A FRAMEWORK FOR FORECASTING PROPERTY-CASUALTY INSURERS' FINANCIAL RESULTS

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Abstract

This paper discusses considerations in modelling insurers' financial results and describes a model developed by the authors to forecast results for the property-casualty industry. One purpose of the model presented is to project industry GAAP-adjusted return on net worth in future years. Rather than model return on net worth directly, e.g., using a single equation, the authors use a component approach that models earned premium, incurred losses, net investment income, etc. separately and uses accounting relationships to calculate return on net worth figures.

To date, in the few cases where the literature of the CAS has addressed financial modelling, the applications have usually been narrow, focusing on only one or two components of total profitability. This paper seeks to provide a ready reference and starting point for actuaries involved in financial forecasting. The paper presents models for most variables of interest and discusses modelling considerations in cases where acceptable models have not yet been developed. Several potential areas of improvement to the models are noted. Considerations in adapting the industry model to a particular company or group are discussed. Some interpretative issues are also addressed, including how to measure profitability of property-casualty insurers and how to adjust statutory income and surplus to be approximately consistent with GAAP.

I. INTRODUCTION

Financial models may take a variety of forms and serve many purposes in business decision making. To mention a few purposes, models may be used to: (1) evaluate an opportunity to sell a new product, (2) determine target sales margins for various divisions or product groups within a company, (3) project overall profitability of a company or industry and (4) test the sensitivity of financial results to changes in the economic environment.

This paper will discuss considerations in constructing a model applicable to property-casualty insurance to address the latter two objectives -- projecting profitability and testing sensitivity to exogenous influences In doing so we will present an industry model, discuss the logic of its design and describe necessary adaptations to apply this type of model to a particular industry segment or individual insurer.

Although actuaries are increasingly called upon to prepare forecasts, the literature of the Casualty Actuarial Society has given relatively little attention to forecasting financial results. Many papers have addressed the selection of trend factors for rate projections, but only a handful of authors have discussed models for projecting components of underwriting results (for example, Alff and Nikstad [1], Lommele and Sturgis [5] and Jaeger and Wachter [2]). Even fewer have tackled the components of profitability and surplus other than underwriting results (one exception is Gillam[4]).

The model presented in this paper is far from the final word on financial projections for the property-casualty industry. We have not yet succeeded in modelling every element of interest and, in many cases where we have constructed a model, we are not yet satisfied that it is the optimal form. However, we believe that we are headed in the right direction, and the model has reached a degree of completeness and refinement so that we are comfortable using it as our work requires.

The remainder of this paper is organized as follows.

Section II provides an overview of the model, discusses the model structure and identifies the variables included in the model.

Sections III, IV and V present the regression results and discuss modelling considerations for various components of the model. Section III includes the underwriting components of the model (premiums, losses, expenses and dividends to policyholders). Section IV presents models for the remaining components of net after-tax income (investment income, realized capital gains and taxes), and Section V discusses models for other surplus changes, including dividends to stockholders and new funds.

Section VI presents a retrospective test of the model's forecasts of 1985 industry results and provides a forecast of 1986 industry results based on the model.

Section VII summarizes areas of potential improvements to the industrywide model, and Section VIII comments on how to adapt the model to apply to a particular company. Section IX identifies sources of data used in the model and acknowledges contributors to the model and this paper. As noted, various publications and data tapes distributed by A.M. Best Co. are the source of most of the historical data presented in this paper and underlying our industry model.

Six appendices are included to provide details on results, judgmental considerations and interpretations of the model:

Appendix A - Line Groups

Appendix B - Considerations in Projecting Items Not Modelled

Appendix C - Measures of Profitability

Appendix D - GAAP Adjustments

Appendix E - Retrospective Forecast Test

Appendix F - Model Forecast

II. OVERVIEW OF THE MODEL

The first step toward building a model consists of a careful selection of those variables that are critical to the predictive capabilities of the model. One must weigh the benefit gained from additional explanatory variables against the cost of a more complex model. We have chosen to forecast the set of variables for our industry model with full knowledge that many of the excluded variables in Table II-1 are not unimportant. The model we are presenting incorporates only the most essential variables and thus has the advantage of relative simplicity.

TABLE II-1: ELEMENTS FORECASTED IN THE MODEL

Written premium	Net admitted assets
Earned premium	Net investment income
Paid losses and LAE	Realized capital gains
Reserve strengthening	Income tax
Incurred losses and LAE	Unrealized capital gains
Underwriting expenses	Dividends to stockholders
Policyholder dividends	New funds
Miscellaneous (Other) income	Miscellaneous surplus changes

These elements are chosen as the items of greatest interest from an industry perspective. For a particular company or market segment, some of the selected elements may not be very important while other elements - not included - may be critical. As examples, dividends to stockholders are of no interest when analyzing mutual companies, but foreign exchange fluctuations may be very important for a company heavily involved abroad.

Of the sixteen variables listed above, eleven are forecasted using regression equations or other techniques described in this paper. The remaining five variables (listed in Table II-2) are currently input items. For these input items, Appendix B provides data analysis and offers insights on the underlying conditions affecting them. These insights provide guidance in selecting future values and may lead some day to the successful development of model equations for these items.

Other than the five insurance items listed in Table II-2, the input items to the model are historical data for the sixteen variables and history and forecasts of various general economic variables. Table II-2 lists the judgmental input items and economic indices that are used as independent variables. All other variables are calculated from historical data, these five basic judgmental input items and the following general economic variables.

TABLE II-2: MODEL INPUTS

Judgmental Insurance Items	General Economic Variables
1) Written premium growth	1) S&P 500 stock index
2) Paid losses and LAE	2) S&P preferred stock index
3) Reserve strengthening	3) S&P municipal bond price index
4) Miscellaneous (other) income	4) S&P U.S. government long-term bond price index
5) Miscellaneous surplus changes	5) Yield rates for S&P 500 stocks, 3-month T-bills, 3-5 year T-notes, 20 year T-bonds and AAA municipal bonds

Given forecasts of each of the items in Table II-1, many important measures of profitability and solvency can be obtained. Specifically, we calculate the quantities listed in Table II-3.

TABLE II-3: ITEMS DERIVED BY THE MODEL

Loss ratio	Statutory surplus
Underwriting gain/loss	Liabilities
Combined ratio	Premium-to-surplus ratio
Operating income	Reserve-to-surplus ratio
Net income after taxes	GAAP-adjusted return (after-tax income)
Loss and LAE reserves	GAAP-adjusted net worth
Unearned premium reserve	GAAP-adjusted return on net worth (RONW)

We have chosen an overall modelling approach that might be termed a "component model". This approach determines several fundamental variables that can either be judgmentally selected or modelled on external data. All other variables of interest are calculated in terms of the fundamental variables and general economic indices.

A component approach was clearly best given our modelling objectives, but we also recognize the merits of alternative approaches. One obvious alternative would be to model return on net worth directly, without the steps we've taken to model intermediate variables. A "direct model" of return on net worth would not have been satisfactory for our purposes because our goal was to project a complete picture of future industry financial results, including premium adequacy, profitability measures and leverage measures.

If we put our various other modelling objectives aside for the moment, though, an interesting question arises: which modelling approach is best if the sole objective is to forecast return on net worth as accurately as possible? Although it is not obvious whether a component approach or a direct approach is preferable in this instance, we still tend to favor the component approach. As indicated by the following list of relative advantages of each approach, the component approach provides a framework for judging and explaining the reasonableness of a predicted rate of return on net worth. In our opinion, this enhanced ability to understand and judge a forecast is an important advantage.

TABLE II-4: RELATIVE ADVANTAGES OF DIRECT MODELS vs COMPONENT MODELS FOR FORECASTING RETURNS ON NET WORTH

Advantages of Direct Models	Advantages of Component Models
• Avoid potential problem of compounding errors from several models.	• Allow judgment to be exercised by modeller/user in a structured manner.
• Discourage excessive use of judgement to alter model forecasts.	• Allow sensitivity to various scenarios to be easily tested.
• Exclude independent variables which may not be important to return on net worth projections.	• Easier to modify when external factors (e.g., federal income tax laws) change.
• May be easier to develop.	• Allow modeller to build consistently upon any previous modelling efforts related to the determinants of return on net worth.

III. MODELS FOR PROJECTING PREMIUMS, LOSSES, EXPENSES AND DIVIDENDS TO POLICYHOLDERS

The model structure includes seven basic underwriting variables:

1) Written Premium
2) Earned Premium
3) Paid Losses and LAE
4) Reserve Strengthening
5) Incurred Losses and LAE
6) Underwriting Expenses
7) Dividends to Policyholders

Three of these seven -- written premium, paid losses and LAE and reserve strengthening -- are judgmental input items and are discussed in detail in Appendix B. The other four variables are discussed below in the following order:

- Premiums
- Losses
- Underwriting Expenses
- Dividends to Policyholders

Following the discussion of these four variables this section concludes by indicating the formulas used for (1) underwriting gain/loss and (2) the combined ratio.

As a general consideration, the seven basic underwriting elements are better modelled on a line (of business) or line group basis rather than on an all-lines basis. We model these items separately for the six line groups discussed in Appendix A. Although the use of line groups has many advantages, it is not essential to the methods of this paper.

Premiums

In the model, net written premium growth is judgmentally selected on a line group basis taking into consideration several factors. Although a model adequately explaining premium growth has eluded us and no general model has yet been published by anyone, an analysis of the components of premium growth is instructive. Appendix B discusses considerations in modelling written premium in terms of four key factors: exposure growth, loss and expense growth, rate level adequacy and self-insurance mechanisms. Given actual written premium amounts in prior periods and a selection of written premium in the current period a reasonably good estimate of earned premium for the current period can be obtained. In a stable environment in which written premium changes are smooth and the line mix is relatively constant, the following simple model expressing current net earned premium (EP) as a linear form in current and prior year written premium (WP) can be utilized.

$$EP_t = A\ WP_t + (1-A)\ WP_{t-1}$$

Using eleven years of data (1975-85), we regress earned premium on prior year and current year written premium and obtain the following coefficients:

$$EP_t = .606\ WP_t + .394\ WP_{t-1}$$

The model fits well with an R^2 of .96, a t-statistic of 29.5 (significant at 1%) and an F statistic of 220.9 (significant at 1%).

Two refinements improve model accuracy when conditions are not so stable: modelling earned premium by line and modelling quarterly data. These refinements are introduced below.

We might expect at the outset that relationships between written and earned premium vary by line of business. Two sources of such variation are (1) differences in policy term and (2) different degrees of use of retrospective rating procedures. In order to keep our model reasonably simple, we use the six line groups discussed in Appendix A.

Table III-1 summarizes the results of regressions for each line group based on eleven years of data (1975-85). Except for Other Commercial Lines, where the regression is insignificant, all t-statistics and F-statistics are significant at the 1% level for these models.

The regression equations are fit based on a single independent variable -- the current-year coefficient A. The prior year's coefficient is then 1-A as indicated by the above equation. The alternative approach of using two independent variables and not forcing the coefficients to sum to unity produces better regression statistics for some line groups, but the resulting forecasts are not significantly different. We use the model form that forces the coefficients to sum to unity for all annual earned premium regression results shown in this paper.

TABLE III-1: ANNUAL EARNED PREMIUM MODELS BY LINE GROUP

Line Group	Coef. (t-stat.) A	R^2	F
Personal Lines	.644 (35.1)	.92	99.2
Accident & Health	.829 (7.4)	.86	53.7
Workers Compensation	.812 (22.5)	.96	206.3
Major Commercial Lines	.586 (35.1)	.99	800.1
Other Commercial Lines	.540*(*)	*	*
Reinsurance	.741 (13.3)	.90	85.0

* Regression fit for Other Commercial Lines is not reasonable; value of A selected.

As with any regression model, the results of the earned premium fits should only be used if they are consistent with a priori expectations. Due to the use of six-month policies in personal lines and retrospective premium adjustments in commercial lines, we expect the regressions to produce current year coefficients (A) that are somewhat greater than .50. The results for Personal Lines, Major Commercial Lines and Reinsurance are in line with a priori expectations. The high current-year coefficient (.812) for Workers Compensation was discussed by Lommele and Sturgis[5] and appears reasonable. The Accident and Health line includes mainly group business (about 70% in 1985) which is commonly written on a retrospective rating basis. Since retrospective premiums are earned as written, it may be reasonable for the current-year coefficient for Accident & Health to be high, but a coefficient of .829 may be higher than can be justificated by this observation.

Due to the volatility of the Other Commercial Lines data, a reasonable regression equation cannot be fit as it can be for the other line groups. To analyze stability and consistency of data, we calcualte an indicated coefficient (A_t) for each year t by the following formula:

$$A_t = \frac{EP_t - WP_{t-1}}{WP_t - WP_{t-1}}$$

A_t represents the coefficient that would exactly predict EP_t given WP_t and WP_{t-1} based on the following equation:

$$EP_t = A_t WP_t + (1-A_t)\ WP_{t-1}$$

Therefore, we expect that each A_t will be positive and less than unity. However, such is not always the case, and for Other Commercial Lines, values of A_t ranged from -0.65 to 0.73. Given unsuccessful regression attempts for Other Commercial Lines, we select the median value of A_t, excluding outliers. This produces a selected coefficient of .540.

An indication of a modest improvement in the forecast due to development of the by-line model is shown by the comparison of 1985 forecasts in Table III-2. This forecast test is not based on the model coefficients shown in Table III-1 above, except for Other Commercial Lines, where the selected value of .54 was used. For the other line groups the test is based on the following coefficients (values of A) from models fit to 1975-84 data:

All Lines	.662
Personal	.663
Accident & Health	.844
Workers Comp.	.790
Major Commercial	.656
Reinsurance	.859

The by-line forecast includes an adjustment factor of 1.003 which increases the sum of the line group earned premiums to match the all lines total reported by A.M. Best for 1984.

TABLE III-2: 1985 EARNED PREMIUM FORECAST
BASED ON 1984 and 1985 WRITTEN PREMIUM
($ Millions)

All-Lines Model	By-Line Model	Actual
135,978	135,764	133,342

The error in the all-lines model forecast is reduced slightly by modelling individual lines. Although the two forecasts are very similar in this instance, we believe that larger differences could occur in the future, and the by-line model will tend to be more accurate.

A second refinement is necessitated by the sharp increase in written premium in the last few years. Because earned premium depends heavily on the timing of the increases, we prefer to model earned premium on a quarterly basis. Our model now takes the following form:

$$EP_q = A \cdot WP_q + B \cdot WP_{q-1} + C \cdot WP_{q-2} + D \cdot WP_{q-3} + E \cdot WP_{q-4}$$

Data are readily available to fit this refined model only for Personal Lines, Major Commercial Lines and Workers Compensation. We consistently find for these line groups that the coefficient E is either insignificant or negative and, therefore, drop the last term from the equation. Table III-3 presents the results of the refined model for these three line groups.

TABLE III-3: QUARTERLY EARNED PREMIUM MODEL
BY LINE GROUP

	Coefficient (t-statistic)					
Line Group	A	B	C	D	R^2	F
Personal	.219(10.1)	.383(16.2)	.226(9.6)	.172(7.6)	.999	18,008
Major Comm.	.225(4.5)	.340(5.7)	.184(3.2)	.244(4.5)	.996	2,921
Work. Comp.	.242(7.0)	.276(7.8)	.228(6.0)	.269(7.2)	.987	806

These quarterly models produce excellent fits. All t-statistics and F statistics are significant at the 1% level. An indication of the substantial improvement in the forecast attributable to modelling quarterly data is provided by the following comparison of 1985 forecasts. As in Table III-3, the forecasts in Table III-4 were developed from models fit with data through 1984.

TABLE III-4: 1985 EARNED PREMIUM FORECAST
BASED ON 1984 AND 1985 WRITTEN PREMIUM BY QUARTER
($ Millions)

Line Group	Annual Model	Quarterly Model	Actual
Personal Lines	61,896	61,699	61,376
Major Commercial Lines	33,815	32,806	32,668
Workers Compensation	16,640	16,267	16,858
SUB-TOTAL	112,351	110,781	110,902
ALL-LINES TOTAL	135,764	134,027	133,342

Overall, the quarterly model improves the 1985 earned premium forecast, but the results are not consistent for all three line groups. For both Personal Lines and Major Commercial Lines, the quarterly model is superior. The striking improvement for Major Commercial Lines is consistent with the fact that this line group saw the most volatile premium growth in 1985. For Workers Compensation, it is puzzling that results for the annual model are better than results for the quarterly model; we suspect that this situation is due to data problems.

Losses

We model calendar year losses in terms of four variables: paid losses, "normal" reserve growth, reserve strengthening (or weakening) and incurred losses. These four variables have strong interrelationships but clearly given any three, the fourth is automatically derivable. We have chosen to model normal reserve growth, to judgmentally select paid losses and reserve strengthening, and then to derive forecasts of incurred losses. Considerations in projecting paid losses and reserve strengthening are discussed in Appendix B. The formula for incurred losses, including "normal" reserve growth, is discussed below.

After paid losses and reserve strengthening are selected, incurred losses are modelled in two steps. We first model incurred loss growth under an assumption of constant reserve adequacy. An examination of the historic data in Table III-5 shows that, in general, incurred losses grow faster than paid losses. Reserves must grow even to maintain a constant level of reserve adequacy because of the increasing influence of casualty business and the resulting lengthening of the tail. We call this phenomenon "normal reserve growth".

TABLE III-5: COMPARISON OF PAID LOSS GROWTH AND INCURRED LOSS GROWTH
PROPERTY CASUALTY INDUSTRY, 1960-85

(1)	(2)	(3)	(4)	(5)	(6)
	Incurred Loss & LAE		Paid Loss & LAE		
Year	Percent Change	Cumulative Ave. Annual Percent Change	Percent Change	Cumulative Ave. Annual Percent Change	Difference (3)-(5)
1960	9.26	9.26	9.16	9.16	0.10
1961	5.44	7.33	7.26	8.20	-0.87
1962	6.55	7.07	7.64	8.01	-0.94
1963	7.52	7.18	5.34	7.34	-0.16
1964	10.32	7.80	10.12	7.89	-0.09
1965	9.16	8.03	7.22	7.78	0.25
1966	5.81	7.71	6.90	7.65	0.05
1967	10.52	8.05	9.80	7.92	0.14
1968	11.83	8.47	11.18	8.28	0.19
1969	14.19	9.03	12.74	8.71	0.31
1970	10.28	9.14	10.81	8.90	0.24
1971	3.65	8.67	0.34	8.16	0.51
1972	9.52	8.74	7.23	8.09	0.65
1973	13.12	9.04	14.91	8.56	0.48
1974	16.48	9.53	17.21	9.21	0.41
1975	14.82	9.85	14.33	9.44	0.41
1976	13.68	10.07	7.94	9.35	0.72
1977	13.01	10.23	9.34	9.35	0.88
1978	13.34	10.39	11.92	9.48	**0.91**
1979	15.14	10.63	17.78	9.88	0.74
1980	10.61	10.63	15.17	10.13	0.50
1981	6.57	10.44	9.57	10.10	0.33
1982	8.69	10.36	11.43	10.16	0.20
1983	7.36	10.23	7.97	10.07	0.16
1984	16.07	10.46	14.14	10.23	0.23
1985	16.44	10.69	11.78	10.29	0.40

In order to estimate the amount of "normal" reserve growth we need to find two years with comparable reserve adequacy. We make the assumption that the 1959 industry reserve was adequate. This assumption is justified by the observations that property insurance dominated and interest rates were low in the 1950's. We then choose 1978 as a recent year in which reserves were most nearly adequate and assume that the levels of reserve adequacy in 1959 and 1978 are comparable. The last column of Table III-5 displays the difference between the average annual growth rates of incurred and paid losses using 1959 as the base year. That difference was .91 in 1978. We have examined the sensitivity of this analysis to the starting year and found that selecting 1960 and 1963 as starting years produces a difference in 1978 of .96 and 1.27 respectively. Based on this analysis we select an additive factor (AF) of 1.0. This factor is added to the percent growth in paid losses to obtain the expected percent growth in incurred losses at the same level of reserve adequacy. A refinement of this procedure would examine the variation of the additive factor by line.

Our calculation of incurred losses adjusts for differing levels of reserve strengthening in successive years. To obtain incurred losses in year t, we subtract our estimate of reserve strengthening during year t-1 from incurred losses in year t-1, apply our expected growth rate of incurred losses developed above, and add reserve strengthening expected during year t.

Symbolically, the formula for incurred losses in year t (ILt) in terms of paid losses (PL), incurred losses in year t-1 (IL_{t-1}), dollars of reserve strengthening (RS) and the additive factor (AF) is:

$$IL_t = \left(\frac{PL_t - PL_{t-1}}{PL_{t-1}} + AF\right)(IL_{t-1} - RS_{t-1}) + RS_t$$

Underwriting Expenses

Underwriting expenses comprise a broad category of expenditures that are subject to varying influences, including premium volume, general price levels in the economy and profitability. Our current model for underwriting expenses uses premium volume and profitability as independent variables. Although expenses also show a statistical relationship to general price levels the relationship is not as strong based on current data, so we do not now include an inflation variable in the model. For comparison, regression results are discussed below for alternative models that include and exclude the inflation variable.

In initial modelling efforts, we expected to find that some components of underwriting expenses, such as commissions and taxes, grow with written premium while other components, such as total industry salaries and overhead, are more closely related to general economic price levels (measured by GNPD, the GNP deflator). We also expected that expenses would tend to be higher in profitable years and lower in unprofitable years, where profits are measured by return on net worth (RONW). A model form that reflects all three influences is shown below along with regression statistics based on 1967-85 annual data.

Model Including GNPD Variable

U/W expense growth = A (WP growth) + B (RONW) + C (GNPD change)

A = .508 (t = 11.1, significant at 1%)

B = .351 (t = 5.3, significant at 1%)

C = .131 (t = 1.3, not significant at 5%)

R^2 = .875

F statistic = 35.7, significant at 1%

All variables in the above equation are expressed as percent growths. For example, the coefficients should be interpreted as follows: a 10% increase in written premium growth will cause a 5.08% increment to growth in underwriting expenses.

Based on a review of the above regression results and other analysis, we do not include the GNPD variable in our current model for underwriting expenses. The current model form and regression results are shown below. A comparison with the above results shows that dropping the GNPD change causes the R^2 to decline only slightly, indicating little loss of explanatory power of the model.

Current Model Form

U/W expense growth = A (WP growth) + B (RONW)

A = .525 (t = 11.8, significant at 1%)

B = .408 (t = 8.4, significant at 1%)

R^2 = .862

F statistic = 51.7, significant at 1%

One difficulty in applying this model is that one of the independent variables (RONW) is itself calculated directly from expenses in the overall financial model. That is, if expenses are unknown so is RONW. To solve for RONW and expenses, then, requires a recursive calculation. We start with an initial estimate of expenses to calculate an initial estimate of RONW. This estimate of RONW can be used in the above model to generate a growth rate for expenses. This procedure is repeated until the changes in RONW and expenses stabilize.

One procedure for choosing an initial expense estimate is to use the simple model:

U/W Exp Growth = A + B (WP Growth)

A regression analysis of this model indicates values for the coefficients A and B of .047 and .489, respectively.

Logically, it may also be appropriate to include a constant term in the expense model. The current form without a constant implies that expenses will be level when there is no inflation and RONW equals zero, which may not be realistic. However, a constant is not significant at the current time (estimated constant = .016; t statistic = 2.0). The significance of the constant term should continue to be monitored as more data become available in the future.

Another consideration for the future may be to break expenses down into more homogeneous categories. As one attempt in this regard, we separated expenses into inflation-sensitive and premium-sensitive categories. The premium-sensitive group was defined to include commissions, taxes, licenses and fees, and insurance, and all other expense items were considered inflation-sensitive. Unfortunately, extensive modelling efforts on these categories proved generally unsuccessful. We concluded that growing market shares of direct writers over the period under study distorted the expense categories by reducing commissions and increasing other expenses. Possibly, separate models for premium-sensitive and inflation-sensitive expenses would be viable if the data were also modelled separately for direct writers and agency companies.

Dividends To Policyholders

Dividends to policyholders are significant in some lines of insurance but negligible in many lines. The largest average dividends relative to premium are distributed to Workers Compensation policyholders, and the majority of industry dividends are distributed in this single line of insurance. As a result, we modelled policyholder dividends separately for Workers Compensation and All Other Lines.

TABLE III-6: SUMMARY OF 1985 DIVIDENDS TO POLICYHOLDERS

Line Group	1985 Ratio of P/H Dividends to Earned Premium	1985 Percent of Total Industry Dividends
Workers Compensation	9.2%	70%
All Other Lines	0.6	30
Total	1.7%	100%

Although dividends are the smallest component of underwriting results, variations in the dividend ratio can be significant. For example, dividend ratios for Workers Compensation have varied by more than five percentage points in recent years ranging from a low of 5.0% in 1977 to a high of 10.4% in 1983.

A review of industry all-lines dividend ratios reveals two characteristics of fairly consistent behavior. In general, dividend ratios exhibit (1) an inverse relationship to loss experience and (2) a certain degree of "stickiness" -- i.e., the dividend ratio in a given year tends to be close to the prior year's result. Recognizing this behavior, we have fit the following regression equation to the current year's dividend ratio (DR_t) in terms of the current year's loss ratio (LR_t) and prior year's dividend ratio (DR_{t-1}):

$$DR_t = A + B\ (DR_{t-1}) + C\ (LR_t)$$

In the above equation, the loss ratio variable is the loss and LAE ratio for the line group being modelled (Workers Compensation or All Other). Regression results for Workers Compensation and All Other Lines based on twelve years of data are shown in the table below.

TABLE III-7: REGRESSION RESULTS FOR P/H DIVIDEND MODELS

	Coefficient (t-statistic)				
Line Group	A	B	C	F-stat	R^2
Workers Comp.	.102 (4.1)	.982 (10.7)	-.121 (-4.0)	60.2	.94
All Other	.010 (2.1)	.019 (0.1)	-.005 (-0.7)	0.3	.06

The Workers Compensation model fits well, as indicated by the high R^2 and an F-statistic and t-statistics which are all significant at the 1% level. In contrast, the model for All Other Lines is not usable in this form. Splitting the All Other Lines group into more homogeneous subgroups may lead to a better model.

Since Workers Compensation dividends represent more than two-thirds of total industry dividends, the above Workers Compensation model represents a very good start in forecasting total dividends to policyholders for all lines. We currently select forecasts of All Other Lines dividends to policyholders judgmentally.

Underwriting Gain

Underwriting gain (UG) is calculated by definition as follows from earned premium (EP), incurred losses and LAE (IL), underwriting expenses (UE) and policyholder dividends (PD):

$$UG = EP - (IL + UE + PD)$$

The model's formulas for the various components of underwriting gain were all described above.

Combined Ratio

The combined ratio (after dividends) can also be calculated based on the model's fundamental underwriting variables. We calculate the combined ratio (CR) in terms of written premium (WP), earned premium (EP) incurred losses and LAE (IL), underwriting expenses (UE) and policyholder dividends (PD) according to the standard definition that follows:

$$CR = \frac{IL + PD}{EP} + \frac{UE}{WP}$$

IV. MODELS FOR PROJECTING INVESTMENT INCOME, CAPITAL GAINS AND TAXES

Section III described our model for underwriting variables, culminating with the calculation of underwriting gain/loss and the combined ratio. This section presents models for three of the four remaining components of statutory net income after taxes:

- investment income
- realized capital gains
- income taxes

The final component of net income -- miscellaneous (other) income -- is selected through a combination of exponential extrapolations and judgment as discussed in Appendix B.

Investment Income

Our investment income model is based on two fundamental variables: the amount invested and the rate of return on invested assets. The model is further refined by applying a current market yield to newly invested (and reinvested) assets and an historical portfolio yield to assets retained. Another factor which should be taken into account in forecasting investment income (although not completely incorporated in our model) is the types of assets held. Certainly, stocks, tax-exempt bonds, bonds and preferred stock will generate differing rates of return. The relative importance of various types of assets in generating industry investment income in recent years is indicated by data in Table IV-1.

TABLE IV-1: INVESTMENT INCOME BY TYPE OF ASSET, 1979-85
($ Millions)

Year	Common Stock	Preferred Stock	Tax Exempt Bonds	Taxable Bonds and Short-Term Investments*	Other*	Total
1979	2,017	487	3,948	3,417	801	10,670
1980	2,110	719	4,690	4,120	947	12,585
1981	2,080	895	5,435	5,062	1,273	14,745
1982	2,742	984	6,041	5,877	1,369	17,012
1983	2,691	1,011	6,449	6,462	1,215	17,828
1984	2,139	1,007	6,436	7,910	1,411	18,904
1985	2,379	889	6,347	9,688	1,468	20,771

* Prior to 1982 Short-term Investments are included in the "Other" category.

We model investment income net of investment expenses. Separate treatment of investment expenses is a potential area of improvement to the model.

The model we use to forecast the change in net investment income (CHII) has the following basic form:

$$CHII_t = A * MY_t ((RES_t - RES_{t-2})/2) + B * (1.12 * RES_{t-1} + SUR_{t-1}) (MY_t - MY_{t-1}),$$

Where: MY_t = Market yield during year t

RES_t = Total loss, LAE and unearned premium reserves at end of year t

SUR_t = Surplus at end of year t

This model form assumes that the change in investment income derives from two sources.

The first source is the expansion of the asset base. In order to avoid dependence of the investment income model on surplus, the above equation assumes that the increase in average invested assets in year t relative to year t-1 is proportional to the change in average reserve levels. Average reserves in year t are taken to be $(RES_t + RES_{t-1})/2$, so the change in average reserve levels is given by $(RES_t - RES_{t-2})/2$. This proxy for change in average invested assets is multiplied by the average market yield (defined below) prevailing during year t (MY_t).

The second source is the net change in investment income which results from liquidating invested assets. These assets are assumed to have been invested at the market yield last year and then re-invested at the current market yield. The amount of admitted assets at the end of year t-1 is approximated as:

$$1.12*RES_{t-1} + SUR_{t-1}$$

Admitted assets are used in the model instead of invested assets since total admitted assets are more readily generated when constructing model forecasts. Fortunately, the ratio of invested assets to admitted assets is fairly steady. In 1985, this ratio was 83%.

The 1.12 factor multiplied by end-of-year reserves is selected to proxy total industry liabilities. Over the twenty-seven year period 1959-1985, the ratio of total liabilities to losses, LAE and unearned premium reserves has never fallen outside the range 1.11 to 1.15.

A regression fit to 1972-85 annual changes in investment income produces the following results:

$A = 1.2877$ ($t = 24.3$, significant at 1%)

$B = .0928$ ($t = 3.6$, significant at 1%)

$R^2 = .91$

$F = 61.4$, significant at 1%

The coefficient B, estimated as 9.3%, is related to the annual turnover ratio of invested assets -- i.e., the portion of existing financial assets that are sold or expire each year. The exact interpretation of this coefficient is somewhat unclear, unless we make some simplifying assumptions. Assuming that assets are liquidated at mid-year and therefore invested at new rates for only one half year, and assuming the 83% ratio of admitted assest to invested assets noted above would imply that roughly one-fifth of the existing portfolio is turned over each year.

The market yield used in the above equation is judgmentally defined as the average of the interest or dividend yields for 3 month T-Bills, 3-5 year T-notes, 20 year T-Bonds, AAA Tax-Free Municipals and the S&P 500 stocks. Market yields calculated in this manner have tended to be higher in recent years than insurers' portfolio yields, defined as net investment income divided by average invested assets (i.e., one-half the sum of beginning-of-year invested assets and end-of-year invested assets). Table IV-2 compares portfolio yields and market yields from 1979-85.

TABLE IV-2: MARKET YIELDS AND PORTFOLIO YIELDS, 1979-85

Year	Market Yield	Portfolio Yield
1979	8.1%	6.6%
1980	9.5	6.9
1981	11.5	7.6
1982	10.6	8.0
1983	8.7	7.9
1984	9.6	8.2
1985	8.2	8.2

As defined, market yields exceeded portfolio yields from 1979-84, and they were approximately equal in 1985. The primary cause of the differences is that interest rates generally rose during the 1970's and early 1980's, but insurers retained a substantial portion of old low-yielding assets in their portfolios.

Capital Gains

Our strategy in modelling realized capital gains is to first model total capital gains and then to model the relationship between realized capital gains and total capital gains.

Our model for total capital gains treats the major sources of total capital gains separately. We find that separate models of components fit better and improve the forecasts of capital gains, relative to a single overall model.

The discussion below presents a single overall model as a benchmark, describes component models of the major sources of total capital gains and compares results of the single vs. component approaches.

Our benchmark single overall model regresses total capital gains in year t (TCG_t) against the percent change in the Standard & Poors 500 Index during year t times stock holdings at the end of the year t-1. Symbolically the simple model is:

$$TCG_t = A*(\text{change in S\&P 500 Index}_t * \text{stock holdings}_{t-1})$$

Based upon 1970-85 data we arrive at the following regression results:

A = .685 (t = 15.6, significant at 1%)

R^2 = .93

F statistic = 210.1, significant at 1%

We hesitate, however, to use this model. There seems to be no reason to expect all the components of capital gains to track with a common stock index. More specifically, capital gains and losses on bonds are significant and do not track with the S&P 500 index. We therefore choose to develop separate models for the major components of capital gains.

Table IV-3 displays the major sources of industry total capital gains and losses for the years 1979-1985.

TABLE IV-3: SOURCES OF INDUSTRY TOTAL CAPITAL GAINS
1979-1985 ($ Millions)

Year	Bonds	Pref. Stock	Common Stock of Non-Affil.	Common Stock of Affiliates*	Misc.	Total
1979	- 299	-291	2,603	759	39	2,814
1980	- 708	-273	4,823	881	106	4,829
1981	-1,378	-246	-1,438	426	232	-2,404
1982	-1,066	285	3,781	525	25	3,550
1983	-1,866	6	4,471	505	342	3,461
1984	- 647	- 93	112	372	461	204
1985	1,536	470	7,118	1,335	251	10,711

*Data for the years 1979-83 reflect our estimates of consolidation effects.

The order of importance of the various elements appears to be as follows: (1) common stock of non-affiliates, (2) bonds, (3) common stock of affiliates, (4) preferred stock and (5) miscellaneous. We use regression models for common stock of non-affiliates, bonds and preferred stock. Capital gains from common stock of affiliates as well as miscellaneous capital gains are combined into a single "other" category. A straight average is used to forecast these other capital gains.

All the models in this section are limited by the fact that data are only available in sufficient detail since 1979. We expect that the models can be improved once more data are available.

The model for total capital gains from unaffiliated common stock (TCGUCS) is:

$$TCGUCS_t / \text{UNAFFILIATED COMMON STOCK}_{t-1} = A\ (\%\ \text{Change in S\&P 500})_t$$

A regression analysis on the years 1979-1985 yields the following results:

$A = 1.006$ ($t = 17.4$, significant at 1%)

$R^2 = .951$

F statistic = 117.3, significant at 1%

Table IV-4 presents the fitted values and residuals. This model fits quite well; aside from the high R^2 and t and F statistics, the fitted values all correctly indicate the direction of the actual annual changes.

TABLE IV-4: MODEL FOR CAPITAL GAINS FROM UNAFFILIATED COMMON STOCK ($ Millions)

Year	Actual	Fitted	Error
1979	2,603	1,918	- 685
1980	4,823	5,043	220
1981	-1,438	-2,534	-1,096
1982	3,781	3,660	- 121
1983	4,471	4,655	184
1984	112	544	432
1985	7,118	6,876	- 242

The model for total capital gains from bonds (TCGB) is:

$$TCGB_t / BONDS_{t-1} = A\ (5\ \text{year}\ \%\ \text{change in bond index})_t + B$$

The logic underlying this model is based on the standard statutory accounting treatment for bonds. Since unrealized capital gains (or losses) on bonds are generally not recorded, capital gains on bonds (accumulated over a period of years) are recorded in the year they are realized. Our model makes the simplifying assumption that those bonds that are sold prior to maturity are, on the average, five years old.

The bond index used is an equally weighted average of the S&P Municipal Bond Index and the S&P U.S. Government Long Term Bond Index. The default of the Washington Public Power Supply bonds in 1983 makes that year atypical, and we exclude it from the regression. Unlike the models for other sources of capital gains, we include a non-zero constant term in the model for capital gains from bonds.

A regression analysis on the years 1979-85 (excluding 1983) yields the following results:

$A = .032$ ($t = 27.1$, significant at 1%)

$B = .003$ ($t = 7.9$, significant at 1%)

$R^2 = .995$

F statistic = 735.1, significant at 1%.

Table IV-5 presents the fitted values and residuals, which indicate that this model performs extremely well. The fitted values all correctly indicate the sign of the actual annual changes, and the errors are relatively small.

TABLE IV-5: MODEL FOR CAPITAL GAINS FROM BONDS ($ Millions)

Year	Actual	Fitted	Error
1979	-299	-255	44
1980	-708	-778	-70
1981	-1,378	-1,441	-63
1982	-1,066	-1,019	48
1984	-647	-555	93
1985	1,546	1,486	-50

The model for total capital gains from preferred stock (TCGPS) is:

$$TCGPS_t / PREFERRED\ STOCK_{t-1} = A\ (\%\ Change\ in\ S\&P\ Pref.\ Stock\ Index)_t$$

A regression analysis on the years 1979-85 yields the following results:

$A = .306$, ($t = 4.9$, significant at 1%)

$R^2 = .790$

F statistic = 22.6, significant at 1%

Table IV-6 presents the fitted values and residuals. This model does not perform quite as well as the two earlier models, possibly due to limitations in the S&P Preferred Stock Index. This index is based on only ten issues and the price index is converted from a yield index.

TABLE IV-6: MODEL FOR CAPITAL GAINS FROM PREFERRED STOCK ($ Millions)

Year	Actual	Fitted	Error
1979	-291	-167	124
1980	-273	-325	- 51
1981	-246	-228	18
1982	285	445	161
1983	6	- 66	- 73
1984	- 93	126	219
1985	470	296	-175

We model other capital gains (including capital gains from affiliated common stock and miscellaneous) by a straight average of the seven years of available data, obtaining a value of $895 million. Table IV-7 compares the actual and average miscellaneous capital gains.

TABLE IV-7: MODEL FOR CAPITAL GAINS FROM OTHER SOURCES ($ Millions)

Year	Actual	"Fitted"	Error
1979	800	895	94
1980	987	895	- 92
1981	658	895	236
1982	550	895	345
1983	847	895	47
1984	833	895	61
1985	1,586	895	-692

While we do not have an adequate model for capital gains from common stock of affiliates, we have identified several variables that may be useful in modelling this field. There is a reasonably strong positive correlation between capital gains from unaffiliated common stock and both the S&P 500 index as well as the profitability of the insurance industry. A two variable regression model yields an R^2 square of .57. With more years of data this model may become useable.

Use of the above models to forecast more than one year into the future requires a prediction of the future distribution of assets between common stock, preferred stock and bonds. We make the simplifying assumption that the most recent distribution will continue.

An overall "fit" of our component model for total capital gains is derived by adding the pieces from Tables IV-4, IV-5, IV-6 and IV-7. Table IV-8 compares the simple model results and the results of the component model.

TABLE IV-8: TOTAL CAPITAL GAINS - COMPARISON OF MODELS ($ Millions)

		Component Model		Simple Model	
Year	Actual	Fitted	Absolute Error	Fitted	Absolute Error
1979	2,814	2,391	423	2,331	483
1980	4,829	4,835	5	5,720	891
1981	-2,404	-3,309	905	-2,838	434
1982	3,550	3,981	431	4,101	551
1983	3,461	4,561	1,100	5,411	1,950
1984	204	1,011	807	571	367
1985	10,711	9,552	1,159	8,419	2,292
Total			4,830		6,968

Although the component model does not produce dramatically better results (and in some years does not even fit as well as the simple model) we believe that it is a better model. The component model reduces the total absolute error by 31%, fits better in five out of the seven years and reduces the maximum error significantly. We also prefer the component model from an intuitive standpoint and expect that with more data it will become even better.

After an estimate for total capital gains is obtained we model realized capital gains using two independent variables. The first variable is an estimate of the total amount of as yet unrealized capital gains available. We assume the "bank" was empty at the end of 1958 and then accumulate each year's difference between total capital gains and realized capital gains. This amount from the end of the prior year plus the current year's total capital gains is considered available to be realized. We call the cumulative quantity "available capital gains" (AVCG). The second variable used is the current

year operating ratio (OR), defined as the ratio of operating income to earned premium.

The model for realized capital gains (RCG) is then:

$$RCG_t = A\ (AVCG)_t + B\ (OR)_t + C$$

A regression analysis on the years 1970 - 1985 yields the following results:

A = .187 (t=5.9, significant at 1%)

B = -141.8 (t=-4.1, significant at 1%)

C = 908.6 (t=3.2, significant at 1%)

R^2 = .867

F statistic = 38.6, significant at 1%

Table IV-9 presents the fitted values and residuals. This model does not perform quite as well as we would like. However, this is an extremely difficult field to model. The decision whether to realize a gain or not depends on many considerations. The tax situation, investment opportunities, as well as corporate raiding manuevers are just a few important influences that are not directly reflected in the model. The variables in the model, however, perform well. The signs of A and B are positive and negative, respectively, as expected. The t and F statistics are highly significant and the R^2 is satisfactory.

TABLE IV-9: MODEL FOR
REALIZED CAPITAL GAINS ($ Millions)

Year	Actual	Fitted	Error
1970	150	388	238
1971	184	54	-130
1972	293	508	215
1973	276	20	-256
1974	-163	-417	-254
1975	141	671	470
1976	290	520	230
1977	329	-504	-833
1978	57	-597	-654
1979	300	72	-228
1980	533	1,046	513
1981	276	657	381
1982	572	1,626	1,054
1983	2,110	2,458	348
1984	3,063	2,898	-165
1985	5,483	4,495	-992

Forecasts of unrealized capital gains (UCG) can now also be detemined by subtracting the model's predictions of realized capital gains from predicted values of total capital gains. Values of unrealized capital gains are used in the model's calculation of change in surplus, as discussed below in Section V.

Income Taxes

Federal and foreign income taxes are volatile and difficult to model since taxes depend on many factors. At a minimum, the following influences need to

be analyzed in selecting a model for income taxes:

1) Net income before tax
2) Percent of net income that is taxable
3) Tax rates applicable to various income sources
4) Net operating loss carryforwards
5) Effects of consolidaton and non-insurance parents

As a first step, we have developed a simple model using underwriting gain/loss (UWG) and net income before taxes minus underwriting gain/loss (OTINC) as the two independent variables. By treating these two components of income separately the model form recognizes the first three of the five influences on taxes listed above. OTINC consists primarily of investment income, which is largely non-taxable, and realized capital gains, which are taxed at a lower rate than underwriting income. The last two influences -- loss carryforwards and consolidation effects -- are difficult to measure on an industry basis. Symbolically, the model is:

$$\text{Income Tax} = A * UWG + B * OTINC$$

A regression fit based on 1959-85 data yields the following results:

$A = .204$ (t=17.1, significant at 1%)

$B = .113$ (t=11.6, significant at 1%)

$R^2 = .937$

F = statistic = 199.2, significant at 1%

Durbin-Watson = 1.2366

Given the simplicity of the above model form, it fits surprisingly well. The R^2 is quite good for such a volatile dependent variable, and both independent variables are highly significant. As expected from a consideration of the pre-1987 tax rate structure, the coefficient of UWG is larger than the coefficient of OTINC. Also, by comparing the actual and fitted values shown in Table IV-10, we see that the model has matched the last four turning points (1970, 1973, 1976 and 1979) in the actual series.

Although the model matches recent turning points and the R^2 is more than acceptable, the model is somewhat unsatisfactory. The fitted value has differed from the actual by more than 30% for twelve of the last twenty-seven years. And of greater concern, there is a clear pattern of positive autocorrelation in the residuals shown in Table IV-10.

The autocorrelation problem is most likely due to the fact that the model does not account for operating loss carryforwards and carrybacks. We now compensate for this problem by using an autocorrelation correction calculated from the Durbin-Watson statistic when preparing forecasts. We are hopeful that with additional testing of more complicated model forms a better model can be developed. However, the Tax Reform Act of 1986 will require significant adjustments to future models to account for revised tax rates, partial taxation of unearned premium reserves, etc.

TABLE IV-10: ACTUAL VERSUS FITTED VALUES FOR FEDERAL INCOME TAX MODEL
PROPERTY-CASUALTY INDUSTRY, 1959-85
($ millions)

Income Taxes

Year	Actual	Fitted	Error
1959	144	113	- 31
1960	165	126	- 38
1961	163	147	- 16
1962	149	123	- 26
1963	59	24	- 35
1964	50	6	- 43
1965	58	17	- 41
1966	161	173	12
1967	177	114	- 64
1968	148	85	- 63
1969	80	54	- 25
1970	159	151	- 8
1971	680	448	-231
1972	829	550	-279
1973	469	381	- 87
1974	- 325	- 152	174
1975	- 555	- 405	149
1976	148	105	- 44
1977	1,015	920	- 95
1978	1,389	1,093	-296
1979	896	815	- 80
1980	593	628	36
1981	55	244	189
1982	- 716	- 352	364
1983	-1,218	- 676	542
1984	-1,723	-2,070	-347
1985	-2,030	-2,239	-259

Net Income After Tax

Net income after tax is calculated by formula from various components determined by the above models:

Net income after tax = underwriting gain/loss
+ net investment income
+ realized capital gains/losses
+ miscellaneous other income
- income tax

V. MODELS FOR PROJECTING OTHER SURPLUS CHANGES

The various sources of changes in statutory surplus are treated by the model in five categories: (1) net income after tax, (2) unrealized capital gains (3) new funds, (4) dividends to stockholders and (5) miscellaneous surplus changes.

The model's equations for net-income after tax and its various components were discussed above. Unrealized capital gains are determined by subtracting realized capital gians from total capital gains, based on models presented in Section IV. Regression models for new funds and dividends to stockholders are developed and discussed in this section. We have not yet developed a regression model for the various miscellaneous sources of surplus change -- they are now forecasted through a combination of linear extrapolations, averaging and judgment. Appendix B includes a detailed discussion of considerations in modeling and selecting forecasts for miscellaneous surplus changes.

New Funds

New funds are defined in this paper as the sum of lines 28a and 29a on page 4 of the consolidated Annual Statement. These new funds may arise either as capital contributions from a non-insurance parent or a public offering of a new equity by an insurer.

From 1968 to 1984, new funds, as a percent of beginning of year surplus, varied from a low of 1.6% in 1979 to a high of 5.9% in 1975 (see Table V-1). In 1985, new funds were at unprecedented levels, totalling 12.1% of industry

surplus. We consider the 1985 new funds ratio to be an outlier and exclude it from regression fits.

TABLE V-1: NEW FUNDS AND RATIOS TO SURPLUS
PROPERTY-CASUALTY INDUSTRY, 1968-85

Year	New Funds ($ Millions)	Ratio to Beginning-of-Year Surplus
1968	250	1.7%
1969	554	3.4
1970	396	2.8
1971	618	4.0
1972	454	2.4
1973	541	2.3
1974	865	4.0
1975	963	5.9
1976	945	4.8
1977	995	4.0
1978	649	2.2
1979	560	1.6
1980	738	1.7
1981	619	1.2
1982	1,487	2.8
1983	1,057	1.7
1984	2,717	4.1
1985	7,743	12.1

Our initial expectations were that the following variables influence the behavior of new funds:

1) Premium-to-surplus ratio
2) Reserve strengthening needs
3) Expected future profitability
4) Condition of the stock market
5) Written premium growth

We define the new funds ratio (NFR_t) as the ratio of new funds in year t to surplus at the beginning of year t, and use NFR_t as the dependent variable in our model.

We find a strong relationship between NFR_t and both the prior year's return on net worth ($RONW_{t-1}$) and the current year's premium-to-surplus ratio (PSR_t).

The prior year's return on net worth indicates the direction of expected future profitability. The logic underlying the return on net worth variable rests, in part, on the cyclical nature of property-casualty industry profits. When returns on net worth are relativity low the industry is expected to recover and new funds stream into the industry. In years of high profitability, however, investors are less optimistic, and less new capital is generated. Therefore, we expect $RONW_{t-1}$ to have a negative coefficient.

The premium-to-surplus variable measures the need for new funds to build additional capacity. We use the ratio of premium to end-of-year adjusted surplus (i.e. what surplus would have been without the new funds) both for intuitive reasons and to avoid the need for a recursive model structure (ie., new funds depend on end-of-year surplus and vice-versa).

The following regression equation is based on data for the years 1968-1984.

$$NFR_t = -.0015 * RONW_{t-1} + .0221 * PSR_t$$

The R^2 for this model is .72. The t-statistics for the independent variables (-4.3 for $RONW_{t-1}$ and 11.2 for PSR_t) indicate that both variables are significant at the 1% level.

Table V-2 below compares actual and fitted values of new funds for the period 1968-85.

TABLE V-2: ACTUAL VERSUS FITTED VALUES FOR NEW FUNDS MODEL
PROPERTY CASUALTY INDUSTRY, 1968-85
($ millions)

Year	Actual	Fitted	Error
1968	250	375	125
1969	554	608	54
1970	396	481	85
1971	618	425	-194
1972	454	329	125
1973	541	604	63
1974	865	965	99
1975	963	795	-169
1976	945	1,036	91
1977	995	1,005	11
1978	649	645	- 4
1979	560	672	112
1980	738	707	- 32
1981	619	1,077	458
1982	1,487	1,099	-388
1983	1,057	1,422	366
1984	2,717	1,958	-759
1985*	7,743	2,794	-4,949

* 1985 data were not used in fitting the regression.

The relatively low R^2 for the new funds model is likely due to fact that some explanatory variables, such as reserve strengthening and stock market conditions, are not directly reflected in the model. With more years of data, a third independent variable may improve this model.

Dividends To Stockholders

We model change in stockholder dividends in terms of two independent variables: (1) net income after tax (NIAT) and (2) other surplus changes (OSC). We define other surplus changes as the change in surplus excluding net income after tax and stockholder dividends. Table V-3 shows stockholder dividends for the years 1966 to 1985.

TABLE V-3: DIVIDENDS TO STOCKHOLDERS
1966-1985 ($ Millions)

Year	Dividends	Year	Dividends
1966	366	1976	1,030
1967	343	1977	1,067
1968	562	1978	1,385
1969	1,387	1979	1,760
1970	567	1980	2,234
1971	795	1981	2,394
1972	916	1982	2,735
1973	1,631	1983	3,001
1974	1,053	1984	2,317
1975	953	1985	2,692

We have not, as yet, found a completely satisfactory explanation for the large increases in stockholder dividends in 1969 and 1973 and the large decreases in the following years. In order not to distort the analysis, we have restricted our regression to the years 1974-85.

Our model for stockholder dividends in year t (SHD_t) is:

$$SHD_t - SHD_{t-1} = A * NIAT_t + B * OSC_t + C$$

A regression analysis on the years 1974-1985 yields the following results, with all t and F statistics significant at 1%.

$A = .104 \quad (t=9.27)$
$B = .054 \quad (t=7.61)$
$C_2 = -389$
$R^2 = .934$
F statistic = 63.7

Values of NIAT and OSC used to fit the above regression equation are values for the entire property-casualty industry, not just stock insurers. Although independent variables based on only the stock segment of the industry may produce a better fit, use of them in forecasting would require that forecasts of stock insurer's results be developed.

The logic underlying the model is that, to some degree, stockholder dividends are inflexible. To the extent that they are paid to outside stockholders, they cannot be reduced drastically without the possibility of undesirable consequences. This makes the prior year's dividend an important determinant of current year dividends.

Changes in stockholder dividends should also depend on surplus changes. The source of the surplus growth is, however, important. Growth due to current earnings (i.e., net income after tax) may lead to larger increases in dividend payments than will other sources of surplus growth (mostly unrealized capital gains and new funds) which are less related to current earnings and less likely to be sustained in future years. The relative magnitudes of the fitted coefficients (.10 and .05) bear out these a priori assumptions.

Table V-4 compares the actual and fitted values of the change in stockholder dividends.

TABLE V-4: STOCKHOLDER DIVIDENDS MODEL
1974-1985 ($ Millions)

Year	Actual Change	Fitted Change	Error
1974	-579	-640	- 61
1975	- 99	-190	- 91
1976	76	8	- 68
1977	37	178	141
1978	318	320	2
1979	375	384	9
1980	474	547	73
1981	160	67	- 93
1982	341	281	- 60
1983	266	186	- 80
1984	-684	-481	203
1985	375	400	- 25

The signs of the fitted values are all correct, and the direction of the annual changes are all correct with the exception of 1977. Despite these favorable results and the good R^2 and t and F statistics, we present this model with some trepidation, since only twelve data points are available to estimate three coefficients. This model should be monitored closely in the future.

Surplus Change

This change in statutory surplus is calculated as:

Surplus Change = Net Income After Tax
+ Unrealized Capital Gains
- Stockholder Dividends
+ New Funds
+ Miscellaneous Surplus Changes

VI. MODEL TEST AND FORECAST

Appendix E provides an overall test of the model by comparing 1985 projections for the property-casualty industry to actual 1985 experience. In preparing the projections, we substitute actual 1985 values for the five judgmental insurance items and the general economic variables listed in Table II-2. All other variables are then determined using the model equations described in sections III, IV and V. Constructed in this manner, the comparisons provide an "ex post" test of how well the model performs when all external inputs are exactly known.

The model performs well in this test. The predicted combined ratio of 116.4 is very close to the actual combined ratio of 116.5; net investment income is predicted within $0.3 billion (or 2%); the predicted change in surplus of $8.1 billion is off by $5 billion (primarily due to the model's prediction falling short of the unprecedented amount of new funds in 1985); and the bottom-line return on net worth is predicted within one percentage point. These and other key results of the test are summarized in Table VI-1. Detailed results of the test are included in Appendix E.

TABLE VI-1: SUMMARY OF MODEL TEST RESULTS
1985 "FORECAST" FOR PROPERTY-CASUALTY INDUSTRY
($ Billions)

Item	Model "Forecast"	Actual
Earned Premium	133.4	$133.3
Underwriting Expenses	37.5	37.6
Underwriting Gain	- 24.8	- 25.0
Combined Ratio	116.4%	116.5%
Net Investment Income	19.8	19.5
Realized Capital Gains	4.2	5.5
Income Tax Credit	2.2	2.0
Net Income After Tax	1.4	1.9
Stockholder Dividends	- 2.5	- 2.7
New Funds	2.9	7.7
Surplus Change	6.8	11.8
Return on Net Worth	3.5%	3.9%

Appendix F provides the model's January 1987 forecast of 1986 results, and Table VI-2 below summarizes key results of the forecast. This forecast uses all available information as of January, 1987 to select the five judgmental insurance items and the general economic variables listed in Table II-2. The remainder of the forecast is derived from insurance industry data through year-end 1985. The accuracy of these forecasts can be evaluated when final year-end 1986 industry data are available.

Although the results of the 1986 forecast generally appear reasonable at the time of preparation, some judgmental modifications are clearly in order based on interim data. Since the model for the most part only uses the latest available annual data points, results should be compared to any later quarterly data available and modified where the model results appear unreasonable.

TABLE VI-2: SUMMARY OF MODEL FORECAST
OF 1986 PROPERTY-CASUALTY INDUSTRY RESULTS
($ Billions)

Item	1985 Actual Value	1986 Model Forecast	Percent Change
Earned Premium	$133.3	166.3	+24.7
Underwriting Expenses	37.6	44.0	+17.1
Underwriting Gain	- 25.0	- 16.6	-
Combined Ratio	116.5%	108.2%	-
Net Investment Income	19.5	21.9	+12.4
Realized Capital Gains	5.5	5.9	+ 7.3
Income Tax Credit	2.0	0.2	-
Net Income After Tax	1.9	11.2	-
Stockholder Dividends	- 2.7	- 3.9	+44.4
New Funds	7.7	2.9	-
Surplus Change	11.8	14.6	-
Return on Net Worth	3.9%	12.2	-

VII. IMPROVEMENTS TO THE MODEL

General Improvements

A general improvement to the model may result from an investigation of non-linear models. At the present time, our model is completely based on linear regression tools. Some fields may better be modelled by other methods; non-linear regression, stochastic models, and game theory methods are just a few possibilities.

A second area of general improvement may result from the availability of more data points in the future. At the current time we are restricted in modelling many items because only data for the years 1979-85 are now available on an industrywide basis.

The overall model may also be improved if we segregate the industry into several types of insurer categories and model each separately. For example: reinsurers, small personal lines companies, specialty companies, surplus lines writers, etc. could be modelled separately for some or all items.

Improvements to the Underwriting Fields

Since underwriting results vary tremendously by line of insurance and are subject to different external influences, we believe that it is important to model the underwriting elements by line group or individual line. Premium growth, rate adequacy, reserve adequacy, payout patterns,

commission rates and dividend ratios differ dramatically from one line to another. While we have modelled many of the underwriting elements by line group, that refinement should be extended to all items. This is particulary true for underwriting expenses since many expense components show substantial variations by line. It may also be possible to refine the line groups so that the groupings are more homogeneous.

Development of models for written premium, paid losses, and reserve strengthening would increase the accuracy of the overall model. The ISO Ad Hoc Economics Applications Subcommittee [AHEAS] and other researchers have been successful in developing premium and loss models for some but not all lines of insurance. Some of the elements that need to be considered in models of written premium and paid losses are discussed in Appendix B, but much work still remains.

We believe that the "normal" reserve growth discussed in the incurred loss section is due to a lengthening of the payout pattern. Payout patterns should be analyzed and modelled separately, by line.

The policyholder dividend model would likely be improved if we modelled this field by company type. Especially in the personal lines, a small portion of the industry is responsible for most of the policyholder dividends paid. The industry dividend ratio for these lines is, therefore, dependent on the growth or decline of this market segment.

Improvements to the Investment Income, Capital Gains and Tax Fields

The investment income model can be improved in several ways. First an attempt should be made to model investment expenses. Second, investment income should be modelled separately by source of income (e.g. interest, dividends, rent,...) and related to the asset generating that income (e.g. bonds, preferred stock, real estate,...). An attempt should also be made to model the type of assets the industry will hold. In order to properly model federal income tax, investment income should be modelled separately for taxable, partially taxable and non-taxable investments.

Models for capital gains from common stock of affiliates and from miscellaneous sources need to be developed. To truly obtain an adequate picture of the insurance industry, unrealized capital gains on bonds should also be estimated.

As noted in Section IV, there is room for improvement in the income tax model, and the model must be modified to account for the 1986 Tax Reform Act. Several major obstacles will have to be overcome. First, we are aware of no information on an industrywide basis of the tax loss carry-forwards at any point in time. Second, insurance groups whose tax returns are consolidated with, and heavily influenced by, non-insurance activities must be analyzed separately. The 1986 Tax Reform Act will at the very least require estimates of the amount of income from municipal bonds purchased after August 7, 1986 (which are subject to "proration"), the effects of reserve discounting and the magnitude of the tax on a portion of the equity in the unearned premium reserve.

Improvements to Surplus Fields

An improved model forecasting new funds would be very helpful, since new funds are particularly important in predicting capacity shortages. An exponential model form may help explain the dramatic rise of new funds in 1985.

The model for stockholder dividends can be improved by studying the unexplained data aberations noted and by relating stockholder dividends to stock insurers' surplus rather than all-industry surplus.

A third area of improvement is in the modelling of miscellaneous surplus changes. The first step -- a preliminary investigation, hopefully leading to an understanding of the sources and causes of the different miscellaneous surplus changes -- has been provided in Appendix B.

VIII. COMMENTS ON ADAPTING THE INDUSTRYWIDE MODEL TO AN INDIVIDUAL COMPANY MODEL

The major thrust of the paper has been the development of an industry financial model. We felt that an actual model should be discussed and the industry seemed the logical choice. Some readers may, however, wish to use the techniques discussed to develop a model of their individual company. This section discusses the application and modification of the industry model to a single company.

The first step is an examination of available data for the particular company. This includes number of years as well as the accessibility of data not available for the entire industry. Our model for the industry was limited to selected fields from the Annual Statement and Insurance Expense Exhibit. To the extent that more information is available for an individual company, each model should be examined for possible improvement. Specifically, written premium forecasts by line may be available and should be considered. Reserve adequacy by line as well as projected reserve strengthening may be available.

The expense model in particular requires major revision. While one may assume a steady exposure growth for the industry and attribute significant premium increases to price firming, that assumption cannot be made for an individual company. One needs to separately model expense components that vary with premium, with exposure, and with inflation. Expected changes in commission agreements can be also included in the expense model.

In modelling losses, it is important to consider a company's market strategy. A company growing faster than the industry may find its loss ratio deteriorating with respect to the industry. On the other hand, a company growing slower than the industry may be able to improve its loss ratio relative to the industry. On the investment side, a company's future investment strategy can be taken into account (e.g. concentration in stocks or bonds, long or short term, dividend or capital gains assets,...). Data at the company level should also be available to measure the amount of unrealized capital gains or losses that exist on its bond portfolio. While it is difficult to model income tax for the industry, better information should be available for an individual company. Knowledge of net operating loss carryforwards, projected investments in taxables versus non-taxables, and the impact of consolidation with a parent allows adequate modelling of income taxes. Also stockholder dividends and new funds can be forecast with more certainty by an actuary for his or her own company.

Although in many ways it is easier to model an individual company, care must be taken in other areas. First, the selection of items to model was based each items's relative importance on an industrywide basis. Thus foreign exchange adjustments, for example, were not modelled. There may be some companies, however, for which foreign exchange adjustments are of major importance.

IX. DATA SOURCES AND ACKNOWLEDGMENTS

Most of the insurance industry data underlying our model and presented in tables throughout this paper are from A.M. Best Company. In particular, we have utilized data from Aggregates and Averages and various standard computer tapes sold by Best's Data Base Services, including Quarterly By-Line, Balance Sheet-Income Statement, Premium-Losses-Expenses, Schedule O and Schedule P.

Histories and forecasts of general economic variables, including the GNP deflator and the S&P 500 Index, were obtained from Data Resources, Inc. and Standard and Poors.

Although the authors accept responsibility for the contents of this paper, several other people contributed to the development of the financial model and to our knowledge of industry financial data and forecasting. We are particular grateful to Michael Kerner for his assistance in developing and programming the model.

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APPENDIX A

LINE GROUPS

Lines of business differ in policy term mix, commission ratio, dividend ratio, rate adequacy, reserve adequacy, etc. Since these items affect model parameters and input variables, it becomes necessary to refine the underwriting segment of the model from its all-lines basis. We did not consider it necessary, however, to develop the model separately for each of the twenty-five lines of business reported separately in the Annual Statement. We took into consideration the following variables in determining our line groups:

1) Rate adequacy - measured by expected premium increases. This is one reason we consider major commercial lines separately.

2) Reserve adequacy - obtained from various studies of reserve adequacy by line. This is another reason we separate major commercial lines.

3) Dividend ratio - this is one reason we consider Workers' Compensation separately.

4) Relationship of written to earned premium - this is another reason we separate Workers' Compensation.

Based on these considerations we define the following line groups:

1) Personal Lines - Private Passenger Auto, Homeowners and Farmowners
2) Major Commercial Lines - Commercial Auto, General Liability, CMP and Medical Malpractice
3) Workers Compensation
4) Reinsurance
5) Accident & Health
6) All Other (Commercial Lines)

Reinsurance, as used here, includes only line 30 of Parts 2B-3A in the Annual Statement Underwriting and Investment Exhibit. Given that a substantial portion of reinsurance business is reported by reinsurers on a by-line basis, the Reinsurance line group field could arguably be combined with Major Commercial Lines.

Accident and Health was treated separately because it is so different from other property/casualty business. It could, however, be combined with All Other without much loss of model accuracy.

APPENDIX B

CONSIDERATIONS IN PROJECTING ITEMS NOT MODELLED

In preparing forecasts based on the current version of the model, the five insurance input items listed below are selected judgmentally. This appendix discusses considerations in selecting forecasts for each item, analyzes historical data and identifies influences that may be incorporated in a future regression model.

i. Written Premium

ii. Paid Losses

iii. Reserve Strengthening

iv. Miscellaneous (Other) Income

v. Miscellaneous Surplus Changes

i. **Written Premium**

To model written premium for the entire industry, some important elements to consider are:

1) exposure growth

2) loss and expense growth

3) rate level adequacy

4) self insurance mechanisms

By exposure growth we mean the growth in insurance requirements due to an expanding population and economy. As our population increases, more cars and homes need to be insured and as the economy grows more

commercial insurance is required. On an all lines basis this can be simply modelled using real GNP growth as an estimator. More sophisticated models would examine the relationship of exposure growth within each line of business to the components of GNP that most strongly affect that line.

Loss and expense growth has at least five components:

(1) monetary inflation, which can be modelled on an all-lines basis using the CPI. If possible, though, components of the CPI such as medical cost or legal cost should be used on an individual line basis to gain greater accuracy.

(2) social inflation, which is the portion of the increase in claim cost not due to monetary inflation. A time series, by line or all lines combined, can be obtained to serve as a guideline in estimating future social inflation. Judgemental consideration of tort reform and social attitudes need to be incorporated.

(3) frequency changes, relative to number of exposures. Here again a by-line model has the advantage of reflecting the particular conditions that affect frequency in a given line. As an example, projected gasoline prices affect auto frequency and projected unemployment rates may affect workers compensation frequency. On an all-lines basis the combination of time series analysis and consideration of current and expected developments comprise a good approach.

(4) perceived reserve adequacy, which in terms marketplace of effects may be more important than actual reserve adequacy. An industry perceiving severe loss reserve shortages will be less likely to quickly return to a soft market.

(5) the growth of new forms of insurance to cover hazards not currently insured. This item might be particularly important when projecting losses over a time horizon of five year or more. The emergence of pollution liability in recent years is an example of insurance covering a hazard that was considered relatively unimportant years ago.

Obviously, industry rate level adequacy is an important element in predicting written premium growth. On a by-line basis, rate adequacy may be measured by the combined ratio. A more sophisticated approach would include investment income and tax considerations on a by-line basis. On an all lines basis, return on net worth can be calculated as a measure that reflects all sources of income. (See Appendices C and D for a more detailed discussion of profitability measures.)

The consideration of rate level adequacy introduces cyclicality into the pattern of written premium growth. High premium growth can be expected as the industry recovers from a soft market. As the industry becomes more profitable, premium growth declines and the seeds for the next cycle are sown.

The model's provision for "leakage" to self-insurance should include premium lost because of higher deductibles, because insureds went "bare" or bought limits lower than necessary, as well as premium lost to more formal self insurance mechanisms such as captives and risk retention groups. Although to our knowledge no comprehensive data on the total size of the self-insurance market now exist, estimates of the impact of captives and risk retention groups can be obtained from various sources.

ii. Paid Losses

The key elements affecting paid losses are:

1) exposure growth
2) monetary inflation
3) social inflation
4) frequency growth
5) self-insurance mechanisms
6) new forms of insurance
7) loss payout pattern

Since estimates of future losses affect our estimates of premium growth, the first six elements are all discussed in above as considerations in projecting written premiums. An additional factor affecting paid losses is changes in the loss payout pattern. We believe that this phenomenon that causes the observed "normal reserve growth" discussed in Section III under Incurred Losses.

iii. Reserve Strengthening

Although we have not yet been able to construct a model forecasting reserve strengthening, several elements that need to be considered have been identified.

The first element is the insurance cycle. Table B-1 shows the relationship between changes in the ratio of loss reserves to paid losses and the combined ratio. During this period casualty losses increased faster than property losses causing the ratio of reserves to paid losses to show a general pattern of increase. Although this ratio increased from 1.0 in 1969 to 1.59 in 1985, the rate of growth has not been constant. In years of increasing combined ratios (1973-1975 and 1979-1984) the ratio of loss reserves to paid losses remained relatively constant. In years of declining or low combined ratios (indicated by an asterisk in Table B-1), the reserves-to-paid ratio increased dramatically. As a general rule, then, loss reserves have been strengthened in years when results were good or improving and weakened in years when results were poor.

TABLE B-1: COMPARISON OF RESERVES TO PAID RATIOS AND COMBINED RATIOS PROPERTY-CASUALTY INDUSTRY, 1969-85

Year	Loss Reserves/Paid Losses	Combined Ratio
1969	1.01	102.4
1970*	**1.02**	**100.1**
1971*	**1.15**	**96.3**
1972*	**1.25**	**96.2**
1973	1.24	99.2
1974	1.20	105.5
1975	1.20	107.9
1976*	**1.33**	**102.4**
1977*	**1.47**	**97.1**
1978*	**1.58**	**97.4**
1979	1.58	100.6
1980	1.57	103.1
1981	1.59	106.0
1982	1.56	109.6
1983	1.58	112.0
1984	1.52	118.0
1985*	**1.59**	**116.5**

*Years in which combined ratio declined or rose modestly from a cyclical low.

A second element to consider is the level of reserve inadequacy (or redundancy) at the time a forecast is being made. We must rely on published estimates or undertake an extensive study (probably using industry Schedule P data).

A third consideration is capacity. Clearly, in periods of capacity shortages, insurer managements will be more reluctant to strengthen reserves than in years where capacity is not a concern.

A fourth consideration is the tax effect of reserve strengthening. There may be a greater incentive to strengthen reserves in a year when a company is profitable and is paying taxes than in a year when a tax loss already exists. A fifth consideration is pressure from auditors and regulators to strengthen inadequate reserves.

Our forecasts of reserve strengthening are based on an analysis of industry loss and LAE reserves. This study calculated reserve inadequacy by Schedule P line. We assume that over the next several years most of the existing inadequacies will be eliminated and judgmentally select the amounts of strengthening by line group and year.

iv. Miscellaneous (Other) Income

Total Other Income as reported on Annual Statement page 4, line 17 consists of three categories of items which are compiled separately on an industry basis: (1) Net Gain or Loss from Agents' or Premium Balances Changed Off, (2) Finance and Service Charges Not Included in Premiums and (3) Miscellaneous Write-in Items (Annual Statement page 4, lines 12-16). As a first step in considering modelling possibilities, Table B-2 shows industry totals for these three items for the years 1979-85. Average annual growth rates are displayed where a pattern of exponential growth is evident.

TABLE B-2: MISCELLANEOUS (OTHER) INCOME AND COMPONENTS
PROPERTY-CASUALTY INDUSTRY, 1979-85
($ Millions)

	Agents' or Premium Balances Charged Off	Finance & Services Charges	Write-in Items	Total Other Income
1979	- 89	167	239	-161
1980	-113	197	-292	-208
1981	-119	234	-381	-265
1982	-152	280	-536	-408
1983	-160	325	-472	-307
1984	-191	371	-133	46
1985	-222	420	-311	-113
Ave. Annual Growth*	+15.7%	+16.9%	----	----

*Exponential growth rate in absolute values of items indicated.

Both Agents' or Premiums Balances Charged Off and Finance and Service Charges have shown consistent rates of exponential growth (in absolute values) since 1979. Although this may not hold true in the future, the monotonic behavior of these series make it difficult to detect any causal relationships. Therefore, we use projections based on exponential growth rates at the current time. As more data become available, a relationship of Agents' or Premium Balances Charged Off with written premium might be established. Following the current period of rapid growth as installment premiums have gained popularity, Finance and Service Charges may prove in the future to be related to written premium (either for all lines or selected lines), interest rates and/or the overall level of consumer financing.

The Write-in Items which affect net income are numorous and diverse. For example, we reviewed consolidated 1985 Annual Statements for eight large insurers and found the following items reported on page 4, lines 12-16:

TABLE B-3: SAMPLE OF WRITE-IN ITEMS
AFFECTING 1985 INCOME FOR EIGHT LARGE INSURERS*

Write-in Item	Frequency	Total Amount (000)
Expenses Related to Service Charges	1	$- 22,392
Corporate Expenses	2	- 59,866
Miscellaneous Income (profit or loss)	6	4,720
Foreign Exchange Gain (Loss)	1	505
Miscellaneous Liability	1	- 752
Change in Accrued Finance & Service Charges	1	- 39
Minority Interest	1	- 383
Unclaimed Checks	1	- 115
Net Educational Program Income	1	113
Adjustment Under Reinsurance Treaty	1	- 26,787
Other Expenses	1	- 6,142
Total	8	$-111,138

*Allstate, CIGNA, GEICO, Hartford, John Hancock, Safeco, St. Paul Fire and Marine, Travelers

The above sample of reported Write-in Items does not exhaust the list of possible items reported by insurers, but it provides some information that is useful in selecting forecasts. Entries such as miscellaneous income, miscellaneous profits, etc. were reported most frequently. These entries tended to vary greatly among companies, and both positive and negative values were reported. The miscellaneous income entries may largely explain the observed volatility in industry totals for Write-in Items.

Two insurers reported corporate expenses as a Write-in Item. In our opinion, these and similar entries are an important factor in explaining why the total Write-in Items have tended to be negative for the industry.

v. Miscellaneous Surplus Changes

As defined in this paper Miscellaneous Surplus Changes include all items that affect statutory surplus which were not previously discussed. Our definition includes the write-in items on page 4, lines 34-38 in the Annual Statement as well as seven items which are reported separately in the Annual Statement. These items are listed in Table B-4 along with industry values for each item for the years 1979-85.

TABLE B-4: MISCELLANEOUS SURPLUS CHANGE AND COMPONENTS[ϕ]
PROPERTY-CASUALTY INDUSTRY, 1979-85
($ Millions)

	1979	1980	1981	1982	1983	1984	1985	**1979-85 Ave.**	1979-85 Ave. Absolute Value
1) Change in Non-admitted Assets	- 499	-307	-438	- 190	-436	- 29	-177	**-297**	297
2) Change in Liability for Unauthorized Reinsurance	- 79	- 45	- 76	- 104	-166	-178	-456	**-172**	172
3) Change in Excess of Statutory Over Statement Reserves	- 256	198	412	168	439	151	115	**175**	248
4) Net Remittances from or to Home Office	- 13	- 13	-139	10	- 25	- 4	125	**- 8**	47
5) Change in Foreign Exchange Adjustment	- 15	- 33	1	- 48	- 49	- 85	- 75	**- 43**	44
6) Change in Treasury Stock	- 49	- 14	- 11	2	- 15	- 18	102	**0**	30
7) Extraordinary Taxes from Prior Years	2	- 13	7	- 38	- 22	- 65	- 45	**- 25**	27
8) Write-in Items (CAS page 4, lines 34-38)	- 746	-488	333	- 804	-237	367	83	**-213**	437
TOTAL	**-1,655**	**-715**	**89**	**-1,004**	**-511**	**39**	**-327**	**-583**	**620**

ϕ All signs in this table indicate surplus effects of the items listed.

When interpreting the components of change in surplus in Table B-4, it is important to note that every value is quantified, as in the Annual Statement, in terms of its effect on surplus. For example, a 1979 Change in Non-admitted Assets of negative $499 million does not imply that insurers' non-admitted assets declined in 1979. Rather, the correct interpretation is that surplus declined in 1979 due to a change in total non-admitted assets. Knowing that statutory accounting excludes all non-admitted assets from surplus, we conclude that total non-admitted assets must have increased during 1979.

Due to the diversity of components and variety of influences on these components, it is tempting to ignore miscellaneous surplus changes when modelling industry results. Unfortunately, these miscellaneous changes are not of negligible magnitude -- the total of miscellaneous surplus changes as defined in this paper was -$1.7 billion in 1979, representing a depletion amounting to 5% of year-end 1978 surplus of $35.4 billion. While we admittedly may not be able to predict industry surplus with less than 5% error, individual items that can have an effect as large as 5% certainly should not be ignored completely in the modelling effort.

On the other hand, limited data and resources may prevent the development of acceptable regression models for the eight components of total miscellaneous surplus change. As seen from Table B-4, the four most important items (i.e., those which have an average absolute value exceeding $100 million) are:

	1979-85 Ave. Abs. Value ($ Millions)
• Write-in Items	$437
• Change in Non-admitted Assets	297
• Change in Excess of Statutory over Statement Reserves	248
• Change in Liability for Unauthorized Reinsurance	172

We have attempted to model each of the above four items, except for the Write-in Items. Due to the fact that only seven years of data are available on an industrywide basis and several of these components are by nature highly variable, modelling is virtually impossible at the present time. For each of the eight components of total miscellaneous surplus change we have selected values based on informed judgement using relationships to internal and external variables that are indicated by data analysis. The projected values of the eight components have been summed to develop the figures for total miscellaneous surplus change included in the model forecasts shown in Appendix F. Observations that are useful in selecting individual components of miscellaneous surplus change are discussed below.

The various Write-in Items on page 4, lines 34-38 of the Annual Statement represent the largest component of Miscellaneous Surplus Changes in terms of average absolute value from 1979-85. Unfortunately, these items are also the most difficult to predict. The Write-in Items may include accounting errors as well as various reserves for unpaid liabilities and accruals. Either positive and negative values may be entered and, in fact, both are common. For example, in 1985, 246 insurer groups reported a negative total for Write-in Items, 177 groups reported a positive total and 363 groups reported zeros. Values in 1985 ranged from a negative $109 million for one insurer group to a positive $195 million for another group.

Given the lack of clear definition of Write-in Items and observing from Table B-4 that industry totals for this field have been equally likely to be positive or negative in the last seven years, we reluctantly forecast future values of zero. However, it is possible to examine historical variability of total Write-in Items and select values other than zero to make a forecast appropriately more or less conservative.

The Change in Non-admitted Assets is second in absolute magnitude and much more predictable than the Write-in Items. On an industry basis, changes in non-admitted assets have had a consistently negative impact on surplus over the last seven years, although negative effects certainly cannot be considered guaranteed in future years.

One method of projecting changes in non-admitted assets is to relate them to changes in admitted assets, which are derived by the financial model discussed in this paper. On an industry basis, annual changes in non-admitted assets have averaged 1.6% of corresponding changes in admitted assets from 1979-85. Although the change in non-admitted assets was as large as 2.7% of the change in admitted assets in 1979 and could be larger, a selection of 1-2% of admitted assets for future years appears reasonable.

The Change in Excess of Statutory Over Statement Reserves is another material component of miscellaneous surplus change. Although the availability of only seven years of data has prevented us from constructing an accurate model for this item, we expect this item to be strongly related to liability underwriting results, and a postulated relationship can be used to select reasonable future values.

Excess statutory reserves arise from the Schedule P test in which loss ratios for the latest three accident years are compared to the lowest ratio (for a year with premium exceeding $1 million) of the prior five accident years or 60% (75% for Workers' Compensation), whichever is greater. In the first half of the 1980's, when Schedule P loss ratios climbed to historical highs, excess statutory reserves were reduced to very low levels. This explains the consistent positive effect of this item on surplus form 1980-85. At year-end 1985, excess statutory reserves as reported on the balance sheet (Annual Statement, page 3, line 16) totalled $169 million for the industry -- only 10% of the year-end 1979 industry total of $1.68 billion.

Since 1986 represents the second consecutive accident year for which Schedule P loss ratios as a whole have improved, we might expect a zero or small positive effect of excess statutory reserves on 1986 surplus. In the 1987 and 1988 we expect continued improvement in three-year loss ratios and rapidly growing negative impacts of excess statutory reserves on surplus.

The Change in Liability for Unauthorized Reinsurance is influenced heavily by both reinsurance market conditions and capacity considerations for primary insurers. When reinsurance capacity is tight, many insurers by necessity will make greater use of unauthorized reinsurance. We believe this occurred from 1981-85 when a general trend toward a tighter reinsurance market led to greater use of unauthorized reinsurance and corresponding charges to surplus. It is important to bear in mind general reinsurance market conditions when projecting future values of this item.

Although the Change in Foreign Exchange Adjustment has been a relatively small contributor to miscellaneous surplus change in the past seven years, its potential effect is much greater. This item is the change in net adjustments of assets and liabilities denominated in foreign currencies[6]. We have compared industry totals for this field to changes in the Federal Reserve Trade Weighted Dollar Index, which measures the value of the U.S. dollar relative to ten major currencies.

This analysis indicates that as the dollar strengthens the Change in Foreign Exchange Adjustment tends to have a negative effect on surplus. This implies that assets denomiated in foreign currencies exceed liabilities in foreign currencies. While no statistically significant model has been developed, the relationship to the Federal Trade Weighted Dollar Index can be used to judgementally select future values of the Change in Foreign Exchange Adjustment.

Net Remittances from or to Home Office reflect the surplus impact of net cash flows between the United States branch of a foreign company and the foreign company home office[6]. We have not yet identified any logical and reliable relationships of this item with external variables. Fortunately, this item has been a relatively small contributor to surplus changes from 1979-85. Until a relationship is established, projections on the order of the historical average of $-8 million may be reasonable.

A Change in Treasury Stock occurs when a company reacquires treasury stock or subsequently reissues it. Changes in treasury stock are relatively rare events -- for example, only 11 insurer groups reported a non-zero change in their 1985 Annual Statement. Of the eleven, only one reported a change greater than $4 million in absolute value. This insurer, which boosted surplus through a $112 million reissue of treasury stock in 1985, almost fully explained the industry change.

Since this item is dominated by seemingly random entries from a handful of insurers, we conclude that it is virtually unpredictable. Projections of zero for future years seem reasonable.

Extraordinary Taxes from Prior Years generally result from audits or recalculations after the previous year's statement was filed. For example, tax adjustments, penalties and interest relating to prior years' income are reported in this field. Although amounts of extraordinary taxes from prior years are erratic, they have consistently been relatively small over the last seven years. Under the presumption that accounting errors are random, projections for future years of zero would be appropriate. Alternatively, an assumption that IRS audits and tax recalculations tend to raise taxes more often than they lower taxes would imply that projected values should be negative. Something on the order of the $-25 million average from 1979-85 would then be appropriate.

APPENDIX C

MEASURES OF PROFITABILITY

This appendix discusses three measures of profitability for property-casualty insurers: (1) combined ratio, (2) operating ratio and (3) return on net worth. Noting advantages and disadvantages of each, we conclude that none is a perfect measure of profitability. We recommend that all three measures be calculated and weighed appropriately, based on the type of comparison being made (e.g., by line results of two insurers, all-lines results of two insurers, insurers vs. non-insurers).

Until recently, it was commonplace to use combined ratios to analyze industry results over time or to compare results between companies or between lines. The usual definition of the combined ratio (CR) is given by

CR = ((incurred losses + LAE + P/H dividends)/earned premium) +
(underwriting expenses/written premium)

One reason for the historical use of the combined ratio to measure profitability was the relative stability and small size of the ratio of investment income to premiums. Table C-1 below shows the ratio of net investment income to net written premium from 1959 to 1985.

TABLE C-1: INVESTMENT INCOME AS A PERCENT OF WRITTEN PREMIUM
PROPERTY-CASUALTY INDUSTRY, 1959-85

Year	Percent	Year	Percent
1959	4.9%	1973	7.4%
1960	5.2	1974	8.1
1961	5.3	1975	7.9
1962	5.5	1976	7.6
1963	5.6	1977	8.0
1964	5.6	1978	8.9
1965	5.7	1979	10.3
1966	5.6	1980	11.6
1967	5.6	1981	13.3
1968	5.8	1982	14.3
1969	5.8	1983	14.6
1970	6.1	1984	14.9
1971	6.5	1985	13.5
1972	6.8		

During the decade from 1960 to 1969, the ratio increased from a low of 5.2% in 1960 to a high of 5.8% in 1969. By contrast, after increasing to 8% by the mid 1970's, it then rose rapidly until reaching a high of 14.9% in 1984. Clearly, profitability can no longer be compared between years without accounting for investment income.

Similarly, using the NAIC formula for allocating investment gain by line on the Insurance Expeense Exhibit shows that the effect of investment gain varies dramatically by line. Table C-2 shows the ratio of investment gain to written premium, as shown on the 1985 Insurance Expense Exhibit, for the major insurance lines.

TABLE C-2: INVESTMENT GAIN AS A PERCENT OF WRITTEN PREMIUM
PROPERTY CASUALTY INDUSTRY, 1985

Line	Percent	Line	Percent
Fire	3.9	Medical Malpractice	32.7
Homeowners	4.9	Workers' Compensation	14.9
CMP	7.7	General Liability	16.2
Auto Liability	9.5		
Auto Physical Damage	2.5		

Mainly because of differences in product mix between companies, combined ratios can generally no longer be used to compare two companies. The combined ratio can still, however, be used to compare the results of consecutive quarters and the results of similar companies.

As an alternative measure of relative profitability, we define an operating ratio (OR) by

$$OR = CR - (\text{net investment income/earned premium}).$$

This measure has the advantage of including investment income and when available is a definite improvement over the combined ratio. The operating ratio is very useful in measuring the profitability of the "business of insurance" and can be readily calculated to compare the results of two insurers. However, this measure of profitability still does not reflect capital gains or income tax considerations. As we discuss later, excluding capital gains and taxes may be desirable since these items can lead to a distorted view of long-term profit potential. The major disadvantage of the operating return measure is the difficulty in allocating investment income by line of business.

To complete the picture, we define return on net worth (RONW) as:

$$RONW = \frac{\text{GAAP-adjusted net income after taxes}}{\text{GAAP-adjusted surplus}}$$

The advantage of RONW is that it provides a bottom line all-inclusive measure of a company's profitability. When comparing an insurance company (or the insurance industry) to other companies (or industries) all income and expenditures must be included. The major disadvantage of RONW is that it is even more difficult (probably impossible) to calculate RONW adequately on a by-line basis. For a discussion of the GAAP adjustments and the exact definition of RONW see Appendix D.

There are, however, pitfalls in using RONW as well. Realized capital gains may not be indicative of the ability of a company to generate future earnings. In addition to the effects of financial markets, which can be far from stable, the sale of a home office or subsidiary or the closing of a pension plan may be the source of a large one-period realized capital gain. Similarly, a large tax credit generated by consolidation of results with a parent for income tax calculations can affect bottom-line results and distort comparisons between an independent insurer and an insurer owned by a tax-paying parent.

Since there is no perfect measurement of an insurer's results we offer two suggestions. First, compute all three measures discussed above and, if they lead to different conclusions, identify the cause of the differences. Second, consider which of the measures is most important in light of the purpose of the analysis being performed. When by-line results of two insurers over the same period of time are being compared, the combined ratio may be preferable, provided that the two insurers, write similar types of business for that line. When comparing the all-lines (insurance) results of two insurers the operating return may be preferred. When comparing an insurer with a non-insurer RONW should generally be considered.

APPENDIX D

GAAP ADJUSTMENTS

Property-casualty insurers' Annual Statements are prepared according to statutory accounting principles (SAP). The objective of SAP is to value assets and liabilities conservatively to assure the ability of insurers to pay the claims for which premium has been collected. Hence, assets are valued on a liquidation basis. There are certainly many benefits to a conservative view of an insurer's assets, particularly at the present time when so many insolvencies are occurring. It is, however, not proper to use statutory results to compare the insurance industry to other industries which prepare statements according to Generally Accepted Accounting Principles (GAAP), reflecting those firms' values on more of a going-concern basis.

One major difference between SAP and GAAP is the treatment of unearned premiums. If an annual policy for $120 is written on December 1, 1986, $10 of premium is earned in 1986 and $110 in 1987. At the end of 1986 the insurer carries a liability, included in the unearned premium reserves, of $110. If $36 of expenses were incurred in 1986 in writing the policy, SAP requires a full write-off of the $36 in 1986 while GAAP requires a write-off of only $3. The $33 difference is defined as the pre-tax equity in the unearned premium reserve.

A second major difference between SAP and GAAP is that SAP defines certain assets as non-admitted. For example, if an insurance company refurbishes its headquarters at a cost of $10 million with the expectation that it will last

for 10 years, GAAP accounting allows the company to charge against income, only the depreciation expense (e.g., $1 million per year). At the end of the first year the company carries its slightly depreciated furniture as an asset valued at $9 million. Statutory accounting, however, requires the complete write-off of the $10 million in the first year. The $9 million is a non-admitted asset. Other examples of non-admitted assets include: agents balances over three months due, excess of book over market value (on bonds, generally), and bills receivable that are either past due or not taken for premium.

A complete discussion of statutory accounting can be found in Strain[6]. A discussion of statutory and GAAP accounting can be found in "Report on the Annual Statement" PCAS LII, 1965 and in the American Institute of Certified Public Accountants, "Audits of Fire and Casualty Insurance Companies", Chapter 9.

Since a major objective of our model was to develop the ability to forecast property/casualty insurance industry results in a form that allows comparison to other industries, we use a rough adjustment to return on net worth that approximates GAAP return for insurers. While this adjustment does not account for all the differences between GAAP and statutory accounting, it does estimate the impact of the two differences discussed above.

The formula we use for GAAP-adjusted return on net worth (RONW) is:

$$RONW = \frac{NIAT + .135 * \text{Change in UEPR}}{\text{Surplus} + .018 * \text{Admitted Assets} + .135 * UEPR},$$

Where:

NIAT	= Statutory net income after taxes
UEPR	= End of year unearned premium reserve
Surplus	= End of year statutory surplus
Admitted Assets	= End of year statutory admitted assets

The unearned premium factor of .135 is the product of an average equity in the unearned premium reserve of .25 and a tax rate of 46%. The non-admitted asset factor of .018 is based on an average ratio of non-admitted assets to admitted assets from 1979-85.

Two important comments need to be made at this point. First, because of the new Tax Reform Act of 1986, the .135 unearned premium factor will have to be changed. Second, both factors will vary widely by company and maybe even by year for a specific company. When modelling data for a particular company, these factors should be developed on the company's own data. The company should estimate its equity in the unearned premium reserve, which depends heavily on commission arrangements. Also, the non-admitted assets can probably be estimated better by company management than by statistical analysis.

APPENDIX E
RETROSPECTIVE FORECAST TEST
FINANCIAL MODEL
UNDERWRITING EFFECTS

	1984	1985 FROM MODEL	1985 ACTUAL
1. WRITTEN PREMIUM	118,591	***	144,860
%CHANGE		***	22.2
2. EARNED PREMIUM	115,010	133,388	133,342
%CHANGE		16.0	15.9
3. LOSS AND LAE PAID	88,715	***	99,072
%CHANGE		***	11.7
4. RESERVE STRENGTHENING		3,100	
%OF 1984 RESERVES		2.3	
5. ADDITIVE FACTOR		2.6%	
6. INC. LOSS & LAE	101,446	118,572	118,572
%CHANGE		***	16.9
RATIO TO EARNED PREMIUM	88.2	88.9	88.9
7. TOTAL U/W EXPENSE	33,184	37,520	37,585
%CHANGE		13.1	13.3
RATIO TO WRITTEN PREM.	28.0	25.9	25.9
8. MISC EXPENSE/INCOME	(55)	***	(20)
9. WORKERS COMP DIV.	1,461	1,469	1,529
10. OTHER P/H DIVIDENDS	637	ACTUAL DIV. RATIO USED	667
11. TOTAL P/H DIVIDENDS	2,098	2,089	2,196
RATIO TO EARNED PREM.	1.8	1.6	1.6
SUMMARY UNDERWRITING STATISTICS			
12. U/W GAIN AFTER DIV.	(21,663)	(24,772)	(24,991)
13. COMBINED RATIO	118.0	116.4	116.5

NOTE : "***" INDICATES THAT THE ACTUAL VALUE OF THE VARIABLE
FOR 1985 WAS USED

FINANCIAL MODEL

INVESTMENT RESULTS AND OTHER EFFECTS ON SURPLUS

	1984	1985 FROM MODEL	1985 ACTUAL
14. NET INVESTMENT INCOME	17,660	19,824	19,508
%CHANGE		12.3	10.5
15. OTHER INCOME	45	***	(114)
16. OPERATING INCOME	(3,958)	(5,062)	(5,597)
17. REALIZED CAP. GAIN	3,063	4,254	5,483
18. FED INCOME TAX(CREDIT)	(1,723)	(2,213)	(2,030)
19. NET INCOME AFTER TAX	828	1,406	1,916
20.1. TCG FROM UNAFF STOCK	112	6,873	7,118
20.2. TCG FROM PREF STOCK	(93)	296	470
20.3. TCG FR BONDS	(647)	1,531	1,536
20.4. TCG FROM OTHER	832	895	1586
20. TOTAL CAPITAL GAIN	204	9,595	10,710
21. UNREALZED CAPITAL GAIN	(2,859)	5,340	5,227
22. STOCKHOLDER DIV.	(2,317)	(2,499)	(2,692)
23. NEW FUNDS	2,717	2,851	7,717
24. MISC SURPLUS CHANGE	38	***	(327)
25. SURPLUS CHANGE	(1,593)	6,771	11,841
26. BEG. OF YR. SURPLUS	65,401	63,671	63,671
27. END OF YR. SURPLUS	63,808	70,442	75,512
28. LOSS & LAE RESERVES	134,926	154,426	154,426
%CHANGE		14.5	14.5
29. UNEARNED PREM. RESERVE	45,499	56,971	57,017
%CHANGE		25.2	25.3
30. TOTAL ASSETS	264,735	304,950	310,485
%CHANGE		15.2	17.3

SUMMARY INDUSTRY FINANCIAL STATISTICS

31. PREMIUM/SURPLUS	1.86	2.06	1.92
32. RESERVE/SURPLUS	2.11	2.19	2.05
33. NET WORTH	74,716	83,622	88,798
34. RETURN	1,305	2,954	3,471
35. RONW(1)	1.75	3.53	3.91
36. RONW(2)		3.73	4.25

(1) THIS FIGURE IS ON AN END OF YEAR GAAP-ADJUSTED BASIS
(2) THIS FIGURE IS ON A MIDYEAR GAAP ADJUSTED BASIS

NOTE : "***" INDICATES THAT THE ACTUAL VALUE OF THE VARIABLE
FOR 1985 WAS USED

BY LINE WRITTEN PREMIUM

	1984	%CHGE	1985 FROM MODEL	%CHGE	1985 ACTUAL
PERSONAL	57,249	***	***	12.2	64,261
A&H	3,837	***	***	-16.5	3,205
WORKERS COMP	15,107	***	***	12.8	17,048
MAJOR COMM	25,216	***	***	52.0	38,319
OTHER COMM	12,954	***	***	26.2	16,347
REINS	4,228	***	***	34.3	5,680
TOTAL	118,591	***	***	22.2	144,860

BY LINE EARNED PREMIUM

	1984	%CHGE	1985 FROM MODEL	%CHGE	1985 ACTUAL
PERSONAL(FROM QUARTERLY)	56,088	9.9	61,651	9.4	61,376
A&H	3,596	-7.9	3,313	-6.8	3,350
WORKERS COMP(FROM QUART.)	15,153	8.1	16,382	11.3	16,858
MAJOR COMM(FROM QUARTERLY)	24,088	32.6	31,952	35.6	32,668
OTHER COMM	12,046	22.7	14,786	16.0	13,976
REINS	4,039	31.3	5,304	26.6	5,114
TOTAL	115,010	16.0	133,388	15.9	133,342

NOTE : "***" INDICATES THAT THE ACTUAL VALUE OF THE VARIABLE
FOR 1985 WAS USED

	INPUT VALUES		
	1984	% CHGE	1985
S&P INDICES			
500 STOCKS	167.90	25.85%	211.30
PREF STOCKS	62.59	10.61%	69.23
MUNI BONDS(1980)	48.11	18.46%	56.99
US GOVT LT(1980)	37.32	31.11%	48.93
* MODEL BOND	42.72	23.98%	52.96
AMOUNTS HELD OF			
COMMON STK(UNAFF)	26,431		
PREFERRED STOCK	9,119		
BONDS	143,373		
OTHER VARIABLES			
MARKET YIELD	0.0963		0.0828
AVAILABLE CAP GAIN	8,269		
1983 RESERVES	164,556		
1985 ALL LINES EXCEPT WORKERS COMPENSATION DIVIDEND RATIO	0.53		
WORKERS COMPENSATION			
1984 DIV. RATIO	9.89		
1985 LOSS RATIO	90.46		

APPENDIX F
MODEL FORECASTS
FINANCIAL MODEL
UNDERWRITING EFFECTS

	1984	1985		1986 FROM MODEL
1. WRITTEN PREMIUM	118,591	144,860		178,513
%CHANGE		22.2	***	23.2
2. EARNED PREMIUM	115,010	133,342		166,312
%CHANGE		15.9		24.7
3. LOSS AND LAE PAID	88,715	99,072		106,007
%CHANGE		11.7	***	7.0
4. RESERVE STRENGTHENING		3,100		12,000
%OF 1985 RESERVES				7.8
5. ADDITIVE FACTOR				1.0%
6. INC. LOSS & LAE	101,446	118,572		136,710
%CHANGE		16.9	***	15.3
RATIO TO EARNED PREMIUM	88.2	88.9		82.2
7. TOTAL U/W EXPENSE	33,184	37,585		44,026
%CHANGE		13.3		17.1
RATIO TO WRITTEN PREM.	28.0	25.9		24.7
8. MISC EXPENSE/INCOME	(55)	(20)	***	0
9. WORKERS COMP DIV.	1,461	1,557		1,533
10. OTHER P/H DIVIDENDS	637	639	***	693
11. TOTAL P/H DIVIDENDS	2,098	2,196		2,226
RATIO TO EARNED PREM.	1.8	1.6		1.3
SUMMARY UNDERWRITING STATISTICS				
12. U/W GAIN AFTER DIV.	(21,663)	(24,991)		(16,649)
13. COMBINED RATIO	118.0	116.5		108.2

NOTE : "***" INDICATES THAT THESE VALUES ARE JUDGMENTALLY SELECTED
BASED ON DATA AS OF NINE MONTHS 1986.

FINANCIAL MODEL

INVESTMENT RESULTS AND OTHER EFFECTS ON SURPLUS

	1984	1985		1986 FROM MODEL
14. NET INVESTMENT INCOME	17,660	19,508		21,925
%CHANGE		10.5		12.4
15. OTHER INCOME	45	(114)	***	(100)
16. OPERATING INCOME	(3,958)	(5,597)		5,176
17. REALIZED CAP. GAIN	3,063	5,483		5,901
18. FED INCOME TAX(CREDIT)	(1,723)	(2,030)		(165)
19. NET INCOME AFTER TAX	828	1,916		11,241
20.1. TCG FROM UNAFF STOCK	112	7,118		4,491
20.2. TCG FROM PREF STOCK	(93)	470		619
20.3. TCG FR BONDS	(647)	1,536		4,800
20.4. TCG FROM OTHER	832	1586		895
20. TOTAL CAPITAL GAIN	204	10,710		10,805
21. UNREALZED CAPITAL GAIN	(2,859)	5,227		4,904
22. STOCKHOLDER DIV.	(2,317)	(2,692)		(3,863)
23. NEW FUNDS	2,717	7,717		2,939
24. MISC SURPLUS CHANGE	38	(327)	***	(600)
25. SURPLUS CHANGE	(1,593)	11,841		14,621
26. BEG. OF YR. SURPLUS	65,401	63,671		75,512
27. END OF YR. SURPLUS	63,808	75,512		90,133
28. LOSS & LAE RESERVES	134,926	154,426		185,129
%CHANGE		14.5		19.9
29. UNEARNED PREM. RESERVE	45,499	57,017		69,218
%CHANGE		25.3		21.4
30. TOTAL ASSETS	264,735	310,485		372,726
%CHANGE		17.3		20.0

SUMMARY INDUSTRY FINANCIAL STATISTICS

31. PREMIUM/SURPLUS	1.86	1.92	1.98
32. RESERVE/SURPLUS	2.11	2.05	2.05
33. NET WORTH	74,716	88,798	107,224
34. RETURN	1,305	3,471	13,071
35. RONW(1)	1.75	3.91	12.19
36. RONW(2)		4.25	13.34

(1) THIS FIGURE IS ON AN END OF YEAR GAAP-ADJUSTED BASIS
(2) THIS FIGURE IS ON A MIDYEAR GAAP ADJUSTED BASIS

NOTE : "***" INDICATES THAT THESE VALUES ARE JUDGMENTALLY SELECTED
BASED ON DATA AS OF NINE MONTHS 1986.

BY LINE WRITTEN PREMIUM

	1984	% CHGE	1985	% CHGE	1986 PROJECTION	
PERSONAL	57,249	12.2	64,261	15.0	73,900	***
A&H	3,837	-16.5	3,205	0.0	3,205	***
WORKERS COMP	15,107	12.8	17,048	16.5	19,861	***
MAJOR COMM	25,216	52.0	38,319	45.8	55,869	***
OTHER COMM	12,529	30.5	16,347	6.0	17,328	***
REINS	4,228	34.3	5,680	47.0	8,350	***
TOTAL	118,166	22.6	144,860	23.2	178,513	***

BY LINE EARNED PREMIUM

	1984	% CHGE	1985	% CHGE	1986 FROM MODEL
PERSONAL(FROM QUARTERLY)	56,088	9.4	61,376	15.1	70,653
A&H	3,596	-6.8	3,350	-4.3	3,205
WORKERS COMP(FROM QUART.)	15,153	11.3	16,858	12.1	18,897
MAJOR COMM(FROM QUARTERLY)	24,088	35.6	32,668	50.1	49,022
OTHER COMM	11,675	19.7	13,976	20.8	16,877
REINS	4,039	26.6	5,114	49.7	7,658
TOTAL	114,639	16.3	133,342	24.7	166,312

NOTE : "***" INDICATES THAT THESE VALUES ARE JUDGMENTALLY SELECTED
BASED ON DATA AS OF NINE MONTHS 1986.

INPUT VALUES

	1981	% CHGE	1985	% CHGE	1986
S&P INDICES					
500 STOCKS	*	*	211.30	14.61%	242.17
PREF STOCKS	*	*	69.23	23.15%	85.26
MUNI BONDS(1981)	37.13	85.05%	*	*	68.71
US GOVT LT(1981)	33.86	71.41%	*	*	58.04
* MODEL BOND(1981)	35.50	78.55%	*	*	63.38
AMOUNTS HELD OF					
COMMON STOCK OF UNAFFIL.	*		30,557		
PREFERRED STOCK	*		8,741		
BONDS	*		170,592		
OTHER VARIABLES					
MARKET YIELD	*		0.0828		0.0629
AVAILABLE CAP GAIN	*		15,916		*
1986 JUDGMENTAL FORECAST FOR DIVIDEND RATIO FOR ALL LINES EXCEPT WORKERS COMPENSATION					0.47
WORKERS COMPENSATION					
1985 DIVIDEND RATIO			9.33		*
1986 LOSS RATIO(JUDGMENTAL)			*		93.00

NOTE : "*" INDICATES THAT THIS VARIABLE IS NOT NEEDED FOR THE MODEL