCE EDUCATION

The S. S. Huebner Foundation for Insurance Education was created in 1940, under the sponsorship of the American Life Convention, the Life Insurance Association of America (then the Association of Life Insurance Presidents), and the Institute of Life Insurance, and operated under a deed of trust until 1955 at which time it was incorporated as a Pennsylvania nonprofit corporation. Its primary purpose is to strengthen and encourage education at the collegiate level. Its activities take three principal forms:

a) The providing of fellowships and scholarships to teachers in accredited colleges and universities of the United States and Canada, or persons who are contemplating a teaching career in such colleges and universities, in order that they may secure preparation at the graduate level for insurance teaching and research.

b) The publication of research theses and other studies which constitute a distinct contribution directly or indirectly to insurance knowledge.

c) The collection and maintenance of an insurance library and other research materials which are made available through circulating privileges to teachers in accredited colleges and universities desirous of conducting research in the insurance field.

Financial support for the Foundation is provided by contributions from more than one hundred life insurance companies and proceeds from the sale of Foundation publications.

The program of activities is under the general direction of a Board of Trustees representing the life insurance institution. Actual operation of the Foundation has been delegated to the University of Pennsylvania under an administrative plan submitted by the University and approved by the Board of Trustees. The University discharges its responsibilities through an Administrative Board consisting of six officers and faculty members of the University of Pennsylvania and three academic persons associated with other institutions. Active management of the Foundation is entrusted to an Executive Director, appointed by the University of Pennsylvania.

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FOREWORD

This is an unusual volume. It is a reprint—of a doctoral dissertation—originally published in limited quantity just fifty years ago—with copies now virtually unavailable. But its true significance lies not in such facts but in the continuous recognition that its contents have received from insurance educators and economists. As Dr. Robert Riegel, Professor of Statistics and Insurance at the University of Buffalo, said in his letter urging that the Foundation issue this under its imprint, "One of the classic books on Insurance is Allan H. Willett's *The Economic Theory of Risk and Insurance*, published as one of the Columbia Studies in History, Economics and Public Law. This has long been a scarce item, in fact, impossible to buy, although every student of Insurance knows that it was the first and still remains the best discussion of the economic principles of Insurance."

Publication of such a volume is in accord with one of the primary objectives of The S. S. Huebner Foundation for Insurance Education, which is to publish research theses and other studies that constitute a distinct contribution directly or indirectly to insurance knowledge. In conformity with this objective, the Foundation has already undertaken the issuance of two series of volumes, known as "Huebner Foundation Lectures" and "Huebner Foundation Studies," the first series comprising a compilation of addresses on selected insurance topics and the second presenting the results of thorough research in specific areas. In re-publishing Dr. Willett's thesis it seems appropriate to group it with the "Studies" series.

The probability of a volume proving useful to teachers engaged in insurance educational work, especially on the college level, has been a prime consideration in the Foundation's publication policy. Experienced insurance teachers whose views were sought by the Administrative Board on the wisdom of publishing this particular work were unanimous in their conviction that the

Foundation would be rendering a genuine service to insurance teachers and their students in taking such action. But its value to others, such as teachers and students in pure and applied economics, and persons concerned with the broad areas of business organization and management, should not be overlooked. In fact, when comparison is made of the status today of insurance education and of collegiate education for business generally with the relatively small beginnings that had been made along both lines when this dissertation first appeared, it is not inconceivable that its benefits may be more widespread and significant during the half-century to come than in that which has passed.

Dr. Willett, son of a Baptist minister, was born in 1863 at Southwick, Massachusetts. He prepared for college at the Connecticut Literary Institution, from which he entered Brown University where he specialized in Latin and Greek. After his graduation from Brown in 1886, he taught the classics for a number of years in secondary schools and in Urbana University, Urbana, Ohio. A growing interest in the field of economics prompted him to enter Columbia University in 1898 and to study for the doctorate, with particular emphasis upon the economic theory of risk and insurance. He received the degree of Doctor of Philosophy in 1901, submitting the thesis here presented in partial fulfillment of the requirements. From 1901 to 1905, Dr. Willett taught Economics at Brown University and then joined the faculty of the newly established Carnegie Institute of Technology where he later introduced a new branch of technical training known as commercial engineering. During World War I he was engaged in war work in Washington with the Bureau of Labor Statistics but in 1920 became Statistician of the National Coal Association, with which he remained until his retirement in 1939. He now resides in Biloxi, Mississippi. It is interesting to note that Dr. Willett's academic and professional interests have been transmitted to his three sons, Dr. Hurd Curtis Willett, Professor of Meteorology at Massachusetts Institute of Technology, Dr. Edward Francis Willett, Professor of Economics at Smith College, and Merrill Hosmer Willett, Civil Engineer, Metropolitan Board of Transportation, New York City.

Grateful acknowledgment is made to our versatile author and to Columbia University Press for granting to the Foundation

the right of reprinting. It is in nowise a reflection on them to point out that, although publication of this volume has been sponsored by the Foundation, the very nature of the purposes for which the Foundation was created precludes it from taking an editorial position on controversial theories or practices relating to insurance.

DAVID MCCAHAN
Executive Director
The S. S. Huebner Foundation for Insurance Education

Philadelphia
September, 1951

CONTENTS

	Page
Foreword	vii
Preface	xi

INTRODUCTION

General Theory of Distribution	xvii
The Static State	xviii
Conception reached by a process of abstraction	xviii
Risk as a disturbing factor	xx
Distinction between the ideal Static State and the approximate Static State	xxi
Profit and the Entrepreneur	xxi
Economic character of the captain of industry	xxii
Nature of profit	xxiii
Distinction between profit and other monopoly gains	xxiv
The entrepreneur as the recipient of profit	xxv
The capitalist-entrepreneur	xxvii

CHAPTER I

The Nature of Risk

Appearance of accident due to limitations of man's knowledge	3
Distinction between chance and uncertainty	5
Risk related to uncertainty	5
How degree of risk may be estimated	7
Effect of increasing the number of risks	8
Area of uncertainty	9

CHAPTER II

Classes of Risks

Economic and extra-economic risks	11
Personal risk	12
Risks to capital and risks to labor	13
Positive and negative loss	13
Static and dynamic risks	14
Developmental risks	16
Comparison of static and dynamic losses	18
Other classes of risks	20

CHAPTER III

The Cost of Risk

	Page
Repellent influence of uncertainty	24
Disturbing factors	24
Effect of inequalities of risk upon the apportionment of capital	26
Effect of the law of diminishing utility	27
How cost of risk may be estimated	28
Burden rests upon consumers	30

CHAPTER IV

The Assumption of Risk

In what sense risk-taking is productive	32
Social gain from the assumption of risk	33
How the amount of the reward for risk-taking is determined	35
Distinction between reward for risk-taking and accidental gains and losses	37
Reward obtained through the insurance fund	38
Insurance fund includes only accumulations for uncertain losses	39

CHAPTER V

The Reward for Risk-Taking

Capitalists assume risks and receive the reward	42
Pure interest and the reward for risk-taking	43
Interest and the insurance fund	45
Profit and the reward for risk-taking	46
Relation of the entrepreneur to risk	48
Advisability of making the reward for risk-taking a separate category of distribution	51

CHAPTER VI

Ways of Meeting Risk

Avoidance, prevention and assumption	54
On what principles the choice is made by a man in isolation; by a man in society	55
Effect of society on risk and on prevention	58
How far preventive measures will be adopted	60

PAGE
Social methods of meeting risk; distribution of losses 62
Corporations 62
Mutual guarantee against loss 63
Transfer of risk 63
The capitalist-entrepreneur as insurer 66

CHAPTER VII

INSURANCE

Definition of insurance 71
Gain from combination of risks 73
Other economic benefits of insurance 76
Cost of insurance 77
Insurance as a method of distributing losses 79
Insurance not gambling 80
How entrepreneurs choose between prevention and insurance 81
Accumulations by insurance companies 83
Productivity of the insuring capital 85
In what sense all insurance is mutual 86

CHAPTER VIII

CONCLUSION

Influence of risk on the accumulation of capital 90
Relation of the entrepreneur to developmental risks 94
Speculation as a method of creating security 96
General summary of the static theory of risk and insurance 100

PREFACE

The following study deals almost exclusively with the idealized conditions of the static state. It only incidentally attempts to show the bearing of the static laws on the phenomena of the real world or the practices of existing insurance companies. It must consequently wear something of the air of unreality which attaches to all discussions that deal largely with abstractions. Its only purpose is to shed a little light on a rather neglected portion of pure economic theory.

A word of explanation may be in order with regard to my failure to give credit to others in all cases for ideas which have been published before. This has sometimes been due to the fact that the ideas were so much common property that it was impossible to assign them to any particular writer. In other instances the omission is to be explained on the ground that in the course of a considerable amount of reading on the subject of insurance, the significance of many statements was overlooked at the time when they were read. After their importance had come to be appreciated, it was not always possible to trace them to their sources.

It gives me pleasure to acknowledge my indebtedness to my friend, Professor James P. Kelley, for the valuable assistance which he has given me in preparing this book for the press. He kindly undertook to read it all in the proof, and I have been indebted to his suggestions for many improvements, both in substance and in form.

ALLAN H. WILLETT.

Columbia University, May 20, 1901.

It is clear that under free competition such a profit must always be transient; it can endure only while the monopoly endures. As other factories adopt the same improvement, the supply of goods at the lower cost of production is increased, until finally the entire demand is supplied at the reduced cost and the price drops to the level which the new cost justifies. When that point is reached, if we disregard secondary changes induced by the primary one, the gain from the improved method of production, which at first appeared as a profit in a particular part of the industrial system, has become a permanent net addition to the productivity of all capital and labor, through the fall in the price of the commodity.

It is clear, therefore, why profit may properly be called a dynamic income. If all dynamic changes were to cease, unequal rates of productivity of capital and labor in different parts of the industrial system would result in a shifting of capital and labor from less productive to more productive groups, until a uniform rate of productivity had finally been reached. The profit would endure only so long as the influence of the dynamic change was felt; with the attainment of the perfect static adjustment it would entirely disappear.

Profit, then, appears as a result of the abnormal productivity of capital and labor in some part of the industrial system. Like all abnormal gains, it is due to a monopoly advantage. But it by no means follows that all monopoly gains ought to be classed as profit. Profit has to be distinguished from certain permanent monopoly gains which either capital or labor individually may create, and which they are, therefore, able to retain as their own income. If certain laborers are in a position to prevent the free flow of labor into their industry and so to keep up the marginal productivity of labor in it, they may be at the same time in a position to force from the employers, in the form of higher wages, the entire excess product; and in the same way, if certain capitalists have a similar monopoly power, they can appropriate to themselves the resulting monopoly gain. If, however, the restriction on the flow of capital into the industry is due to the power of the entrepreneur to keep it out, as in the case of his ownership of a patent-right, the resulting abnormal product is an entrepreneur's profit. Profit is due to the increased productivity of

the industry as a whole. Laborers as such have no claim to it, as they are entitled to no more than the market rate of wages; capitalists as such cannot appropriate it, as their reward is determined by the market rate of interest. The monopoly gains of labor alone or of capital alone are created by the agents which receive them; profit is an extra product, created by capital and labor as the result of a localized increase of productivity, which neither is in a strategic position to claim for itself.

It is profit as thus defined which Professor Clark regards as the peculiar reward of the entrepreneur. Considered from the side of his income, the entrepreneur is a person who is in a position to appropriate the results of the extra productivity of capital and labor. The person to whom such extra gains accrue in any industry is the person who has the legal right to the residual product of the industry. Cases can be imagined in which they would accrue to one who had contributed neither capital nor labor. Such a person would be a *pure entrepreneur,* and his income would be *pure profit.* But it is evident that generally speaking the residual claimant or entrepreneur is at the same time a capitalist. He owns the whole or a part of the capital invested in the industry, and his claim to the residual share of the product is based on his property rights. Such a person combines the functions of capitalist and entrepreneur, and only that part of his income is profit which is in excess of the return he could obtain by allowing another to use his capital in the same way in which he is himself using it.

Such is the conception of the function and reward of the entrepreneur which is obtained by considering them from the side of income. The residual claimant in any industry is the entrepreneur. Evidently it is impossible to reconcile this conception with the popular one described above. If the same term is to be employed to denote the person who is entitled to the residual share of the product, called profit, and the person who renders the complex industrial service commonly attributed to the entrepreneur, it is necessary to show, first, that there are no directors of industry who are not residual claimants, and, second, that there are no residual claimants who are not directors of industry. Neither of these claims can be established unless we give to the term *director of industry* a much broader meaning than it has

in popular usage. The owner of a few shares of stock in a large corporation is one of the residual claimants, entitled to a portion of any profit which may appear; but common economic usage hardly justifies us in calling him an entrepreneur. It is true that he is legally entitled to a voice in controlling the policy of the corporation through his right to vote for the board of directors; but such imperfect and remote control as that is not the form which is had in mind when the director of industry is spoken of. On the other hand, the work of directing the productive forces of society is often done by men whose income is entirely in the form of a fixed salary. Hired managers are frequently the ones who inaugurate improvements in any industry or adopt improvements introduced by others, and help to establish the productivity rate of wages and interest, which is one of the chief results of the activity of the directors of industry. Common usage does not justify us in denying to such a person the title of entrepreneur.

If the preceding analysis is correct, it is impossible to establish any necessary and universal connection between the one who performs the function of the entrepreneur, as the term is ordinarily used, and the recipient of the residual product of industry called profit. A recognition of these facts will clear up many of the difficulties which have arisen from the attempt to use the same term to denote the two persons. Common custom has undoubtedly been on the side of using the word to denote the person performing the directive work of society. But, as we have already stated, in discussing questions of distribution it is more useful to adopt a conception of the entrepreneur which connects him with a distinct form of income, than one which is based on a complex form of activity, with no definite significance for distribution.[4] Functional distribution must logically precede personal; and for the purpose of a discussion of functional distribution terms must be defined in such a way that each economic agent may be connected with a distinct form of income. The conception of the entrepreneur as the recipient of the normal profit must be acknowledged to be more precise and more serviceable than the complex conception commonly attributed to the term.

[4] The entrepreneur has a certain function, but it is of a passive, mercantile nature, not to be confounded with the active function of the captain of industry. I have placed a great deal of emphasis upon the income, because it is easier to identify the entrepreneur by means of it than in any other way.

It is customary in economic analysis to speak of capitalists and laborers as though they were always separate and distinct persons. It is just as convenient many times to use the conception of a *pure entrepreneur*, a man who is neither capitalist nor laborer, and whose income includes neither wages nor interest. It is necessary to think of him as a person who has no capital of his own, but is able in some way to obtain capital from others by paying the market rate of interest; who performs no labor on his own part, but hires the labor of others at the market rate of wages; to whom the product of the industry in the first instance belongs, and whose income is pure profit, the net return which he can obtain for his product in excess of the wages and interest that he has to pay for his labor and capital. In the discussion which follows the term pure entrepreneur is always to be understood in this sense.

The pure entrepreneur with no capital of his own would be at a great disadvantage in the actual world. There are few owners of capital who would be willing to give the use of it to persons with no security to offer for its safe return. The more common form of entrepreneur is one who has some capital of his own which serves as a guarantee fund and enables him to obtain more capital from others. To such a person Professor Clark has given the compound title *capitalist-entrepreneur*.[5] I shall use that term to denote a person who employs his own capital and that of others in the production of commodities, who is the original owner of the product of the industry, and whose income consists of interest on his own capital and whatever net profit may be realized in the sale of the product. Whether speaking of the pure entrepreneur or of the capitalist-entrepreneur as above defined, I shall for the most part leave out of consideration that portion of his income which is attributable to his own labor and which would properly be classed as wages. A pure entrepreneur is one who is entrepreneur and nothing else, and whose income is normal profit; a capitalist-entrepreneur is one who is entrepreneur and capitalist, and whose income consists of interest and profit. And

[5] This term atones by its definiteness for its lack of brevity. President Hadley has used the term *speculator* with much the same meaning, but this word is used in too many other senses to be very precise. Its indefiniteness is probably partly responsible for the large but vague part which risk plays in his theory of distribution.

while, as has been shown, there is no necessary and universal connection between the recipient of profit and the captain of industry, still it may be said that in general it is the entrepreneur as here defined, who performs the directive work of society. It is his desire to realize a profit by lowering the cost of producing commodities which is the main incentive to industrial progress.

THE ECONOMIC THEORY OF RISK AND INSURANCE

distribution his income falls; or we may differentiate the various forms of economic income, and identify the entrepreneur by the fact that he receives a distinct share in the distributive process. The problem is usually approached from the side of activity, and not of reward. The attempt is made to identify the entrepreneur by considering what he does, and not what he receives. He is regarded as the captain who marshals and directs the productive forces of society. He brings together labor and capital, to cooperate in the production of the commodities which society needs. He strives to anticipate future changes in human wants, and to adapt the stream of commodities to the demands of society. He is perpetually on the alert to devise improvements in organization or in methods of production which will diminish his expenses, and to adopt such improvements when introduced by others. It is the activity of entrepreneurs which is continually causing divergences between expense of production and price, and it is the competition of entrepreneurs which tends to annihilate these divergences after they have appeared, and in the end to assure to capitalists and laborers the entire product of their industry.

Under which category of economic activity does this service of directing the productive forces of society fall? On this question there appears the greatest diversity of opinion. To some the person who renders it is a laborer, performing a special kind of work, and his income appears as wages of management; to others he is a capitalist, serving society by carrying risk, and his reward, though called by another name, is a form of interest; while still others look upon him as a combination of laborer and capitalist, and consider his extra gain to be due to the advantage this dual role assures him.

This very diversity of opinion is an indication of the complexity of the service which the captain of industry renders. He is undoubtedly a laborer, and it is necessary to recognize in his income an element of wages. Its amount would be determined in the same way as the wages of any independent workman are determined. It is that part of his income which he could obtain by giving the service of his knowledge and ability to an employer. He may be a capitalist, and if he is, his income contains an element of interest, which is equal in amount to the return he could obtain by allowing another person to use his capital. He

may be the residual claimant in the industry which he directs, and as such he will receive the profit of the industry, the residual product after allowing for the payment of all labor and capital employed, his own included.

Now in the accepted nomenclature of economic science, the term entrepreneur has come to designate this director of industry. But it is evident that such a conception is extremely complex, involving more than one of the distinct forms of economic activity. It is consequently of little service in attempts to solve problems of distribution. The chief reason for differentiating the entrepreneur from the other productive agents is the desire to dispose of the element in distribution which is neither wages nor interest, and which is commonly called profit. In other words, the conception of the entrepreneur which will be useful in economic analysis is the one which is obtained by approaching the problem from the side of reward instead of that of activity.

All wealth is produced by capital and labor. In an ideal static state the productivity of all units of capital is the same, and each unit receives as its share in the distributive process the portion of the product specifically attributable to it. The same thing is true of labor. Interest, the return to capital, and wages, the return to labor, absorb the entire net product of industry. But in a dynamic state this uniformity of productivity does not prevail. Dynamic changes are continually disturbing the static adjustment. An improvement in technique, for example, introduced in a particular factory belonging to a special industry, reduces the expense of producing the commodity which the factory turns out. So long as this factory has a monopoly of the improvement, it may continue to sell its output at the price fixed by the former cost of production. The same amount of product can be turned out with a smaller amount of capital and labor, or a larger amount of product with the same amount of capital and labor. That is, the productivity of each unit of labor and capital in the group is increased. The excess of receipts over expenses of production, with market wages for labor and interest for capital included in the latter, is profit. Its source is usually in a dynamic change, resulting in a localized lowering of expense of production, or, what is the same thing, in a localized increase in the productivity of capital and labor.

the industrial system. Dynamic forces, on the other hand, are continually introducing new disturbances into the industrial system and creating new variations in the productivity of different units of labor and capital. In the world of reality both kinds of forces are in operation, the latter causing new discrepancies between actual values and normal values, and the former gradually obliterating them after they have been created.

It is no part of my task to attempt a complete statement of the specific productivity theory of distribution, or to enter into a discussion of the arguments for and against it. But there are two points in the theory which must be touched upon in order to make the following discussion intelligible. It is my purpose to attempt to show the influence of risk and of insurance on static rates of wages and interest; and that makes necessary a statement of the relation of risk to the static state. I shall also discuss the connection between the reward for risk-taking and the income of the entrepreneur; and as there is no phase of economic theory which is in a more unsettled condition than the doctrine of the entrepreneur, a preliminary explanation of the conception of his function on which the argument is based seems indispensable.

The Static State

The conception of the static state is purely ideal. Economists have always recognized the necessity of distinguishing between existing values and *normal* or *natural* values, and have made more or less successful attempts to isolate the forces which contribute to the determination of the latter, and to study them apart from temporary and local disturbances. What earlier writers did in a more or less indefinite and incomplete way, Professor Clark has done definitely and completely. He has made a clear and precise distinction between the forces which are responsible for variations of existing values from normal values, and those which are continually tending to bring about agreement between the two. To the latter class of forces he applies the term static; and the static state is one in which all disturbing forces have ceased to act, and actual values have been brought into agreement with normal or *static* values.

The conception of the static state is reached by a process of abstraction. It is necessary in the first place to put aside all eco-

nomic phenomena which occasion new variations in the productivity of different units of labor and capital.[1] These are caused by dynamic changes, which may be grouped under five heads: changes in the quantity of labor, changes in the quantity of capital, changes in technical methods of production, changes in methods of industrial organization, and changes in human wants.[2] Moreover the process of abstraction cannot stop here. If all dynamic changes were to cease, the ideal static state would never be realized in human society. There are other assumptions which have to be made, such as a high degree of mobility of capital and labor, the universal prevalence of the economic motive,[3] and the power of accurately foreseeing the future. These

[1] Professor Clark in his classification of dynamic changes includes only such as are found in a progressive society. But he recognizes that a complete science of dynamics would have to include a discussion of the effects of changes in the opposite direction, a theory of retrogression as well as a theory of progress.

[2] It has been suggested that changes in legal relations ought to be recognized as a separate group. This would include changes in laws affecting property rights, franchises, taxation, immigration, and the like. Manifestly such changes have a very disturbing effect on economic relations; but it is only in so far as they bring about economic changes. They are primarily social, and all the possible secondary changes of an economic nature are included in the classification given above.

[3] The relation of competition to the static state has been discussed by Mr. Padan in a recent number of the *Journal of Political Economy* (Vol. ix, no. 2, p. 182, *et seq.*). He proposes to include "*circumstances of competition*" as "an important agent of a highly dynamic character." His idea of the static state involves the absence of competition. According to his conception "a static state is simply an instantaneous photograph of a dynamic period *(sic)* at any moment." Manifestly such a static state "is incapable of setting a standard *(of wages and interest) because it is incapable of creating one.*" The unequal rates of wages and interest brought about by the previous dynamic changes would simply be perpetuated. But it is very different with the static condition here described. If the dynamic changes above enumerated were to cease, there would be a period during which capital and labor would be shifting from group to group, seeking the most advantageous employment. After a time, however, the existing amount of the two agents *would be so apportioned that all units of each would be equally productive*, and there would no longer be any reason for shifting. Mr. Padan tries to make it appear that we have here two kinds of static state, and that in the former, according to Professor Clark, competition is imperfect, and in the latter perfect, and that perfect competition is no competition. The fact is, of course, that the intermediate condition is not a static state, that the static state is reached only when the condition of uniform productivity prevails, that such a condition would be *permanent* for lack of any incentive to change, and that competition, or the desire to improve one's economic condition, is assumed to be just as "perfect," that is, "active," in the one state as in the other. In the ideal static state its effect is not seen in motion because there is no advantage to be gained by movement. But to say for that reason that it is absent is as absurd as to say that the force of gravitation is not acting on the water in a pond if there is no motion of the drops.

assumptions depart more or less from the actual condition of things. Labor and capital are far from being absolutely mobile, rates of wages and interest are not determined exclusively by economic considerations, and the result of an industrial operation does not always agree with the expectations of those who enter upon it.

It is the influence of the last of these disturbing factors on static rates of wages and interest that we are to seek to determine. The ideal static adjustment could be realized only on the condition that there were no discrepancies between the anticipated and the actual results of economic activity. Production and consumption must go on either with absolute uniformity or with a regular periodicity which in a series of years would result in uniformity. Unusually warm winters with a reduced consumption of woolens and furs, or unusually dry summers with a reduced production of agricultural commodities, must occur at stated intervals, if at all, so that they may be accurately foreseen and provided for. The unreasoning vagaries of fashion, which cause unexpected shiftings of value from one form of commodity to another, must be replaced by a fixed or a uniformly varying demand, whose effect on values can be anticipated.

While unforeseen losses are occurring, either through the failure of an industrial operation to yield the physical product which it was expected to give, or through a variation between the anticipated and the actual value of the product, the ideal static state is not realized. Every such loss is in itself a dynamic change. The possibility of such chance variations is one of the conditions under which economic activity is carried on. It is a fact of experience to which mankind has to adapt itself, just as it adapts itself to the other conditions of its physical environment. An unexpected loss, when it occurs, reduces the amount of capital at some point in the industrial system, and the failure of an anticipated loss to appear leaves an abnormally large amount of capital in some part of the system. Every occurrence of either kind makes necessary more or less shifting of capital to restore the static condition.

While uncertainty exists, then, the ideal static state can never be realized. Not only do the losses cause a disturbance of the static adjustment, but the risk of loss also has an influence on

economic activity. In discussing the pure static theory it is necessary to abstract from the possibility of accidental loss, and to assume a degree of certainty in human affairs which does not actually exist. The purpose of the following discussion is to restore to this conception the element of risk, and to determine in what way the static state, as it can be realized while risk exists, differs from the ideal static state for whose realization the absence of risk must be assumed. If men should acquire no greater control over the forces of nature and no better devices for restraining the irregularities of human conduct, than they now possess, and if knowledge and ability to foresee the future should remain in their present imperfect condition, the static state which would develop even after the lapse of a long period of time could be only approximately perfect. Rates of wages and interest would not exactly coincide with static rates. Why they would vary under the influence of risk, and to what degree, are the questions which we are to try to answer. As a matter of convenience we shall refer to the perfect adjustment which would be reached in the absence of all disturbing forces, including risk itself, as the *ideal static state*, and to the adjustment which would be reached while risk continued to affect human activity, as the *approximate static state*. And we shall first endeavor to discover the effect of the existence of risk unmodified by the influence of any social device for counteracting it, and then see in what way and to what degree the introduction of insurance will modify this influence.

Profit and the Entrepreneur

The only phase of the theory of risk which has been discussed to any extent has concerned the relation which it bears to the function and reward of the entrepreneur. Does the income of the entrepreneur consist in whole or in part of reward for assuming risk? The answer to that question will evidently depend on the definition which is given to the term entrepreneur. It is necessary, then, to state clearly the sense in which the term is used, before attempting to pass judgment upon the connection of the entrepreneur with risk and the reward for assuming it.

There are two ways of approaching the problem of the entrepreneur. We may seek to determine what forms of activity he carries on, and from them infer under which of the categories of

CHAPTER I

THE NATURE OF RISK

To live and labor in uncertainty is the common lot of all men. Life and health, property and income, are all exposed to countless dangers. The precariousness of the results of human effort has been a favorite theme of poets and philosophers of all ages. "The best laid schemes o' mice an' men Gang aft agley," and the possibility of such a mischance profoundly modifies the conduct of rational beings. In their economic activity in particular the influence of uncertainty can be clearly discerned. While exact mathematical measurements are in the nature of the case impossible, the direction of this influence, and to an approximate extent its degree, may be ascertained. It has long been considered a commonplace of economic theory that the reward of capital, and to a less extent the reward of labor, varies directly as the degree of risk to which they are exposed as a result of their economic activity. But until recently, no attempt has been made to isolate the phenomena of risk and risk-taking, and to determine the laws which govern them. The new interest in the subject has sprung for the most part from discussions as to the exact nature of the function and reward of the entrepreneur. Professor Mangoldt in Germany, and Mr. Hawley in the United States, have made independent attempts to elaborate a theory of distribution in which the assumption of certain risks shall be the special function of the entrepreneur, and his income the reward for risk-taking; and though few writers have adopted their general doctrine, the notion that in some way the function of the entrepreneur has a peculiar connection with risk is by no means uncommon. In all the previous discussion, however, one will search in vain for a thorough treatment of the nature of economic risk and the way in which its influence makes itself felt.

We are told by the philosophers that all the activities of the universe are obedient to law. Nowhere have they left any oppor-

tunity for the intrusion of chance. Events which appear to take place in a purely accidental way are just as much determined as those whose occurrence can be accurately foretold. The appearance of accident is due entirely to human limitations. It is because we do not know all the previous conditions or all the laws governing them that a particular phenomenon appears to us to occur by chance. In this sense, then, chance is purely subjective; it is merely an appearance, resulting from the imperfection of man's knowledge, and not a part of the course of external nature. But the term may be used also in an objective sense. By chance in that sense is meant the degree of probability that a particular event will occur, as it is estimated with the aid of all the attainable knowledge of the preceding conditions. If the only fact known about the condition of a number of balls in a bottle is that there is an equal number of white ones and of black ones, there is an even chance that the first ball to come out will be white, and this chance is independent of any personal peculiarities of the person who estimates it. It is in this objective sense that the term is commonly used, and, to avoid any possibility of ambiguity, it is in this sense alone that it will be used in the following pages. By chance will be meant the degree of probability of the occurrence of any future event.[1] It may vary all the way from absolute certainty that an event will not occur, through the different degrees of probability, to absolute certainty that it will occur.

Chance affects economic activity through the psychological influence of uncertainty. Man's conduct is modified in one way by coming events which he can definitely foresee and provide for, though he can do nothing to prevent their occurrence; it is affected in a different way by events which are only possible, and which may never occur, or may occur at an unexpected time. In the latter case he will not act just as he would if he knew that they would occur, and occur at a definite time, and he will not act just as he would if he knew they would not occur at all. His conduct will be modified by the very uncertainty as to the occurrence of the future event, that is, by what appears to him as chance.

A distinction must be made and kept clearly in mind between

[1] This term may also be used to denote the probability that an event has occurred in the past, when it is impossible to obtain any certain information about it. Premiums for the insurance of overdue ships are determined partly by the chance of loss as estimated from past experience.

the chance, or the degree of probability, and the degree of uncertainty. Manifestly the greatest degree of uncertainty does not accompany the greatest degree of probability. When the chance is zero, the uncertainty is also zero. A slight degree of probability brings with it a slight degree of uncertainty. But the two cannot go on indefinitely increasing at the same rate, as at the end of the series we should have the absurd combination of the highest degree of probability, which is certainty, with the highest degree of uncertainty. The uncertainty is the greatest when the chances are even, that is, when the degree of probability is represented by the fraction ½. In such a case we say that there is nothing to show what the outcome will be. As we go from an even chance either towards greater probability or towards less probability, the uncertainty diminishes, and at either end of the series it entirely disappears. For example, there is an even chance that the first card drawn from a perfect pack will be red or black, and there is absolute uncertainty as to which it will be. If, however, one of the red suits is replaced by a third black suit, the degree of probability is altered. The chance of drawing a red card is now one in four, and the chance of drawing a black one is three in four. The chance has been increased or decreased, according to the color whose appearance is made the basis of comparison. But the degree of uncertainty has been reduced, and this is equally true of the uncertainty about the appearance of either color. And after a black suit has been substituted for the remaining red suit, the chance of drawing a red card has been reduced to zero, and the chance of drawing a black card has been increased to a hundred per cent, while all uncertainty as to which color will be drawn has disappeared.

I have dwelt at such length upon this simple distinction because of its fundamental importance for the determination of the nature of risk. The word risk, as it is employed in common speech, is by no means free from ambiguity. It is sometimes used in a subjective sense to denote the act of taking a chance, but more commonly and preferably in an objective sense to denote some condition of the external world. To avoid ambiguity its use in the following pages will be confined to this latter sense. The act of incurring a risk will be called risk-taking or the assumption of risk.

But even when used in this objective sense its significance is

not always the same. It is possible to think of risk either in relation to probability or in relation to uncertainty. As the degree of probability of loss increases from zero to one hundred per cent, the degree of risk may be said to increase *pari passu*. This is undoubtedly the way in which the term is ordinarily used. A person who should enter upon an undertaking in which the chances were ninety in a hundred that it would result in failure, would undoubtedly be said to run a tremendous risk. But if the term is used in this sense, it will not be true, as I shall attempt to show later on, that the special net reward for assuming risk invariably increases as the degree of risk increases. This net premium increases as the uncertainty increases; but after the point of even chances is passed, the uncertainty diminishes as the probability increases. Beyond that point, therefore, the net premium for risk-taking will also diminish as the probability of the occurrence of the loss increases. When the loss is certain to occur the premium entirely disappears, as in the case of the ordinary replacement of capital used up in productive operations. As, however, the risks assumed in industrial life are usually well below the point of even chances, so that the uncertainty as to the outcome increases as the probability of loss increases, it will be more convenient to continue the discussion as though such risks only were to be considered. Whatever statements are intended to apply to greater chances will be put in a form that will make their application clear.

This is not the place to undertake to establish the law laid down above. My only reason for mentioning it here is to show why it seems necessary to define risk with reference to the degree of uncertainty about the occurrence of a loss, and not with reference to the degree of probability that it will occur. Risk in this sense is the objective correlative of the subjective uncertainty. It is the uncertainty considered as embodied in the course of events in the external world, of which the subjective uncertainty is a more or less faithful interpretation.[2]

[2] This definition involves considerable departure from ordinary usage. The word *uncertainty* might be used in this objective sense, or a new term might be coined to designate its objective aspect. But it has seemed better to keep to the term ordinarily used by economists in this connection. It is important not only to develop more clearly than has yet been done the effect of risk on economic activity, but also to note that many of the statements commonly made about it are true only when the term is defined in this way.

Considering risk in this sense, we find that the method by which the degree of risk may be ascertained depends upon the relative perfection of the knowledge of preceding conditions. In some cases it may be known directly from the circumstances attending it. The uncertainty about the color of a card drawn at random from a perfect pack is of this kind. No one would consider that the chance at the tenth trial was altered by the fact that at every one of the preceding nine trials a red card had been drawn. But when no such definite knowledge of preceding conditions is attainable, the degree of risk is estimated in a different way. It is ascertained by applying the laws of probability to the accumulated results of past experience. The chance that a particular loss will occur is denoted by the fraction expressing the ratio between the actual number of such losses and the possible number in a given period of time. If during each year for a series of years the loss has been one in one hundred in the case of buildings of a certain kind, the chance that a similar building will be destroyed during the following year is expressed by the fraction $\frac{1}{100}$ on condition that there is no appreciable change in the methods adopted for preventing loss. If for the moment we assume that it is known that the actual number of losses every year will correspond with the average number, the only uncertainty for the group as a whole will be as to which of the buildings will be the one to suffer the loss. The chance that any particular building will be destroyed will be one in a hundred, but the number of losses for the group as a whole will be fixed.

But as a matter of fact the loss for the group as a whole is not likely to correspond exactly with the average loss as determined by past experience. The actual number of losses in any year will vary more or less from the average. This variation is not absolutely indefinite. By the laws of chance a figure can be obtained which will indicate the probable variation of the actual number of losses from the average. This figure will vary in different cases according to the nature of the series from which the average has been obtained. The probable variation will be much less in the case of a series in which the losses from year to year have varied little from the average, than it will be in the case of a series which shows great fluctuations. Thus, to take a simple illustration, if the losses for four years have been 1, 11, 30 and 18 per hundred,

the average is 15 per hundred, but it is evident that the actual number may vary greatly from the average. If on the other hand the series had been 13, 14, 16 and 17, while the average would have been the same as before, the actual number for the following year would be much more likely to be near the average. The probable variation of the actual number of losses from the average may be ascertained by calculating the average of the actual variations during the series of years under observation. Thus in the first illustration given above, the variations were respectively 14, 4, 15 and 3, giving an average variation of 9. In the second series the variations were 2, 1, 1 and 2, and the average was 1½. It is evident, therefore, that the greater the fluctuations are from year to year in the number of losses, the greater is the uncertainty as to the number which will occur in a particular year. It must be borne in mind that risk is connected with the uncertainty. If the number of losses may vary from 1 to 30, the area of uncertainty includes the entire number of possible losses; but if the number may vary only from 13 to 17, then whatever may be the uncertainty about the fate of any particular building, for the group as a whole 13 losses can be counted upon, and the area of uncertainty includes only the 5 losses from the 13th to the 17th.

This distinction between the certain and the uncertain losses is of the utmost importance. If, as I shall attempt to show, uncertainty imposes a cost upon society, the removal of the uncertainty will in itself be a source of gain—not that the replacement of the possibility of a small amount of loss by the certainty of a large amount would result in a net gain. The effect of the occurrence of disaster is in itself the same, whether it was foreseen or not. It is the destruction of a certain amount of capital. But the net result of the occurrence of a certain amount of loss which was definitely foreseen, is different from the net result of the occurrence of the same amount of loss, plus previous uncertainty whether it would be greater or smaller. And the influence of the latter element is greater when the anticipation of future loss is based on an average obtained from a fluctuating series of past losses. The greater the probable variation of the actual loss from the average, the greater the degree of uncertainty.

Finally it must be noted that the probable variation varies

with the number of cases included in a group. According to the well-known statistical law, the figure denoting the probable variation increases only as the square root of the number of cases. Increasing the number of similar risks a hundredfold increases the probable variation by only tenfold. If for example we assume that past experience, based on the observation of 10,000 cases for a number of years, has shown that on the average one house in every thousand is destroyed by fire each year, the average loss has been 10 houses a year. But the actual loss has varied from year to year. The probable variation of the actual loss from the average can be determined only by a calculation based on the actual losses during the years under observation. But we will assume that for 10,000 cases this variation is 5. Then if there is no change in the chance of destruction to which the houses are exposed, the loss next year will probably be between 5 and 15. It is probable that as many as 5 and no more than 15 of the houses will burn. The area of uncertainty, then, is 10, or 1/10 of 1 per cent of the number of cases. If we now increase the number of houses exposed to the same danger a hundredfold, from 10,000 to 1,000,000, the average loss will be 1,000, but the probable variation of the actual loss from the average will not increase a hundredfold, from 5 to 500, but only tenfold, from 5 to 50. The actual loss next year will probably be between 950 and 1050. The area of uncertainty is now 100, or 1/100 of 1 per cent of the number of cases. We have used the term *area of uncertainty* to denote the number of cases lying between the largest probable number of losses, or the average plus the probable variation, and the smallest probable number, or the average minus the probable variation.[3] We may say then that the area of uncertainty increases as the square root of the number of cases, and that its ratio to the entire number of cases becomes correspondingly less.

Risk, in the sense in which we are to use the term, is, so to speak, the objectified uncertainty as to the occurrence of an

[3] I need not point out that the average variation itself denotes only a probability and not a certainty. There is additional uncertainty as to the extent to which the actual variation in any year will vary from the probable. I have not thought it necessary to consider the various devices of the mathematicians for obtaining more significant figures than averages. My only purpose is to show that with the increase in the number of cases the actual degree of uncertainty for the entire group diminishes, and that fact is sufficiently well brought out by the use of crude averages.

undesired event. It varies with the uncertainty and not with the degree of probability. In that sense the degree of risk in any individual case is a definite quantity. It may be ascertained in some cases by direct observation of the conditions on which the possibility of the occurrence of the event depends. When such knowledge can not be obtained directly, it is sought indirectly by a statistical study of the results of past experience. The chance of the occurrence of a loss is denoted by the fraction expressing the ratio between the actual number of losses and the possible number in a given period of time. The value of this figure varies with the regularity of the series from which it has been obtained. There is greater uncertainty about the number of losses that will occur in a given year when the average has been obtained from a fluctuating series than when it has been obtained from one which was comparatively uniform. The figure expressing the average variation of the actual losses from the average loss for a number of years is called the probable variation. The greater the ratio between the probable variation and the whole number of cases, the greater is the uncertainty. The probable variation increases only as the square root of the number of cases, therefore its ratio to the whole number becomes less as the number is increased. Consequently the more individual cases there are included in a group, the less is the uncertainty as to the amount of loss which the group as a whole will suffer. The bearing of these laws upon economic conduct, and their significance for economic theory, will appear in subsequent chapters.

CHAPTER II

CLASSES OF RISKS

CAPITAL of any kind is exposed to a certain liability of loss, but the degree of risk varies greatly in different forms of investment. In the same way participation in any form of industrial activity may bring with it some chance of personal injury, but the degree of danger is not the same in all occupations. The minimum degree of risk incurred by the choice of capital goods rather than consumption goods, or by using one's power in any kind of work, does not have the same kind of influence on economic activity as the additional risk involved in particular employments. The former affects directly the willingness of men to labor or to accumulate capital; the latter affects their choice of the manner in which they shall employ their labor or capital.[1] These two kinds of risk may be called *economic*, because their existence is due to participation in economic life.

There are other risks to which men are exposed, the existence of which is not the result of economic activity. In contrast to the former kind these may be called *extra-economic*. Of this kind is the danger of contracting a contagious disease, to which all men are more or less exposed, or the possibility of the loss of consumption goods by fire or theft. Such risks may affect economic activity; but not in the same way as those will affect it which are incurred as an incident of the activity itself. It is one question how a man will act because he is exposed to a certain degree of risk; it is a different question how he will act when the degree of risk depends on his conduct. It is with economic risk alone that we shall be

[1] Cf. Haynes: "Risk an Economic Factor," *Quarterly Journal of Economics*, vol. ix, p. 410. Mr. Haynes regards the minimum degree of risk to which all capital is exposed as ineffective. Such an adjective, however, can hardly be applied to it. It is certainly "effective," but its effect is not of the same sort as that of the additional risk involved in some investments.

concerned; that is, with the risk that a man incurs on account of his participation in economic life.[2]

If the subjective value which a person puts upon any commodity is higher than its objective exchange value, the loss of the commodity will cause a greater feeling of discomfort than would be occasioned by the loss of an equally costly article, to which no sentimental value attached. It is in general to consumption goods that such abnormal values belong. Souvenirs and heirlooms whose market value is slight may be prized very highly by their possessors on account of their past associations. A particular book or article of furniture may become so necessary to the comfort of its owner that the loss of it will affect him like the departure of a familiar friend. Occasionally the same sort of personal attachment may spring up towards some capital good, as the boat used for a long time by a fisherman, or the building in which a man's business life has been spent. The loss of such a commodity causes a certain amount of personal suffering which is not relieved by the recovery of its market value; and the risk of losing it will have a greater influence than the risk of losing an indifferent commodity of equal value. To this possibility of undergoing personal suffering through the loss of any commodity may be given the name *personal risk*. It is so rarely that its influence is felt in the case of capital goods that it will not be necessary to consider it in discussing the risk to capital. A capitalist is nearly always indifferent about the loss of capital goods of any kind, if he is certain that the full value of the lost property will be restored to him. In most of the risks which he assumes this personal element is entirely lacking.

It is very different with many of the dangers to which the laborer is exposed. The economic risk which threatens him is loss of income. This may be brought about in various ways. Sometimes it is attended with great physical suffering, as when a painful accident incapacitates him for labor; sometimes it brings with it freedom from the necessity of toil, as when it is due to the impossi-

[2] It is conceivable that there may be a diminution of risk instead of an increase, as a result of economic activity. Thus wealth invested in government bonds is exposed to less danger than wealth in the form of high-priced driving-horses kept for pleasure. In such cases the opportunity of avoiding risk will have an influence precisely the opposite of that exerted by the necessity of incurring greater risk; but they occur so rarely that they need not be considered in a general discussion.

bility of obtaining employment. In neither case will the certainty of obtaining an income equal to the one he was receiving make the laborer indifferent to the possibility of the occurrence of the event. He will not be willing to endure the physical suffering resulting from the accident, just because his income will be continued; and he will be more than willing to give up the search for employment, if he can obtain as large an income without work as with it.

We have here an important distinction between the dangers which threaten labor and those to which capital is subjected. In nearly all the dangers to which labor is exposed, there is involved a considerable share of what I have called the personal element, while the dangers threatening capital are almost entirely free from it. This fundamental distinction brings with it others no less important, relating to the possibility of transferring risk, and the effect which this possibility has on the conduct of the person who makes the transfer. For that reason it seems inadvisable to attempt to deal with the two kinds of risk in the same discussion. In the following pages we are concerned almost exclusively with risks to capital. Whenever it seems necessary to make any statements about the relation of labor to risk, they will be expressed in such a way as to indicate the class of risks to which they apply.

Risks to capital may be classified in various ways from different points of view and for different purposes. A classification which is of great importance for the technique of insurance is based on the nature of the uncertainty. There may be uncertainty whether the event will occur, when it will take place, or in what way—*casus incertus an, quando,* or *quomodo.* Thus, with reference to a particular building, there is uncertainty whether it will ever be destroyed, when its destruction will occur, and whether it will be due to fire or flood, wind or lightning. The greater the number of these kinds of risk involved in a given case, the greater is the resulting uncertainty. Insurance companies usually limit their responsibility to losses occurring within a fixed time, and in one or more specified ways.

A second form of classification is based on the character of the possible loss. There is the possibility that existing wealth may be lost by its owner, and the possibility that expected future wealth may never be obtained. We may distinguish these forms of loss as

positive and negative. The destruction of a building by fire illustrates the former kind; the failure to find the expected market for a commodity is an example of the latter. This classification is of importance for the theory of risk, since the peculiar form of loss caused by uncertainty is entirely of the negative kind. Writers on insurance have had in mind much the same distinction in their recognition of the difference between present and future values. To a certain extent also it corresponds to the distinction between loss of capital and loss of income from capital.

A more fundamental and significant classification of risks than any yet noted is based on the distinction between static and dynamic losses. We have already spoken of the difference between static forces and dynamic forces, and have shown that the conception of the ideal static state, with an absolutely unchanging amount of capital apportioned in such a way as to be uniformly productive, is inconsistent with the existence of risk. For risk involves the possibility of a divergence between the expected course of events and the course actually realized; and every such divergence will result in a change either in the amount of capital or in its apportionment, and so in a disturbance of the static adjustment. The non-occurrence of an expected loss will have this disturbing effect as well as the occurrence of an unexpected loss. In this sense, therefore, the expression *static risk* involves a contradiction of terms.

But we may conceive of a static state of a modified form, which shall embrace the element of uncertainty from which man's economic life can never be free. In this approximate static state certain forms of risk, that is, the possibility of certain forms of accidental loss, will still survive. These risks may be called static, because their existence does not depend upon the occurrence of dynamic changes.[3] They are connected with losses caused by the irregular action of the forces of nature or the mistakes and misdeeds of human beings. According to the occasion of the loss, they may be further subdivided. Some are caused by inanimate forces, as fire, wind, or water; others by the action of animal or plant life,

[3] A slight amount of dynamic risk would also be present so long as there were slight local changes in the amount of capital, due to the failure of the actual course of events to agree with the expected course. Every such minute dynamic change would slightly affect values in other parts of the economic system.

as moth or mould; others by the carelessness either of the owner of the wealth destroyed or of another person, which gives opportunity for the unfavorable action of animate or inanimate nature; and still others by the fraud or violence of the criminally disposed, seeking to appropriate to their own use wealth which does not belong to them. All these forms of loss will continue while human life endures, and uncertainty as to the exact time or amount of loss to be anticipated from these sources involves also the existence of static risk.

Dynamic risks are those involved in the possibility of dynamic changes. Not all dynamic changes, however, are equally important in this connection; for it is not the change itself which constitutes the risk, but the uncertainty about the time or amount of future changes. Growth of population and increase of capital take place with comparative regularity, and therefore cause little incidental loss, except in so far as they may be necessary to one of the other dynamic changes, and pave the way for it. It is with changes in human wants, and still more with improvements in machinery and organization, that the greatest amount of uncertainty is connected.[4] Those included in the first of these groups originate on the side of consumption; those in the second, on that of production. To some extent the former are capable of being anticipated or even controlled, while the latter occur in the most irregular and uncertain ways, and to that extent there is greater risk connected with the latter than with the former. No one thing is more essential for success in modern business than the ability to forecast future changes in the desires of consumers. It is important to note also that the loss may result from the non-occurrence of an anticipated event, as well as from the occurrence of one which was not anticipated; and that the special cost entailed upon society by the existence of risk will have to be borne whether or not the uncertain loss actually occurs.

[4] Certain short-time fluctuations in human wants would exist even in the static state. With change of season would come changes in the consumption of commodities; and exceptional events, such as the death of a ruler and the consequent general assumption of mourning, would cause temporary alterations in the character of the articles demanded. So far as these fluctuations occurred with uniform regularity, they could be provided for with accuracy and would involve no risk. So far as the time of their occurrence and the extent of the change could not be foreseen, the possibility of such changes would be a form of static risk.

Examples of the losses caused by these dynamic changes are to be found on every hand. The tide of fashionable travel turns from seashore to mountains, and large investments of capital at ocean resorts lose their value. Bicycles and automobiles are used by people who formerly wanted horses and carriages, and the value of the latter declines. An unexpected change in the fashionable color leaves manufacturers and dealers with stocks of goods which they are obliged to sell at reduced prices. The effect of improvements in mechanical and chemical appliances is equally obvious. A system of street railways operated by cable was introduced in a western city, and when its career of usefulness had hardly begun, it was replaced at great expense by a system operated by electricity. A flouring mill was fitted up with the best available machinery, and within a very short time the new machinery was discarded, and an improved pattern introduced at an expense of hundreds of thousands of dollars. Every investment of capital in forms whose usefulness is limited to the production of a specific commodity, is exposed to the danger of losing its value through discoveries or inventions which render it obsolete and useless.

There is a special form of dynamic risk which needs to be pointed out, both on account of the large part it plays in modern industrial life and because of its great theoretical importance. In a state of society like the present, in which wealth is increasing at a rate out of proportion to the increase in population, there is always a large fund of newly created capital looking for favorable investment. This must be used either in increasing the supply of existing consumption goods or in creating kinds not before produced. These results may be reached either through the larger employment of the kinds of capital goods already in use, or through the creation of new kinds adapted to the production of the old or the new consumption goods. If the only investment for the new capital were to be found in the creation of consumption goods already in use, by methods and machinery now employed, the rate of interest would rapidly fall, and there would be little opportunity for the realization of profit. To avoid this result capital is continually seeking new forms of investment. The simplest device is to invent a cheaper method of creating a commodity already in use. Every

improvement of this kind will yield a temporary profit to the entrepreneur who first employs it, but in the end it must result in a lower rate of interest on all capital. As a second resource additional capital goods of forms already employed may be used to create new kinds of consumption goods; or, finally, the new capital may be embodied in new kinds of capital goods, intended for the production of consumption goods not before created. If the new consumption goods produced in either way is one which men desire, so that as a result of its production there is a net increase in the sum of human wants, its influence will be felt in the direction of a greater willingness of men to labor, a consequent greater demand for capital, and a retardation in the fall in the rate of interest. The introduction of the new goods and new machinery also offers an opportunity for the realization of temporary profit by those who first produce or use them.

The relation of risk to these different forms of investment of new capital is readily seen. In the first case no uncertainty is involved, except possibly as to the elasticity of the demand for the commodity whose production is increased. In the second case there is to be added uncertainty as to the technical result, a form of uncertainty which is usually connected to a greater or less extent with the introduction of any untried appliance or process. With the progress of physical science, however, it is evident that this form of uncertainty is being gradually eliminated, and that in many cases the successful working of the new device can be safely counted upon in advance. There is still greater uncertainty involved in the creation of new commodities and new machinery for producing them. If the new commodity is intended to satisfy an existing need, it may be uncertain how far it will accomplish its purpose. The claim that it meets a long felt want is hardly sufficient to assure its success. If, on the other hand, the commodity precedes the want, and is produced with the expectation that its own intrinsic merits and extensive advertising will create a market for it, the possibility of failure is evidently greatly increased. Finally, if existing kinds of capital goods are used in producing a new commodity which fails to find a sale, they can be turned to the employment for which similar machines had been used before and thus preserve a part of their value; but if new kinds of machines have to be brought into service, besides

the element of uncertainty as to the technical success of the machine, there is a possibility that the entire investment will be lost if the commodity falls dead on the market.

The investment of capital in attempts to produce new commodities which shall find a ready sale is one of the most characteristic features of modern industrial life. The rapid accumulation of capital, the consequent fall of the rate of interest in old forms of investment, and the large gains to be realized under our patent system by the creation of a new commodity which appeals to the public taste, combine to push production out tentatively in all directions. Large amounts of capital are sunk every year in experiments which end disastrously, and large fortunes are made out of successful ventures. In order to be able to refer without circumlocution to the risk involved in these experiments, it seems best to give it a separate name. For lack of a better term let us call it *developmental risk*. By that term will be meant the uncertainty as to the return to be realized from the investment of capital in the production of a new commodity or of a new capital good, due to the possibility that it may not find the expected market, or may not perform the work for which it was intended.

To return now to the general distinction between static and dynamic losses, we find that there are several important differences between them. A static loss results either from the physical destruction of the object, in which case the entire loss is a net loss to society, or from the change of possession, as the result of carelessness or fraud, which may or may not in itself involve a social loss, according to the efficiency with which the object is utilized by the old and the new possessor. A dynamic loss results from a decrease in the value of the object, and in a progressive society the very conditions which cause the loss to the individual generally make it certain that society will be benefited by the change.

In the second place static losses usually affect one unit or several units of the same or of different kinds of capital goods, while dynamic losses affect all the units of a given class at the same time. Fire may destroy one building here and another there, while the great majority of similar buildings go unscathed; but an invention which takes the value out of one machine takes it out of all similar machines at the same time, and a change in con-

sumption which causes a falling off in the demand for any kind of commodity affects the value of all existing stocks of that commodity in the hands of manufacturers and dealers.

In the third place static losses occur with more or less approach to regularity, if comparisons are made over considerable periods of time, while dynamic losses are very irregular in the time and place of their appearance. Statistics show that the losses by fire in different decades bear an approximately fixed ratio to the possibility of loss. But dynamic losses in one period may vary greatly from those in another, and in any particular industry the amount to be expected in a given time is almost wholly indeterminable. In other words, if large groups of similar cases are considered, the uncertainty as to the amount of the loss to be anticipated from the action of static forces is far less than the uncertainty about the amount of the dynamic loss. Or, as risk and uncertainty are correlative, we may say that the risk of dynamic loss is greater than the risk of static loss.

These points of unlikeness between static and dynamic losses are of great importance for the technique of insurance. Because dynamic losses are so irregular and incalculable in their appearance, it is impossible to estimate with any approach to certainty what funds must be accumulated to meet them; and because when they occur they affect entire classes of goods at the same time, it is impossible to compensate those who suffer loss, at the expense of others who are exposed to the same danger, but are so fortunate as to escape. The result is that while dynamic losses are the ones which most deserve compensation, because in general they occur through no negligence or fault on the part of the persons suffering them, and while they are the ones which society can best afford to make good, since they are usually accompanied by a net social gain, they are also the ones against which the least protection is furnished by existing methods of insurance.

The distinction between static and dynamic losses is as important for the theory of risk as it is for the technique of insurance, but to attempt at this place to show what economic consequences flow from it, would be to anticipate a considerable part of the argument that is to follow. Its significance will appear most prominently in the discussion of the activity of the capitalist-entrepreneur and its relation to risk.

Somewhat analogous to the distinction here drawn between static and dynamic losses is that made by Mangoldt between technical and economic losses.[5] A technical loss is due to the failure of an investment of capital to yield the physical product expected of it. He cites as illustrations an unexpectedly small increase from an investment in agriculture, the failure of a machine to perform the work expected of it, and the loss of a ship at sea. An economic loss is due to an unfavorable discrepancy between the anticipated value of the product and the value actually realized. As an illustration he cites the case of a railroad, physically, or "technically," able to perform the work expected of it, but yielding less than the usual reward to the capital invested, because the demand for its services is not so great as was anticipated.[6]

Now it is evident that Mangoldt's economic losses are all dynamic. They are connected with improvements in methods of production or with changes in human wants. But not all of his technical losses are static. The failure of a machine to do the work expected of it may be of either kind. It is static if the machine is of a form already in use, and its failure to work is due to a flaw in its construction, or to the accidental destruction of the machine itself; it is dynamic, however, if the machine is of a new and untried type, and its failure is caused by a mistake of judgment as to the way in which it will perform its work. That Mangoldt includes in the technical group this kind of dynamic loss, which I have called developmental, is shown by his statement that "the danger of failure (in the case of technical risks) is naturally greatest where there is something essentially new about the commodity, means of production, or method."[7]

Mangoldt's purpose in making this classification was to identify the kinds of risks which according to his theory of distribution

[5] H. von Mangoldt: *Volkswirthschaftslehre*, Stuttgart, 1868, p. 184.

[6] There is a striking similarity between Mangoldt's classification and that developed at greater length by Professor E. A. Ross. (See "Uncertainty as a Factor in Production," *Annals of the American Academy*, vol. VIII, p. 92.) Professor Ross dwells upon the importance of the distinction between uncertainty as to the relation of outlay to product, and uncertainty as to the relation of product to price; but it is with their influence upon production that he is primarily concerned, and only incidentally does he touch upon their relation to distribution.

[7] *Ibid.*, 186. "Am grössten ist natürlich die Gefahr des Misslingens da, wo es sich um etwas wesentlich Neues in Bezug auf Gegenstand, Productionsmittel oder Methode handelt."

it is the special function of the entrepreneur to bear. In an isolated economy, he says, economic loss could occur only as a result of technical loss. When production for exchange begins, there arises the possibility of economic loss not occasioned by an attendant technical loss, and then the entrepreneur appears. He produces goods for exchange, and consequently is exposed to the danger of economic loss. It is for bearing this risk that he obtains his special reward. I must postpone for the present a complete discussion of Mangoldt's theory. To indicate its imperfection it is sufficient to point out two things. In the first place it is not true that a man living in isolation could suffer an economic loss only as result of a technical loss. A Robinson Crusoe might accumulate a stock of some commodity with the expectation that it would be of great service to him, and afterwards discover a substitute so much more efficient that he would no longer attach any value to his former accumulation. In the second place no important service to economic theory can be rendered by a classification of functions which rests on a distinction of so little significance as the one that separates these two classes of risks.

Of other classifications of risk which have been attempted I will mention but one, and that only because of a question of distribution with which its author has connected it. Professor H. C. Emery distinguishes risks of production from speculative risks.[8] Risks of production are enumerated by him without being defined; but speculative risks, we are told, are "the risks of price fluctuations affecting the whole market, that is, the distinctively Conjunctur-risks." It is evident that for the most part this classification, like Mangoldt's and Ross's, is based on the distinction between uncertainty as to physical product and uncertainty as to value; and as the risk undertaken by an entrepreneur who puts new goods on the market is not considered, the risks included in the two groups fall for the most part under the head of static and dynamic risks respectively. Of the risks of production, we are told, some "are borne by the laborer, some by the capitalist, most of them by the entrepreneur," while the assumption of speculative risks is the function of the speculator, whose economic

[8] Henry Crosby Emery: "The Place of the Speculator in the Theory of Distribution," *Publications of the American Economic Association*, vol. i, no. i, p. 104.

identity it is the purpose of the article to help determine. As I shall have occasion to consider some of Professor Emery's arguments when I speak of the relation of the speculator to insurance, I have thought it best to mention the principle on which his classification of risks is based.

Let us briefly review the conclusions that we have reached as a result of the foregoing analysis. The only risks that are important for our purposes are those that are incurred as a result of participation in economic life. The element of personal suffering involved in many losses is a disturbing factor which we are obliged to leave out of account. Partly because this is usually present in the risks to which labor is exposed, and partly on account of the limited extent to which these risks can be transferred to other persons, we shall confine our attention to the effect of risk on capital and its employment.

For theoretical purposes the most significant classification of economic risks to capital is the division into static and dynamic risks. Static risks are those which are inseparable from any form of economic activity, and which will therefore be present in a stationary society as much as in one that is either progressive or retrogressive. They are involved in the possibility of loss as a result of the action of the forces of nature or of the carelessness or criminality of human beings. Dynamic risks are connected with the possibility of loss resulting from dynamic changes. As the degree of risk is correlative with uncertainty, the greatest amount of risk is associated with those kinds of dynamic change that occur with the greatest irregularity. Changes in population and wealth occur with comparative uniformity, and therefore involve little unexpected loss. Changes in human wants are less uniform and produce a greater degree of uncertainty. Changes in machinery and in methods of production are still more irregular in their appearance, and it is with them that the greatest amount of uncertainty is connected. A special form of dynamic risk, and one of great importance in modern life, is the developmental risk incurred by those who make investments of capital in the production of new and untried commodities, whether they are intended for consumption or for producing consumption goods.

I need not stop to repeat what has been said about the differences between static and dynamic risks, or about the importance

of the other classifications which we discussed. I will close this lengthy chapter with a word of explanation as to the bearing which any such classification has upon the general theory of risk. So far as the effect of the risk itself on economic activity is concerned, its place in any classification has practically no significance. Risk is the objective correlative of uncertainty about the relation between present outlay and future return. Upon a person considering the advisability of any investment of capital, the influence of a given degree of uncertainty about the outcome will in general be the same, whatever may be the location of the uncertainty or the source of the possible loss. The only question which concerns him is as to the degree of risk involved. It is in the discussion of special phases of the theory of risk, and still more in the examination of the different devices which society has adopted for counteracting its unfavorable influence, that the importance of the classifications given above will appear.

CHAPTER III

THE COST OF RISK

Risk and uncertainty are the objective and subjective aspects of apparent variability in the course of natural events. Whatever effect risk may have on economic activity is brought about through the psychological influence of uncertainty. The fundamental facts of human nature on which the doctrine of risk is based are that in economic affairs uncertainty is in general a disagreeable state of mind, and that the disagreeableness increases as the uncertainty increases. This means more than that every man prefers a certain gain to a probable one of the same amount, a sure return of five per cent to a possible return of five per cent which may never be realized. It means that he prefers a certain return of five per cent to an uncertain return which may be nothing or may be ten per cent, with no indication of where it will fall between the two limits. As a general rule uncertainty exercises a repellent influence in economic life.

This general statement, however, is subject to numerous qualifications. In the first place it is evident that the same degree of risk does not have the same amount of influence on all men. This may be because different men form different estimates of the degree of risk involved in any undertaking. In such a case the influence which will be exerted will depend upon the subjective estimate of the objective risk; for it is only through the subjective uncertainty that the objective fact makes its influence felt. It may be because of differences in the mental and moral nature of the men. A venturesome, self-reliant man may find little unpleasantness, or possibly even a positive pleasure, in assuming a risk from which a timid man would shrink; and on the other hand one with little prudence and foresight will readily incur a risk which a more rational man would avoid. To some the excitement involved in assuming risks becomes so attractive that it is in itself a sufficient inducement to lead them to expose themselves to

almost certain loss. The gambling instinct has entirely overcome what may be called in contrast the business instinct. The difference may be due to unlike personal relationships. A man with others dependent upon him for support will be less ready to take chances than one who has only himself to consider. Finally, it may be due to inequalities in the amount of wealth possessed by the men in question. Other things being equal, the man with a large fortune will be less unwilling to expose a definite sum to a given risk than one with little wealth.

In the second place, the same person is not always affected in the same way by risks which he estimates alike. This variation may be brought about in several ways. It may be because of non-economic considerations. If the odor of respectability attaches to an uncertain form of investment, while a safer form has plebeian associations, these facts may more than counterbalance the effect of the larger risk. It may be on account of differences in the nature of the risks themselves. Adam Smith was the first to point out the unlike effects produced by a great chance of winning a small amount, and a small chance of winning a large amount. Readiness to assume the latter kind of risk is frequently far greater than would be justified by its true actuarial value. It is to this peculiarity of human nature that the excess in the amount of capital invested in certain extra-hazardous occupations, such as gold-mining, is partly to be attributed. Finally, with changes in a man's economic condition, his reluctance to incur risk also changes. As his wealth increases the marginal utility of a fixed sum becomes smaller, and for that reason his unwillingness to expose it to a definite risk also diminishes.

How far the economic behavior of mankind in the face of uncertainty is affected by such considerations as these, could be determined only by an inductive study. In the discussion of the general theory of risk we are obliged to neglect all these disturbing elements, and to assume for man's conduct a degree of regularity which does not actually prevail. Except when a definite statement to the contrary is made, the argument proceeds on the assumption that the effect of a given degree of uncertainty is the same upon all men, regardless of any peculiarities in the nature of the risk or of the persons assuming it.

The first proposition to be established is that uncertainty in

economic affairs is an evil, causing a net loss to society in addition to all the losses occasioned by the occurrence of unfavorable events. A certain amount of capital will be accidentally destroyed during the coming year. On account of the uncertainty as to the amount of loss which will occur, the economic condition at the end of the year will be less favorable than it would be if the same loss were to occur, but the time and place of its occurrence could be accurately foreseen. Or, to state the same thing in a different way, if none of the possible accidental loss should actually occur, but the present degree of uncertainty should continue, the condition at the end of the year would be less favorable than it would have been if the uncertainty had been absent as well as the loss.

This net loss, due to the existence of risk, is the result of the repellent influence of uncertainty upon normal human beings. Uncertainty is a form of disutility which no one will voluntarily incur unless something is to be gained by so doing. The first place where its influence can be detected is in the accumulation of capital. If risk were uniform in all kinds of investment, the rate of accumulation in a dynamic society would evidently depend partly on the degree of risk to which capital was exposed; and with unequal degrees of risk in different investments the same relation exists, though it is more difficult to trace.

But this is properly a dynamic question, to which we shall return later on. In a static society the effect of uncertainty is visible only in the employment of the capital already in existence. In an ideal static state capital would be so apportioned that every unit of it would be equally productive. The same thing would be true of an approximate static state on the assumption that there was the same degree of risk involved in all forms of investment. But the real world shows no such uniformity of risk. The static state which would evolve, if dynamic changes were to cease, would be one in which different forms of investment would involve unequal degrees of uncertainty. This condition of things would prevent the perfect static apportionment of capital. No one would be willing to make investments in hazardous enterprises with the expectation of receiving only the same average net return that he could obtain in safe investments. The apportionment of capital would be so made that the net return in different invest-

ments would vary directly as the degree of uncertainty involved in them. The flow of capital into hazardous enterprises would cease while its marginal productivity in them was still enough above its marginal productivity in safe investments to yield the additional net reward necessary to induce investors to incur the risk. If the degree of risk in some form of investment is such that it requires a net return of two per cent above the rate in safe investments to induce any capitalist to assume it, there is no way in which competition can do away with the extra two per cent so long as the degree of risk remains unchanged. The flow of capital into the industry ceases while the return to it is still two per cent above the return in safe investments. The extra two per cent is the incentive necessary to induce any investor to incur the risk, and for that reason no one will bring down the rate towards the normal level by offering capital for a smaller reward.

So far in our discussion we have made no allowance for the important consequences of the influence of the law of diminishing utility on the reluctance to incur risk. Every unit added to a man's wealth has less value to him than the preceding unit. If a man with $10,000 ventures it in an enterprise in which he runs a risk of losing it all or winning another $10,000, the $10,000 he will win in case of success will have far less utility to him than the $10,000 he will lose in case of failure. And if he ventures only $1,000, it is still true, in a less degree, that the additional $1,000 will have less utility to him than the marginal $1,000 he already possesses. A perfectly fair wager, therefore, in which due allowance is made for the different degrees of utility of the sum wagered to the two parties, is never economically justifiable. Thus if two men, to whom $1,000 has the same marginal utility, wager it on the toss of a penny, the one who loses will necessarily lose more than is gained by the one who wins. There is a net loss to the two by the transaction.

The effect of this psychological principle is obvious. The amount of the extra remuneration which will be required to induce the investor to incur a risk is influenced by the diminishing utility to him of additional units of capital. If he possesses 5 units of capital, we may let 10 represent the utility of the first

unit, 9 of the second, 8 of the third, 7 of the fourth, and 6 of the fifth.[1] Then the total utility of his capital is represented by 40. If the utility of additional units continued to diminish at the same rate, 5 more would have the utility respectively of 5, 4, 3, 2 and 1, or a total of 15. Therefore, he would subject himself to the chance of losing all his capital or of winning another equal amount, for this reason alone, only when in his judgment the chance of success was to the chance of failure as 40 to 15; and he would incur the risk of losing his marginal unit or of gaining another unit, only when the chances were as 6 to 5. Or if we assume equal chances of success or failure, the sum to be gained would have to exceed the sum to be lost by a sufficient amount to make the utility of the two sums equal.

It is evident, then, that the effect of man's natural unwillingness to subject himself to uncertainty in his economic activity, reinforced by the effect of the diminishing utility of successive increments of wealth, will be such an apportionment of the existing amount of capital among different industries that the return to it will vary with the degree of uncertainty. The most productive apportionment of capital would evidently be the one in which the marginal productivity was the same in all industries. The loss which society would suffer in a static state on account of the existence of risk would be due to the diminution in the productivity of capital caused by its uneconomic apportionment. If for the sake of simplicity we assume that all the forms of investment of capital are capable of being arranged in two groups, such that the risk in the first is twice as great as that in the second, capital will be so apportioned that its productivity in the former will exceed its productivity in the latter. Compared with the productivity under the uniform apportionment that would prevail if the risk were equalized, the former group will show a net increase, and the latter a net decrease. The cost of the risk cannot be ascertained by subtracting the wealth created by the capital in the less productive group from the wealth which would be created by the same capital if it were as productive as that in the other group. The diminished productivity of that part

[1] Adapted from J. B. Clark: "Insurance and Business Profit," *Quarterly Journal of Economics*, vol. xii, p. 41.

of the capital is partially offset by the increased productivity of the other part. The cost of the risk is the difference between the net excess of the product created in the more hazardous group, as compared with the amount that would be created by the same capital in a static apportionment, and the net deficiency in the product of the other group.

This net loss due to the existence of uncertainty must not be confounded with the loss of capital which results from the actual occurrence of the uncertain event. The former is always of the kind that I have called negative. The existing amount of capital and labor would create a certain amount of wealth if it were apportioned in the most productive way. It creates a smaller amount when the realization of this apportionment is prevented by the existence of risk. The difference between these two sums, that is, the wealth whose creation is made impossible by the uneconomic apportionment, is the cost of risk to a static society. A full discussion of the connection between the chance losses and gains due to the occurrence or non-occurrence of uncertain events, and the negative loss caused by the existence of the uncertainty itself, can be better undertaken in the next chapter, when we come to consider them from the point of view of the person who assumes the risk.

It must be noticed also that the statement that risk or uncertainty entails a burden upon society by no means implies that society would necessarily be better off if all risk were avoided. If the uncertainty involved in existing forms of investment could be abolished, with no additional expense for protection from accidental loss, and no change in the amount that actually occurred, the result would be a saving to society of the net loss which the risk now causes. But if the uncertainty were avoided by withdrawing capital from all investments in which more than the minimum degree of risk is involved, society would suffer a great diminution of well-being. The fact that capital can obtain the extra reward necessary to induce it to enter a hazardous employment shows that society values so highly the product of the industry that it prefers to bear the extra expense rather than content itself with the products of safe investments.

We will conclude our discussion of the cost of risk to society

with a consideration of the distribution of the burden among the different categories of economic persons. The laborer as such is not affected by inequalities in the degree of risk to which different units of capital are exposed. The amount of capital in a hazardous investment is limited, and its productivity is for that reason abnormally high; but there is nothing in that fact to interfere with the static apportionment of labor, which will make its productivity and its reward everywhere the same. The immediate return to the laborer will be the same in an industry in which the capital is exposed to a high degree of risk as it is in one involving little risk.

Obviously this is not true of capital. The principle that we are trying to establish is that the return to capital from investments with unequal degrees of risk will vary as the uncertainty varies. The additional reward, however, is not, strictly speaking, an abnormal gain, like that which might be obtained by a capitalist who controlled the supply of a valuable natural product. Other capital is not prevented by an external force from coming in and obtaining a share in the extra reward. It cannot properly be said, therefore, that some capital gains at the expense of the rest on account of inequalities in the risk to which it is exposed. The capital in the hazardous investment is performing a greater social service, and for that reason obtains a greater reward.

It is upon the consumer that the whole burden of risk in a static society would fall. The extra reward of capital can be obtained only through the medium of higher prices. The commodities produced by the hazardous industries cannot be sold as cheap as they would be if the uncertainty were removed. Whoever consumes any such commodity bears a part of the burden of risk. The extra price paid by all the persons who use commodities whose production involves so much risk that the capital engaged in producing them obtains a reward higher than it could obtain under the ideal static adjustment, is from this point of view the cost of risk to society. But here again allowance must be made for the gain which partially offsets the loss. If the prices of commodities produced in hazardous industries are higher than the static level, the prices of other commodities, produced in industries free from risk, must be below that level. The net loss to consumers would be ascertained by subtracting from the excess in

price of the former class of commodities the saving made by those who purchased the latter class.[2]

This brings us to the final point to be noticed in this connection. The burden of risk is not borne equally by all consumers, nor is it distributed according to the amounts spent in the purchase of consumption goods. A far larger share of it is borne by one whose purchases are confined to the products of hazardous industries than by one who buys almost exclusively articles in whose creation little risk is involved. A consumer might even realize a net gain on account of risk, if it were possible for him to confine his purchases to consumption goods whose price is below the static level. The burden of risk is borne by those who consume the products of the hazardous industries, and it is distributed according to the amounts spent in the purchase of such commodities, with proper allowance for the savings realized from the purchase of the abnormally low priced goods.

The following are the principal points that we have sought to establish in the present chapter: Risk affects economic activity through the psychological influence of uncertainty. Uncertainty is a kind of disutility, and it will not be borne without some inducement. Its influence is largely enhanced by the fact that the utility of successive increments of capital gradually diminishes. In a dynamic society the effect of uncertainty is seen in a retardation of the rate of accumulating capital. In a static society the inequality in the amount of uncertainty involved in different investments causes such an apportionment of capital among them that its productivity varies as the degree of risk to which it is exposed. The most advantageous apportionment would be the ideal static condition, in which all units were equally productive. The loss of productivity caused by the uneconomic employment of existing capital is the cost of risk in a static state. This burden is borne by consumers, and it is distributed among them according to the relative amounts spent for consumption goods whose creation involves comparatively high degrees of risk, and for those produced with little or no risk.

[2] If the commodity produced in the hazardous industry is a capital good instead of a consumption good, the extra cost is first borne by the purchasers of the capital good. It hardly seems necessary to point out how it is shifted from person to person until it finally rests upon the one who uses the consumption good which the capital good helps to create.

CHAPTER IV

THE ASSUMPTION OF RISK

The existence of risk in an approximate static state causes an economic loss. The assumption of risk, on the other hand, is a source of gain to society, and a part of the gain is obtained by the risk-takers as their special reward. We will first consider in what sense and under what conditions risk-taking is socially productive, and then examine the nature and amount of the net reward received by the person who assumes the risk.

It is evident that risk-taking is not productive in the same sense in which capital and labor are. It has no claim to rank as a third coördinate productive agent. All wealth is created by labor and capital, and by them alone. No one would think of attempting to divide the social product into three parts, saying that one was created by capital, another by labor, and the third by risk-taking. The very incongruity of these statements is sufficient to indicate that the term productivity, when applied to risk-taking, is used in a somewhat loose and inaccurate way. The fact is that, as we have already shown, inequalities in the degree of risk involved in different investments of capital bring about inequalities in productivity. Capital in a hazardous investment will create more product than that which is not exposed to risk. It is evidently not the risk-taking that creates the extra product, but the capital itself.

It would hardly seem worth while to insist on a point which is so nearly self-evident if there were not instances of confusion of thought resulting from the failure to make this distinction. The difficulty may be due to an unconscious attempt to think in terms of productivity and sacrifice at the same time. Risk-taking is rewarded in the same sense as abstinence, or labor, considered as a form of sacrifice; but the reward which it receives is no more created by the risk-taking than interest by abstinence, or wages by the unpleasant feelings aroused by labor. The extra reward

is created by the capital that receives it. Risk-taking is productive only in the secondary sense that it occasions the increase in the productivity of capital.

Even in this sense it is manifest that the assumption of risk is not always productive, but only when it takes place under certain conditions. That it is not productive when the risk is voluntarily and unnecessarily created, as in the case of a wager, is self-evident; for the gain to society from the assumption of a risk can never be as great as the loss due to its existence. It is only when the risk is a necessary and unavoidable incident of socially desirable economic activity that its assumption can be advantageous to society. Moreover, there is need of a still further limitation. The assumption of an economic risk is not *per se* a good thing for society. It is desirable only when the commodity whose creation involves the risk is one for which the demand is so intense that it can command a price high enough to replace all capital lost in its production, and leave a net return at least as large as the usual rate of interest.

Under these conditions it would be advantageous to society to have capital assume all risks in which the probability of gain exceeds the probability of loss. The assumption of an infinite number of such chances would result in a net gain. But we have already seen that the influence of the unwillingness of men to incur risk, and of the diminishing utility of additional increments of wealth, causes the assumption of risks by individuals to stop far short of the point of equal chances. A risk will be assumed only when the commodity created as a consequence is so important that consumers are willing to make good all losses to the capital as a whole and to give to each capitalist a special reward for incurring the risk.

A clear conception of the nature of the service that the assumption of risk within these limits performs, may be obtained by considering the loss entailed by a contraction of risk-taking. We will assume that society has reached an approximately static condition, in which the highest degree of risk involved in any form of investment of capital may be represented by 10, and the extra reward necessary to induce capitalists to incur it, by 5. Now let us imagine a slight increase in the reluctance to assume risk, so that it would require an extra reward 6 to attract capital into the

most hazardous investment, which was before assumed for the reward 5; and that the demand for the product of that industry is so inelastic that none of it will be consumed at the price necessary to yield the larger reward. That commodity would no longer be produced. The most hazardous investment now undertaken would involve a degree of uncertainty which we will represent by 8, and the necessary extra reward under the new conditions we will assume to be 4. How would society be affected by the change?

In the first place, consumers would have lost the entire product of the abandoned industries, commodities which they wanted with sufficient intensity to make them willing to pay the price necessary to yield the extra reward 5 to the capital producing them. On the other hand, the capital and labor withdrawn from the non-hazardous enterprises would have to find employment in fields already occupied. Whatever industry any of it entered would yield a larger amount of physical product than before. But the price of each commodity was already so adjusted as to furnish a market for just the amount produced and no more. To find purchasers for the new product it would be necessary to lower the price. The amount of the necessary reduction would vary in different industries according to the elasticity of the demand for the different products. In course of time a new adjustment of the productive forces would be reached, in which again the supply of the product of each industry would just suffice to meet the demand for it. But the new supplies of commodities of different kinds must be catering to wants of a lower degree of intensity than those formerly satisfied by the articles produced in the hazardous enterprises. This is proved by the fact that society was willing to give the extra reward to the capitalists who would create the latter. If the productivity of capital and labor is measured in terms of social well-being, every unit of capital and every unit of labor is now less productive than it was before. The result is a slight falling off in the incentive to productive effort. In the end there would probably be some increase in the consumption of the products of the safe investments, some diminution in the amount of capital, and some reduction in the length of the labor day. If all these things, however, were to be considered as gains, they would not be enough to offset the loss that

society would suffer through its inability to obtain the products of the hazardous industry. The social service rendered by the assumption of a risk for which society is willing to pay is the satisfaction of wants of a higher degree of intensity than would otherwise be reached. The result is an increase in the productivity of all capital and labor—that is, in their power to minister to human well-being.

So far we have been considering the productivity of risk-taking from the point of view of society. We will now consider it from the side of the risk-taker. In a static state, where production and consumption are properly correlated, every producer who carries a risk above the minimum will receive a special reward for its assumption. Competition cannot take it away from him, because no one is willing to bear the risk unless he is rewarded for doing so. It is obtained through the obstruction which the risk offers to the free flow of capital into the investment. There is less of the product of the hazardous industry created than there would be if the risk were absent. As a result the price is higher than it would be under a perfect static adjustment. Out of this abnormally high price comes the extra reward for the risk-taker.

This brings out at once the method by which the amount of this extra reward is determined. On the supposition that all the units of a commodity are produced under conditions involving the same degree of risk, and that this risk has the same influence on all investors, it is clear that the reward which may be obtained for assuming it is definitely fixed. If, for example, the risk involved is represented by 5, and the reward necessary to induce capital to incur it by 2, no one can permanently obtain a higher reward for assuming it. Capital will continue to come into the industries involving the risk, until the increase of product has lowered the price to a point where it yields the extra reward 2 and no more; and, on the other hand, the reward cannot be brought below that point, because by hypothesis no investor is willing to incur the risk for any less. The amount of the reward to be obtained by assuming any degree of risk is determined by the disutility involved in enduring the resulting uncertainty.

But it is not the fact that all units of every product are created under conditions involving the same degree of risk. The demand for some commodity may be so great that a part of the supply

has to be produced under exceptionally dangerous circumstances. The capital engaged in producing this part of it must be rewarded in proportion to the risk to which it is exposed. If all other expenses of production are everywhere equal, the necessity of paying extra for the extra risk will make this part of the supply the most expensive. The price of all units of the commodity, therefore, will be fixed at the point that will cover the expense of producing this portion of it. The capital that is exposed to a lower degree of risk in creating the same commodity will receive a larger reward than the sacrifice of its possessor calls for. This extra gain is of the kind which is commonly spoken of as rent. It naturally attaches itself to that portion of the capital which is invested in land.

Nor is it true that a given degree of risk has the same influence on all investors. For various reasons, of which we have already spoken, some men are less reluctant to incur risks than others. The reward which they will demand will be correspondingly less. Let us divide all investors into three classes, of different degrees of unwillingness to incur risk, so that for assuming the risk 5 they will respectively require the extra rewards 3, 2 and 1. If the demand for the commodities in whose production the risk 5 is involved is so great that it is necessary to use some of the capital of the most reluctant investors in producing them, it is evident that the price of the commodity will be fixed at the point that will give these investors the extra reward they demand. As the price of all units of the commodity must be the same, all capital will receive the same extra reward 3. Those investors who would be willing to incur the risk for 2 or 1 will receive a larger reward than is made necessary by their individual sacrifice. This extra gain might be called a risk-taker's surplus. It is one form of the producer's surplus, of which Professor Marshall speaks.[1]

Making allowance for these inequalities in the degree of risk

[1] It hardly needs to be mentioned that we can speak of such a surplus only when comparison is made with the sacrifice of the individual investor. According to the productivity theory capital is rewarded in proportion to the product it creates, and not in proportion to the sacrifice of its owner. Capital that is equally productive receives the same reward. The impossibility of correlating individual rewards with individual sacrifices is the rock on which any sacrifice theory of distribution goes to pieces. The recognition of the existence of the so-called producer's surplus is a virtual abandonment of the whole position.

and in reluctance to incur risk, we shall have to modify our statement of the law which regulates the amount of the reward for risk-taking. That reward will be fixed at the point which will make the most reluctant investor whose capital is needed willing to incur the highest degree of risk involved in the creation of any part of the product for which consumers are willing to pay. There is a margin of risk-taking, just as there is a margin of labor or of abstinence; and in the case of any given degree of risk, it is the marginal risk-taker whose reluctance fixes the amount of reward which is obtained for assuming it.

It may be well to bring out more clearly than we have yet done the exact nature of the net reward for risk-taking. It is not always easy to distinguish between the effect of the assumption of risk and the effect of accidental gains and losses. The statement that the assumption of risk yields a special reward is not intended to imply that every risk-taker will be better off at the end of a year, or even at the end of a number of years, than he was when he put his capital into the hazardous investment. I do not refer now to the loss he may suffer on account of having underestimated the chances of failure or the possibility of disaster. Even though all risks could be and were accurately estimated, it is evident that all persons who assumed them could not fare alike. Some of the possible loss would be realized and some would not. One person might suffer early and seriously, while another might escape for a number of years. Uncertainty as to the amount of loss which each investor will actually suffer is an essential element of the risk. Without the possibility of varying results for different investors there would be no question of risk to consider. If the different men formed the same estimate of the risk they were assuming, they would naturally make the same preparations to meet the accidental loss. The one who was early overtaken by it might reach the end of a period of years far worse off than he would have been if he had confined himself to safe investments. The one who went through unscathed would, on the other hand, be far better off. The important point to notice is that the reward for risk-taking is obtained by both the fortunate and the unfortunate investor, although its amount cannot be determined directly from the results of the two investments. The man who has suffered the loss whose possible occurrence was foreseen is better

off than he would have been if his capital had not been abnormally productive; and the man who anticipated the possible occurrence of a loss which he did not suffer is also better off on account of the abnormal productivity of his capital. The reward for risk-taking could be identified only in the case of an investor who suffered just such an amount of loss as past experience had shown might on the average be expected. The return which such an investor would realize from the use of his capital would exceed pure interest, or the return in safe investments, by a certain amount, which would be the net reward for assuming the risk. As it is the degree of uncertainty which determines the unwillingness of investors to enter the industry, this net reward would vary according to the previous uncertainty as to the probable variation of the actual loss from the average.[2]

Additional light may be shed upon this point by a consideration of the way in which the extra reward for assuming risk is obtained. Let us consider the conduct of a person who is planning to use his capital in a more or less hazardous employment. He has to look forward to two kinds of losses. In the first place he will have to meet certain definite expenses involved in replacing various capital goods as they are used up in the process of production. For this purpose he will accumulate what is called an amortization fund. In the second place he will expect to suffer some loss through the occurrence of the events whose possibility constitutes the risk of the investment. His accumulation for this purpose is commonly spoken of as his insurance fund. In considering the advisability of making the investment, he will allow for both these forms of loss, and his decision will depend upon

[2] Marshall recognizes the existence of this net premium for risk-taking: "As a rule, a person will not enter on a risky business unless, other things being equal, he expects to gain from it more than he would in other trades open to him, after his probable losses had been deducted from his probable gains on a fair actuarial estimate." (Alfred Marshall, *Principles of Economics*, 3d ed., p. 693.)

Pantaleoni, on the contrary, apparently overlooks it: "Mere compensation, however, for the risk of an undertaking cannot constitute a *normal source of rent;* for if this compensation has been estimated strictly in proportion to the risk, it must, on an average for a number of years, be exactly equivalent to the latter, so that the net rent left would be equal to zero; whilst, on the other hand, if the compensation is not commensurate with the risk, it is anti-hedonic in its origin, the disproportion being due to ignorance as to the frequency and magnitude of the risk." (Maffeo Pantaleoni, *Pure Economics*, translated by T. B. Bruce. London, 1898, p. 279.)

the amount of the net return which he may hope to realize. He will embark in the industry only on the condition that the price of the product is high enough to enable him to accumulate these two funds and to obtain in addition the usual reward for the use of his capital.

Now it is clear that the amounts of the two funds cannot be determined in exactly the same way. To meet definitely foreseen losses he can obtain no more than just enough to cover them. If he were seeking a larger return, other capital would come in, and the price of the product would fall. The size of the insurance fund, however, cannot be determined by the amount of the actual loss, since it is about the amount of loss that will be suffered that the uncertainty exists. If the attempt were made to secure enough to cover all possible loss, it is clear that other capital would come in and accept a somewhat smaller return, on the chance that the possible loss might not be realized. But it is equally clear that the influx of new capital will cease before the price of the product has been brought so low that the insurance fund is reduced to the amount of the average loss. The amount of the net reward for risk-taking will be determined by the relation between the size of the insurance fund which can be accumulated, after the competition of different investors has reduced it to a minimum, and the amount of accidental loss which is expected to occur. According to the principles which we have sought to establish, the influx of new capital will cease while the price of the product enables investors to accumulate such a fund in excess of the probable amount of accidental loss; and the amount of this extra accumulation will be the greater, the more the uncertainty as to the variation of the actual loss from the average. If we assume that in a series of years the losses which an investor suffers just equal the amount which previous experience had shown to be the average, he will be left at the end of the period with a net gain, which is his reward for assuming risk.

One other point remains to be noticed. In speaking of the difference between the amortization fund and the insurance fund, the assumption was made for the purpose of convenience that it was possible to distinguish between the certain and the uncertain loss by some external characteristic, such as the source of the loss or the form in which it occurs. The real distinction, however,

lies in the element of uncertainty itself, and nowhere else. Preparation for any kind of certain loss is made by means of the amortization fund; preparation for any kind of uncertain loss by the insurance fund. Let us illustrate this point with an example.

In certain industries capital has to lie idle during part of the year. The idleness in itself causes a loss. To make up for it, the capital will have to be abnormally productive during the months in which it is active. If the period of idleness is the same every year, so that its duration and the consequent loss can be definitely foreseen, the amount of the accumulation to meet the loss will also be fixed; and, in the absence of other disturbing forces, it will be fixed at the amount of the foreseen loss. If, however, there is uncertainty about the duration of the idleness, there will be the same uncertainty about the amount of accumulation which will be necessary to cover the loss; and in determining its size, allowance will be made for the possibility that the actual loss may exceed the average. In the former case we have an amortization fund, and in the latter an insurance fund. Finally, if a certain minimum of loss can be foreseen, and the only uncertainty concerns the extent to which the actual loss may exceed the minimum, the accumulation to meet the certain part of it will be of the former kind, and that to meet the uncertain part, of the latter.

The definiteness which the application of this principle gives to the significance of the term insurance is evidently not in accord with the ordinary commercial usage of the word. I shall refer to that point again when I come to speak more at length of insurance as an economic institution. Moreover, it is not claimed that investors in all cases actually go through the calculations involved in the two ways of making accumulations. There is usually no literal separation of the amortization fund from the insurance fund. It is the general result of an investment by which the conduct of men is influenced. Even in those cases in which a definite sum is set aside to meet some special form of accidental loss, while this accumulation is usually spoken of as an insurance fund, it is not customary to make any distinction between the part which is to replace the minimum of loss that is certain to occur, and that for the additional possible loss, whose occurrence is uncertain. The so-called insurance fund is very apt to include

the accumulation to meet all the loss of a certain kind, whether or not its occurrence can be definitely foreseen. Still the fact remains that the competition of investors with one another will force down the amount of the possible accumulations to the point where it will equal the amount of the certain loss of all kinds, plus the average amount of the uncertain loss, plus an additional increment, the size of which will depend on the degree of uncertainty as to the actual amount of the uncertain loss, and will be in no way affected by the amount of the certain loss.

The conclusions that we have reached in the present chapter may be briefly summarized as follows: Risk-taking is productive only in a secondary sense; it increases the productivity of capital. The person who assumes a risk under the right economic conditions receives a special reward. The amount of the reward depends on the degree of risk and on the unwillingness of men to incur it. The reward is obtained through the accumulation of a fund to meet future losses. For those losses whose occurrence can be foreseen an amortization fund is accumulated. Its size is fixed by competition at the amount of the foreseen loss. For those losses whose occurrence is uncertain an insurance fund is accumulated. Its size exceeds the probable amount of loss as determined from past experience. The excess varies with the degree of uncertainty about the amount of loss that will be suffered. This extra accumulation is the reward for risk-taking.

CHAPTER V

THE REWARD FOR RISK-TAKING

In our discussion hitherto we have as far as possible avoided the use of language which involved a prejudgment as to the economic character of the reward for risk-taking. It is now time to turn our attention to the consideration of this phase of the question. We shall seek to determine under which of the categories of distribution the reward for assuming risk falls. Incidentally we shall have to notice one or two of the attempts that have been made to identify this peculiar reward with the income of the entrepreneur. In conclusion, we shall consider the advisability of adopting the suggestion that the reward for risk-taking be made an independent category of distribution, coördinate with wages, interest and profit.

It seems to be a self-evident proposition that no one can assume a risk in economic affairs unless he has something to lose. As it is capital that is exposed to danger, it would seem that it must be the owner of the capital, that is, the capitalist, who assumes the possibility of loss. A society in which one class of people owned the capital, and another class enjoyed the unrestricted privilege of exposing it to risk, would soon suffer economic shipwreck. It is the possessor of capital who is interested in its safety, and he seeks to protect it by demanding for its use a return commensurate with the chance of loss to which it is exposed. In just what sense a man can be said to run a risk of loss, who has nothing to start with, and who, therefore, cannot fail to come out from his venture at least as well off as he went in, it is not easy to understand. Only those who have capital can suffer the loss of capital. Therefore, it is they alone who can expose themselves to the chance of loss. Unless, then, we are to limit the term capitalist to those who use their capital in ways involving no more than the minimum amount of risk, the conclusion is unavoidable that

the one who assumes a risk to capital is in all cases a capitalist.

It is nearly as self-evident that under normal conditions the person who assumes a risk is the one who will receive the special reward. By what inter-play of economic motives would a capitalist be led to take upon himself the disutility involved in subjecting himself to uncertainty, while surrendering to another the right to the extra product created by his capital because of the uncertainty? No one need expose his capital to more than the minimum degree of risk unless he receives more than the minimum reward for the use of it; therefore, if the economic motive prevails, the assumption of risk and the receipt of the reward for it will be acts of one and the same person. As it is the capitalist who assumes the risk, it is the capitalist who will normally receive the award for risk-taking.

The same fact may be shown more directly by considering the source of the net reward. The attempt has been made in the preceding chapters to prove that the reward for risk-taking is created by the capital exposed to the risk. In a static state every unit of capital will obtain as its reward the part of the product that is specifically imputable to it. Therefore, the owner of the capital that is abnormally productive on account of the risk to which it is exposed will receive the extra product. To claim that this extra product may normally accrue to some one other than the owner of the capital that created it, is to adopt a system of distribution under which some men are able regularly to appropriate wealth created by the capital of others. Such a view is irreconcilable with a productivity theory of distribution, which gives to every agent the product that it creates. It is in this case equally irreconcilable with a sacrifice theory of distribution, since the entire burden of the disutility of risk-taking must evidently be borne by the person who is actually exposed to the possibility of loss.

The net return to capital from a productive operation is economic interest. It is the part of the net product that is created by the capital. It is customary, however, to make a distinction between the product of capital in an industry where competition prevails, and its product in an industry where the capitalist possesses a monopoly advantage. In the latter case, a part of its

product is called a monopoly gain, or a monopoly profit. But the difference between the return to capital in the competitive industry and its return in the monopolized one is not a difference in kind. In both cases it receives the part of the product that it creates. It is entirely a question of convenience whether we shall say that the rates of interest are unequal in the two industries, or that the rates of interest are the same and the extra reward is a monopoly profit. In every instance of an abnormally high interest rate, the excess is due to the possession of a monopoly advantage by the owner of the capital. It is important, however, to distinguish between two kinds of monopoly. There is one kind that is founded in the nature of things and another that is artifically created. The capitalist who exposes his capital to risk has a quasi monopoly advantage of the former kind. The obstruction that prevents the free flow of capital into a hazardous investment is not maintained by the owner of the capital already in it. The monopoly is due to the unwillingness of other capitalists to enter the industry. Its effect, unlike that of permanent artificial monopolies, is to promote the best use of capital under existing conditions. The amount of the reward for risk-taking is determined by direct competition, while monopoly profit is determined by the principle of the maximum net revenue.

In the case of capital in hazardous investments, however, as in the case of a true capitalistic monopoly, it is a matter of convenience whether we shall give the name interest to the entire net return to capital, or divide it into two parts and call one pure interest, and the other reward for risk-taking. The important point to notice is that there is no difference in nature between the two incomes. Both are created by capital, and both accrue to the capitalist, and the amount of both is determined on competitive principles. This fundamental unity in the nature of the two incomes seems to be better brought out by applying the term interest to both. We should say, then, that under the influence of risk, capital will be so apportioned in a static state that the rate of interest in different investments will vary with the degree of uncertainty involved in them. In this interest may be distinguished two elements, pure interest, equal in amount to

the return to capital in the least hazardous investments,[1] and the reward for risk-taking, the additional return which capital in a more hazardous investment receives.[2]

It is not unusual to divide the gross return to capital, over and above the amount necessary to make good the part regularly used up in productive operations, into pure interest and insurance premium. Here, as before, pure interest is the return to capital in safe investments, but the so-called insurance premium is by no means the same thing as the net reward for risk-taking. The purpose of the insurance premium is the replacement of capital accidentally destroyed. It does not, as a whole, form a part of the net interest on capital. Out of the insurance fund are to be paid all the losses of an uncertain character. Whether the fund will exceed or fall short of the amount necessary to make good the losses cannot be known beforehand, but, as we have already shown, every capitalist will require a large enough gross return on his capital to enable him to set aside an insurance fund in excess of the probable amount of loss as determined by the average of past experience. This excess constitutes the net reward for risk-taking. So, in the case of commercial loans on doubtful security, it would be a mistake to regard the entire excess above the rate on government bonds as net reward for assuming risk. In the absence of other disturbing influences, the reward for risk-taking is the part of the extra return which would be left after deducting an amount large enough to cover the probable loss. It is a matter of common observation that inexperienced investors are apt to be unduly influenced by the apparently high rate of

[1] It may be well to state that all disturbing forces except risk, such as social esteem and difficulty of realizing on an investment, are here left out of consideration. The assumption is that there exists a perfect static adjustment of capital, except for the influence of risk.

It is also necessary to bear in mind the distinction between the capitalistic monopoly mentioned above, in which the possessor of the capital receives the extra product, and an entrepreneur's monopoly, as in the case of the ownership of a patent right, in which the entrepreneur obtains his capital at the market rate and appropriates the extra product.

[2] *Pure* interest, as thus defined, is not to be confounded with *normal*, or *static* interest. The latter is the reward that capital would receive if it were so apportioned that all units of it were equally productive. Pure interest is the reward received in safe investments under an apportionment of capital in which the productivity varies with the uncertainty. Pure interest, therefore, will always be below the static level.

interest in unsafe investments. They do not make sufficient allowance for the losses, the possibility of which is the cause of the high nominal interest. It may be, therefore, that the net return on investments of this kind is below rather than above the return in safe investments. This fact, however, constitutes no exception to the general rule that when risks are properly estimated and appreciated, the net rate of interest will vary in different investments according to the risk involved in them.

That the reward for risk-taking is created by capital and is, therefore, an element of interest, would probably never have been questioned but for the confusion that has resulted from attributing a very complex form of activity to the entrepreneur. It may be worth while to take up directly the question of the relation of the income of the entrepreneur to the reward for risk-taking.

The income of the entrepreneur is called profit. In what sense the term profit must be understood, in order that it may denote an income of a different nature from wages and interest, has been pointed out in the Introduction. In only one respect does it resemble the reward for risk-taking. Both incomes are due to abnormally high productivity in some part of the industrial system—both are quasi monopoly gains. The monopoly advantages in the two cases, however, are not of the same kind. Profit is due to a local and, in a sense, unnatural advantage, which is transient in its character, since it can endure only so long as others are prevented from making use of the device which is the source of the superiority. The reward for risk-taking is due to an advantage the existence of which is founded in the nature of man, and which will endure so long as man's unwillingness to incur risk remains unchanged. Competition will sooner or later annihilate all profit, but it cannot abolish the reward for risk-taking. Profit is a dynamic income; it appears as the result of a dynamic change, and disappears when the inequality in productivity due to the change has induced sufficient movement of capital and labor from group to group. Reward for risk-taking is a static income; it will be present in the approximate static state which alone can be realized while risk exists; other capital will not flow in to cut down the reward to the capital already receiving it, since without the full reward no capital will assume

the risk. Profit is a residual income, realized by the sale of the product at a price above the cost of production, and its amount, therefore, cannot be determined until the price is known; reward for risk-taking is a direct income, whose amount is determined by circumstances preceding the sale of the product, just as wages and interest are determined. Reward for risk-taking is a part of the cost of production; profit is the surplus over and above the cost of production.

The attempt to identify the reward for risk-taking with profit runs counter to the obvious fact that there is no uniform relation between the amount of profit and the degree of risk. A large profit may be obtained under conditions involving little or no risk. The gain from the introduction of an improved method of manufacture may be manifest as soon as the improvement is thought of; and the adoption of the new device, while involving no risk, may lead to the appearance of a considerable profit. On the other hand, risk may perfectly well be involved in a form of investment in which no profit is appearing. The manufacture of explosives is an industry in which a fluctuating amount of accidental loss will always be suffered; but in the absence of dynamic changes the possibility of obtaining a profit in that industry would not exist. Indeed, in a dynamic society a profit may be obtained by adopting an improvement whose only purpose is to lessen the chance of uncertain loss, and thus reduce the risk. Such a profit is not the reward for risk-taking, but the result of abolishing risk. Like all other profit it is transient, and will disappear as soon as the improvement has been generally adopted. It is manifest, therefore, that there is no necessary connection between degree of risk and amount of profit.

It has been said that just because profit is a residual income it is an uncertain one, and that it is for the endurance of this uncertainty that the entrepreneur receives his reward. The first statement is obviously not true. As I have already shown, an income is not necessarily uncertain because it is residual. But if that difficulty is overlooked, it is not easy to understand the rest of the statement. We are asked to think of profit as a reward paid to a person for assuming a risk of obtaining no profit. Why should a reward be paid for assuming a risk of which the outcome must be either a gain or no loss? Clearly the incurring of such a risk

involves no disutility, and therefore no special inducement is required to assure its assumption. Moreover, even if such a notion were conceivable, it would still be necessary to show a constant relation between the degree of uncertainty as to whether a profit will appear and the size of the profit; and that is as impossible as it is to prove such a relation between profit and risk as ordinarily understood.

The fact that reward for risk-taking is no part of profit, the income of the entrepreneur, may be proved also from the method in which an industry is established. Let us for the sake of simplicity assume an organization of society in which capitalists and entrepreneurs are distinct persons, and in which the entrepreneur performs the organizing and directing work. The capitalists furnish the capital used in the productive operation and receive in return interest, the rate of which is fixed in advance; the entrepreneurs direct and manage the industry, hire the capital and labor, pay all the expenses of production, and receive as their special reward any profit that may be realized. Under such circumstances, will it be the capitalist or the entrepreneur who will obtain the reward for assuming risk?

There are only two ways in which the entrepreneur can realize a net gain because of the existence of risk. He must be able either to obtain his capital at a rate that does not include the reward for assuming risk, or to sell his product at a price higher than is necessary to enable him to pay the reward for risk-taking. Is it possible for him to adopt either of these plans?

As the entrepreneur has no capital to act as a guarantee fund for the capitalist, it is evident that the latter must look to the success of the enterprise for the safety of both principal and interest. He will calculate the risk of loss that he is assuming, and will demand a return in proportion to it. Now the reason why he is able to obtain pure interest on his capital in a safe investment is that the entrepreneur can obtain capital from no one else without paying the interest. Why, then, should he forego the extra reward for risk-taking in a hazardous investment when the entrepreneur must pay the extra reward to any other investor whose capital he may seek to obtain? No economic motive for such conduct can be conceived. The entrepreneur will have to pay for his capital a price proportionate to the risk to which it is

to be exposed. Moreover, as we shall see, if capitalists did not demand the extra reward, entrepreneurs would be unable to appropriate any part of it as their own income.

Mangoldt and others have attempted to divide the reward for risk-taking into two parts, and to assign one part to the capitalist and the other to the entrepreneur. A special kind of risk, called by some economic, by others industrial, is said to be assumed by the entrepreneur, and the reward for assuming such risks is either identified with profit or considered to be a part of it. But it seems clear that there can be no ground for such a distinction, on our assumption of a complete separation of the functions of entrepreneur and capitalist. As the entrepreneur has nothing to lose, it is impossible for him to assume a risk of any kind; and as the capitalist bears the entire risk, there is no reason why he should be any more willing to suffer loss in one way than in another. It is all one to him whether he loses his capital through a technical failure or an industrial one. It is not reasonable to suppose that he would demand a consideration for assuming the risk of loss in one way and gratuitously assume a risk of another kind. Finally, if all capitalists did act in that uneconomic way, it would be impossible, as I shall show presently, for the entrepreneur to obtain any extra gain on account of the industrial risk.

It seems clear, then, that as no capitalist will incur a risk of any kind unless he is rewarded for it, no entrepreneur can obtain capital without paying a price proportionate to the risk to which it is to be exposed. Does the existence of risk make it any more possible for him to obtain a price for his product that will leave him a net gain? In the long run the price he can get is determined by the expense of production. Only when he is obtaining a higher price is he realizing a profit. The existence of such a profit in any part of the industrial system is an invitation to other entrepreneurs to come in and share it. If, then, we assume that an entrepreneur who is using capital in a hazardous industry is obtaining a price for his product that leaves him a net profit after paying for his labor and capital, with the reward for risk-taking included, it is clear that such a profit would soon be annihilated by the competition of other entrepreneurs.

The same thing would happen to the extra gain that an entrepreneur would realize if capitalists as a class should suddenly

become willing to forego the reward for assuming either all kinds of risk or a special kind. The necessity of exposing capital to the chance of loss can have no terrors for the entrepreneur, since the loss will not fall upon him, but upon the capitalist. If, then, all capitalists consent to assume risks for nothing, all entrepreneurs will be able to obtain capital for purposes involving risks at a lower rate than they formerly paid; and the competition of entrepreneurs with one another will prevent any one of them from keeping the price of the product above the level that his reduced expense justifies. If capitalists incur risks without any extra inducement, it will be consumers, and not entrepreneurs, who will benefit by their forbearance.

For the entrepreneur the reward for risk-taking is an element in the cost of production. The price of a commodity in whose creation risk is involved is higher than it would be if the risk were absent. The gross return to the entrepreneur is greater. The entire excess, however, due to the existence of risk, he has to hand over to the capitalist; for the amount of the extra return that he can secure on account of the risk is fixed by the extra interest that he is compelled to pay for his capital.

The most consistent attempt that has been made to identify entrepreneur's profit with the reward for risk-taking is that of Mr. Hawley.[3] Many of the arguments with which he defends his position have been considered in the comparison already made between the two forms of income; but there is at the basis of his contention a misconception concerning the significance of the term productivity as applied to the assumption of risk, to which it may be well to devote a little attention. It is most clearly brought out in the following passages. Professor Clark, he says, "acknowledging that the reward of risk-carrying exists and has hitherto escaped recognition, and that it constitutes a peculiar form of income, . . . refuses to accompany me in identifying it with profit, and claims that the reward of enterprise inures to the capitalist as such, and not to the entrepreneur as such, thus making the capitalist unique among producers, in that he alone enjoys two quite distinct forms of income, the one springing from the use and the other from the venturing of the capital, but

[3] Frederick G. Hawley: "The Risk Theory of Profit," *Quarterly Journal of Economics*, vol. vii, p. 459.

both accruing to him in his peculiar industrial function." "It is not of course impossible," he continues, "that the exercise of a single function may be followed by two *radically* distinct classes of results. But it appears to me as an axiom of scientific method, that two *radically* distinct classes of results shall not be ascribed to the same function as their source." And yet again: "According to Professor Clark, if I rightly comprehend him, we have in economics a problem of four forces, producing five distinct classes of results—land yielding rent, labor yielding wages, capital yielding interest and reward for risk, and coördination (if he will allow me to so name the force) yielding profit."

In spite of the ambiguity involved in Mr. Hawley's use of the term "enterprise" to denote the activity of the entrepreneur, we seem to be justified in inferring that according to his idea it is by virtue of his assumption of risk that the entrepreneur obtains a profit, and that the reason for distinguishing the reward for risk-taking from interest, and assigning it to a separate productive agent, is to be found in the necessity of assuming distinct functions as the sources of "*radically* distinct classes of results." Now it may be "an axiom of scientific method that two *radically* distinct classes of results shall not be ascribed to the same function as their source," but the principle has no application in the present case. There is no such difference in the natures of the two incomes, interest and reward for risk-taking, as Mr. Hawley seems to imagine. I have already shown that risk-taking is productive only in a secondary sense; it increases the productivity of capital. Capital creates the reward for risk-taking, and receives it as a part of its net income. It receives a higher rate of interest in a hazardous investment than in a safe one, but the additional return differs in no essential respect from the minimum return, to which the term pure interest is applied.

Mr. Hawley proposes to put in a separate category of distribution the excess of interest that capital receives as the result of assuming risk. If he should follow his method of analysis to its logical conclusion, he would have to treat in the same way every other excessive increment in the return to capital. Risk is not the only thing that prevents the static apportionment of capital. Social odium, for example, may have the same result. If the investment of capital in any kind of business brings with it

loss of public esteem, an abnormally high return will be necessary to induce capital to enter it. The marginal productivity of capital in the industry will be above the static level, and the rate of interest will be correspondingly high. But Mr. Hawley would hardly be willing to carry out the principle he has laid down and regard the incurring of social odium as a separate economic function, creating and receiving a radically distinct share of product. There is no more reason for making such a distinction in the case of the abnormally high interest that capital receives as a reward for incurring risk.[4]

We have seen that the attempt to identify reward for risk-taking with entrepreneur's profit is based on a misconception of the nature of the two incomes, and that the recognition of this reward as a separate category of distribution cannot be justified on the ground that the reward is created by a distinct economic agent. But the suggestion has been made[5] that it might be well for other reasons to give that form of income an independent place in the scheme of distribution. Without stopping to consider the arguments that have been advanced in favor of such a course, I may mention two or three that seem to me to be conclusive against it.

If the new category were to include the extra reward that labor sometimes obtains in dangerous occupations, as well as the extra reward of capital, it would be found impossible to make much practical use of it, on account of the different principles by which the two rewards are determined. Moreover the inclusion of a part of wages and a part of interest in one group would cut across the classes already recognized, and seriously impair the significance of the classification.

If, on the other hand, it is proposed to have the new category include only the extra reward that accrues to capital on account of risk, the objections to the plan are no less weighty. In the first place it is inexpedient. It places the emphasis on the points of unlikeness between pure interest and the reward for risk-taking, when it is more important to bring out their essential likeness.

[4] Mr. Hawley's classification of incomes fails to make any disposition of profit, as the term is here used. It is not a part of wages or of interest, and if the preceding argument is sound, it by no means corresponds to the reward for risk-taking.

[5] T. N. Carver, "The Place of Abstinence in the Theory of Interest," *Quarterly Journal of Economics*, vol. viii, p. 58, note.

Clear economic thinking will be promoted by establishing the distinction between the reward for risk-taking and profit, and in no way can that be better accomplished than by showing the identity of the former income with interest. In the second place it is unscientific. It completely destroys the coördination of the classification. To divide incomes into profit, wages, interest, and the reward for risk-taking, is much like dividing material bodies into inanimate objects, plants, animals, and men. There are reasons why it is important to distinguish the reward for risk-taking from other interest, just as there are reasons for distinguishing men from other animals; but to make a separate and distinct class out of a subdivision of a class already recognized is to do violence to scientific method.

Wages, interest and profit are independent, exhaustive, and mutually exclusive forms of income. Reward for risk-taking may be a part of wages or it may be a part of interest; it has no independent standing, and therefore it has no claim to rank as a coördinate category of distribution. It is best to abide by the existing classification of incomes, and to think of rates of wages or of interest as varying in different employments under the influence of risk.

In the present chapter we have attempted to show that the reward for risk-taking is neither the whole nor any part of profit, and therefore does not accrue to the entrepreneur; that it is a part of interest and accrues in all cases to the capitalist; and that it is inexpedient and unscientific to make it an independent category of distribution, coördinate with wages, interest and profit.

CHAPTER VI

WAYS OF MEETING RISK

Up to this point in our discussion we have proceeded as if the degree of risk involved in any enterprise were an unchangeable quantity, which the investor must in all cases assume if he decides to enter the industry. As a matter of fact, however, the degree of risk may be changed by the conduct of the investor himself. The adoption of devices for lessening the chances of accidental loss, and for diminishing the unfavorable influence of uncertainty, is one of the most important forms of progress in a dynamic society How much risk would be involved in different industries in the approximate static state, and how much deterrent effect a given degree of risk would have on investors of capital, would depend on the stage of economic development that the society had reached before dynamic changes ceased. We must now turn our attention to a consideration of the devices that have been adopted by society to counteract the unfavorable influence of risk. Some of these may be carried out by an individual investor; others require the combined action of two or more men, and are therefore of a social nature. We will begin with those that do not require social cooperation.

A man living in isolation may carry on certain productive operations and accumulate a limited stock of capital goods. Let us imagine that he has cleared a piece of land and fashioned tools with which to work it. On half of the land he is able to raise all of some crop, as potatoes, that he cares for; he is considering whether he shall raise corn or tobacco on the other half. The circumstances on which his decision depends are these: He would much rather have a crop of tobacco than a crop of corn; the cost in labor and in wear and tear of his capital is the same in the two cases, if he cultivates the tobacco in the easiest way; but there is considerably more uncertainty about the size of the tobacco crop than about that of the corn crop. Under such condi-

tions it is evident that his choice between tobacco and corn will depend on the relation between the excess of the utility of the tobacco over that of the corn, and the disutility of the uncertainty about the amount of tobacco he will obtain.

It may be that the uncertainty in the case of the tobacco can be diminished by a change in the method of cultivation. Let us suppose that it is due to the occasional failure of a crop on account of prolonged drought. It may be possible to adopt measures to guard against the loss. If the tobacco is to be raised, any change in the method of cultivation that lessens the chance of loss without increasing the cost in labor and capital will evidently be adopted. If the tobacco would suffer less on that part of the land where the potatoes had been raised, while the latter would do as well on one part as on the other, the change of location of the two crops would certainly be made. If, on the other hand, the method of counteracting the effect of the drought involved additional cost, the decision as to the advisability of adopting it would not be so easy to reach. It might be possible by a system of irrigation to lessen or even to annihilate the danger of loss from drought; but the introduction of such a system would involve more or less additional cost. On what principle would the choice be made between the two possible methods of cultivation? It would evidently be by a comparison of disutilities. The disutility of the additional sacrifice incidental to the introduction of the system of irrigation would be set over against the disutility of the uncertainty involved in raising the tobacco without artificial irrigation. If the former were less than the latter, irrigation would be adopted; if it were greater, the danger of accidental loss would be borne.

A man in isolation, then, face to face with unequal degrees of risk involved in different ways of using his capital and labor, is restricted to three possible modes of conduct. He may avoid the uncertainty peculiar to a specific form of industrial activity by keeping out of the industry; he may reduce the degree of uncertainty by adopting devices that make the occurrence of the loss less probable; or he may assume the risk and endure the attendant uncertainty. The first form of activity may be called avoidance of risk, the second, prevention, and the last, assumption. It is possible to combine the second and third methods by

partially eliminating the risk through preventive measures and assuming the rest of it. The choice between different possible modes of action will be determined by a comparison of the disutilities involved in going without the product of the hazardous industry, in using the additional labor and capital necessary to reduce the risk, and in enduring the uncertainty incidental to the creation of the product.

A man living in society has the same opportunity of making a selection between the three ways of meeting risk, and his choice is determined by a similar comparison of utilities and disutilities. These, however, are not of precisely the same nature as those which the man in isolation compares. The commodities created by different producers are not intended for the immediate satisfaction of the wants of those who create them; they are produced for exchange. It is no longer possible, therefore, for the person who produces a commodity to make a direct comparison between its utility to the consumer of it and the disutility involved in creating it. Confining our attention now to the risks incurred in the employment of capital, let us see in what way the utilities in question are determined.

The choice between safe and unsafe investments turns on the relative risks and rates of interest in the two investments and on the unwillingness of the investor to incur risk. If the extra return to be expected in the unsafe investment is large enough to offset the reluctance of the investor to incur the risk, he will choose that investment. He compares the utility of the probable increase in income with the disutility of the uncertainty.

We have already noted that the reluctance to incur risk is not the same in all men. This fact has an important influence upon the assumption of risk in a catallactic society. Those who are most unwilling to take any chances naturally seek the safest investments, and those whose reluctance is least find their advantage in entering hazardous industries. The utility of the additional gain to be realized in such investments more than offsets for them the disutility of the uncertainty. If there were enough investors of all degress of unwillingness, so that the unwillingness always varied inversely as the risk, the entire cost of inequalities in risk would be annihilated. But evidently such is not the case. There is a disproportionate amount of capital in safe investments. It

is true, however, that on account of this adaptation of investors to risks, the reward to be obtained for assuming risk does not always increase in proportion to the risk. The selection of the more hazardous investments by those who are least reluctant to assume risk reduces the net cost of risk to society.

The choice between a safe and an unsafe investment, then, is determined by the subjective estimates put by the investor upon the utility of the increased income in the hazardous investment and the disutility of the uncertainty. As the decision thus depends upon subjective factors, it is impossible to prophesy how any particular investor will act. The choice between different methods of carrying on an industry, that is, the question as to the adoption of any preventive measure, is determined in the first instance in much the same way. Comparison is made between the disutility involved in investing the additional capital necessary to introduce the preventive measure, and the disutility of the greater uncertainty if such a measure is not introduced. But here it is evident that the choice is not left entirely at the discretion of the investor. It is only when the interest on the capital required to introduce the preventive measure just equals the extra price necessary to bring about the assumption of the risk if the preventive measure is not introduced, that it is optional with an entrepreneur which method he shall adopt. If one method makes it possible to produce a commodity with less expense than the other involves, that method, in the absence of disturbing influences, will finally become universal. Therefore in the end it is by a comparison of the relative expenses that the choice between the different methods will be determined. All preventive measures will be adopted that do not involve as much expense as would be incurred on account of the necessity of paying capital for the assumption of the risk that the measures are intended to annihilate.

It is easy to see that in a dynamic society the possibility of realizing a profit by first using a preventive device that reduces expense is a great incentive to progress in the technique of production. It would be a mistake, however, to suppose that progress must always be in the direction of reducing risk. The reward for risk-taking is only one element in the cost of production. If the adoption of a more uncertain method of creating a commodity

made possible a considerable reduction in the amount of the capital and labor employed, it might cause the appearance of a profit. There would be less danger of destruction of property if the speed of trains were limited to ten miles an hour. The gain in other directions from the increased speed, however, more than counterbalances the effect of the greater uncertainty about the amount of loss. Whenever the additional expense caused by the increase in uncertainty is less than the saving due to the increased productivity of labor and capital, a profit may be realized by inaugurating the more uncertain method of production.

A person living in a society where production is carried on for the purpose of exchange, and where all sorts of personal relationships are established, is exposed to different risks from those which threaten a man in isolation. Some forms of static risk are reduced through the existence of society; others are greatly increased; while all those connected with the relations established between different men exist only in society. Special social institutions, such as the credit system, introduce many peculiar chances of loss and greatly increase the uncertainty of economic life. Dynamic risks are even more affected. A man living in isolation, producing solely for his own consumption, is not entirely free from risk of this kind. There may be a change in his disposition so that he ceases to care for a commodity of which he has accumulated a store; or he may make a discovery or an invention which renders useless a capital good that he has created. One who is producing commodities for exchange, however, is evidently subjected to far greater chances of dynamic loss. It may befall him on account of his failure to anticipate changes in the wants of distant consumers; or it may be due to an invention made by any one of a thousand competing producers. Another form of dynamic risk appears only in society, namely, uncertainty as to the action of governments on such questions as taxation, franchises, property rights, and the like. While, therefore, it is undoubtedly true that what may be called *natural* risk, uncertainty connected with the direct relations between man and nature, is much reduced by the development of a social state, society brings with itself a large class of distinctly *social* risks, resulting from the relations established between different human beings, which far exceed in number and variety the risks of the isolated state.

On the other hand, society does much to assist the individual in warding off many forms of loss. Armies and navies, judges, magistrates, sheriffs, and policemen are supported largely for the purpose of preventing loss through violence or fraud. Information of various kinds is collected and disseminated by the government to assist its citizens in forming correct judgments as to the future movements of prices. There is a cordon of life-saving stations to lessen the dangers of the sea, and a weather bureau to give warning of the approach of unfavorable climatic conditions. Cities and towns support fire services to reduce the danger of conflagrations and to limit their destructiveness. Education is intended to increase honesty and carefulness as well as knowledge and ability.

The state goes even further than this. It compels its citizens to do some things and to refrain from doing others, when such regulations are necessary to protect other persons from the chance of loss. A man having knowledge of an intended robbery must give warning to the proper authorities; within specific limits no one is allowed to erect a wooden building; the manufacture and storage of explosives in thickly settled communities is frequently restricted. In many ways the freedom of the citizen is limited for the purpose of warding off injury to the property of others.

It is not alone through its official organs that society seeks to guard the security of its members. The same object is sought through voluntary associations of many varieties. There are combinations of manufacturers, wholesale dealers, retailers, real-estate owners, bankers, members of professions and of trades, inhabitants of sections of cities or of county districts, and countless others, that exist, wholly or in part, to protect those who belong to them from various kinds of loss. Finally, other forms of preventive activity are carried on by individuals for the purpose of private gain. A trade journal is partly supported by those who wish to reach correct judgments about existing industrial conditions by means of the information the paper contains, and thus lessen the danger of mistakes in the quantity and quality of the commodities they produce. The chief benefit of a mercantile agency is the protection it affords against the unwise extension of credit. The development of cheap and rapid means of communication has

done much to reduce the amount of dynamic risk. On the one hand, it makes it possible to secure early information about industrial changes in distant places, and on the other hand, it enables a surplus of commodities in any limited area to be distributed throughout society. It has also led to the development of a special trade custom, which has reduced the dynamic risk connected with the production of many articles. To a great and increasing extent commodities are now manufactured "to order," and the danger of piling up large stocks for which no market can be obtained is thus avoided.

These facts, and many others of a similar character which will occur to the reader, indicate the great importance that is attached to the prevention of accidental loss and the reduction of the amount of uncertainty. Every such device substitutes a definite expense of production for the chance of an indefinite loss. So far as the nature of the expense is concerned, it is a matter of indifference whether the preventive measure is carried out by individuals, by private associations, or by public bodies. Its distribution among these different agencies depends upon considerations of relative cost and efficiency. The question of the adoption of any such device is determined by a comparison of the relative costs of the device and of the uncertainty it is intended to annihilate. The statement sometimes made that as far as possible all accidental loss is prevented, is true only in a modified sense. It is easy to see that much more could be done to make such losses impossible. For instance, farmers might build their barns of fireproof material, or burglary might be almost entirely prevented by a sufficient increase in the number of policemen. The correct statement would be that everything is done that can be done economically. It would be poor economy for society, for the purpose of preventing accidental loss, to use up deliberately more capital than would be destroyed by the event whose occurrence is dreaded. The tendency will be to adopt every preventive device which in the end yields a net gain to society; and the practical test will be found in the comparative cost of producing the commodities by the more and the less uncertain methods.

It may be worth while to consider whether the self interest of entrepreneurs can be relied upon to insure the adoption of all preventive measures which are economically desirable for society.

It is evident that this is not the case when the measure is one whose adoption has been made compulsory by law. If one builder could avoid expense by substituting a somewhat inflammable material for the fireproof material that his neighbors and competitors are compelled to use, his risk of loss by fire would not be increased in proportion to the reduction in his expense. It is sometimes said, however, that there is a more fundamental opposition than this between public and private interests, and that it may at times be necessary for society to compel the adoption of preventive measures which individual entrepreneurs would have no incentive for introducing. Let us assume that an industry has been carried on under conditions that allowed a fluctuating amount of loss. The commodity produced in that industry will then be selling at a price which in a series of years will make good the loss to the group as a whole, and give each investor an extra reward on account of the risk he has been carrying. Let us suppose further that by the adoption of some preventive measure the average amount of accidental loss and the extent of the fluctuations could both be reduced. The improvement would evidently be adopted by individual entrepreneurs unless the expense of it was so great that the commodity could not be sold at as low a price as it was before. If it did involve an increase in price, would it under any circumstances be to the economic advantage of society to have it adopted? It appears not. It is true that the improvement would prevent the accidental destruction of a certain amount of capital, and would also cut down the amount of the extra reward for risk-taking; but that saving could be accomplished only by the deliberate destruction of a greater amount of capital to prevent the occurrence of the accidental loss. It appears clear, therefore, that under conditions of free competition the adoption by individual entrepreneurs of any preventive measure that is for the economic advantage of society will be assured by the possibilty of obtaining a profit as a result of introducing it.[1]

[1] In the absence of any system of insurance, legal compulsion may be justified in two classes of cases, namely: when the economic loss of the individual is liable to be accompanied by physical or mental injury to others, and when it is apt to cause loss of property by those who are unable to protect themselves. Laws prescribing the use of fireproof material in dwelling houses in thickly settled communities may be justified in either way.

We have been considering the social aspect of the three ways of meeting risk that are common to men in isolation and to those in society. We have called them respectively avoidance, prevention and assumption. We must now notice other courses of action, which are possible only in society. These are distribution, transfer and combination of risks. That these different methods of meeting risk are by no means mutually exclusive will be manifest as we proceed. We will consider each of them in turn.

If ten men each put $1000 into a hazardous investment, the risk may be said to be distributed. If a loss occurs it will be partially borne by each of the ten men. We have already noted that under the influence of the law of diminishing utility an investor's reluctance to expose a given amount of capital to a definite risk decreases as his wealth increases. In general, we may say that the smaller the ratio is between the sum to be risked and the person's entire capital, the less is the reluctance to expose it to risk. If, then, the capital for a hazardous industry is made up of the marginal increments of the capital of many investors, the amount necessary to induce them to incur the risk will be less than the reward that would be necessary to induce a single investor in the same economic circumstances to advance the entire amount. The superiority of the corporate form of industry is partly due to this fact.[2] It brings together the marginal increments of the capital of many investors. That it possesses many other great advantages goes without saying; but we are concerned only with its relation to the assumption of risk. In a dynamic society it creates the possibility of making many industrial experiments which no individual investor would care to undertake. In a static society the prevalence of the corporate form of industry lowers the expense of producing commodities by reducing the reluctance to incur risk and the amount paid for its assumption. On account of the limited liability of the members of corporations this gain is partially offset by an increase in the risk of those who become creditors of the corporation. On the other hand, the very limitation of liability greatly reduces the reluctance of the members of the corporation to incur risk. The net result is undoubtedly a very considerable gain to society in

[2] J. B. Clark, "Insurance and Business Profit," *Quarterly Journal of Economics*, vol. vii, p. 52.

the form of a cheapening of commodities, made possible by the reduction in the amount paid to capital for assuming risk.

A second method of distributing risk is the mutual guarantee against loss, sometimes entered into by a number of producers exposed to the same danger. This form of combination is too familiar to need any lengthy description. It is generally known as mutual insurance. In some cases the mutual guarantee is attended with the accumulation of a surplus, in others it is not. As the introduction of a surplus brings with it certain consequences which must be left for later consideration, we will for the present confine our attention to the effect of the guarantee alone. By such a guarantee all the members of a combination pledge themselves to make good a loss of some specified kind which befalls any one of them. The payments of each member are determined partly by the amount of loss that actually occurs and partly by the value of the property insured by him. It is evident that, on the assumption that the amount of positive loss is not affected by the existence of the combination, such an arrangement will reduce the cost of risk to society. There is a substitution of a large chance of a small loss each year for a small chance of a large loss. Now the unfavorable consequences of a loss increase out of proportion to the increase in the amount of the loss; and therefore, while the amount of the probable loss for a series of years is not affected by a mutual guarantee, the reluctance of the producers to assume the chance of such loss is diminished. There will be, therefore, a reduction in the price of the products of the industries affected. It must be borne in mind that the gain realized by society through the devices that we are considering is not due to any diminution in the amount of capital actually destroyed. A mutual guarantee against loss need not in any way affect the amount of positive loss. Whatever social gain is made is entirely due to the diminution of the negative loss which the existence of risk entails. Any device that lessens the unwillingness of men to incur risk brings the apportionment of capital nearer to the ideal static standard and thus increases its productivity. It is the increased product thus created that constitutes the social gain.

There is another economic advantage in the mutual guarantee against loss, which is due to the combination of a number of

risks in a group and the consequent reduction of the degree of uncertainty for the group as a whole. This is the third of the social devices for meeting risk, the discussion of which must be postponed to the following chapter. We will now turn our attention to the second device, the transfer of risk.

If one person guarantees another against possible accidental loss of any kind, there is a transfer of the risk of such loss from the latter person to the former. When the transaction takes place between persons who estimate risk alike, and who are equally reluctant to assume it, it will not occur without a simultaneous transfer of the reward to be obtained for carrying the risk. There would be no social gain in such an operation. If, however, the person who assumes the risk is for any reason less reluctant to do so than the one from whom it is transferred, the price paid for the transfer may be fixed somewhere between the reward demanded by the latter and the minimum amount which the former would require. There is an opportunity for both parties to the transaction to realize a net gain. The one to whom it is transferred obtains a reward for carrying it in excess of the amount that would be necessary to induce him to assume it; and the one who transfers it purchases security at a price that does not take from him the entire net reward for risk-taking in the industry in which his capital is invested. Both of these gains are profits. The competition of the less reluctant risk-takers will gradually cut down the price that can be obtained for assuming the risks to an amount that just compensates the marginal member of the group; and on the other hand, if all investors in the hazardous enterprise can find risk-takers who will relieve them of uncertainty for a lower reward than they themselves demand, there will be an influx of capital into the industry which will sooner or later bring down the price of the product to the level that the reduced expense justifies. When the new adjustment has been reached, the productivity of capital will have been increased and society benefited.

Now it is a matter of common observation that men differ greatly, both in their confidence in their own judgment about the chance of loss and in their willingness to assume chances that they estimate alike. There is in consequence a differentiation of the owners of capital into two classes according to their attitude

towards risk. To the more enterprising class, anxious for industrial control, and willing to incur the incidental risks, President Hadley gives the name speculators.[3] The others may in contrast

[3] Arthur Twining Hadley, *Economics*, New York, 1896, p. 112. The influence of risk occupies so prominent a place in President Hadley's discussion of distribution that it seems necessary to give his treatment of it special attention. It is not easy, however, to determine just what his position is. On the one hand, there is no separate discussion of the theory of risk, and on the other, it is sometimes difficult to reconcile statements concerning risks, made in different connections. The entire net return to capital he calls gross profits. Their amount is determined in the following way: "The competition of capitalists with one another leads them to advance to the laborers a sum equal to the expected price of the product, less a compensation for waiting and the risks attendant upon it, sufficient to induce the proprietors to hazard the required amount of capital" (p. 300). Here gross profits seem to be regarded as reward for waiting and for risk-taking. Many of his statements, however, do not refer specifically to the waiting, and therefore seem, in form at least, to attribute gross profits to risk-taking alone. Thus on p. 265: "In fact, they [capitalists] will not wish to go so far as this point [*Or*]; for at *Or* they simply recover what they advance [to laborers in the form of wages], with no compensation for the risks which are always involved. To assume these risks they must have some adequate motive." Yet we find (p. 267) gross profits divided as follows:

1. "A payment for *capital* known as *interest*.
2. "A payment for *location* known as *rent*.
3. "A payment for *skill* known as *net profit*."

"The separation of interest from net profit or rent results in a separation of the reward for waiting from the rewards for risk and foresight" (p. 300). The last sentence seems to mean that interest is the reward for waiting, net profit for risk-taking, and rent for foresight. It is not easy to understand exactly how the same income can be at once reward for skill and reward for risk-taking. Skill and the assumption of risk are by no means universally correlated. But we are still further confused when we find from other passages that interest and rent are also affected by risk. As to interest: "This rate [of interest on what is considered absolutely good security] is not looked at by the individual as a payment for risk. Yet its height is probably in large measure a result of past experience as to losses" (p. 280, note). As to rent: "Economic rent and net profit are like the producers' and consumers' surplus . . . in being differential gains. . . . They are unlike them . . . in being affected by differential losses which in some instances more than neutralize the gains. . . . But in point of fact, both rent and profits are of the nature of compensation for risk" (p. 288). It thus appears that all forms of income except wages are more or less "of the nature of compensation for risk." It is not thought possible, however, to correlate the income of the individual with the risk he runs. "Many of the writers who treat of the relation between business risk and business profit make the mistake of assuming that profits are an amount paid to the individual capitalist to cover *his* risk of loss. Far from it. They are paid to capitalists as a class for protecting the public against *its* risk of loss" (p. 288).

One fact stands out clearly in all of President Hadley's references to "compensation for risk." The income to which he applies that term is not at all the same as that which we have identified as the special reward for assuming risk. What he has in mind is the chance gain of those capitalists who are so fortunate as to escape disaster. It is that sum which he connects with the skill of the investors, and which he is naturally unable to correlate with the amount of risk they run. Nowhere does he appear to recognize the existence of the net reward for assuming risk. As he definitely rejects productivity and

be called investors. The class of investors embraces those capitalists who for any reason are chiefly concerned with obtaining a sure income, even if the amount of it is small; the class of speculators consists of those who are so powerfully attracted by the possibility of securing large gains, that they are willing to assume the chance of suffering accidental losses. Of course no hard-and-fast line can be drawn between the two classes. Degrees of risk and degrees of unwillingness to incur risk increase from the lowest to the highest by infinitesimal increments. In a general way, however, the two types of capitalists can be readily distinguished.

Of the effect of this difference in character on the direct assumption of risk we have already spoken; we are now concerned only with the system of transfer of risk which it makes possible. Venturesome capitalists are evidently the ones who will be most likely to assume exceptional risks. They may be attracted either by the exceptionally large reward for assuming risk, or by the hope of realizing a profit. They constitute the class of capitalist-entrepreneurs, whose peculiar relation to risk must now be considered.[4] It has already been shown that an entrepreneur with no capital of his own must pay for capital a price proportional to the risk to which it is to be exposed. Reward for risk-taking is no part of his income. On the other hand, a capitalist-entrepreneur who uses no capital except his own will receive as his income the entire net product of the industry in excess of the amount paid for the labor he hires. It would be difficult to distinguish practically between his interest, with the reward for assuming risk included, and his profit. There is a special complication, however, in those cases where the entrepreneur makes use both of his own capital and of borrowed capital in the same venture. It is the effect of this combination of capital that we are to consider.

The relation between the capitalist-entrepreneur and the persons from whom he obtains his additional capital are affected

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sacrifice as determinants of the reward to capital, and as it is, so far as man's knowledge is concerned, uncertain which of two equally able and cautious investors will escape accidental loss of capital, it is evident that the influence of chance fills a very large place in President Hadley's theory.

[4] J. B. Clark, "Insurance and Business Profit," *Quarterly Journal of Economics*, vol. vii, p. 47, *et seq.*

by the following facts: The capitalist-entrepreneur generally has a large part of his capital invested in the industry that he is managing, while his borrowed capital may consist of the marginal units of several investors. The desire of capitalists for a reasonable assurance of the safety of their capital leads them to limit the amount that they will lend to the capitalist-entrepreneur. The latter is generally personally liable for all loss and indebtedness, while the possible loss of the other investors cannot exceed their actual investment. Finally, it is seldom that an industrial venture results in total loss; and in case of partial loss the capitalist-entrepreneur has to bear it all, unless it exceeds the total amount of his own capital. Under such conditions it is evident that, while all the capital is used in the same industry, it is not all exposed to the same degree of risk. The capitalist-entrepreneur has assumed practically all the risk. The other capitalists have made a transfer of the risk to which their capital would naturally have been exposed in the industry in question. Consequently they demand only a small reward in excess of pure interest for incurring the small risk which they still bear. While the degree of risk to which the industry as a whole is exposed remains unchanged, and the capitalist-entrepreneur may, therefore, be able to obtain a large extra reward on account of the risk, he is obliged to hand over to the other capitalists little or none of this extra gain. It becomes a part of his own income.

It is important to notice that this part of the capitalist-entrepreneur's income is not profit. It accrues to the capitalist, and not to the entrepreneur. Because the capital of the capitalist-entrepreneur is exposed to a high degree of risk, it is able to obtain a high rate of reward. If the income were profit, it would be annihilated by the competition of other capitalist-entrepreneurs. They would obtain capital on the same terms, and cut down the price of the commodity to the point where it would yield only so much extra income as it was necessary for them to pay to the other capitalists for the slight risk that the latter still ran. But capitalist-entrepreneurs will not act in that way. Their own capital is exposed to a high degree of risk, and they will not be willing to assume it without adequate reward. Their competition will reduce the price of the commodity only to the point where it yields them in addition to pure interest a net

income that is just enough to reward them for assuming the risk. This income is determined directly, just as pure interest is, and its amount is fixed by the reluctance of the capitalist-entrepreneurs to expose their capital to risk.

As we have already stated, the transfer of risk does not necessarily reduce the degree of risk. The danger that actually threatens the capital in an industry may be in no way affected by the fact that the risk is disproportionally borne. At the same time, the cost of risk must be in some way reduced by the transfer, if there is to be any social gain from the transaction. The capitalist-entrepreneur must be willing to bear the risk that is transferred to him by other capitalists for a smaller reward than they would demand, if they managed the business themselves. This greater readiness to enter a hazardous industry may be due to the hope of large gains from sources not open to the other capitalists, or it may be due to differences in personal character. In a dynamic society the former influence is frequently predominant. It is sometimes the possibility of realizing a large temporary profit from a successful industrial venture, and not the amount of the reward for risk-taking, that makes the capitalist-entrepreneur willing to assume a high degree of risk for a small reward. In a static society, however, it is evident that any social gain that may be obtained through this form of organization must be due to differences in the character of different capitalists. On the one hand, those of a more venturesome disposition will be less reluctant to assume risk, and therefore will be found in the more exposed positions. On the other hand, if the capitalist-entrepreneur possesses, along with the venturesomeness, greater skill in calculating risk, and readiness in devising expedients for avoiding danger, than the other capitalists, the result of the transfer will be an actual reduction of the risk. Because the risk which the capitalist-entrepreneur assumes is less than that to which the other capitalists would be exposed if they were managing the business, the entrepreneur is willing to assume the risk of the industry for a smaller reward than the others would demand. The outcome will be a differentiation of capitalists according to their fitness for different kinds of service. Those who are especially reluctant to incur risk, and those who are poorly adapted to manage hazardous industries, will put their

capital into positions of comparative safety; those who should occupy the exposed positions on account of their peculiar fitness for doing so, will assume the large risks incidental to the performance of the function of the capitalist-entrepreneur. Society will be benefited by the arrangement, as it is by all forms of division of labor that result in securing the right man for the right place. So far as the influence of risk is concerned, the gain will be measured by the reduction in the cost of commodities due to the actual diminution of the risk and to the lowering of the reward necessary to induce the assumption of risk.

There is a point of special importance in connection with this peculiar income of the capitalist-entrepreneur that must not be left unmentioned. It is commonly said that according to the productivity theory of distribution each unit of capital in a static state receives as its reward the part of the net product that is specifically imputable to it. It may be asked, then, in what sense the capital of the capitalist-entrepreneur is more productive than the rest of the capital in the same industry. It is evident that all the capital, after it has been put into an industry, contributes equally to the creation of the physical product. The capital of the entrepreneur, however, renders an additional service; it insures the capital of the other investors. The answer to the question here raised, therefore, evidently depends on the answer to the more general question, in what sense capital is productive whose only service is the creation of security. As it will be more convenient to consider that question in connection with the subject of insurance, we shall postpone our discussion of it to the following chapter.

We have examined in the present chapter the three ways of meeting risk that are common to men in isolation and to men in society, calling them respectively avoidance, prevention and assumption. The attempt has been made to discover on what principle the choice between them would be determined by a man in isolation, and how the application of this principle is affected by the existence of society, and by a system of production for exchange. Two essentially social methods of meeting risk have also been considered. These are the distribution of risk, realized by the corporate form of industry, and by the system of mutual guarantee against loss, and the transfer of risk, one form

of which is seen in the capitalist-entrepreneur mode of organization. It remains to examine another device, which combines the two social methods already noticed and the third method, to which we have referred as the combination of risks. In the next chapter we shall discuss the economic significance of insurance in a static society.

CHAPTER VII

INSURANCE

The term insurance has already been used in describing the fund accumulated to meet uncertain losses. It is evident that in a static state all producers who are exposed to risk must accumulate such funds. While it is uncertain whether the accumulation of any individual producer will be enough to meet the loss he suffers, that of the entire body of producers in any industry must be large enough to cover the losses of the group as a whole. Otherwise there would be in the long run a great diminution in the amount of capital in hazardous industries, and a serious disturbance of the static adjustment. Such a phenomenon is inconsistent with the notion of the static state. A fruit-dealer who at irregular intervals suffers loss through decay must add to the price of his fruit enough to cover such uncertain loss. A shipowner has to increase his freight rates more or less, if his ships occasionally lie idle in port. In this sense, then, every producer, in the absence of all opportunity of transferring his risk, must insure himself. Such insurance would be defined as the accumulation of a fund to meet uncertain losses. From the point of view of economic theory, as has already been shown, the insurance fund includes only that part of the accumulation that is intended to cover the uncertain part of the loss; it is that part only whose amount is affected by the influence of uncertainty.

This individualistic method of providing for uncertain loss is spoken of sometimes as *latent* insurance,[1] and sometimes as *self*-insurance. The latter term is usually applied to such conduct on the part of large concerns with many risks of kinds commonly

[1] "Partout où il y a un risque à courir, une assurance latente protège la valeur ou même le gain menacé par ce risque. On la retrouve dans la commission prélevée par le banquier, dans les prix surélevés du marchand qui livre à crédit, dans les taux parfois usuraires de certains prêts."—Michel Lacombe, "Assurances," Say and Chailley's *Nouveau Dictionnaire d' Economic Politique*, vol. i, p. 101.

transferred to regular insurance companies; the former is more frequently used of the preparation to meet risks of kinds which insurance companies do not assume. While it may be impossible to avoid the use of the term insurance in referring to these forms of economic activity, it is evident that in common usage the word is ordinarily employed in a different sense. It is used to denote the transfer of risk. Any person who guarantees another against accidental loss of any kind is said to insure him. It is in this sense that the capitalist-entrepreneur insures the capital of those from whom he borrows. This use of the term insurance, however, like the preceding, fails to bring out its real significance. To apply it to all individualistic preparation for uncertain loss extends it too far in one direction; to apply it to every transfer of risk extends it too far in another. To form a complete conception of insurance, it is necessary to add to the notions of accumulation of capital and transfer of risks the idea of the combination of the risks of many individuals in a group. We should define insurance, then, as that social device for making accumulations to meet uncertain losses of capital which is carried out through the transfer of the risks of many individuals to one person or to a group of persons. Wherever there is accumulation for uncertain losses, or wherever there is a transfer of risk, there is one element of insurance; only where these are joined with the combination of risks in a group is the insurance complete.

In many respects the increase in the number of distinct risks that an individual producer carries is analogous to the combination of the risks of many individuals. Other things being equal, a ship-owner who has a hundred ships, and who carries his own insurance, is in the same economic condition as any one of a hundred ship-owners, each possessing one ship, who have combined their risks in a group through a system of insurance. The gain from the combination of risks is due solely to the increase in the number of risks in the group; and if that increase takes place through the growth of a single industry, the same advantage is obtained. It is partly because of this fact that large industrial concerns are able to carry their own insurance. With the increase in the number of distinct risks to which they are exposed, the cost of carrying the risk relatively diminishes. This gain is one of the influences that foster the growth of large indus-

trial organizations. In the absence of all other conditions affecting their size, it would lead in the end to the concentration of each line of industry, or even of all lines, in the hands of a single organization; and in the presence of these other conditions, the size that would finally be found most advantageous would be affected by the increase in the number of risks.

It is time to point out the exact nature of the gain under consideration. It is evident that it will not be due to any reduction in the actual amount of positive loss. What the increase in the number of separate risks in the group does bring about is a reduction of the uncertainty for the group as a whole, a substitution of certain loss for uncertain loss. As was pointed out in the first chapter, the probable variation of the actual loss in any year from the average for a series of years increases only as the square root of the number of separate chances of loss included in a group. Now, as we have seen, it is through the accumulation for meeting uncertain loss that the special reward for risk-taking is obtained. Competition will not cut the accumulation for this purpose down to the average amount of loss; it leaves a margin of safety. It is evident, therefore, that anything that diminishes the degree of uncertainty reduces the cost of risk to society. As the uncertainty diminishes, the accumulation to meet the uncertain loss is brought nearer to the probable loss as estimated by the law of averages. If all the uncertainty could be annihilated, the accumulation would be limited to the exact amount of the foreseen loss, as in the case of any other fixed element in the cost of production.

The application of this principle to the institution of insurance is evident at a glance. The risk that an insurance company carries is far less than the sum of the risks of the insured,[2] and as the size of the company increases the disproportion becomes greater. It is primarily through this reduction of uncertainty that a static society would be benefited by the existence of insurance. The cost of commodities would be reduced through the diminution of that part of the expense of producing them that is involved in the necessity of paying for the assumption of risk. The

[2] "The aggregate danger is less than the sum of the individual dangers, for the reason that it is more certain, and that uncertainty of itself is an element of danger." William Roscher, *Principles of Political Economy*, Translated by J. J. Lalor. New York, 1878, vol. ii, p. 261.

nature of this gain may be made clear by a simple illustration.

Let us assume that there are 10,000 capitalists of the same reluctance to incur risk, each owning a house valued at $5,000; that all the houses are exposed to the same danger of destruction by fire; that the average annual loss for a period of years has been 50, and the average variation 20; and that the rate of interest in safe investments is 3 per cent. If each owner makes an allowance of 3 per cent a year for the amortization fund, what annual rental will he demand for his house?

The uncertainty to which each investor is exposed is the resultant of two factors, the average loss and the probable variation. What would be the reluctance of an investor to incur the risk in the case assumed, and what reward would be necessary to overcome the reluctance, are empirical facts that we have no means of discovering. It is a conservative estimate that on account of the risk each capitalist will demand an extra one per cent on his investment. The annual rent will then be at the rate of 7 per cent, that is, $350 for each house. At the end of a decade, if the favorable and unfavorable years just offset one another, the group will have suffered a loss of 500 houses, valued at $2,500,000. This gives an average annual loss of $25 for each of the 10,000 investors. Meantime each of them has received $50 a year on account of the risk. In the group as a whole the destroyed capital has been replaced, and each investor has received a net reward of $25. The hirer of the house, who has had to pay this additional rent, is not at all concerned with the way in which the income has been distributed among the different owners. Some of these have suffered losses which the $50 a year was not enough to cover; others have escaped loss, and the entire $50 represents a net gain for them. Each consumer, in this case each house-renter, has had to pay $25 a year more than he would have had to pay if it had not been for the uncertainty.

Now let us examine the situation of the same persons after a system of insurance has been introduced. We will leave out of consideration the incidental expense of the insurance itself, and for the sake of simplicity it will be assumed that the reluctance of the insurer to assume risk is the same as that of the house-owners, and that the fact that the houses are insured has no effect upon the probability of loss. What is the uncertainty to which the

insurer is exposed when he is carrying the risk of the entire group, and what reward can he obtain for assuming it?

As the average variation of the annual loss has been 20, we may assume that a minimum loss of 25 houses for the group is certain to occur each year. The insurer, then, has to face a certain loss of 25 houses a year, and a probable loss, as determined by past experience, of 25 more. For the former, the competition of other insurers will prevent him from obtaining more than enough to replace the loss. That will be $125,000 for the group, or $12.50 for each house. For the uncertain loss we will assume that he will be able to obtain a return of twice the probable amount of loss, just as the single investor did, though there are reasons why he would probably demand rather less. That will make this part of his income $250,000 for the group, or $25 for each house. Each house-owner, therefore, will have to pay the insurer $37.50 a year, and their competition with one another will prevent any one of them from obtaining more than that from the person to whom he lets the house. The entire rent will now be $337.50 a year. Each consumer saves $12.50 a year, and each capitalist is still rewarded at the same rate as before for carrying risk. If these 10,000 houses had been joined with a large number of others, so that there were, let us say, 1,000,000 in the group, a similar calculation would show that the cost of the risk to each hirer of a house would be reduced to $26.25 *per annum*, or only $1.25 more than enough to cover the actual loss in a series of years.

That this gain is in no way dependent on the combination of the risks of different investors in one group, and that it could equally well be obtained by a single concern with an increasing number of risks is manifest. It is equally manifest that it would be advantageous for a person with a large number of risks to join them with as many others of the same kind as possible. While so-called self-insurance becomes cheaper as the number of risks increases, it would never be as cheap as regular insurance if the insurance business were rightly managed. If it is cheaper for a concern to carry its own risk than to pay premiums to an insurance company, it shows either that the company considers the risk higher than the concern thinks is right, or that the insurance business is so expensively managed that the cost of the management more than offsets the gain from the increase in the number

of risks. The prevalence of the custom of self-insurance against risks such as the regular insurance companies assume is a serious reflection on the management of the companies.

The effect of the principle that we are considering on the size of insurance companies is the same as that already noted in speaking of independent industrial organizations. It is a force working towards large companies. The larger an insurance company is, the cheaper it can afford to give insurance. It might be impracticable, but it would not be economically unjustifiable, to require small companies to carry higher reserves in proportion to the amount insured than large companies are compelled to carry. In the absence of conflicting influences each branch of insurance would finally be concentrated in the hands of a single company. Nor is there any reason why the process of centralization should stop here. There is the same economic advantage in combining risks of entirely different kinds, provided they are correctly estimated, as there is in combining risks of the same kind. The difficulties in the way of such general combinations are all of a practical nature. Whatever may be said on the ground of expediency for the laws passed by some of our states restricting the freedom of insurance companies in the matter of assuming different kinds of risks, economic theory affords no justification for such a policy. The more risks the cheaper the insurance, is a universal economic principle. One enormous company carrying all static risks would be the ideal organization of insurance in the static state.

The gain due to the combination of risks and to the consequent reduction of uncertainty is not the only economic benefit of insurance. There is another advantage resulting from the transfer of risk, which is of the same kind as the one previously noticed in speaking of the capitalist-entrepreneur. It is desirable for society that risks should be correctly estimated. Men differ much in their ability to judge them. The segregation of the work of estimating risks leads to a differentiation of capitalists, as a result of which those who are especially adapted to that task will be the ones who will undertake it. Moreover, their natural ability will be further developed through the experience and training of the work itself. On the other hand there are many men capable of rendering good service to society in comparatively safe industries,

who are so constituted that the necessity of running any great chance of loss seriously diminishes their efficiency. The possibility of transferring the risks of their business to others for a fixed premium frees them from the paralyzing influence of uncertainty, and enables them to make the best use of their powers in other directions. The gain to society from the transfer of risks is obtained partly through the reduction in the cost of carrying the risks when they are borne by those who have the most ability to estimate them and the most confidence in their own judgments about them, and partly through the increase in the efficiency of those who are abnormally sensitive to the influence of uncertainty.

The gains of which we have been speaking are partly offset by the cost of carrying on the insurance business. This cost consists of interest on the capital and wages for the labor employed in the actual performance of the work. What that cost ought to be, if insurance companies were economically conducted, and how far the actual cost exceeds that amount, we need not stop to inquire. There is a generous margin between the price for which a large insurance company can afford to assume a risk and the price which an individual producer would demand for carrying it. That this margin is not exhausted even by the extravagant methods of management that characterize existing insurance companies is proved by the almost universal prevalence of the custom of insurance. That it is more nearly exhausted than it ought to be is proved by the persistence of the custom of self-insurance. It must not be forgotten, however, that insurance companies carry on many other forms of activity besides their special work of furnishing insurance. Investment is a prominent feature of so-called life insurance, and preventive measures of various kinds are carried out by insurers of property. Insurers of boilers have their inspectors, fire insurance companies have their patrols, burglarly insurance companies their private watchmen, and so on through the list. The part of the premium which is used in carrying out these protective measures ought not to be considered as part of the cost of insurance. It is work that would have to be done in some form by individual producers or by society, if it were not performed by the companies. The fact that the companies do it is an indication that it is accomplished more cheaply or more efficiently by them than it could be by the in-

sured themselves. Another legitimate form of expense that ought to be recognized is the cost of securing the services of experts in appraising property and estimating risks. This work would also have to be performed in some way by individual producers if they carried their own risks. It might perhaps be accomplished more cheaply by them, but it would certainly be done more crudely and inaccurately. The gain from the accurate valuation of risks by experts more than counterbalances the necessary increase in the expense.

There is another form of loss of serious proportions which must not be left unnoticed in comparing the advantages and disadvantages of insurance. It is an essential feature of a perfect system of insurance that the occurrence of the event for whose economic consequences compensation is guaranteed shall never be a source of gain to the insured. In an ideally complete system the payment by the insurance company will just equal the loss of the insured. Now it is a matter of common observation that insurance is often obtained in excess of the actual value of the property insured. As a consequence there is considerable wilful destruction of property for the purpose of obtaining the insurance. Moreover, it is doubtful whether it is practically desirable that the amount of the insurance equal the full value of the property, since no incentive would be left to the insured to guard against the destruction of his property. Over-insurance leads to fraud, full insurance to carelessness, and even partial insurance to some diminution of watchfulness. Whatever increase may occur in the amount of positive loss either through fraud or through carelessness must be deducted from the diminution in negative loss in estimating the net gain which insurance brings to society.

The economic significance of insurance in a static state is connected with its influence in reducing the burden which the existence of risk imposes on society. So far as the degree of risk is lowered, and the reluctance to assume it is diminished, so far is society benefited by the institution of insurance. How great the gain is, even under existing imperfect conditions, it is impossible to estimate, since it is difficult to conceive how the large enterprises of the present day could be carried on without the possibility of transferring to insurance companies many of the risks

involved in them. It could certainly be done only on a much larger margin of safety than is now considered necessary.

The essential features of economic insurance as we have defined it are the accumulation of capital to meet uncertain losses, and the transfer and combination of risks. Many other conceptions of insurance have been held by various writers on the subject. Some originated in an over-emphasis of a comparatively unimportant phase of the institution, others in a wrong interpretation of some feature of it. As an example of the former kind may be mentioned the conception of those writers who find the significance of insurance in the diffusion of positive losses over a large group of persons.[3] That the insured in the long run pay all the losses is undoubtedly true, but the distribution of the losses is only an indirect result of the insurance; it is neither the purpose of it nor the immediate consequence. The purpose of securing insurance is to avoid uncertainty. The insured buys security by the payment of a fixed premium, and after he has bought it his condition is not affected by the number of losses which the insurer may have to make good. If the number of losses increases, the premium rate may be raised; but in all cases of complete insurance the cost of it is a definite element in the expense of production, the amount of which is fixed before the occurrence of the losses. Only in the case of mutual assessment companies is there a direct distribution of losses over a group. A member of such a company is not in the same economic situation as one insured for a fixed premium. He has not transferred his risk and purchased security; he has exchanged one risk for another, usually a small chance of a large loss for a larger chance of a smaller loss. Where there is a mere diffusion of loss there remains some degree of uncertainty as to the amount of loss that each member of the group will suffer;

[3] "Considerée dans son principe même, l'assurance est une association qui a pour objet de répartir entre tous ses membres les pertes occasionnées à quelques-uns d'entre eux par certains événements fortuits, de telle sorte que chaque membre supporte sa part de l'indemnité due aux victimes du sinistre." —Ch. Dumaine, "Assurances," Say's *Dictionnaire des Finances*, vol. i, p. 220.

"Versicherung im *wirthschaftlichen* Sinne ist diejenige wirthschaftliche Einrichtung, welche die nachtheiligen Folgen (zukünftigen) *einzelner*, für den Betroffenen *zufälliger*, daher auch im *einzelnen Falle* ihres Eintretens unvorhergesehener Ereignisse für das Vermögen einer Person dadurch beseitigt oder wenigstens vermindert dass sie dieselben *auf eine Reihe von Fällen* vertheilt, in denen die gleiche Gefahr droht, aber nicht wirklich eintritt."—Adolph Wagner, "Versicherungswesen," Schönberg's *Handbuch*, 4te Auf, 2 Band 2, s. 359.

where there is complete insurance the insurer has taken upon himself the entire chance of loss, so far as concerns the risks covered by the insurance. To define insurance, then, as the distribution of losses is to make too prominent an indirect and comparatively unimportant result of it, and to leave entirely out of the definition the elements in which its economic significance really lies.

The other erroneous conception of insurance to which reference has been made is even more indefensible than the one just noticed. Instead of arising from an over-emphasis of a comparatively unimportant feature of the institution, it is based on an essentially false idea of its nature. Because each insurance contract considered by itself is a contingent contract, and because the event upon which the payment by the insurer to the insured depends is uncertain, many writers have regarded insurance as a form of gambling.[4] But the resemblance is in reality of the most superficial kind. It is not difficult to discover the mark of distinction between the two transactions. Insurance involves the transfer of an existing risk from one person to another; gambling involves the creation of a new risk to which neither party to the transaction was exposed before the contract, and to which they are both exposed after it. If a man insures his factory, he frees himself from uncertainty, and the other party to the contract assumes it; if he makes a wager with another, his own uncertainty and that of the other person are both increased at the same time. Undoubtedly in the past many transactions which wore the virtuous guise of insurance were no better than gambling contracts. If a person takes out a policy on property in which he has no insurable interest, he

[4] "Let us now contrast the workings of insurance. In this case also the contract is a wager. A house-owner pays an insurance company fifty dollars, in return for which he is to receive five thousand dollars in case his house burns down within a specified time; just as he might pay a bookmaker fifty dollars and receive five thousand in case a specified horse wins a race."—Arthur T. Hadley, *Economics*, p. 99.

"Le contrat aléatoire est une convention réciproque dont les effets, quant aux avantages et aux pertes soit pour toutes les parties, soit pour l'une ou plusieurs d'entre elles, dépendent d'un événement incertain. Telles sont le contrat d'assurance, . . . le jeu et le pari, . . ."—Code civil français, Art. 1984. Quoted in Charles Berdez, *Les Bases de l'Assurance Privée*, p. 36, note.

"Wenn also der unorganisierte Spiel des Schicksals den Menschen in Gefahr bringt, so begreifen wir, dass das Mittel, welches er ihm entgegensetzt, ein organisiertes Glückspiel sein wird. Er erreicht dadurch die Wirkung, dass er zur selben Zeit, wo er von eineme Verlust betroffen wird, durch das Glückspiel einen Gewinn erhält, der gerade den Schaden deckt."—R. Schlink, *Die Natur der Versicherung*, Würzburg, 1887, s. 13.

virtually makes a wager with the insurance company that the property will be destroyed. Such contracts are clearly against public policy, and legislation has done much to limit their number. The courts on the other hand have frequently given a liberal construction to the phrase "insurable interest," and many contracts of doubtful legitimacy are still tolerated. A legitimate insurance contract, however, may always be distinguished from a gambling contract by the principle pointed out. Insurance is the transfer of risk, gambling the creation of risk.

After a system of insurance against any class of risks has been established, an entrepreneur has a choice between three methods of meeting such a risk in an industry that he has decided to enter. He may adopt preventive measures, he may obtain insurance, or he may carry the risk and pay a higher price for the capital he borrows. His selection among these different modes of conduct will depend upon their relative cost. Expenditure for any one of them is to him an item in the cost of production, and he will naturally adopt the one that is cheapest. As a matter of fact, in nearly all cases it is necessary to combine the three methods. Preventive measures are adopted by which the total amount of risk is somewhat reduced; a part of the remaining risk is transferred to insurance companies; the rest is borne by the capital in the industry. The amount of the expenditure for each of these purposes is determined according to the principles already established. The payment for the capital exposed to risk contains an element of reward for risk-taking, which is large in proportion to the degree of risk; the payment for insurance contains a relatively smaller element of the same kind; the payment for prevention contains none at all.

The entire sum paid by the insured to the insurance company is called the insurance premium. As the companies carry on many forms of activity which are not an essential part of their business of furnishing insurance, and the expense of which is paid out of the premiums they receive, the cost of the insurance itself is less than the amount of the premium. In a strict economic sense the insurance premium includes only that part of the payment to the company that would have to be made to induce it to assume the risk. Expenditures for preventive measures, whether made directly by the entrepreneur himself, or first incurred by the insurance

company and then recovered from the insured, are no part of the cost of insurance. This distinction, however, is not observed by all writers.[5] Because the entrepreneur has a choice between prevention and insurance, it seems to be inferred that the two forms of expenditure are essentially alike. It is evident, however, that if all expenditures for the purpose of preventing accidental loss are to be regarded as insurance premiums, a very considerable part of the cost of production must come under that head. Such an extension of the term insurance utterly destroys its economic significance. Nor is the situation much improved by limiting its application to the expenditures for those preventive measures that make it possible to obtain insurance from organized companies at a lower rate. The distinction does not depend on any such accidental circumstance as that. It goes back to the fundamental difference between the methods by which the amounts of the two kinds of payments are determined. One includes an element of reward for risk-taking, which in the case of insurance goes to the insurer, whose capital is bearing the risk; the other is determined by the direct cost of introducing the preventive measure, whether the work is done by the entrepreneur himself or by the company. Prevention and insurance are complementary methods of preparing to meet uncertain losses; only confusion can result from the attempt to make them identical.

Not only do insurance companies carry on many forms of activity that are no part of their peculiar functions as insurers, but not all their activity as insurers has any direct bearing on the productivity of capital. The insurance of consumption goods is almost as common as the insurance of capital goods. It would not be difficult, in the light of the principles already discussed, to discover the laws that determine the adoption of insurance by the owners of consumption goods, or the nature of the social service that such insurance renders. A study of that sort would not be without interest, but it is outside the range of our

[5] See, for example, Alfred Marshall, *Principles of Economics*, vol. i, p. 469, note. "Again, certain insurance companies in America take risks against fire in factories at very much less than the ordinary rates, on condition that some prescribed precautions are taken, such as providing automatic sprinklers, and making the walls and floors solid. The expense incurred in these arrangements is really an insurance premium. . . ."

investigation. We are concerned only with the insurance of capital, that is, with insurance as a method of lowering the cost of producing commodities.

Insurance is primarily a method of making accumulations to meet uncertain losses. Attention has already been called to the gain that accrues to society through the reduction in the amount of such accumulations which insurance brings about. There are one or two other points in connection with this aspect of the institution that deserve consideration. Capital alone can insure capital. The guarantee of security by one who had no means of making good the losses that occurred would be a fruitless proceeding. The amount of capital necessary to give security evidently depends on the amount of risk that the capital assumes. As the number of risks carried by an insurance company increases, the amount of its accumulations also must increase. Stock companies start with a certain amount of capital contributed by the members of the company, and make additional accumulations out of the contributions of the insured. Mutual companies, if they are to perform their functions perfectly, must also make accumulations of the same kind, but these funds are all contributed by the insured themselves, who virtually constitute the company. From the point of view of economic theory the difference between the two kinds of companies is of no significance. One form of insurance is not necessarily any cheaper than the other. If the entire business of insurance were on a strictly competitive basis, and if the accumulations of the companies were in all cases limited to the amounts necessary to give security, it would be a matter of no importance by whom the funds were contributed. Capital is invested in the business of insurance for the same purpose that any other investment is made—in order to obtain a reward. If the insuring fund of the mutual companies is made up out of the current contributions of the insured, the owners of the capital thus invested will require in some form the same return on their capital that they could obtain in any other investment with the same degree of risk. The members of the mutual company are carrying on the business of insurance with a part of their capital, which acts as a guarantee fund for the capital that they have invested in more hazardous enterprises. The gain accrues to the insured as insurers instead of accruing

to the members of a stock company. As there is no reason why the accumulations of mutual companies should be any less than the accumulations of stock companies, of which the capital stock forms a part, there is no reason why the return to the capital thus invested should be any less in the former than in the latter. Whatever gain can be secured under competitive conditions by insuring in a mutual company rather than in a stock company is due to the fact that the insured themselves have invested capital in the insurance business.

How large the accumulations of insurance companies ought to be in proportion to the risks they carry, can be determined only by experience. The prime requisite of such an institution is security. Therefore the accumulations must be large enough to cover the probable losses, with a margin of safety for unexpectedly large ones. It is safe to say, however, that the accumulations of many companies are in excess of the amount thus determined. I do not refer here to the accumulations made by life insurance companies, which combine entirely different functions with that of insurance, and a large part of whose funds represent simply investments of capital by the insured. Nor do I include that part of the funds of insurance companies which is used for other purposes than insurance, such as the expenditures for preventive measures. That part of their accumulations which is strictly an insurance fund is often larger than it needs to be. The possibility of making such unnecessarily large accumulations is due to imperfect competition, which does not force the cost of insurance down to the competitive level. If, however, it were necessary for these funds to lie idle in the vaults of the company, it is evident that there would be no motive for making accumulations larger than the conditions of the business demanded. Any excess would be distributed as dividends among the stockholders of the company, or, in a mutual company, would result in an immediate lowering of the insurance premium. That this distribution of the entire surplus does not take place is explained by the fact that capital which is insuring the other capital is not prevented on that ground from participating in other forms of industrial activity. We have already seen in the case of the capitalist-entrepreneur that while his own capital acts as a guar-

antee fund for the capital that he borrows, it at the same time performs its part in the direct productive activity of the industry in which it is invested. The fulfilment of the insurance contract does not require the creation of new capital; it requires merely the transfer of the ownership of existing capital. Therefore the accumulated funds of insurance companies, even that part of them which is economically necessary, instead of remaining otherwise unproductive, are invested in such ways that they earn an income for the company. Of course there are certain restrictions as to the forms in which such investments should be made. For practical reasons it is desirable that the funds should be invested where there is the least danger of loss, and where the difficulty of realizing on the investments is at a minimum. But the important point is that capital which is insuring other capital may at the same time be directly employed in the production of wealth. The unnecessarily large surpluses of insurance companies are allowed to accumulate, not for the sake of the reward they can obtain in the insurance business, but for the sake of the interest paid for their use by those to whom they are lent.

It is evident that the possibility of using productively the reserve funds of insurance companies reduces the cost of insurance. Under competitive conditions the return that capital invested in the insurance business can secure will be fixed. In the long run it will consist of pure interest plus the reward for carrying the risk to which it is exposed. All other income that the companies receive will operate to reduce the payments of the insured. If it were necessary for reserve funds to remain unproductive, the income that they now earn would have to be obtained from the insured in the form of higher premiums.

One question in this connection remains to be answered. In what sense is the employment of capital to insure other capital a productive function? The difficulty in answering this question is due to two circumstances. On the one hand, capital which is insuring other capital may at the same time be productively employed in other ways and create the same amount of physical product as any other capital so employed. On the other hand, the reward which capital obtains for insuring other capital is entirely created by the capital that is insured. It is evident, there-

fore, that insuring capital, as such, is not directly creating physical product. Its service is to create a condition which increases the productivity of the capital that is insured. In return for this service a part of the product of the insured capital is handed over to the insurer. But this is not to deny the productivity of the insuring capital. In an economic sense the product of a unit of capital is the part of the total product whose creation is due to the presence of that particular unit. If, then, the insuring capital, by virtue of its service in guaranteeing safety, increases the total product of the insured capital, the additional part must be attributed to the insuring capital as its product. If there were a monopoly of the privilege of granting insurance, the entire increase in product might be appropriated by the insurers. Perfect competition, on the other hand, would bring about an influx of capital into the insuring business which in the end would reduce the total return to capital in it to the same proportions as the return to capital in any other industry involving the same degree of risk. The remainder of the economic gain due to the existence of the institution of insurance would then accrue chiefly to the consumers of the commodities created in the industries in which the insured capital is employed. There is no fundamental difference in kind between the reward for risk-taking which accrues to capital employed directly in a hazardous enterprise and the reward which insuring capital obtains for the risk it assumes. In both cases there is an increased productivity of industry on account of the assumption of the risk, and in both cases the capital exposed to risk obtains a part of the increased product as its special reward. In both cases, moreover, the amount of the extra reward which capital can obtain by assuming risk is fixed by the sacrifice of the most reluctant investor whose capital is needed to meet the demands of society. The only difference between the two kinds of income is the comparatively unimportant one that in the former case the extra product is created directly by the capital that receives it, while in the latter case it is created by other capital and handed over to the insuring capital as a reward for creating the conditions which make possible the increased productivity of the capital which is insured.

The statement is sometimes made that all insurance is mutual

insurance.[6] It is evident from a consideration of the facts already established that this is only partially true. All insurance is mutual in the sense that all the losses are in the long run paid by the insured. Obviously an insurance company could not long survive if it systematically made good the losses of the insured out of its own capital. To the company the payment of losses is an element in the cost of carrying on its business, and in the long run consumers necessarily pay all the expenses of production. This mutual aspect of insurance, however, does not bring out its fundamental significance. This lies in the reduction of the cost of producing commodities through the relief of producers from the disagreeable feelings aroused by uncertainty, and the substitution of security for insecurity. The burden of insecurity which would rest upon individual producers in the absence of a system of insurance is in no way borne by the insured as a body after insurance has been introduced. A large part of it is entirely annihilated, and the remainder rests upon the insurers whose capital has assumed the risks of the insured. Even in the case of so-called mutual companies, while the surviving uncertainty is still borne by the members of the company, the real significance of the institution does not lie in this fact, but in the reduction of the uncertainty as a result of the insurance. The over-emphasis of its importance in causing a diffusion of loss is due to an imperfect analysis of its economic effects.

Insurance is evidently far from being a gratuitous gift to society. The component parts of its cost are the wages of the labor employed in the insurance business, interest on the capital invested in it, and any increase in the amount of positive loss through fraud or carelessness, which the existence of insurance induces. This cost first falls upon the entrepreneurs who choose to insure their capital rather than to pay capitalists a higher price on account of risk. To the entrepreneurs, therefore, it is a part of the cost of production; it will be embodied in the price of the commodities, and will thus be shifted to the shoulders of consumers. It is in the end the consuming public that pays the entire expense of insurance. This does not by any means imply that the

[6] See, for example, H. C. Emery, "The Place of the Speculator in the Theory of Distribution," *Publications of the American Economic Association*, 3d Series, vol. i, no. 1, p. 105.

condition of consumers is not benefited by the existence of insurance. The comparison lies, not between the cost of insurance and no cost, but between the cost of insurance and the cost of risk without insurance. The gain to the consumer comes through the reduction in the price of commodities, and the amount of the reduction is determined by the difference between the interest which the entrepreneur would have to pay for capital exposed to the entire risk of the industry on the one hand, and the lower interest on the capital when it is insured, plus the cost of the insurance itself on the other hand.

There has been a singular lack of unanimity among writers on political economy with regard to the division of economic theory in which the treatment of insurance ought to be placed. Some have considered it in connection with production, others have regarded it as a phenomenon of consumption, while still others have found it inexpedient to bring it under any of the recognized divisions, and have put it at the end of their works along with other subjects of a more or less dubious economic character. There seems to be little occasion for such uncertainty. If the old divisions of production, distribution, exchange and consumption are to be maintained, there is no doubt that the proper place for the discussion of insurance, at least so far as insurance of capital is concerned, is in the department of production. With regard to the insurance of consumption goods the case may not seem so plain at first sight, since there is not the same direct relation between such insurance and the productivity of industry. Nevertheless, it undoubtedly belongs in the division of production. It belongs there, not because it affects the productivity of other capital, but because the creation of security is in itself a form of production. If the owners of consumption goods are willing to pay a price for the sake of having them insured, it is evident that they are obtaining something in exchange which is of more value to them than the money with which they part. What they obtain is security, and whether or not it seems best to consider such security as a consumption good, or as any form of wealth, it cannot be questioned that the capital and labor engaged in creating it are serving mankind in the same way as that employed in the creation of any commodity for which consumers are willing to pay.

The conclusions reached in the present chapter are in part as follows: Complete insurance, in the economic sense, is the accumulation of funds for uncertain losses and the combination of the risks of individuals in a group. The advantage of such an institution in a static society would be the result of its influence in reducing the burden of risk. To call all insurance mutual, or to define it as the distribution of losses, is to put the emphasis on a comparatively unimportant aspect of it; to call it gambling is to confuse forms of activity fundamentally different both in their purpose and in their consequences. Capital employed in insuring other capital is productive, and the reward it receives is a part of its product. Capital employed in insuring consumption goods is creating something for which the owners of the goods are willing to pay. It, therefore, is also productive. The treatment of insurance naturally belongs in the division of economic theory that deals with the phenomena of the production of wealth.

CHAPTER VIII

CONCLUSION

Before attempting to give a summary of the static theory of risk and insurance developed in previous chapters, it may be worth while to consider briefly one or two special phases of the influence of risk in a dynamic society. No attempt will be made to work out a complete dynamic theory. Static laws are comparatively easy to discover, since the economic forces at work in a static society are by hypothesis few and simple. In a dynamic society the conditions are very different. Dynamic changes are continually introducing disturbances into the economic system. The new forces modify the action of the static forces, sometimes reinforcing them and sometimes opposing them, and the simplicity of the static state is replaced by the apparent irregularity and confusion of the existing industrial world. That this irregularity is only apparent, and that with the progress of economic science general principles will be discovered by which the movements of a dynamic society can be classified and traced to their sources, is undoubtedly true. It is in this field that the most difficult and most important work of economic theory remains to be done. It will naturally be divided into two parts. One will deal with the laws governing the dynamic changes themselves, and the other will trace the working of the laws of the static state under dynamic conditions. It is in the second of these divisions that the following brief discussions would fall. The most that will be attempted is to point out the bearing of the static laws of risk already discovered on certain dynamic problems. We shall take up only these three questions: the influence of risk upon the accumulation of capital, the relation of the entrepreneur to developmental risks and the economic character of the service of the speculator as insurer.

Risk retards the rate of accumulation of capital. Every increase in the amount of capital, other things being equal, diminishes the productivity and reward of each unit of it. On the other

hand, every additional unit of capital saved, other things being equal, involves an increased sacrifice on the part of the person saving it. Saving is carried by each individual to the point when the sacrifice and the reward offset each other, and then it ceases. Now the necessity of exposing capital to risk increases the sacrifice involved in saving. Saving ceases while the marginal productivity of capital is still high enough to reward the risk-taking as well as the abstinence. If the degree of risk were uniform in all investments, it is evident that the extent of the influence in this direction would depend entirely upon this uniform degree of risk. With unequal degrees of risk, the relation between the risk and the accumulation of capital is not quite so simple. The effect of the risk is determined immediately by the relation between the risk and the reward in safe investments. But the rate of interest here is itself affected by the risk in other investments. We have seen how the requirement by capitalists of an abnormally high reward in hazardous industries reduces the return in safe industries below the normal level. When the risk in different investments is unequal, therefore, its influence in retarding accumulation is much greater than would be inferred from the degree of risk in those which are safest. In order to determine what that influence is, it would be necessary to calculate some sort of an average of the risks in all investments. It is possible that this might be taken at a point where greater and smaller risks are so balanced that the productivity of capital is not affected by the inequality in the degrees of risk. The reward necessary to overcome the reluctance to incur this average degree of risk determines the margin of saving.

As risk retards the accumulation of capital, anything that reduces the degree of risk or the reluctance to assume it promotes accumulation. Insurance in a dynamic society may be regarded as a method of fostering the growth of capital. The gain in question is not at all the one on which enthusiastic life insurance agents lay so much stress. Whatever may be the advantage of so-called life and endowment insurance as forms of investment, furnishing opportunity for investment is no part of the insuring function.

The advantage to which we refer is of a more fundamental character. It is due to the influence of insurance in extending

the range of safe investments. There are large amounts of capital, such as trust funds, savings-bank deposits, and even the reserves of the insurance companies themselves, in the investment of which safety is the prime consideration. This fact tends to reduce the rate of interest in safe investments to a very low point. Every increase in the opportunity for making such investments has an influence in retarding the fall of the rate of interest in them, and so in pushing further out the point of equilibrium between the sacrifice and the reward of saving.

One other point in connection with the influence of risk on the accumulation of capital deserves to be noticed. Just as the sacrifice of abstinence diminishes, other things being equal, as a man's income increases, so the sacrifice of risk-taking becomes less as his capital becomes greater. The result is a tendency towards a more and more unequal distribution of capital. The sacrifice of a laboring man in saving a hundred dollars from his year's income is apt to be very great. There is, therefore, need of a large reward to make him willing to undergo the sacrifice. And just because it costs so much to accumulate the capital, he feels great reluctance to expose it to the chance of loss. Safety is to him a matter of the first importance. In the use which he makes of his capital, therefore, he is confined to the least hazardous investments; and in these investments the rate of interest is near the minimum. Those who need the largest reward to make them willing to save are the ones who can obtain only the smallest reward on account of their unwillingness to incur risk.[1] By far the larger part of the savings of society come out of the incomes of large capitalists and entrepreneurs; the contributions of laborers and small capitalists are comparatively insignificant. Now the increase of capital is in itself almost an unmixed good. Moreover, there are certain advantages in its unequal distribution. The total saving of society is thereby increased, and the existing capital is more productively employed. The growth of large fortunes in recent years has done much to extend the margin of industry into the territory of hazardous enterprises. Even the small capitalists are indirectly benefited thereby,

[1] In considering the influence of the rate of interest on accumulation some allowance ought undoubtedly to be made for the tendency of a fall in the rate of interest to induce larger savings on the part of those who are chiefly concerned to assure to themselves or their families a certain fixed income

through the drawing off of capital from safe investments and the retardation in the fall of the rate of interest in them. But it is possible to pay too high a price for the gain thus realized. The accumulation of capital is not an end in itself, nor is its distribution a matter of no importance. Clearly every device that will promote saving on the part of the laboring class is to be welcomed; and it can hardly be doubted that a less unequal distribution of capital, even though it involved some falling off in the productivity of industry as a whole, would increase the sum total of human welfare. The influence of insurance, so far as it widens the range of safe investments and thus promotes saving on the part of people of small resources, has a tendency to reduce the inequalities in the distribution of wealth.

The influence of private ownership of land in promoting saving is also worthy of note. I do not refer to the well known fact that the desire of the average man to own a piece of ground stimulates his productive activity. It is the influence of the security of the investment to which I wish to call attention. In spite of local fluctuations in value as population shifts from place to place, investments in land under normal conditions have always been regarded as exceptionally secure. A very considerable part of the savings of small capitalists has for this reason been placed in this form of investment, either directly or through the medium of savings-banks and building and loan associations. The withdrawal of land from private ownership would reduce the area of safe investments to such a degree as to cause a serious fall in the rate of interest in them. Whatever may be said on other grounds for or against private ownership of land, it cannot be questioned that on account of the wide opportunity for safe investment which it affords it has a great influence in promoting saving by persons of small means.

From the same point of view, no greater service could be rendered society than that which would result from the introduction of a method of giving security to the bonds of large industrial corporations. Something is already accomplished in this direction through the custom of underwriting which has been growing in recent years. A large banking concern undertakes to float a loan for a corporation, and to give to the bonds the backing of its own reputation, on condition that the directors of the

corporation agree to observe certain principles in the management of their property. The object of this stipulation is to prevent unwise action on the part of the directors, such as would tend to injure the earning capacity of the property and impair the security of the bonds. Obviously such action is limited both in its range and in its efficiency. The invention of a system of guarantee and control which would give to the bonds of all established corporations the security which now attaches only to government bonds would enormously increase the opportunity for safe investment, would raise the rate of interest in such investments well above its present level, and would thus encourage saving by those to whom the disutility of insecurity is very great.

One of the greatest services which the entrepreneur renders society is the result of his activity in opening up new avenues for the employment of capital. The growth of capital is a characteristic feature of a progressive society, and with that growth comes the necessity of finding new methods of employing it, if the rate of interest is to be kept from falling rapidly. The discovery of new methods of employing capital has the same sort of influence on the rate of interest and the incentive to save as the extension of the range of safe investments. Of the different ways in which new capital may be employed, and the different degrees of risk involved in them, enough has already been said. A few points remain to be noticed about the relation of the entrepreneur to this kind of risk.

The incentive to activity by which an entrepreneur is led is the hope of realizing a profit. Now the origin of profit is always in change. It is of the nature of entrepreneurs, therefore, to be continually experimenting with new methods, new machinery and new products. There are very unequal degrees of risk involved in these experiments. In some cases it is practically certain from the moment the new idea is conceived that the application of it will lead to the appearance of a large profit; in others the outcome is a matter of a great deal of uncertainty. As we have already seen, there is no constant relation between the degree of uncertainty and the amount of profit. Still it is evident that of two equally uncertain experiments the one would first be tried in which the profit would be larger in case of success; and that of two experi-

ments holding out hope of equal profit, the less uncertain one would be first undertaken. This seems to indicate some sort of relationship between risk and profit. What is it, however, that limits the action of entrepreneurs in this way?

So far as the experiment involves danger to existing capital, their choice may be due to their unwillingness to expose their own capital to danger, or to the difficulty of obtaining capital from others for such a purpose. If entrepreneurs were able to obtain gratuitously all the capital they wished, there would be no such limitation to their unwillingness to incur risk. It would still be true, however, that a certain profit would have more attraction than an uncertain one of the same size. Any one naturally prefers a certain gain to an uncertain one. Moreover, an entrepreneur has to devote time and labor to the management of his business, and must have a reasonable assurance of receiving at least as large a return from it as he could obtain by selling his services to others. Finally, the reputation for sound judgment and efficient management, which continued success gives, is of value to him, since it enables him to secure capital at a lower rate. This reputation, however, is a part of his equipment as a laborer, and would increase his wages if he sold his services to others. The extra reward that he obtains for risking it is a part of his wages of management and not a part of pure profit. In our discussion all consideration of that part of the entrepreneur's income which is wages of management and which accrues to him as laborer and not as entrepreneur is excluded.

As there is a limited number of entrepreneurs, there must be a limit to the range of their activity. As a certain gain is more attractive than an uncertain gain, entrepreneurs will naturally first select those experiments in which the probability of success is great. To induce one of them to undertake a more uncertain experiment when a less uncertain one is open to him, the profit in the former, if it succeeds, must be greater than the profit in the latter. To this extent there will be a relation between the chance of obtaining a profit by undertaking an industrial experiment and the probable amount of the profit. It is evident, however, that this extra profit is not the reward for bearing risk. Under the conditions assumed, the entrepreneur is exposed to

no risk of loss in either undertaking. The amount of profit to be obtained in the more hazardous experiment is in no part due to the risk. It is determined by other conditions with which the risk has nothing to do. Although the entrepreneur obtains a larger profit by undertaking a more hazardous experiment, he does not obtain it because the experiment is more hazardous. If the only opportunity open to him were one in which the chance of success was slight and the profit in case of success not large, he would have no hesitation about undertaking the experiment, provided he risked no capital of his own and his wages of management were assured him. While, therefore, in their selection of industrial experiments entrepreneurs are naturally led to undertake first those in which there is the greatest reward in proportion to the uncertainty of success, and while in consequence there is a relation between uncertainty and profit in this class of undertakings, the action of the entrepreneur in entering upon the experiment cannot be called the assumption of risk, and the large profit is not to be confounded with the reward for risk-taking. The person who furnishes the capital, and stands to lose it if the experiment fails, bears all the risk of the undertaking. The choice of a certain profit rather than an uncertain one by the entrepreneur is the same sort of an act as the choice of a large profit rather than a small one.

On account of technical limitations the activity of insurance companies has been for the most part confined to the assumption of risks in which the existence or the possession of property was involved. They have made few attempts to insure goods of any kind against loss of value. Many commodities are liable to great fluctuations in value, and in some cases these fluctuations have serious consequences for the welfare of society. Agricultural products are commodities of this kind. That the fluctuations of their value are great is due to imperfect control of the supply by those who produce them and to the inelastic nature of the demand for them; that these fluctuations seriously affect the welfare of society is due partly to the fact that they constitute an important part of the consumption of the masses of the people, and partly to the fact that the efficient distribution of the supply requires temporary accumulations of large stocks of the goods in the hands

of manufacturers and dealers. The former fact makes it difficult for people with small incomes to apportion their expenditures over a series of years to the best advantage. Excessive consumption in times of low prices is followed by too great a contraction of consumption in times of scarcity. The total utility of the commodities consumed is thereby diminished. The second fact tends to increase the price of the commodities in times of abundance and scarcity alike, since the great uncertainty incurred by investing capital in large stocks of the goods, for purposes either of manufacture or of sale, restricts the flow of capital into such investments to amounts which yield a large reward.

It is in reducing the cost of this special kind of risk that speculators serve society as insurers. By a system of transfer of risks, which will be considered in a moment, they take upon themselves the chance of gain or loss through fluctuations in the value of certain commodities in the hands of manufacturers and dealers. That this is no part of the purpose of the speculators is undoubtedly true. Their immediate object is to make money through fluctuations of prices. We need not stop to consider the general phenomena of speculation nor its influence upon society.[2] We are concerned only with that part of the activity of speculators which serves indirectly to reduce the cost of uncertainty. The way in which this service is rendered may be made clear by a concrete illustration.

A miller who buys large quantities of wheat to grind into flour is exposed to a chance of gain or loss through a change in the market price of the grain. If the price of wheat varies, the price of flour will probably vary with it. This uncertainty about the movement of prices is a disturbing factor in the miller's calculations. He frees himself from it by a transaction on the wheat market. At the same time that he buys a quantity of wheat for his mill, he sells the same amount to a speculator for future delivery. When he sells his flour he delivers the wheat. If the prices

[2] See H. C. Emery, *Speculation on the Stock and Produce Exchanges of the United States*, 1896, for an account of the activities of speculators and the mechanism of stock exchanges. See also "The Place of the Speculator in the Theory of Distribution," by the same author, *Publications of the American Economic Association*, Third Series, 1, 1900, pp. 103-114, for a discussion of the question suggested by the title of the article. The illustration of the service of the speculator, given in the text, is condensed from this article.

of wheat and flour have fallen, his loss on the flour is made good by his gain on the wheat; and, on the other hand, if prices have risen, the extra gain that he realizes from the sale of the flour is used in settling his contract with the speculator. In either case he is left with the legitimate profits of his business, unaffected by any changes in the price of wheat.[3]

It is evident that for the miller this transaction is a form of insurance. By means of it he purchases security from certain dangers to which he would otherwise be exposed. Its nature is somewhat concealed by the peculiar form of the premium which the miller pays. Instead of paying a fixed amount, he surrenders to the speculator the chance of gain at the same time that he transfers to him the chance of loss. This fact, however, does not alter the real character of the transaction. It is evident that in the long run the speculators obtain the advantage, as otherwise they would not continue to render the service. Whether on account of their better information as to the condition of the market, or their greater shrewdness in anticipating future movements of prices, their contracts are made on such terms as to yield them a reward. This gain is virtually the insurance premium.

The benefit which society derives from this transaction is of the same kind as that which regular insurance companies confer. The diminution of the uncertainty to which the miller is exposed makes him willing to carry on his business on a much smaller margin than he would otherwise require. He no longer demands a large extra reward for carrying risk. How this increases the productivity of capital and causes a gain for the consumer of flour through a fall in its price, can be seen at once in the light of the principles already established.

Professor Emery raises a question as to the economic character of the service which speculators render and the category of distribution in which his income belongs. He finds it difficult to discover in the insuring activity of the speculator any recognized productive function. Thus we read: "Speculative risks stand in a way outside the *process* of production and speculative gains

[3] By this transaction the miller does not wholly free himself from "speculative" risk. There is a possibility of an independent change in the price of flour during the period of grinding. This risk the miller himself still carries.

constitute, not a coördinate share with wages, interest and profits, but rather such claims to the product as are represented in all property rights." Again we read: "Speculation does not directly produce wealth, but there is a real increase or decrease in the value of property due to outside causes, and this gain or loss in value is shared by speculators."

Now the appropriation by speculators of gain which accrues to property that they themselves own does not require any explanation. The possibility of such chance gains is an incident of the institution of private property. Evidently this is not what Professor Emery has in mind. It must be the appropriation by speculators of a part of the gain that accrues to the property of others that he is considering. If the owners of the property are willing to make over this gain to the speculators, the reason must be that the latter are rendering some economic service for which the former are willing to pay. Otherwise the whole affair is reduced to the plane of a gambling transaction and has no place in economic theory. The only economic claim that any one has to a share of the social product is based on the fact that he has helped to create the product. That speculators, so far as they act as insurers, use their capital and labor in a way that increases their productivity, Professor Emery himself recognizes in many places. We read, for example, "This does not mean that the speculative market is not an aid to production. It is difficult to see how a great world trade in such staples as grain and cotton would be possible without it." We are told more specifically that "Under the old method (before speculation was introduced) the trader had to allow a margin of five or ten cents a bushel on wheat to cover a possible fall in value. Today traders will carry wheat on a margin of a fraction of a cent, and the allowance for risk is practically nothing." In view of these facts and many others of a similar character which Professor Emery cites, it is not easy to understand why he is unwilling to acknowledge the productivity of the activity of the speculator. If traders carry wheat on a smaller margin, it means that less capital is needed to perform a given amount of work. In other words, the capital is more productive than it was before. This surely justifies us in calling the activity of the speculator productive. Speculation, so far as it is insurance, is a phenomenon of the

production of wealth. Distribution through this kind of speculation is a direct result of productive service.[4]

Speculation, from the point of view from which we have been considering it, is an institution which society has created for the purpose of obtaining security against a special class of risks. Perhaps it would be more accurate to say that the institution has been created for other ends, some good and some bad, and has been utilized by society for this purpose. Insurance is something of a by-product. That other operations of speculators, which are of very doubtful service to society, have to be set over against their activity as insurers cannot be denied. The evils of speculation are many and gross. It may well be hoped that in the course of time a different method of reducing the burden of this kind of risk may be evolved, which shall be as efficient as speculation and free from many of its attendant evils.

The central principle of the static theory of risk, so far as it deals with risks to capital, may be stated in a single sentence. In the approximate static state, capital will be so apportioned under the influence of risk that the productivity and reward of the different units, in the absence of other disturbing influences, will vary directly as the risk to which, in the judgment of its owner, it is exposed. The economic cost of risk in such a society would be due to inequalities in the degree of risk in different investments. This would prevent the perfect static apportionment of capital. The loss of productivity on account of the uneconomic apportionment of capital is the measure of the cost of risk in a static society.

As long as man's knowledge remains imperfect, accidental destruction of capital will be an incident of the production of wealth. The amount of such loss is far greater in some industries than in others. If society wishes to enjoy the product of a hazard-

[4] Space is lacking for a consideration of the difficulties raised by Professor Emery as to the economic identity of the speculator. There seems to be a confusion between personal and functional distribution in his discussion. The speculator could not secure the miller from loss unless he possessed the requisite amount of capital; he must therefore be a capitalist. A part of his income is interest, and this is high on account of the hazardous nature of the business. His occupation calls for the expenditure of much physical and mental energy; he is therefore a laborer. A part of his income is wages, and this part is also high on account of the great degree of skill required in the business. As he is at the same time residual claimant, he is in the position of the entrepreneur, and is entitled to any profit that may appear. The speculator, therefore, combines the three functions of capitalist, laborer and entrepreneur.

ous industry, it must be willing to pay a price high enough to replace the capital accidentally destroyed as well as that used up in the process of production. Such replacement keeps the fund of capital intact, and so long as that is done, society as a whole is not concerned with the way in which the fortunes of individual capitalists may be affected by accidental causes. To the individual, however, it makes a great difference whether he is the one who suffers the accidental loss or the one who escapes. If his capital has been accidentally destroyed, it is small comfort to him to know that the social fund of capital has been kept intact. He is, therefore, reluctant to invest his capital in hazardous industries, and he does it only when the average net return in them is above the marginal return in safe investments. This extra net return which the investor demands on account of uncertainty is the reward for risk-taking. The amount of the reward will vary with the degree of the uncertainty. It will be fixed for each degree of risk by the reluctance of the marginal investor whose capital has to be employed under conditions where it is exposed to that risk.

Entrepreneurs have to pay for the capital they borrow in proportion to the risk to which it is to be exposed. To the entrepreneur, therefore, reward for risk-taking is a part of the expense of production. He recoups himself by adding the extra cost to the price of the commodity he produces. In this way the cost of risk is finally shifted to the consumers. Consumers, then, as well as capitalists, have a voice in determining whether a hazardous industry shall be carried on. The capitalist decides what net reward he will require on account of the uncertainty. The consumer then indicates whether his desire for the product of the industry is so intense that he is willing to pay a price for it which will replace the capital used up and accidentally destroyed and leave the capitalist the reward which he demands.

There are two ways in which society may reduce the cost of uncertainty. It may adopt means to prevent the occurrence of accidental loss, or measures which will reduce the degree of uncertainty or its repellent influence without affecting the amount of positive loss. All measures of the former kind may be grouped under the name of prevention. The advisability of adopting any such device depends upon the relative expense of production with it and without it. It is the entrepreneur who decides, and he does

it by comparing the interest on the cost of the preventive measure with the saving of interest on his present investment through the diminution of risk. Those measures will be adopted which in the end are cheaper than the uncertainty they annihilate.

The general method of reducing uncertainty and unwillingness to bear it is through the transfer of risk. Considered as a transaction between individuals, this is advantageous to society whenever the one to whom the risk is transferred is for any reason less reluctant to carry it than the one from whom it is transferred. Its greatest benefit, however, is realized only when the risks of many individuals are combined in a group. When this is done the degree of uncertainty for the group as a whole is diminished. The risk of the group is less than the sum of the risks of the individuals. The institution through which this combination of risks is generally brought about is insurance.

Accumulations to meet accidental losses of capital are called insurance funds. As the amount of loss which will occur is in the nature of the case more or less uncertain, the amount of accumulation cannot be fixed exactly at the amount of loss. It is fixed at the probable amount of loss, as determined by past experience, with an allowance for fluctuations. This allowance varies with the degree of uncertainty as to the variation of the actual loss from the average. If all producers carry their own risks, the sum of these extra accumulations due to uncertainty will be very great. When the risks of the individuals are transferred to an insurance company, the company makes the accumulations for the entire group. Since the degree of uncertainty for the company is far less than that of any individual producer, the amount of the accumulation, when it is made by the company, is less than the sum of the accumulations of the individuals. The total accumulation is brought nearer to the total loss, and the extra amount, which from the point of view of society is an undesirable expense, is greatly reduced. Insurance is a method of making accumulations to meet uncertain losses, and the economic benefit which it confers upon society is the result of the reduction in the amount of these accumulations and the elimination of the part due to uncertainty.

The desire to secure the gain which the combination of risks produces is a force which fosters the growth of insurance. After the institution has once been introduced, it is evident that in the

absence of opposing influences its use will become universal. If primary dynamic changes were to cease, when time had been allowed for all friction to be overcome and for the static adjustment of the productive forces of society to be reached, all forms of risk existing in such a society would be found combined in one group. The number of risks in such a group would be so great that the allowance to be made for fluctuations of losses would be almost or entirely eliminated. The amount of positive loss would not be affected, but the amount of the accumulation to meet the accidental loss would be fixed approximately at the amount of the loss. The individual producer, no longer feeling the necessity of protecting himself against disaster, would no longer feel any reluctance to enter an industry on account of risk. So far as the influence of risk was concerned, there would be that perfect static adjustment of capital which insures its greatest productivity, and the negative loss which unequal degrees of risk would cause in a static state would entirely disappear.