## Expense Allocation and Policyholder Persistency

### 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, and an Associate of the SOA in 1986. 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, and he is presently a member of the CAS Syllabus Committee. 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 *Actuarial Forum*, and the *CAS Discussion Paper Program*.

### Abstract:

Many insurers and rating bureaus use "expense flattening" procedures to allocate insurance expenses to policyholder classifications. High risk insureds, with large expected pure premiums, do not necessarily cause higher "general and other acquisition" expenses. Flattening the expense loading reduces total premium for high loss cost policyholders, thereby enhancing equity and alleviating affordability problems.

Such is the theory. In truth, many high risk policyholders have poor persistency. Insurance expenses are incurred primarily in issuing the policy, not in renewing it, particularly for direct writing carriers. Expenses incurred are a higher than average percentage of premium for many high-risk low-persistency insureds.

Expense flattening has been used to reduce automobile insurance premiums for young male drivers - a high loss cost classification. The paper examines persistency rates for young male drivers versus other drivers, and calculates the actual expenses paid by the carrier in insuring these risks. The average expense incurred for insuring young male drivers is a larger percentage of premium than that incurred for insuring the average driver.

Thus, both equity and competitive pressures lead to the same conclusion: many high risk insureds require a higher than average expense load. The true incidence of expenses exacerbates affordability problems for policyholders of the discerning insurer, and it erodes profitability for the "expense flattening" insurer.

# EXPENSE ALLOCATION AND POLICYHOLDER PERSISTENCY

## Introduction

The allocation of insurance expenses among Personal Lines policyholders has long been a thorny problem. Until the late 1970's, most companies assigned all expenses in proportion to loss costs. Insureds with higher expected losses contributed more toward expenses, whether or not the expenses truly varied with losses or premiums.

Three factors changed this rate making philosophy. First, rate differentials widened between classes of automobile insureds, with poorer individuals - young drivers, minorities, inner city residents - generally paying higher premiums.[1] Since expenses were proportional to premiums, these drivers paid a larger part of insurance expenses, although many of these expenses did not vary directly with loss costs. Some state regulators, seeking to mitigate "affordability" problems or to subsidize auto insurance for lower income citizens, castigated insurers for not fairly allocating expense costs.[2]

Second, the proportional expense loading was considered inequitable, since the gross premiums did not accurately reflect the true incidence of expenses. Separating expenses into "fixed" and "variable" portions (actually, into expenses that varied directly with premiums and those that

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[1] Auto insurance rate differentials widened as insurers adopted more refined classification systems. See Daniel J. McNamara, "Discrimination in Property-Liability Insurance Pricing," in John D. Long and Everett D. Randall (eds.), *Issues in Insurance*, Third Edition, Volume I (Malvern, PA: American Institute for Property and Liability Underwriters, 1984), pages 8-13, for a brief history of Personal Automobile insurance classification systems in the United States.

[2] A 1977 statement by James Sheeran, Insurance Commissioner of New Jersey, illustrates this concern: "There are built into the pricing system for automobile insurance elements that increase beyond necessity the cost of insurance for those least able to bear it. The distribution of the expense dollars in proportion to the dollars assigned for losses places a cost upon the city dwellers and the households with young drivers beyond what can be reasonably attributed as the cost of providing the coverage" (James J. Sheeran, *Statement to the Governors' Conference on Automobile Insurance*, Princeton, New Jersey, March 10, 1977).

did not) would more equitably spread the costs of insurance among policyholders.[3]

Third, a proportional expense loading that does not accurately reflect total costs may result in poor pricing strategy. The insurer using a proportional expense loading would have too high an expense load on high premium policies and too low an expense load on low premium policies. It would lose market share among the high premium policies and attract more risks among the low premium policies. But the low expense loading on the latter policies would make the total premiums inadequate, leading to reduced profits.[4]

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[3] See Carl Spetzler, Barbara Casey, and Jacques Pezier, *The Role of Risk Classification in Property and Casualty Insurance: A Study of the Risk Assessment Process* (Menlo Park, CA: Stanford Research Institute, 1976), page 99; Insurance Services Office, "Expense Provisions in the Rates," CAS Part VI Examination study note, pages 8-9; James H. Hunt, "The Allocation of Insurer Expenses Among Automobile Policyholders," in Andrew F. Giffin, Vincent Travis, and William Owen (eds.), *Automobile Insurance Risk Classification: Equity and Accuracy* (Boston: Massachusetts Division of Insurance, 1978), pages 121-143; and Diana Childs and Ross A. Currie, "Expense Allocation in Insurance Ratemaking," in *Pricing Property and Casualty Insurance Products* (Casualty Actuarial Society 1980 Discussion Paper Program), pages 32-66.

[4] See Roger C. Wade, "Expense Analysis in Ratemaking and Pricing," *Proceedings of the Casualty Actuarial Society*, Vol LX, No. 113 (1973), pages 3-4. Wade gives the following example, using 1973 Pennsylvania rates: A 35 year old male driver residing in Reading, using his car for pleasure only, pays $62 annually for a standard policy. A similar individual residing in Philadelphia and driving his car more than ten miles to work pays $277 annually for the same coverage. If the premium rates are determined with a proportional *general expense* loading of 10%, the first driver contributes $6.20 towards general expenses whereas the second driver contributes $27.70.

But if half of these general expenses are unrelated to premium, then the true incidence of the general expenses is $11.86 for the first driver and $22.04 for the second driver (assuming an equal spread of exposures between Reading and Philadelphia). The insurer using a proportional expense loading is underpricing the low risk driver, and it will attract this business for which its rates are inadequate. Conversely, it is overpricing the high risk driver, and it will lose market share in this classification where its rates are redundant.

These expense figures are determined as follows: Total general expenses for the two policies are $33.90. Half of this, $16.95, is unrelated to premium. It should be divided equally between the two drivers, or $8.475 to each. Proportional general expenses constitute 5% of premiums, or $3.38 ( = [$62 - $6.20 + $8.475]/19) for the insured residing in Reading. His contribution to total general expenses is $8.475 plus $3.38, or $11.86. Proportional general expenses, or 5% of premium, are $13.57 ( = [$277 - $27.70 + $8.475]/19) for the insured residing in Philadelphia. His contribution to total general expenses is $8.47 + $13.57, or $22.04.

These arguments seem sound; they are compelling enough that many insurers and rating bureaus have adopted "expense flattening" procedures.[5] But these arguments ignore policyholder persistency, which reverses the intended conclusions. *Because of policyholder persistency patterns, expenses are a greater average percentage of premiums among many high loss cost insureds than among low loss cost insureds for the major Personal Automobile carriers.*

Data supporting this assertion are presented below. Persistency patterns overwhelmingly reject the "expense flattening" arguments, particularly for the direct writers, and to a lesser extent for Independent Agency companies. Surprisingly, casualty actuaries have ignored persistency patterns, perhaps because there are no policy reserves in Property/Casualty insurance and perhaps because the traditional (Independent Agency) commission rates do not vary by policy year. Life and pension actuaries carefully examine persistency and withdrawal rates, and casualty actuaries can learn much from their methods.

The true incidence of expense costs among policyholders will make some regulators uneasy - particularly those regulators who seek to subsidize high risk insureds. First, expense flattening is the poorer pricing strategy. The prudent carriers avoid risks with poor

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[5] Several states have mandated, by statute or regulation, Personal Automobile expense flattening procedures. For example, the New Jersey Insurance Laws, section 17:29A-37, paragraph (a), states: "Every filer making automobile rates in this State shall apply on a flat and uniform fee basis per insured automobile Statewide those miscellaneous taxes, licenses, and fees, as defined in the most recent rate filing of an automobile filer, and at least 90% of its general expenses and acquisition, field supervision, and collection expenses, excluding commissions, as such expenses are defined in the filer's most recent rate filing with the commissioner."

In a July 1978 letter to licensed insurance companies, "Expense Allocation Procedure in the Ratemaking Process," the California Department of Insurance advised: "The use of fixed percentage expense loadings for most expense elements causes an unreasonably large proportion of these costs to fall upon the higher-rated classifications in such a patently inequitable manner that the expense allocation procedure appears to result in unfair rate discrimination. . . . Companies must take immediate action to spread [general administrative expenses], when combined with other acquisition costs, more evenly among all policyholders." Two improved allocation methods are suggested in the letter: "To revise the ratemaking procedure to load flat dollar amounts to the loss costs projection; or to build the final rate as had been done in the past, back out the flat percentage loading, and replace it with a flat dollar amount."

Some states prohibit a proportional loading of administrative expenses, but require only a "reasonable" or "equitable" allocation among policyholders. See, for example, the New York Insurance Laws, Article 23, Section 2332; the Michigan Uniform Trade Practices Act, Section 500-1209; or the Florida Department of Insurance Rule 4.43-02.

persistency - most of whom also have high loss costs. Second, expense flattening makes the classification system less equitable, not more equitable. Flattened expenses diverge more from the true incidence of expenses than proportional expenses do. Third, an accurate reflection of expense costs in the premium rates, with appropriate consideration of persistency patterns, will increase the rates of many high risk drivers, instead of decreasing them.

*Nevertheless, this paper is concerned with equity, not public policy.* The direct writing carrier which accurately reflects expense costs in the premium rates will widen its classification differentials, increasing its rates for high risk insureds. This will exacerbate "affordability" problems, not alleviate them. Rectifying the expense allocation procedures will not mitigate the high costs of Personal Automobile insurance.

**Proportional Expense Loadings**

Until the late 1970's, most rate making procedures for Personal Lines insurance used proportional expense loadings. Expenses were averaged over all policies, and the premium was divided into a loss portion, the "expected or permissible loss ratio," and an expense-plus-profit portion, the "expense ratio." Philipp Stern, writing in 1965, provides an early example of this:[6]

Figure 1: Philipp Stern's Standard Loss and Expense Items
for Private Passenger and Commercial Cars

| | |
|---|---|
| Production Cost Allowance | 20.0% |
| General Administration | 5.5 |
| Inspection and Bureau | 1.0 |
| Taxes, Licenses & Fees | 3.0 |
| Underwriting Profit & Contingencies | 5.0 |
| Subtotal | 34.5% |
| Expected Loss and Loss Adjustment Expenses | 65.5% |

[6] Philipp K. Stern, "Ratemaking Procedures for Automobile Liability Insurance," *Proceedings of the Casualty Actuarial Society*, Volume 52 (1965), page 165.

If a pure premium rate making procedure is used, statewide average loss costs, or average loss costs by classification or territory, are divided by the expected loss ratio to give the average gross premium. For instance, if average loss costs for a given classification and territory are $1,000 for one car-year, then the average gross premium would be $1,000 / 0.655, or $1,527.

If a loss ratio rate making procedure is used, the experience loss ratio is divided by the expected loss ratio to give the indicated rate change. For instance, if the experience loss ratio is 75%, then the indicated rate change is 0.750 / 0.655, or +14.5%.

For expenses that vary directly with premiums, such as state premium taxes, a proportional expense loading is appropriate. For expenses that do not vary with the size of the premium, such as policy issuance costs, the proportional expense loading does not reflect the actual incidence of expenses. Pricing actuaries have therefore revised their rate making procedures to more appropriately account for expenses.

Certain expense items, such as agency commissions, do vary with the size of the premium for the insurance carrier, though the agent's efforts do not necessarily vary in the same manner. Some state regulators have asked, "If an agent does not expend much more time selling a policy to a high risk driver than to a low risk driver, so why should his commission be so much larger for the former policy?"[7] These regulators have called for revised agency contracts that distribute expense costs in relation to actual distribution efforts.

These criticisms have led to "expense flattening" procedures for Personal Automobile insurance, as described in the following section. Persistency patterns by classification reverse the conclusions, as the remainder of this paper shows.

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[7] New York Insurance Department, *Opinion and Decision*, February 28, 1977. See also James H. Hunt, "The Allocation of Insurer Expenses Among Automobile Policyholders," *op. cit.*, pages 136-140.

## Expense Flattening

In the late 1970's, the Insurance Services Office implemented an "expense fee program," or expense flattening procedure, for Personal Automobile rate making. Expenses are divided into those that vary directly with premium, or "variable expenses," and those that do not vary directly with premium, or "fixed expenses," as shown in Figure 2.[8]

Figure 2: ISO Expense Fee Program Implementation:
Fixed and Variable Expenses

| | Total Expense Provision | Percent Fixed | Fixed Expense Provision | Variable Expense Provision |
|---|---|---|---|---|
| Production Cost Allowance | 20.0% | 0% | 0.0% | 20.0% |
| General Expenses | 7.5 | 75 | 5.6 | 1.9 |
| Premium Tax | 2.0 | 0 | 0.0 | 2.0 |
| Taxes, Licenses, & Fees | 1.0 | 7.5 | 0.8 | 0.2 |
| Underwriting Profit | 5.0 | 0 | 0.0 | 5.0 |
| Total: | 35.5% | - - | 6.4% | 29.1% |
| Expected Loss Ratio (ELR) | | | = 1 - 0.355, or 64.5% | |
| Complement of Variable Expense & Profit Ratio (CVEPR) | | | = 1 - 0.291, or 70.9% | |
| Fixed Expense Ratio (FER) | | | = 6.4% | |

The expense fee is the average rate times the fixed expense ratio (FER) divided by the complement of the variable expense and profit ratio (CVEPR), or

$$\text{Expense fee} = \text{Average rate} * \text{FER} / \text{CVEPR}$$

[8] The terms "variable" and "fixed" expenses are misnomers; economists consider almost all of these to be variable costs. The true distinction is whether the expense varies directly with premium.

For example, if the average total limits bodily injury premium in a given state and territory is $1,000 for a car-year, then the expense fee is

$1,000 * 0.064 / 0.709, or $90.[9]

The premium rate for any policyholder is the sum of the variable rate and the fixed expense fee. The $1,000 average rate implies an average pure premium of $645. A classification with exactly this average pure premium pays a premium of $645/0.709 + $90, or $1,000. A classification with an average pure premium of $1,500 pays a premium of $1,500/0.709 + $90, or $2,206.

A proportional expense loading applied to the pure premium of $1,500 indicates a premium of $1,500 / 0.645, or $2,326. Expense flattening has thereby reduced the premium for high risk drivers.

**New Business and Renewal Expenses**

Insurance expenses differ greatly between new and renewal business. Acquisition and underwriting expenses are incurred primarily in writing the original policy, not in renewing the policy. The costs of advertising, underwriting the applicant, issuing the policy, and setting up files are incurred when the policy is first issued.

Similarly, agency efforts are expended in attracting new insureds, not in renewing existing policies. The independent direct writers, who write the majority of Personal Automobile policies, vary agency commissions by policy year. A typical commission scale is 25% of

[9] It is unclear why ISO flattens expenses by classification, but not by territory. Perhaps this is a response to the regulatory concerns for rate reductions primarily for high risk drivers. Regulators seeking to reduce auto insurance costs in urban areas generally restrict territorial rating instead of delving into expense procedures in policy pricing.

premium for new policies and 3% of premium for renewal policies.[10]

The figures in this paper use a commission scale that varies by policy year, since this is now the dominant mode used for Personal Automobile insurance in the United States. Independent Agency commissions, which do not vary by policy year, are discussed subsequently.

Figure 3 shows sample acquisition and underwriting expenses for original and renewal policy years subdivided between "fixed" and "variable."[11]

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[10] The high new business commission rate is often paid during the entire first policy year. Thus, if the insurer issues six month policies, the new business commission rate is paid during the first *two* policy terms. The high other acquisition and general expenses - such as advertising, underwriting, and policy issuance expenses - apply only to the first policy term.

The incidence of acquisition expenses varies greatly among direct writing insurers. Most carriers compensate their agents in a manner similar to that in the text. Others use a renewal commission unrelated to premium. Direct mail insurers incur large expenses in attracting insureds, but almost no acquisition expenses on policy renewals.

Most of these alternatives, particularly the direct mail system, magnify the discrepancy between new and renewal acquisition expenses and provide even more support to the arguments of this paper.

[11] ISO's expense flattening procedures considers 75% of the "other acquisition and general expenses" and of the "taxes, licenses, and fees" to be fixed. To demonstrate the strong effects of policyholder persistency, we classify an even higher percentage of these expenses as fixed. In fact, even if all these expenses are considered fixed, persistency patterns among young male drivers would reverse the standard "expense flattening" conclusions.

Figure 3: Acquisition and Underwriting Expenses by Policy Year

| | New Policies | | Renewal Policies | |
|---|---|---|---|---|
| | Fixed Expense Provision | Variable Expense Provision | Fixed Expense Provision | Variable Expense Provision |
| Agency Commissions | 0.0% | 25.0% | 0.0% | 3.0% |
| Advertising and Other Acq. | 5.0 | 0.0 | 0.0 | 0.0 |
| General Expenses | 12.0 | 3.0 | 3.0 | 1.0 |
| Premium Tax | 0.0 | 2.0 | 0.0 | 2.0 |
| Taxes, Licenses, & Fees | 0.8 | 0.2 | 0.8 | 0.2 |
| Total Expenses: | 17.8% | 30.2% | 3.8% | 6.2% |
| Underwriting Profit | 0.0 | 5.0 | 0.0 | 5.0 |
| Total Expenses & Profit | 17.8% | 35.2% | 3.8% | 11.2% |

The profit provision is shown in Figure 3 as a flat 5% load that does not vary by policy year. This is solely to facilitate comparison with the previous expense allocation procedures. In truth, the profit provision should reflect the risk undertaken by the carrier in providing insurance. This risk lies primarily in attracting and selecting insureds, not in renewing existing policyholders.

In other words, even if the actuary prices for an overall 5% underwriting profit, the profit provision should actually be about 10% for new policies and about 2% for renewal policies. Moreover, a 5% underwriting profit is no longer realistic for Personal Automobile pricing.[12]

[12] Stewart Myers and Richard Cohn, "A Discounted Cash Flow Approach to Property-Liability Insurance Rate Regulation," in J. David Cummins and Scott E. Harrington (eds.), *Fair Rate of Return in Property-Liability Insurance* (Boston: Kluwer*Nijhoff Publishing, 1987), pages 55-78, derive a "fair" underwriting profit margin of -3.0% for Personal Automobile Bodily Injury insurance and +1.2% for Property Damage. Raymond Hill, "Profit Regulation in Property-Liability Insurance," *The Bell Journal of Economics*, Vol 10, No. 1 (Spring 1979) pages 172-191, derives "fair" profit margins of -0.2% for stock auto carriers and +0.5% for mutual auto carriers. Howard C. Mahler, "An Introduction to Underwriting Profit Models," *Proceedings of the Casualty Actuarial Society*, Volume 71 (1987), pages 239-277, illustrates his method for Private Passenger Automobile Property Damage Liability and calculates a +3.7% underwriting profit margin. Historical industry Personal Automobile underwriting profit margins for 1979-1988 have averaged -13.6% for liability coverages and +3.2% for physical damage coverages; see *Best's Aggregates and Averages*, 1989 Edition, (Oldwick, NJ: A. M. Best Corporation, 1989), page 98.

Nevertheless, we have retained the traditional profit loading, lest the reader presume that our conclusions are influenced by changes in the profit provision.

The difference between first year and renewal expenses is striking. Issue expenses, excluding profits, are 48% of premium. At the first renewal, when new business commissions are paid but no further acquisition and underwriting costs are incurred, expenses are 32% of premium. At subsequent renewals, expenses are only 10% of premium.

Policyholder persistency therefore has a great effect on average expenses. If a policy persists for 2 terms, average expenses are (48% + 32%) / 2, or 40% (see Figure 9). If the traditional flat 5% profit provision is included, average expenses are 45%. If a policy persists for 10 terms, average expenses are (48% + 112%) / 10, or 16%. If the traditional flat 5% profit provision is included, average expenses are 21%.

## Policyholder Persistency - Exposure Distributions

Policyholder persistency may be measured in two ways. We examine first the distribution of exposures by policy term: what percentage of automobiles are newly insured, have been renewed once, twice, three times, and so forth. Figure 4 shows smoothed distributions of countrywide Personal Automobile liability exposures for a major carrier, separately for all drivers and for young male drivers.

"Young male drivers" are defined here as all male drivers under age 25 as well as unmarried male drivers aged 26 through 29. These are the classifications with the highest rate relativities, and with the largest benefits envisioned from expense flattening procedures.[13] Yet

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[13] Lawrence W. Scammon, "Automobile Accident Statistics by 'Age of Driver,'" *Proceedings of the Casualty Actuarial Society*, Volume 37 (1950), pages 43-56, shows that drivers under age 25 had about twice the pure premiums as other drivers did, using data from Massachusetts and New York. See particularly his statistics on pages 46, 48, 53, and 54, and his summary on page 44: ". . . while mileage had some minor bearing . . . the age factor was the deciding one from a rate making standpoint."

Patrick M. Butler, Twiss Butler, and Laurie L. Williams, "Sex-Divided Mileage, Accident, and Insurance Cost Data Show That Auto Insurers Overcharge Most Women," *The Journal of*

even for these insureds, as shown below, the actual incidence of expenses is a greater percentage of premium than for all drivers as a whole.

The policy duration is six months long. "Policy Term 1" comprises newly insured automobiles. "Policy Term 2" comprises automobiles with one renewal - i.e., the policy was issued or the automobile was added to the policy between six and twelve months before the accounting date. Automobiles in their tenth or later policy terms are grouped together in the data. To determine the exposure distribution and the average expense ratios, we must estimate the average policy term for automobiles in this category.

Figure 4: Exposure Distribution by Policy Term
Countrywide Personal Automobile Liability Experience
(Policy Years 1986 and 1987)

| All Drivers | | Young Male Drivers | |
|---|---|---|---|
| Policy Term | Exposure Distribution | Policy Term | Exposure Distribution |
| 1 | 10.7% | 1 | 16.5% |
| 2 | 10.3 | 2 | 15.5 |
| 3 | 8.9 | 3 | 12.4 |
| 4 | 7.5 | 4 | 9.7 |
| 5 | 6.2 | 5 | 7.1 |
| 6 | 5.2 | 6 | 5.6 |
| 7 | 4.2 | 7 | 4.4 |
| 8 | 3.7 | 8 | 3.5 |
| 9 | 3.2 | 9 | 2.7 |
| 10+ | 40.1 | 10+ | 22.6 |

There are several shortcomings with these exposure distributions. First, they severely underestimate the number of short term policies. Suppose a driver is issued an automobile policy on August 1, and he pays half of the six month bill. The most common cause of policy termination is a failure to pay the required premium (see Figure 8 below). So suppose this driver fails to pay the second quarterly premium, due by November 1, and the policy lapses. The insurer has incurred all fixed acquisition, underwriting, and policy issuance costs, but the

*Insurance Regulation*, Part I in Volume 6, No. 3 (March 1988), pages 243-284, and Part II in Volume 6, No. 4 (June 1988), pages 372-420, provide extensive evidence that men have about twice as many accidents as women. (These authors ascribe the difference to mileage rather than to gender-distinct diving habits, though the cause of the pure premium differences does not affect the conclusions of this paper.)

policy never shows up in an exposure distribution determined from December 31 experience. This phenomenon has a large influence on the true termination rates in automobile insurance, and we correct for it below.

Second, the exposure distributions are not appropriate for rapidly expanding or contracting books of business. If there is no change in business volume, then the 10.7% of all drivers in the first policy term implies that about 10.7% terminate by the first renewal. But if the business volume is growing, then even if only 5% or so of policies terminate by the first renewal, 10% may be in the first policy term. Exposure distributions derived from rapidly growing carriers require adjustment.

Third, if insureds did not change classifications over the lives of their policies, the exposure distributions shown in Figure 4 would accurately reflect persistency patterns. But young male drivers do change classifications: a 23 year old married male driver becomes an adult driver two years later. In other words, we really need exposure distributions based on the insured's classification *at policy issuance*. We seek to know what percentage of young male drivers issued insurance policies will terminate their coverage within a given time. This is not the same as the percentage of young male drivers, who were issued policies within a given past time period, who terminate their coverage during the current term.[14]

Data on original classification are rarely available. Insurance companies code policy records each year, with the current premiums and classifications. If the year of policy issuance is also coded, one can form exposure distributions as in Figure 4. But the insured's classification at policy issuance is seldom preserved.

Fortunately, by the second or third policy year, the probabilities of termination do not differ greatly between young male drivers and all drivers as a whole. The exposure distributions in

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[14] The classification changes, along with the average years of driving experience among young insureds, bias the exposure distributions. Many young male drivers have recently obtained licenses and so are in early policy years. As they gain experience and enter subsequent policy years, their classification changes to adult drivers. If we coded drivers by *original classification at policy issuance*, we would eliminate this bias. See the subsequent discussion in the text.

Figure 4 are similar for both groups of insureds between the fifth and ninth policy terms.[15] And as we shall see below, the *probabilities of termination* - the percent of new policyholders who terminate at a given renewal date - are practically the same for all drivers and for young male drivers for fifth and subsequent renewals. No adjustment to the exposure distributions is therefore made for classification changes.[16]

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[15] Since the policy term is six months long, the fifth policy term is the first half of the third coverage year.

[16] The termination *rates*, however, are different for these two groups of insureds at all renewals. The **termination rate** is *the number of terminations at a given renewal date divided by the sum of terminations at that date plus active policies at that date.* The **probability of termination** is *the number of terminations at a given renewal date divided by the number of originally issued policies.*

An illustration should help clarify the difference. Suppose 100 policies were issued to adult drivers and 100 policies were issued to young male drivers. By the fifth renewal, 20 of the adult drivers had lapsed, and 60 of the young male drivers had lapsed, leaving 80 adult drivers and 40 young male drivers. By the next renewal, an additional 5 adult drivers and 5 young male drivers terminate their coverage.

The *termination rates* are 5/80, or 6.25%, for adult drivers and 5/40, or 12.5%, for young male drivers. The *probability of termination*, however, is 5% for both groups of insureds. The expense analysis requires probabilities of termination, not termination rates. For actual automobile insurance experience, see Figure 6, where we convert termination rates to probabilities of termination.

The distinction between termination rates and probabilities of termination is borrowed from life insurance. The *mortality rate* is the annualized probability that an individual will die at a given time. The corresponding *probability* is the number of deaths at a given age divided by the number of insureds who have attained that age. Similar definitions are used for withdrawal (or lapse) rates and probabilities. See R. W. Batten, *Mortality Table Construction* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1978), and David B. Atkinson, *Pricing Individual Life Insurance*, Society of Actuaries Course I-340 Study Note (1989), pages 51-54.

Our use of these terms is not identical to that of life actuaries. The life insurance *lapse rate* pertains to a given moment of time. The *probability of lapse* is the percent of withdrawing policyholders during the year. The *termination rate* as used in this paper is equivalent to the probability of lapse. The *probability of termination* is the percent of *original* policyholders who terminate in a given year. The diagram below illustrates the use of these terms.

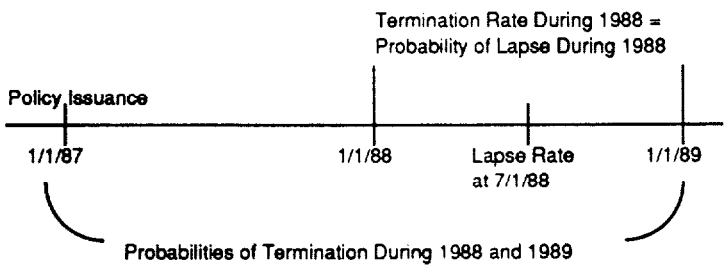
**Probabilities of Termination**

To correct for the first problem mentioned above - the loss of data on early terminations - we examine termination rates by renewal period, and then convert these to probabilities of termination.

It would be simple to calculate such rates if terminations always occurred on policy anniversaries. However, the most common cause of policy termination is a failure to pay the premium. When a driver fails to remit the premium by the due date, the insurance carrier does not immediately drop the policy from its records. (Many insureds simply pay their premiums a few weeks late.) Of course, if the insurer has not received the premium within a month or two after the due date, it will indeed terminate the policy.

Thus, we extend the policy anniversary by 45 days to determine the renewal period of each termination.[17] For instance, if an insurer issues a half year policy on March 1, 1987, and its books show that the policy terminated on April 1, 1988, we assume it terminated at the second renewal. If the insurer's books show that the policy terminated on June 1, 1988, we assume that it persisted through the second renewal, and that it terminated during the third policy term.

Figure 5 shows termination rates by policy period for all drivers and for young male drivers. A




[17] The length of the extension depends upon the carrier's "grace period" and accounting system: how long it takes for non-payment of premium to be recorded as a policy termination. Further automation of premium collection and accounting systems may slightly reduce the "extension" in the future.

termination during the first policy period means that the policy terminated between the issue date and 45 days beyond the first renewal date. A termination during the second policy period means that the policy terminated between 45 days after the first renewal date and 45 days after the second renewal date. The definitions for terminations during subsequent policy periods are similar.

"Non-issues" are not included in the figures below. In other words, if an individual applied for automobile insurance coverage and paid the policy premium, but the insurer's underwriter decided not to issue the policy and instead returned the premium, this policy is not considered a termination during the first policy period. Although some fixed underwriting expenses are indeed incurred on such policies, commissions are generally not paid. The inclusion of such policies would therefore distort the expense analysis.[18]

[18] One may argue that different "non-issue" rates by classification should be reflected in the allocation of underwriting expenses. See, for example, the Aetna Life and Casualty report, *Automobile Insurance Affordability* (March 1978), page 64: "In considering how expenses should be allocated to policyholders, it must also be noted that the company must charge policyholders for the underwriting costs of *rejecting* applications. Thus, even if the actual cost of underwriting each accepted risk were known, the amount charged to a policyholder would have to exceed that actual cost to compensate for the costs associated with the applications of rejected applicants, from whom the company collects no premium." From a purely economic viewpoint, the expense allocation should reflect the total costs for all applicants in a classification. Equity considerations may argue otherwise: why should one young male driver be charged for the expenses of other young male drivers who were declined insurance policies?

Figure 5: Termination Rates by Policy Term
Countrywide Personal Automobile Experience
(Policy Anniversaries during Fourth Quarter 1987)

| All Drivers | | Young Male Drivers | |
|---|---|---|---|
| Policy Term | Termination Rate | Policy Term | Termination Rate |
| 1 | 15.5% | 1 | 26.8% |
| 2 | 12.1 | 2 | 19.8 |
| 3 | 11.2 | 3 | 19.2 |
| 4 | 10.6 | 4 | 18.4 |
| 5 | 10.2 | 5 | 17.9 |
| 6 | 9.2 | 6 | 16.1 |
| 7 | 8.2 | 7 | 14.9 |
| 8 & Subsequent | 5.6 | 8 & Subsequent | 14.2 |

Figure 5 shows *termination rates*: the percentage of active policyholders who terminate their coverage. We need *probabilities of termination*: the percentage of original policyholders who terminate their coverage during each policy period. (See footnote 16 for a more complete discussion.) Thus, we must convert the termination rates to probabilities of termination.

Consider the experience for all drivers. 15.5% of insureds terminate their coverage during the first policy term, or 84.5% persist through the first renewal. Of these, 12.1% terminate during the second policy term. In other words, 84.5% * 12.1%, or 10.2%, of original insureds terminate during the second policy term. 74.3% (100% - 15.5% - 10.2%) of original policyholders persist through the second renewal. Of these, 11.2% terminate during the third policy term, or 8.3% (74.3% * 11.2%) of original policyholders terminate during this term.

The complete set of termination probabilities is shown in Figure 6. Note that the termination percentage for eighth and subsequent policy terms is simply the complement of the sum of the previous termination probabilities.

Figure 6: Termination Rates and Percentages by Policy Term
Countrywide Personal Automobile Experience
(Policy Anniversaries during Fourth Quarter 1987)

| All Drivers | | | Young Male Drivers | | |
|---|---|---|---|---|---|
| Policy Term | Termination Rate | Termination Percentage | Policy Term | Termination Rate | Termination Percentage |
| 1 | 15.5% | 15.5% | 1 | 26.8% | 26.8% |
| 2 | 12.1 | 10.2 | 2 | 19.8 | 14.5 |
| 3 | 11.2 | 8.3 | 3 | 19.2 | 11.3 |
| 4 | 10.6 | 7.0 | 4 | 18.4 | 8.7 |
| 5 | 10.2 | 6.0 | 5 | 17.9 | 6.9 |
| 6 | 9.2 | 4.9 | 6 | 16.1 | 5.1 |
| 7 | 8.2 | 3.9 | 7 | 14.9 | 4.0 |
| 8 + | 5.6 | 44.2 | 8 + | 14.2 | 22.7 |

Figure 7 compares the exposure distributions from Figure 4 with the termination probabilities from Figure 6. The only significant difference is in the first policy term, where actual probabilities of termination are much higher than those indicated by the exposure distribution. We will use the "selected factors" for the expense analysis. These factors are based on the probabilities of termination for the first seven policy terms, and on the exposure distributions for the eighth and subsequent policy terms.[19]

[19] The selected factors for the eighth and subsequent policy periods are the probabilities of termination for these periods spread according to the exposure distributions. For example, the "2.8%" selected factor for young male drivers at the eighth policy period equals 22.7% * 3.5% / (3.5% + 2.7% + 22.6%).

Figure 7: Exposure Distribution and Termination Percentages by Policy Term
Countrywide Personal Automobile Experience

| Policy Term | All Drivers Exposure Distribution | All Drivers Probability of Termination | All Drivers Selected Factor | Young Male Drivers Exposure Distribution | Young Male Drivers Probability of Termination | Young Male Drivers Selected Factor |
|---|---|---|---|---|---|---|
| 1 | 10.7% | 15.5% | 15.5% | 16.5% | 26.8% | 26.8% |
| 2 | 10.3 | 10.2 | 10.2 | 15.5 | 14.5 | 14.5 |
| 3 | 8.9 | 8.3 | 8.3 | 12.4 | 11.3 | 11.3 |
| 4 | 7.5 | 7.0 | 7.0 | 9.7 | 8.7 | 8.7 |
| 5 | 6.2 | 6.0 | 6.0 | 7.1 | 6.9 | 6.9 |
| 6 | 5.2 | 4.9 | 4.9 | 5.6 | 5.1 | 5.1 |
| 7 | 4.3 | 3.9 | 3.9 | 4.4 | 4.0 | 4.0 |
| 8 | 3.7 \ | | 3.5 | 3.5 \ | | 2.8 |
| 9 | 3.2 ) | 44.2 | 3.0 | 2.7 ) | 22.7 | 2.1 |
| 10+ | 40.1 / | | 37.7 | 22.6 / | | 17.8 |

**Termination Reasons**

Note how different the exposure distribution is for young male drivers versus all drivers combined. There are many reasons for this. Young male drivers are more likely to voluntarily terminate their policies, perhaps because they move to other locations, they get married and switch to their wives' insurers, or they drop their coverage after an accident. Company underwriters are more likely to cancel the coverage of a young male driver than that of an adult driver, since the young male driver is more likely to have caused an accident and be considered too risky to insure. Young male drivers are likely to experience financial difficulties and therefore fail to pay the required premiums. Finally, young male drivers with high premium payments have more incentive to shop around for cheaper coverage.

Insurance carriers rarely know the reasons lying behind a policy termination. Generally, the insured simply fails to pay the required premium. Nevertheless, the table in Figure 8, drawn

from a sample of about 220,000 automobile policies in 1988, is instructive.[20] Non-payment of premium, policy rewrites, and valid underwriting causes are the major reasons for the differences in termination rates between young male drivers and all other drivers. Disposal of the automobile and requests of the insured are less significant factors.

Figure 8: Policy Termination Reasons
1988 Personal Automobile Experience (One State Sample)

| | Young Male Drivers | All Other Drivers |
|---|---|---|
| Policy Renewals: | 73.7% | 84.9% |
| Policy Terminations: | | |
| Non-payment of premium | 14.0 | 7.3 |
| Cancellations and rewrites to other policies | 4.0 | 2.1 |
| Valid underwriting causes (e.g., prior accidents) | 3.4 | 2.0 |
| Disposal of automobile | 0.9 | 0.8 |
| Insured's request (e.g., dissatisfaction with service) | 4.0 | 2.9 |
| Total | 100.0% | 100.0% |

**Expense Flattening and Policyholder Persistency**

We have exposure distributions only for the first nine policy periods, or the first 4 1/2 years. For simplicity, we estimate the average policy term for automobiles in the 10+ category as 20 terms, or 10 years. (We assume that by the tenth policy term, the persisting young male drivers have become adult drivers, so we make no difference between the two groups of insureds.) We determine average insurance expenses for automobiles in each policy term, and then weight by the exposure distribution to determine overall expenses, as shown in Figures 9

[20] Note that this sample has higher termination rates than those for the countrywide experience as a whole. However, the relationship between the two groups of insureds is the same: terminations by young male drivers are about twice as frequent as those by other drivers.

and 10.[21] If a flat 5% underwriting profit margin is included, the variable and total expense ratios should be increased by 5%.

Figure 9: Average Expenses by Policy Term
Countrywide Personal Automobile Liability Experience

All Drivers

| Policy Term | Exposure Distribution | Issue Expenses Var | Fix | Total | Renewal Expenses Var | Fix | Total | Average Expenses Each Year Var | Fix | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 15.5% | 30.2% | 17.8% | 73.0% | 0.0% | 0.0% | 0.0% | 30.2% | 17.8% | 48.0% |
| 2 | 10.2 | 55.2 | 17.8 | 73.0 | 3.2 | 3.8 | 7.0 | 29.2 | 10.8 | 40.0 |
| 3 | 8.3 | 55.2 | 17.0 | 73.0 | 9.4 | 7.6 | 17.0 | 21.5 | 8.5 | 30.0 |
| 4 | 7.0 | 55.2 | 17.8 | 73.0 | 15.6 | 11.4 | 27.0 | 17.7 | 7.3 | 25.0 |
| 5 | 6.0 | 55.2 | 17.8 | 73.0 | 21.8 | 15.2 | 37.0 | 15.4 | 6.6 | 22.0 |
| 6 | 4.9 | 55.2 | 17.8 | 73.0 | 28.0 | 19.0 | 47.0 | 13.9 | 6.1 | 20.0 |
| 7 | 3.9 | 55.2 | 17.8 | 73.0 | 34.2 | 22.8 | 57.0 | 12.8 | 5.8 | 18.6 |
| 8 | 3.5 | 55.2 | 17.8 | 73.0 | 40.4 | 26.6 | 67.0 | 11.9 | 5.6 | 17.5 |
| 9 | 3.0 | 55.2 | 17.8 | 73.0 | 46.4 | 30.4 | 77.0 | 11.3 | 5.4 | 16.7 |
| 10+ | 37.7 | 55.2 | 17.8 | 73.0 | 114.8 | 72.2 | 187.0 | 8.5 | 4.5 | 13.0 |
| Average: | | | | | | | | 16.7% | 8.0% | 24.7% |

[21] New business commission expenses of 25% are paid both at issue and at the first renewal. At subsequent renewals, a 3% commission rate is paid. For example, at the second policy term, expenses to date are as follows: (A) new business expenses of 30.2% (variable) and 17.8% (fixed) plus (B) 25% (variable) of first renewal commissions, and renewal expenses of 3.2% (variable, excluding renewal commissions) and 3.8% (fixed). Average variable expenses to date per policy period are (30.2% + 25% + 3.2%) / 2, or 29.2%. Average fixed expenses are (17.8% + 3.8%) / 2, or 10.8%.

Subsequent renewal expenses are 6.2% (variable, including renewal commissions) and 3.8% (fixed). Thus, at the third policy term, average variable expenses are (30.2% + 25% + 3.2% + 6.2%) / 3, or 21.5%. Average fixed expenses are (17.8% + 3.8% + 3.8%) / 2, or 8.5%.

Figures 9 and 10 show representative expense ratios; they are derived from the incidence of expenses shown in Figure 3. Each insurer in a given distribution system has slightly different expense ratios, though these differences do not materially affect the conclusions in this paper.

Figure 10: Average Expenses by Policy Term
Countrywide Personal Automobile Liability Experience
Young Male Drivers Only

| Policy Term | Exposure Distribution | Issue Expenses Var | Fix | Total | Renewal Expenses Var | Fix | Total | Average Expenses Each Year Var | Fix | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 26.8% | 30.2% | 17.8% | 73.0% | 0.0% | 0.0% | 0.0% | 30.2% | 17.8% | 48.0% |
| 2 | 14.5 | 55.2 | 17.8 | 73.0 | 3.2 | 3.8 | 7.0 | 29.2 | 10.8 | 40.0 |
| 3 | 11.3 | 55.2 | 17.8 | 73.0 | 9.4 | 7.6 | 17.0 | 21.5 | 8.5 | 30.0 |
| 4 | 8.7 | 55.2 | 17.8 | 73.0 | 15.6 | 11.4 | 27.0 | 17.7 | 7.3 | 25.0 |
| 5 | 6.9 | 55.2 | 17.8 | 73.0 | 21.8 | 15.2 | 37.0 | 15.4 | 6.6 | 22.0 |
| 6 | 5.1 | 55.2 | 17.8 | 73.0 | 28.0 | 19.0 | 47.0 | 13.9 | 6.1 | 20.0 |
| 7 | 4.0 | 55.2 | 17.8 | 73.0 | 34.2 | 22.8 | 57.0 | 12.8 | 5.8 | 18.6 |
| 8 | 2.8 | 55.2 | 17.8 | 73.0 | 40.4 | 26.6 | 67.0 | 11.9 | 5.6 | 17.5 |
| 9 | 2.1 | 55.2 | 17.8 | 73.0 | 46.4 | 30.4 | 77.0 | 11.3 | 5.4 | 16.7 |
| 10+ | 17.8 | 55.2 | 17.8 | 73.0 | 114.8 | 72.2 | 187.0 | 8.5 | 4.5 | 13.0 |
| Average: | | | | | | | | 20.7% | 10.0% | 30.7% |

**Average Premiums**

To properly allocate the fixed expenses among policyholders, we must know the average total policy premium by classification. Three considerations affect the ratio of the average total premium for young male drivers to the average total premium for all drivers:

1. *Young male driver rate relativities by coverage:* Average rate relativities for young male drivers are approximately 2.5 for Bodily Injury, Property Damage, and Collision, and about 2.0 for Comprehensive, compared with the "base" classification rate (adult pleasure use). The total average young male driver rate relativity to that of *all* drivers is approximately 2.0.[22]

2. *Physical damage coverage by classification:* Young male drivers are more likely than other

[22] These average relativities were drawn from the current classification plan and experience of a major insurer. The same is true of the subsequent observations on coverages, limits, and deductibles. C. A. Kulp and John W. Hall, *Casualty Insurance* (New York: John Wiley and Sons, 1968), pages 391 and 393, show similar rate relativities the 1967 classification plan of the Insurance Rating Board.

drivers to have only liability coverage but no physical damage coverage, because their premiums are so high and because they drive less valuable automobiles.

3. *Average liability increased limits and physical damage deductibles:* Young male drivers have lower average liability limits and higher average physical damage deductibles for a given type of automobile. The higher average premiums for young male drivers and the reluctance of company underwriters to provide high liability limits or full physical damage coverage to high risk drivers are the major reasons for this.

Note that the fixed acquisition and underwriting costs do not vary with the number of coverages purchased, the liability limits, or the physical damage deductibles. In other words, we should not simply compare the average young male driver Bodily Injury rate to the average rate for all drivers. Rather, we must compare the average total premium for young male drivers to the average total premium for all drivers.[23]

A sample of 278,000 1988 automobile policies showed average annual premiums of $439 for all drivers and $656 for young male drivers. The ratio of average total premium for young male drivers to the average total premium for all drivers is 1.494, which we round to 1.5 for the subsequent expense analysis. (The absolute dollar amounts vary by year, state, and territory, but the ratio of 1.5 fluctuates much less.)

Thus, only two thirds (1 / 1.5) of the fixed expenses of young male drivers should be allocated to these policyholders. Of their 10.0% fixed expenses, 6.7% should be allocated to young male drivers and 3.3% should be allocated to other classifications. The average expense ratio for young male drivers is therefore 20.7% + 6.7% = 27.4%. This is still almost three percentage points above the average expense ratio for all drivers (24.7%).

**Independent Agency versus Direct Writing Companies**

The conclusion is clear: insurers incur more expenses, even as a percentage of premium, for

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[23] See Diana Childs and Ross A. Currie, "Expense Allocation in Insurance Ratemaking," *op. cit.*, pages 53-54.

young male drivers than for all drivers as a whole. Many field underwriters have long been aware of this. They issue a policy to a high risk driver, pay the agent's commission, set up files, prepare premium billings, and then find that the insured terminates the coverage half a year later. The policy issued to a middle-aged married couple living in a small town, however, may persist for 15 years, with very low renewal expenses.

But what about independent agency companies, which pay level commissions each policy year? Should we not flatten their expense ratios?

There are two major distribution systems for automobile insurance: direct writing and independent agents. The direct writing companies are more efficient distributors, and they are steadily gaining market share. Persistency patterns make many of the high risk classifications less profitable for these companies than the low risk classifications are. Direct writing companies would like to insure the profitable risks, leaving other drivers to the independent agency companies.

The disparity between independent agency commission rates and actual acquisition efforts make independent agency companies less efficient. By flattening expenses, these companies would reduce premiums for high risk drivers, thereby attracting more of these risks from the direct writers. Meanwhile, they would increase premiums for low risk drivers, causing these insureds to move to direct writers.

Direct writers continually seek to reduce their penetration among unprofitable classifications and increase their market shares among profitable classifications. By flattening expenses, independent agency companies do this work for them - sending more profitable insureds to direct writers and keeping less profitable insureds for themselves. This hardly seems like a sensible business strategy.

We have illustrated expense allocation procedures for young male drivers, since these are the insureds that "expense flattening" methods are intended to help.[24] Similar analyses may be done

[24] Throughout this paper, we have assumed that general expense and acquisition costs do not vary among policies except for persistency differences. However, there is reason to believe that they do, though there is insufficient data to quantify the differences. For instance, Louis E. Buck, in summarizing the findings of the Aetna Automobile Insurance Affordability Task Force for the National Association of Insurance Commissioners (Zone IV meeting, Indianapolis,

for other groups. For instance, retired drivers have extremely low termination rates and therefore form a very profitable market segment.[25] Policyholder persistency is an essential element of accurate actuarial pricing.

## Conclusion

Life and health actuaries carefully examine persistency patterns. Issue expenses must be amortized over the life of the policy, so early lapses cause a net loss to the insurer. Mortality and morbidity rates also vary with persistency patterns, since unhealthy insureds make greater efforts to retain their policies.[26] Persistency patterns are analyzed by issue age, duration,

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Indiana, October 9, 1978), said: ". . . there are differences by classification in the cost of handling policies. It is more expensive to handle a policy for a young, single male in a given territory than an adult policy in the same territory. This difference can be attributed to such factors as more frequent policy changes and flat cancellations in the youthful male policies." His accompanying statistics show policy processing costs to be 50% to 100% higher for youthful unmarried male drivers than for adult drivers. See the Aetna Life and Casualty report, *Automobile Insurance Affordability* (March 1978), statement of Louis E. Buck, page 9. Some of these factors, such as cancellations, are related to persistency. Others, such as policy changes, are independent.

[25] See the companion paper, "Persistency and Profits," for an analysis of the Personal Automobile retired driver discount.

[26] See, for example, William F. Bluhm, "Cumulative Antiselection Theory," *Transactions of the Society of Actuaries*, Volume 34, pages 215-246. Speaking of health insurance, Bluhm notes that "Those insureds who are aware of their 'impaired' status (meaning that they have higher claim expectations) logically have a lower lapse rate than healthy policyholders, at least during the early durations, when lapse rates are higher" (page 216). The greater persistency of impaired lives produces consistently deteriorating loss ratios, from below 50% in the first two policy years to above 150% after twelve years (pages 227-229, using Bluhm's assumed lapse rate parameters).

Persistency patterns are particularly important for pricing "select and ultimate term" life insurance policies (also called "revertable term" or "re-entry term"). Applicants are initially charged select term life premium rates. After five years, the insured must either resubmit evidence of insurability to qualify for a new period of select term life insurance rates, or he is charged higher "ultimate" rates. Since these ultimate rates are higher than traditional term life insurance rates, policyholders who do not qualify for re-entry select rates often lapse their policies and seek cheaper coverage elsewhere.

interest rates, sex, rating (standard, preferred, and substandard), policy face amount, premium payment pattern (whole life versus paid up life; annual, monthly, and payroll deduction), policy form (whole life, universal life, traditional term, select and ultimate term), and numerous other variables.

Casualty actuaries have ignored this topic. We have no published studies of the effects of persistency on Property/Casualty loss ratios or expense ratios. We have not examined persistency patterns by classification, territory, or policy form.

Yet low expense and loss ratios form only half of a good insurance strategy; persistency patterns form the other half. An insurer would gladly give up a point or two in its operating ratio to build a stable group of persisting policyholders. The persisting policyholder provides profits not just in the current year but in future years as well, whereas profits from the terminating policyholder end abruptly. The casualty actuary must forecast the long-term profits from a group of insureds - and he can not do that without knowing their persistency pattern.

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On pricing these policies, Gregory D. Jacobs writes: "Mortality and withdrawals are intimately related and are extremely important assumptions in pricing Select and Ultimate Term products. In pricing traditional (aggregate) Annual Renewable Term, a withdrawal assumption (or scenario of assumptions) is generally made, based on recent experience. An underlying level of mortality is also set. However, assuming the majority of insureds that lapse are good risks and persisters tend to be worse risks, an increasing mortality ratio should be applied to renewal mortality rates. This is the classical anti-selection theory." See his *Pricing Non-Traditional Individual Life Products* (Society of Actuaries Course I-340 Study Note), no date, page 17.

Thus, policyholders who do not qualify for re-entry have a high lapse rate. Of these, it is primarily the healthy insureds who lapse and seek coverage elsewhere. The cumulative anti-selection process that Bluhm analyzes for health insurance applies with equal force to select and ultimate term life products.