

**TITLE:** UNDERWRITING CYCLES IN THE PROPERTY-  
CASUALTY INSURANCE INDUSTRY

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## INTRODUCTION

The president of a major insurance brokerage firm recently observed that: "During the past 25 years, with one minor variation, three years of underwriting gains have been followed precisely by three years of underwriting losses."<sup>1</sup> This view of cyclical patterns in the industry is confirmed by the trade literature which calls it the underwriting cycle. Underwriting profits are roughly the premiums earned during the period less the incurred losses, loss adjustment expenses and other underwriting expenses. Although exact specifications and timing are debated, the tendency for underwriting profits to fluctuate in a regular cycle is almost universally accepted.

A general description of the cycle is as follows: When profits are high, insurance companies decide to expand their activity by seeking new business. This new business is of two general types: 1) customers currently doing business with other firms, and 2) business that was previously judged to be of greater risk. Attempts to coax away competitors' customers usually entail reducing the price charged for insurance coverage presently offered; offering better coverage for the same price; or increasing sales costs. Pursuing the riskier business raises the probability that the firm will experience higher claims costs.

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<sup>1</sup>Harold H. Hines, Jr., "A Price Theory of Underwriting Cycles," Risk Management, November 1979, p. 53.

As other firms also engage in this activity, underwriting profits shrink and some firms begin experiencing losses on their underwriting activity. The firms begin to tighten their underwriting standards and turn to the regulatory authorities for relief from this cutthroat competition.<sup>2</sup>

Total company profits are composed of underwriting profits and income from investments, including realized appreciation.<sup>3</sup> States regulate rates so as to allow insurance companies to earn a specific rate of return on premiums written without considering investment income.<sup>4</sup> When the potential gains in the investment area are relatively high, companies are willing to accept an actual return on their underwriting that is lower than allowed simply to get the premium dollars to invest. By competing through price reductions or lowering underwriting standards to increase premium volume, a firm may actually experience underwriting losses so long as the investment opportunities are sufficiently lucrative. This situation, however, is not a stable one.

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<sup>2</sup>A similar situation existed in the airline industry prior to deregulation. See G. W. Douglas and J. C. Miller III, Economic Regulation of Domestic Air Transport: Theory and Policy (Washington, D.C.: The Brookings Institute, 1974) and Theodore Keeler, "Domestic Trunk Airline Regulation: An Economic Evaluation," in Study on Federal Regulation, Committee on Governmental Affairs, U.S. Senate, Appendix to Vol. VI, Framework for Regulation, U.S. Government Printing Office, 1978.

<sup>3</sup>James A. Walter, "Regulated Firms Under Uncertain Price Change: The Case of Property and Liability Insurance Companies," Journal of Risk and Insurance, 46 (June 1979), 5.

<sup>4</sup>However, this situation is changing most notably in the consumer oriented personal insurance of homes and automobiles and is gaining ground in some areas of business insurance.

Since the higher investment returns are generally associated with inflation or the expansionary phase of the business cycle, there exist countervailing forces that usually cause the situation to change. In the case of inflation, these forces are also felt on the cost side of underwriting associated with loss expenses. For the property-casualty insurance industry revenues occur in the present and loss expenses in the future - sometimes several years in the future. The impact of inflation is inherently uncertain and the inability to accurately predict the incidence and expense of future losses combine frequently to give a much poorer underwriting result than first anticipated. When firms have cut their margins too closely, the actual losses associated with writing specific business at a point in time may effectively obliterate the investment income that arose from the initial assumption of the business.

Regulators, who are usually charged with the duty to protect the financial solvency of the insurance firms under their supervision as well as the obligation to protect consumers from undesirable behavior by the insurance firms, are by this time sympathetic to the firms' pleas and respond with higher allowed rates. These higher rates, combined with a more conservative underwriting attitude toward risk taking, lead the firms to a rosier profit picture, and the cycle is ready to start all over again.

The existence of such a cycle and its component processes poses some fascinating questions. There is almost nothing written about this phenomenon in the academic literature nor do

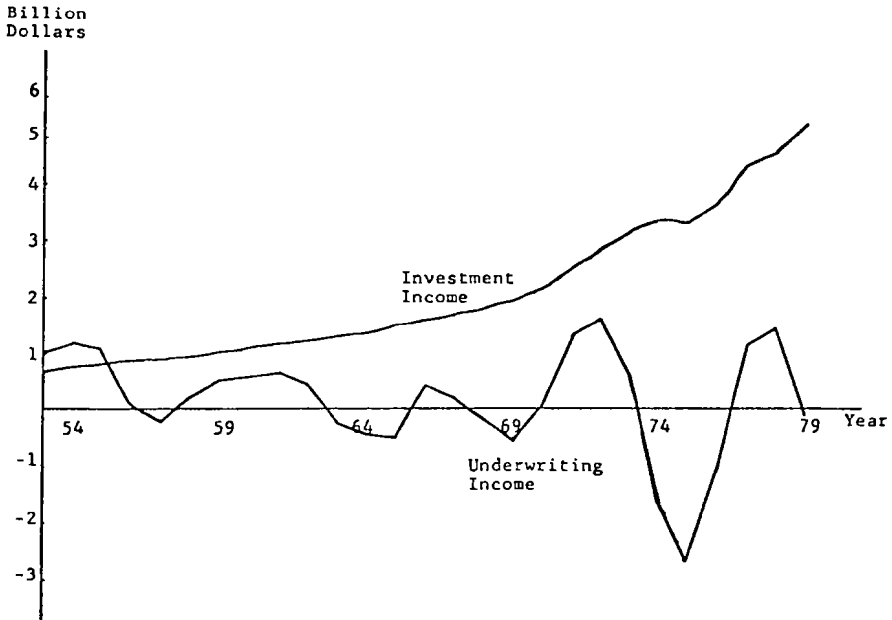
there seem to be any in-depth analyses in the industry literature. Frequently, individuals within the industry put forth their ideas in an article or speech; however, there does not appear to be much evidence of a systematic attempt to discover a causal theory that can be tested empirically.

This paper deals with the underwriting cycle in the property - casualty insurance industry and attempts to identify the underlying causal relationships that lead to the cyclicity in underwriting profits. Having identified behavioral relationships between industry characteristics, inflationary effects, and regulatory activity, the final step will be the construction of a model which traces this underwriting cycle and can be used to predict turning points.

#### UNDERWRITING CYCLES

It was pointed out earlier that financial stability is an important performance criterion. It has also been alleged that the income derived from the sale of property-casualty insurance exhibits wide swings from profit to loss. Figure 1 shows the real income received from underwriting and investment activities from 1953 to 1979, and there appear to be definite cycles. This diagram tells us some other things as well. Namely, that the swings in underwriting appear to be getting more violent and that investment income is outweighing underwriting profits by a larger factor, especially since around 1970.

Figure 1  
Underwriting and Investment Income,  
1953-1979 in 1972 Dollars



Source: Calculated from data in Best's Aggregates and Averages, annual.

In this section of the paper, we will be investigating this situation in detail. The questions we will be especially concerned with are:

- (1) Historically, what have been the factors leading to this cyclicity?
- (2) What changes have occurred in the past few years that may be causing the more volatile performance?
- (3) Can we formulate empirically testable hypotheses for what happened in the past, and use the insights we gain to project what will happen in the future?

Up until about 1970, the description of the cycle was fairly straightforward. When profits were up, firms were interested in growth and would be willing to write marginal business. They would also attempt to woo the customers of other insurers by offering better coverages and/or lower premiums to obtain the new business. To keep existing clients, firms would be forced to meet competitive quotes, thus lowering their profit margin on business of a known risk.

As this activity continued, the insurers would end up with more business of relatively greater uncertainty. Since it takes time for a loss experience to develop, the real profitability (or lack thereof) of new business would not emerge until some time later. If the profit margin on retained business were reduced, the cushion for losses on new business would possibly be inadequate, and overall underwriting losses would occur.

By the time the real situation was recognized, the industry would already be in a downturn. There appears to be a recognition lag as well as a reaction lag associated with the decision to

petition regulators for rate relief. The length of time necessary to compile the required information, submit rate revision requests and receive regulatory approval can be significant. Further, the longer the loss situation persists, the more likely it is that the regulators will overcompensate in the amount of rate increase they allow.<sup>5</sup> A contributing factor is the fear of firm failure.<sup>6</sup>

The mere fact that new rates are permitted, however, does not necessarily improve the position of the insurers until the previous policies expire. Only when a policy comes up for renewal may an insurer impose higher premiums, and some policies, especially in commercial lines, last more than one year.

In addition to the higher allowed rates, insurers are more cautious concerning the risks they are willing to cover. This tighter underwriting standard combined with higher allowed rates tends to improve the profits of insurers. There appears to be very little price competition in this phase of the cycle even though the allowed rates may be higher than the initially requested revisions. The attitude seems to be "we better get all we can now because when the cycle turns we could lose."

The basic causes of the cycle stem from the expectations of insurers concerning future profits and their actions in response

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<sup>5</sup>R. A. Ippolito, "The Effects of Price Regulation in the Automobile Insurance Industry," Journal of Law and Economics, 22 (April 1979), 81.

<sup>6</sup>See J. D. Hammond, A. F. Shaprio, and N. Shilling, "Analysis of an Underwriting Decline: 1972-75," CPCU Journal, 32 (June 1979), 66.



to these expectations especially concerning supply.<sup>7</sup> One trait that seems to characterize the firms in this industry is a lack of recognition of their collective interdependence. Each firm seems to decide to expand its premium writings based on expected profitability without taking into consideration that other firms are observing the same signals and drawing the same conclusions. Recognition lag refers to the time between the decision to expand and the time when the firms realize everyone else is doing the same thing, at which point the same behavior persists as a defensive strategy since failure to continue competing may result in a net loss of premium writings.

Cyclicalities are certainly not unique to the property-casualty industry; most industries are subject to fluctuations. The difference lies in the relationship between changes in supply and demand. Many industries are subject to variations in demand, and the corresponding supply reactions result in swings in prices and profits.

The demand for property-casualty insurance is a function of real economic activity, and, as such, tends to increase slowly over time in a fairly stable fashion.<sup>8</sup> The supply of property-casualty insurance, however, is very volatile. When there has been an increase in demand in most industries, the short run responses are fairly limited and usually involve higher prices and profits, but no significant increases in output occur since it

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<sup>7</sup>Richard E. Stewart, "A Look at the Risk Money Game," National Underwriter: Property/Casualty, 18 January 1980, p. 29.

<sup>8</sup>Hines, p. 54.

takes time to add capacity. Property-casualty insurance is different in that the supply may be increased almost instantaneously; a decrease is slower since, in general, existing policies must be honored and any reductions must come as old policies expire and are not renewed.<sup>9</sup>

One industry that shares this supply side cyclicity is agriculture.<sup>10</sup> Actors in both industries tend to make supply decisions based on expected future profits and, having made that commitment, are frequently without viable defenses when the real situation deviates from the anticipated since other agents acted the same way for the same reasons. For the property-casualty insurance industry the supply side volatility results from the peculiar nature of capacity in this industry. In most industries productive capacity is fairly easily defined; this is not so easily accomplished in this industry. To discuss this problem and to provide the background for later analysis, it is necessary to make a short detour through insurance accounting.

### Insurance Accounting

In the property-casualty insurance industry the overall measure of sales activity is premiums written during a calendar year. However, to balance their exposure and reduce the potential

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<sup>9</sup>See R. A. Hershberger, "Insurance Underwriting Capacity: A Psychometric Approach," Journal of Risk and Insurance, 42 (March 1975), 51.

<sup>10</sup>Richard A. Stewart, "Profit, Time and Cycles," Speech before Casualty Actuarial Society, May 1979, p. 9.

impact of a single catastrophic loss, firms buy and sell portions of their premium writings to other insurance firms and to specialists in reinsurance. When overall writings are aggregated and adjusted for reinsurance, the figure obtained is referred to as net premiums written.

Occasionally, the net premiums written are for insurance policies that extend for more than one year; these premiums are generally collected at the inception of the policy. Insurance accounting standards require that the firms show the proportion of these written premiums as "earned" over the life of the policy and not at the time of policy issuance. For this reason the earned premium of a company includes premiums written in the current year as well as prior years.

As was discussed earlier, the premium (price) of a particular coverage includes an estimate of expected losses, a component for the expenses associated with settling claims, provision for the expenses associated with writing the business initially (underwriting expense), and a profit margin. There are two key ratios for assessing the performance of the industry. The first of these is the loss ratio. It relates estimated losses and loss adjustment expenses incurred to the premiums earned during the year, that is, the proportion of earned premiums which can be expected to be required to settle claims against the policies in force and claims arising from earlier policies. The second ratio is the expense ratio. This ratio expresses the underwriting expenses as a proportion of net premiums written during the year. The rationale for using net premiums written is that these

expenses are primarily incurred in writing the business initially and do not generally continue over the life of the policy as the premium is "earned".

The sum of these two ratios is the (trade) combined ratio. This ratio is a measure of the overall profitability of the pure insurance side of the industry; it does not include any consideration of investment income. In the industry this ratio is generally reported on a basis of 100., like an index. When the combined ratio equals 100.0, underwriting activity is occurring on a breakeven basis for that period. When this ratio is less than 100.0, underwriting profits are being made; if it is greater than 100.0, underwriting is being undertaken at a loss.

As was pointed out earlier, when premiums are written, the portion that applies to a given accounting period constitutes earned premiums. The state laws regulating property-casualty insurance require that the firms set up an unearned premium reserve account to record the portion of the premium that the company has already received yet has not "earned".<sup>11</sup> This is a liability account.

Another liability account which is important for this analysis is the loss and loss adjustment reserve. "Loss reserves, as liabilities of the insurance company, include specifically: (1) claims for which loss reports have been filed, but on which losses have not yet been paid, and (2) claims arising from losses

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<sup>11</sup>J. D. Long and D. W. Gregg, eds., Property and Liability Insurance Handbook (Homewood, Ill.: Richard D. Irwin, Inc., 1965), p. 912.

that have occurred, but which have not been reported."<sup>12</sup> Reserves are also set up for the adjustment expenses associated with settling a claim. The actual amounts associated with these items are estimated using past experience and expected future costs.<sup>13</sup> As such, there is a great deal of subjectivity and uncertainty especially in times of inflation and when liability determinations are being made. A reserving policy that is very conservative, that is, having generous reserves, will tend to understate profits from underwriting (or overstate underwriting losses).

The sum of unearned premium reserves and loss adjustment reserves is referred to as the reserves of a property-casualty insurance company.<sup>14</sup> Some confusion results from this terminology since "reserves" are frequently considered an asset item, whereas these accounts are liabilities. Part of the reason for this confusion stems from fact that these reserves constitute a great portion of the capital that is invested and on which investment income is earned.

The last accounting peculiarity we need to discuss is policyholders' surplus. The difference between total assets and total liabilities is policyholders' surplus (or simply surplus). Stock companies' surplus includes paid-in capital and earned surplus that is derived from the underwriting and investment

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<sup>12</sup>Ibid.

<sup>13</sup>Hines, p. 54.

<sup>14</sup>Frequently, reserves are supplemented by voluntary reserves for such things as accrued taxes or dividends. See Long and Gregg, p. 918.

profits of prior periods. Since the policyholders of a mutual company are also the owners, this distinction is not made for mutuals. It is easy to understand why the surplus is called "policyholders' surplus" for mutual companies, but it is not as clear when dealing with stock companies. Because the surplus represents a sort of cushion to the policyholders against catastrophic losses by the firm, and since the claims of the stockholders are subordinate to the claims of the policyholders on the assets of the insurance company,<sup>15</sup> evaluation of the surplus, in reality, determines how well the policyholders are protected.<sup>16</sup>

#### The Cycle Continued

Since the late 1960's there have been several major developments that have had a dramatic effect on the behavior and performance of the property-casualty insurance industry.<sup>17</sup> These are: (1) the conglomerate merger wave and its impact on capacity; (2) the trend in the courts to extend the traditional notions of liability that has resulted in "social inflation"; and (3) price inflation. A related phenomenon is the relative amount of attention paid to investment income opportunities vis-a-vis

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<sup>15</sup>Since there is very little debt financing in property-casualty insurance, claims of creditors are not a crucial concern. See Hines, p. 56.

<sup>16</sup>R.W. Strain, ed., Property - Liability Insurance Accounting (Santa Monica, Ca.: The Merritt Company, 1976), p. 165.

<sup>17</sup>James E. Walker, "Regulated Firms Under Uncertain Price Change: The Case of Property and Liability Insurance Companies," Journal of Risk and Insurance, 46 (June 1979), 21.

underwriting profits. Although the realization has always existed in this industry that the profits derived from investment activities were available to redeem an otherwise bad profit picture in underwriting, it will be argued that the combined impact of the three factors listed above on relative profitability and the costs of losses has produced a major shift in the focus of insurance managers concerning the primary source of profits,

In the late 1960's when the conglomerate merger movement was reaching frenzied proportions, attention turned to the cash-rich property-casualty industry.<sup>18</sup> Reasoning that this industry had an excess of investable funds and excellent cash flow, investors quickly began acquiring firms to obtain capital with which to make further non-insurance acquisitions. Many insurance companies organized their own conglomerate organizations, often to avoid being swallowed up by someone else.<sup>19</sup> This non-insurance acquisition activity ultimately resulted in a reduction of policyholders' surplus.

One measure of capacity in this industry is the relationship between net premiums written and policyholders' surplus.<sup>20</sup> "Traditionally, a property-liability insurer is considered to have over expanded when its annual premiums written exceed twice its surplus to policyholders."<sup>21</sup> The impact of the reduction

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<sup>18</sup>Webb et al., p. 157.

<sup>19</sup>Ibid., p. 158.

<sup>20</sup>E. J. Gordon Henry, "Insurance Pricing and Capacity Who Really calls the Shots"? Risk Management, August 1979, p. 11.

<sup>21</sup>Webb et al., p. 159.

in surplus did not become apparent until the stock market debacle of 1974-75.<sup>22</sup>

Valuation of the assets of an insurance company is dictated by state law. Whereas bonds (unless in default) are valued at the amortized value based on yield, stock holdings are valued at their market price. Appreciation or depreciation of these stock holdings is not reflected in investment income unless the stock is actually sold; it is, however, reflected in the surplus account.<sup>23</sup> The dramatic decline in stock prices and the resulting reduction of surplus sent the ratio of net premiums to surplus soaring above 2.0 in 1974.<sup>24</sup>

This capacity constriction forced insurers to pull back on their writings to the point where the demands for insurance could not be met at prices acceptable to customers.<sup>25</sup> Many new techniques of risk management, such as captive insurance companies, became more attractive as did other forms of self-insurance.<sup>26</sup> This departure from traditional insurance channels has had and will continue to have important ramifications for the underwriting profitability of property-casualty insurers.

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<sup>22</sup>"The Outlook for the Property/Casualty Insurance Industry," Best's Review: Property/Casualty, November 1976, p. 92.

<sup>23</sup>Strain, p. 313.

<sup>24</sup>Calculated from data in Best's Aggregates and Averages, annual.

<sup>25</sup>Stewart, "A Look at the Risk Money Game," p. 21.

<sup>26</sup>Webb et al., p. 159.



Social inflation refers to the activities of courts, regulators, and legislators in extending liability into areas where it previously did not exist and establishing new standards for putting a value on traditional liabilities.<sup>27</sup> Malpractice and products liability are two excellent examples of this type of expanded liability. Since premiums are based on probabilistic estimations of future losses, social inflation tends to change the rules half way through the game. It introduces tremendous expansions in exposure to loss for which insurers have no basis to determine the real risk.

A rising price level affects this industry in several ways. On the underwriting side there are three major areas on which the impact is most pronounced. Inflation raises the cost of business already on the books and for which no price relief is possible until the policy expires. The premium having been determined at an earlier time, it is unlikely that the calculations used in determining the premium included an accurate estimation of future cost increases. Another area that is eroded for the same reason is the loss reserves. With a lag in the regulatory response to inflation, the inability to adjust premiums accurately to reflect rising prices causes a slow deterioration in real policyholders'

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<sup>27</sup> "The Overload on the Nation's Insurance System,"  
p. 46.

surplus. When inflationary forces lead to adverse performance in the stock or bond markets, policyholders' surplus is further endangered.<sup>28</sup>

While these dangers are real and serious, the greatest threat from inflation is the effect it has on the actuarial science of rate determination. Frequently, actuaries are accused of steering the industry by looking through the rearview mirror; and in non-inflationary periods past history is probably the best evidence of what can be expected in the future. However, when the economy is experiencing rapid changes in the price level, the practice of determining a premium for insurance coverage of future losses based on past experience has a much higher margin of error. Inflation dramatically increases the uncertainty inherent in forecasting the future, which is at the heart of the property-casualty industry. This greater uncertainty is especially insidious in the liability areas such as malpractice where claims for losses may not be made until several years after the policy period.

Having considered the ways in which inflation affects the industry on the underwriting side, attention is now turned to the investment side. Frequently, during periods of inflation the higher yields on financial assets make investment activities relatively more attractive to insurance company management since the returns on these assets include a component to adjust for

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<sup>28</sup>Brian C. Moore, "The Effects of Chronic Inflation on a Property/Casualty Insurance Company," Best's Review: Property/Casualty, March 1980, p. 24.

expected inflation. Looking back at Figure 1, one can understand why this might be the case. Investment income has been steadily increasing since about 1970, while underwriting income has exhibited wide swings. One of the positions that is becoming more widely held is that the shifting focus from underwriting to investment as the primary source of income has exacerbated the cyclicity in underwriting and, thus, weakened the underlying capacity in the industry.<sup>29</sup> This is a hypothesis which will be tested empirically in the next section of the paper.

#### THE MODEL

In this portion of the paper we will specify several hypotheses that will be tested using empirical methods. It has been argued that the underwriting performance in this industry is a function of changes in the price of insurance, cost changes, the capacity in the industry and investment opportunities.<sup>30</sup> To test these relationships, annual data were gathered for the period 1953-1976.

The sample included all stock and mutual companies active during this period. Reciprocal exchanges and Lloyd's type operations were excluded since many of the items for which data

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<sup>29</sup>Ben Weberman, "Here We Go Again?" Forbes, 28 April 1980, pp. 34-35.

<sup>30</sup>Barbara D. Stewart, "Understanding the Underwriting Cycle," National Underwriter: Property/Casualty, 4 January 1980, p. 15.

were collected were unavailable; however, since these organizational structures comprised only around five percent of the total activity, their elimination should not have any noticeable impact on the results. Prior to 1953 certain items were defined differently which led to comparability problems.

The variable whose behavior we will be attempting to explain is the (trade) combined ratio before policyholders' dividends. As discussed earlier, a combined ratio greater than 100.0 indicates underwriting losses; a ratio less than 100.0 indicates underwriting profits.

The variables that are included to explain the behavior of the combined ratio are: (1) price changes, (2) cost changes, and (3) the impact of investment activity. Changes in prices and costs can be dealt with in a fairly straight forward fashion. Investment activity requires a slightly more complex analysis and will be examined both directly and indirectly for its relationship to industry performance.

It has been assumed here that there is a stable relationship between the real demand for property-casualty insurance and real economic activity, and that inflation affects nominal insurance demand and nominal economic activity in the same way. The difference in the rate of change of insurance activity and overall economic activity is taken to represent changes in the price of insurance.<sup>31</sup>

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<sup>31</sup>Barbara D. Stewart, "The Next Cycle: How Bad Will It Be?" National Underwriter: Property/Casualty, 12 October 1980, p. 35.

The real price change variable is defined as follows:

$$\frac{\text{PWRIT}_t - \text{PWRIT}_{t-1}}{\text{PWRIT}_{t-1}} - \frac{\text{GNP}_t - \text{GNP}_{t-1}}{\text{GNP}_{t-1}}$$

Where:

$\text{PWRIT}_t$  = Net premiums written during time  $t$

$\text{GNP}_t$  = Nominal gross national product during  $t$

Therefore, real changes in the price of insurance are inferred when the per cent change in premiums written is different from the per cent change in nominal economic activity. That is, if net written premiums are growing faster than nominal gross national product, given our assumptions about the stable relationship and inflation, then this implies that prices are rising for insurance. If net written premium is growing more slowly than nominal GNP, then prices are falling.

In the earlier discussion of the cycle it was pointed out that rising prices are associated with two distinct points. The first is when profits are bad and regulators have just granted rate relief, and the overall price that could be charged is at a higher level; however, existing policy terms must be honored so that profit levels cannot increase in a corresponding fashion until renewal terms are negotiated. The second point follows this when the profitability picture has improved, but firms do not yet feel secure enough to compete on price or coverage. Therefore, depending on the phase of the cycle, rising prices could be associated with a combined ratio that is either rising or falling.

If the price change variable is included for the current and the previous period, the signs are expected to be different, although it is not clear which should be positive and which

negative in sign. Since it takes time for the losses to occur and develop, the impact of marginal business would not be felt in the same period as it was put on the books. For this reason a competitive strategy such as a reduction in price in period 1 would be associated with an increase in the combined ratio in period 2.

Profits are basically the difference between revenues and costs; changes in profits thus result from either changing prices, changing costs or both. The costs that are relevant in this industry are the costs associated with the items that are insured, the cars, houses, factories, wages and so forth. To capture the effect of inflationary cost changes in this industry, the annual change in the gross national product implicit price deflator was used. This price index was judged to be a better indicator of price level changes pertinent to the property-casualty insurance industry than the consumer price index, or other indices, due to its breadth. The expected sign is positive since inflation has an adverse effect on the combined ratio due to higher costs.

The impact of investment activity on the combined ratio must be examined both directly and indirectly. The capacity to write insurance is a function of the policyholders' surplus such that an increase in surplus facilitates increased premium writings. Part of the changes in surplus results from the prior investment activities. The fluctuations in the value of the portfolio of stocks stemming from the changes in the market price are not realized unless they are actually sold; however, insurance

accounting standards require that policyholders' surplus be adjusted to reflect these changes. Therefore, the success or failure of earlier investment strategies shows up as changes in the policyholders' surplus which in turn affects the capacity of the industry to write insurance. An increase in surplus in one period is expected to have a negative effect on the combined ratio in the next period since an increased surplus permits a higher level of premiums which increases the denominator of the combined ratio.

The definition of this variable is:

$$\text{SURP}_{t-1} - \text{SURP}_{t-2}$$

because the premiums written in time  $t$  move directly with a change in surplus in the prior period. Since we are assuming that inflation affects surplus and written premium in a similar fashion, it is appropriate to use changes in nominal surplus because it is the ratio of premium to surplus which is important for this analysis and the inflation effect cancels out of this ratio.

The direct impact of realized investment activities is considered by including a variable to reflect investment performance. The argument that has been stated earlier relates changes in the policyholders' surplus to changes in investment opportunities. For this reason using the absolute investment return on earned premiums does not capture the desired relationship. A proxy for new opportunities is the change in the rate of return over a period. The actual measure used here is the difference

between the investment returns earned in the current period and two periods earlier.

The rate of return in time  $t$  is:

$$\frac{\text{Investment income less expenses before taxes in time } t}{\text{Premiums earned in time } t}$$

Since it is assumed that inflation affects both terms in a similar fashion, this ratio reflects a real rate of return. An increase in this ratio indicates that the real investment opportunities have improved. The change in this ratio over the prior two periods was used because it is hypothesized that in a three year cycle, more than the last year's results are considered important. For these reasons, a positive change in the value of this variable over the two prior periods is expected to lead to looser underwriting standards and thus a higher combined ratio in time  $t$ .

One final variable that was included in the analysis is the combined ratio for the prior year. This is another way of examining the indirect impact of prior investment (and underwriting) activity. The reasoning is that the industry reacts to either good or bad performance by changing its strategy. If things were bad, the industry takes steps to correct its mistakes; if they were good, the industry's confidence is buoyed and firms are willing to compete by accepting marginal business.

If the combined ratio went up in time  $t-1$ , circumstances are getting worse and firms are tightening their standards. This activity affects the numerator and denominator of the loss component of the combined ratio in the same manner so that no change in the combined ratio is expected from the loss ratio



component. This is not the case for the expense component, however.

The expense ratio relates underwriting expenses to net premiums written. When firms tighten, net premium written tends to grow more slowly, if at all, while underwriting expenses grow more rapidly since these are composed in part of the upfront costs of evaluating new and renewal business, some of which is refused. Additionally, much of these expenses are fixed costs that continue even with a decline in real premium writings. As a result the expense component of the combined ratio increases which, in turn, increases the overall combined ratio because there are no offsetting forces in the loss component. The expected sign of this variable is positive.

Using multiple regression analysis, three different equations were estimated. Each of these included variables to capture the effect of price changes; a variable designed to relate changes in costs to industry performance; and a variable (or two) that is intended to act as a proxy for investment opportunities. The general hypothesis of this research is that the behavior of the combined ratio can be explained by these three factors.

Furthermore, it is assumed that each of the explanatory variables may affect the combined ratio directly and independently of the other variables. For example, a change in prices will influence the combined ratio and may not be related to changed cost levels, but may result from regulatory activity or competitive conditions. Cost changes may occur without corresponding

price changes depending on the degree of competition. Alternatively, non-price adjustments such as tightened underwriting standards may be the result of higher costs that also influence the combined ratio. Investment opportunities are affected by exogenous factors more nearly associated with underlying economic activity that would not necessarily influence prices and costs of property-casualty insurance.

Since the combined ratio may change even if one (or more) of the independent variables does not, a multiplicative functional form would not be appropriate. Also, it is not assumed that per cent changes in the independent variables lead to per cent changes in the combined ratio. The combined ratio is an index, and absolute changes in the ratio are assumed to be related to absolute changes in the explanatory variables. For these reasons the functional form of the equations to be estimated is linear.

The price and cost change variables are the same in each equation. Earlier it was pointed out that investment activity may affect the industry performance via different mechanisms; therefore, the equations differ in the form of the variable designed to relate investment activity to the combined ratio.

In the first equation the relationship is assumed to be an indirect one whereby the investment income plus the changes in the value of the portfolio cause the policyholders' surplus to fluctuate. Given that the ratio of net premiums to surplus is relatively stable, fluctuating surplus implies fluctuating premiums which would cause the combined ratio to change.

The direct impact of investment opportunities is considered in Equation (2). The change in the investment rate of return on earned premium is used to represent the potential gain from investing premium dollars. When this change is positive, and as it increases, the potential investment returns are improving and there is incentive to increase premiums written to fund the investments. The lag is designed to allow the adverse effects of loose underwriting to be felt in an increased combined ratio in a subsequent period.

In the last equation the same direct measure is used, plus a different indirect measure is included. This indirect measure is the combined ratio for the prior period. Because this measure reflects past underwriting performance as well as investment related behavior, it represents the cumulation of historical experience that provides the basis for current decision making, the success of which is shown by the current combined ratio.

The equations that were estimated are as follows:

$$(1) \text{CRAT}_t = b_0 + b_1P_t + b_2P_{t-1} + b_3C_t + b_4\text{SURP}_{t-1}$$

$$(2) \text{CRAT}_t = b_0 + b_1P_t + b_2P_{t-1} + b_3C_t + b_4\text{INV}_{t-2}$$

$$(3) \text{CRAT}_t = b_0 + b_1P_t + b_2P_{t-1} + b_3C_t + b_4\text{INV}_{t-2} + b_5\text{CRAT}_{t-1}$$

Where:

$\text{CRAT}_t$  = Combined ratio in period t

$P_t$  = price changes in period t

$C_t$  = cost changes in period t

$\text{SURP}_{t-1}$  = changes in policyholders' surplus between period t-2 and period t-1

$\text{INV}_{t-2}$  = change in investment return on earned premium between period t-2 and period t

The estimated coefficients are shown in Table 1 (with standard error given in parentheses).

In equations (1) and (2) the coefficients of the price change variables were significantly different from zero and alternated in sign as was hypothesized. For both equations the current ratio is positively related to price changes in the current period and inversely related to price changes in the prior period. It also appears that the lagged effect is stronger; that is, if prices rise this year, we can expect the combined ratio to fall more next year than it will rise this year. This pattern seems to support the idea that rising prices occur in periods when conditions are tighter, and that the primary effect of price changes is felt only after the loss history has had time to develop.

Cost changes, as measured by changes in the gross national product implicit price deflator, were also significantly different from zero and carried the predicted sign in Equations (1) and (2). When the cost index increases by one point, the combined ratio may be expected to rise by approximately four tenths of a point, other things constant.

The cyclicality in the combined ratio can be partially explained, in spite of this consistently rising component, by the offsetting impact of the price change variable. For example, if in period  $t$  costs went up by 10 percentage points and prices did also, the combined effect would be for the combined ratio to increase by approximately 7 points in time  $t$ , however, in time  $t+1$  the lagged price effect would reduce the combined ratio by almost 9 points all other things the same.

TABLE 1

REGRESSION ESTIMATES FOR FACTORS AFFECTING  
COMBINED RATIO, 1953-1976

Independent Variable	Equations		
	(1)	(2)	(3)
$P_t$	.3437* (.1503)	.3465* (.1360)	-.0010 (.1366)
$P_{t-1}$	-.8972* (.1718)	-.7484* (.1736)	-.7634* (.1317)
$C_t$	.0040* (.0015)	.0046* (.0013)	.0015 (.0013)
$SUPR_{t-1}$	-.000003 (.000002)		
$INV_{t-2}$		-.8125 (.3243)	.1791 (.3545)
$CRAT_{t-1}$			.5989* (.1543)
CONSTANT	.9776 (.0073)	.9773 (.0065)	.4004 (.1487)
$R^2/\bar{R}^2$	.7649/.7296	.8006/.7707	.8915/.8687
D-W	1.6708	1.9875	2.0229
SER	.0196	.0181	.0137
$F_{3,20}$	21.67	26.78	-----
$F_{4,19}$	-----	-----	39.03

\*Significant at 95% level

In neither equation did the investment opportunity variable support the hypotheses concerning the relationship between investment activity and the combined ratio. In the first equation the variable was not significant and in the second it carried the wrong sign. It may be that the lag structure was not correctly specified.

A more likely explanation, however, is that the investment opportunity variables were poor proxies for the relationship between management attitudes toward accepting marginal business and good investment income opportunities. The argument was that if managers expected to be able to get a high return on investing the premium dollars, they would be willing to underwrite some losing business. The key is expectations. What was needed to test this hypothesis was some variable that reflected the investment opportunities the managers saw at that time. The variables that were used, changes in investment return or changes in surplus, reflected what happened after the managers had acted on their expectations.<sup>32</sup>

Equation (3) presents markedly different results. In this formulation price changes have no impact on the combined ratio for the current period but are still important for the subsequent period. Neither cost changes nor the direct measure of investment opportunities was significant.

The variable that does offer some explanatory insight is the combined ratio for the prior period. It was argued earlier that a

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<sup>32</sup>I would like to thank Russ Johnson for pointing this out.

rise in the combined ratio is received by the industry as a signal of worsening circumstances and firms respond by becoming more cautious. Due to certain fixed components in the expense ratio, the combined ratio will continue to rise in the next period even with these tighter standards.

A clue to why the ratio does not continue on this upward path can be found in the loss component of the combined ratio. Whereas a rising ratio in time  $t-1$  leads to tightening in time  $t$ , this conservatism leads to a lower loss ratio in time  $t+1$ . This effect, along with the lagged inverse price effect, seem to have a combined impact sufficient to cause a switch in the direction of the cycle every three years. Referring back to Figure 1, we can see that a fairly regular three year pattern does exist.

Given the results of this analysis, it appears that the workings of the underwriting cycle are better explained by the industry's reaction to past experience and price level changes. The hypothesized impact of investment activity was not supported by this research; however, it is also the case that the variables designed to capture this relationship were not properly formulated. Correctly specified variables might give support to the hypothesis.

As a final test of these results, two of these equations were used to predict the combined ratio for 1977-79. Figures 2 and 3 show the actual and estimated values of the combined ratio obtained using Equations (2) and (3).

Both models track the actual values fairly well, but equation (3) catches the turns better, especially in the 1960's. Table 2

Figure 2

Actual and Estimated Values of Combined Ratio  
Based on Equation 2

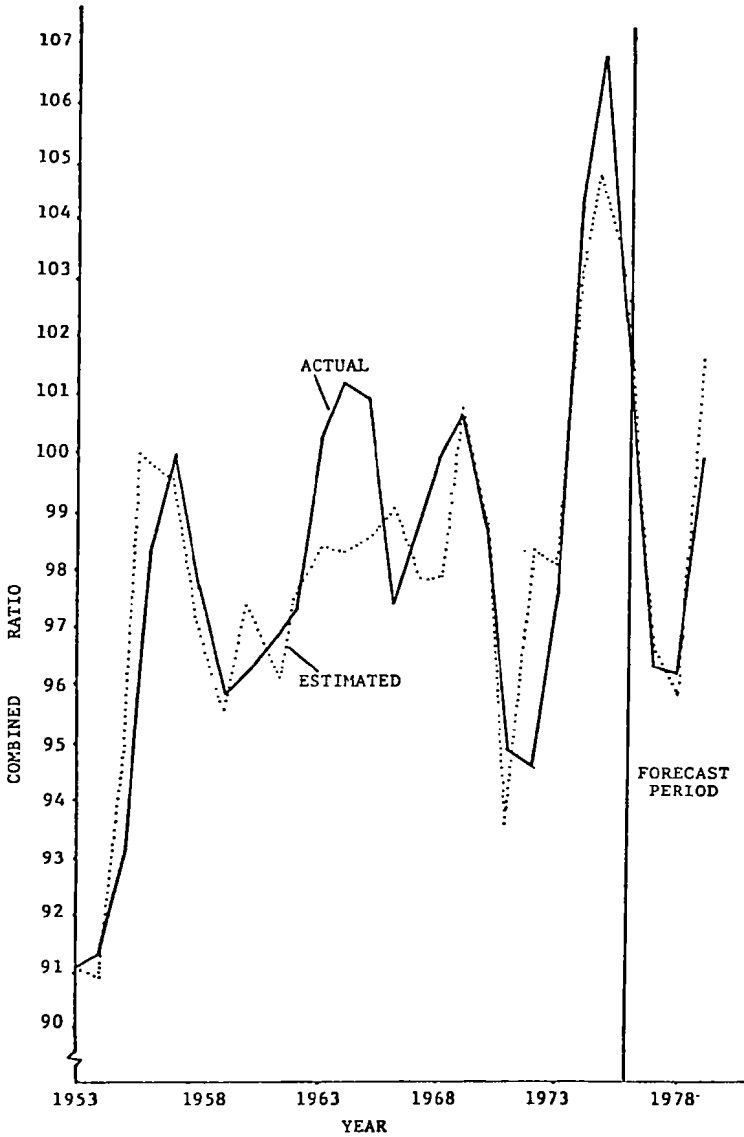
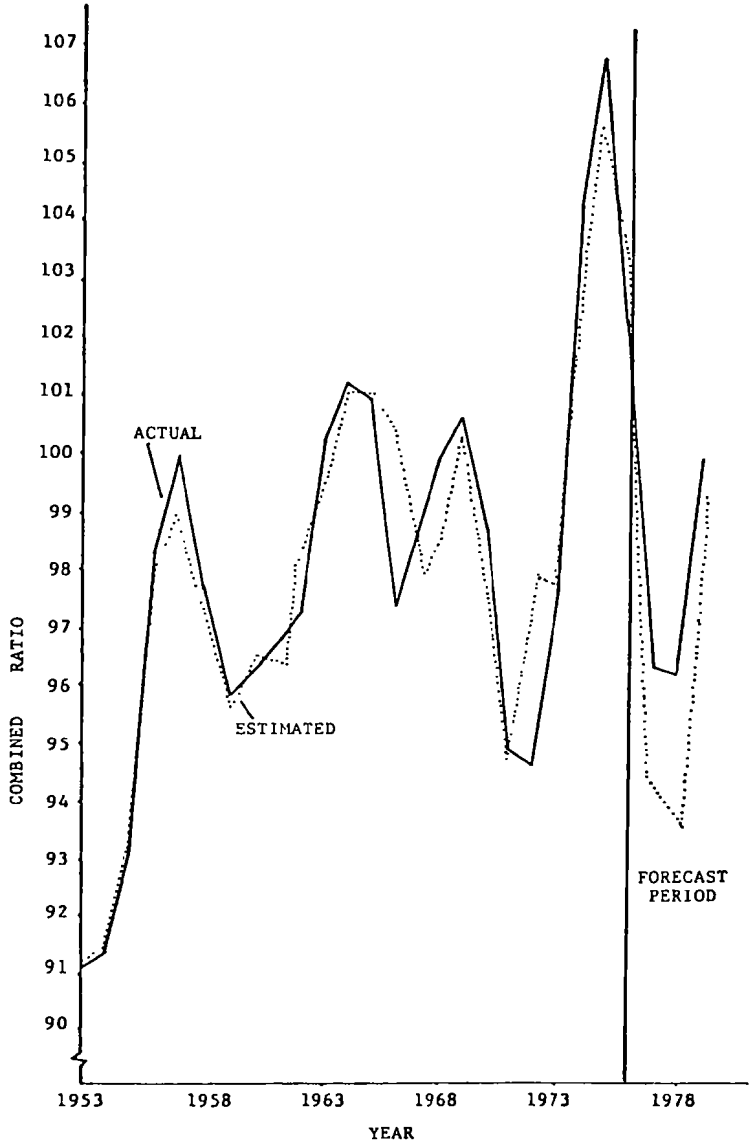




Figure 3

Actual and Estimated Values of Combined Ratio  
Based on Equation 3



shows the actual and predicted values for the combined ratio using data from 1977 and 1978 and forecast data for 1979.

TABLE 2

PREDICTED VALUES OF COMBINED RATIO, 1977-79

	Actual Value	Predicted Value	
		Equation (2)	Equation (3)
1977	96.2	96.2	94.5
1978	96.1	95.6	93.3
1979*	99.8	102.3	99.3

\*Estimated actual value obtained from Best's.

Both equations successfully caught the turn which did occur and, as for magnitude errors, equation (2) performed better in 1977 and 1978, equation (3) better for 1979. It appears that the predictive capabilities of these models are good. Better results would have been likely had quarterly data been available since the actual turns probably do not conveniently occur at year end.

## CONCLUSIONS

Historically, underwriting activity in the property-casualty insurance industry has been characterized by a regular cyclical pattern of profitability and loss. However, beginning around 1970 these cycles began to increase in amplitude while income from investment activities began to grow almost exponentially. The purpose of this paper has been to attempt to unravel the many complex relationships that underlie the behavior of these sources of income.

The property-casualty insurance industry appears to have many of the structural characteristics associated with a competitive industry. There are a large number of firms and the level of concentration is fairly low. Entry is not very restricted nor do there seem to be appreciable economies of scale.

Despite these factors this industry is directly regulated in many states. Although the actual degree of regulatory interference in the marketplace has lessened in the past few years as consumers were willing to bear more risk for a lower cost product, the conduct in the industry is still much affected by regulation, especially where pricing is at issue. The tendency on the part of firms to run to the insurance commissioner for rate relief when the underwriting cycle clouds their profit picture reflects this.

The cycle itself was analyzed to construct a causal model which could be used for prediction purposes. The hypotheses that

were tested related industry performance to changes in the price of insurance, changes in the costs of providing insurance and changes in the opportunities to earn higher investment income.

The results of this analysis offered support for the relationship between performance and price and cost changes. The direct link between the cycle and investment opportunity was not supported; however, an alternative specification of the independent variable would possibly remedy the problem.

## BIBLIOGRAPHY

Best's Aggregates and Averages, Property-Casualty, annual.

Conning & Company. The Regulatory Challenge: Business Principles Versus Social Pressures (An Analysis of Property and Casualty Insurance Regulation) Hartford, Conn.: Conning & Company, December 1978.

----- A Study of Why Underwriting Cycles Occur. Hartford, Conn.: Conning & Company, November 1979.

Douglas, G. W. and J. C. Miller III. Economic Regulation of Domestic Air Transport: Theory and Policy. Washington, D.C.: The Brookings Institute, 1974.

Fairley, W. B. "Investment Income and Profit Margins in Property-Liability Insurance: Theory and Empirical Results." Bell Journal of Economics, 10 (Spring 1979), 192-210.

Hammond, J.D., A. F. Shapiro, and N. Shilling. "Analysis of An Underwriting Decline: 1972-1975." CPCU Journal, 32 (June 1979), 66-73.

Henry, E. J. Gordon. "Insurance Pricing and Capacity - Who Really Calls the Shots?" Risk Management, August 1979, p.11.

Hershberger, R.A. "Insurance Underwriting Capacity: A Psychometric Approach." Journal of Risk and Insurance, 42 (March 1975), 51-68.

Hines, Harold H. Jr. "A Price Theory of Underwriting Cycles." Risk Management, November 1979, pp.53-58.

Ippolito, R.A. "The Effects of Price Regulation in the Automobile Insurance Industry." Journal of Law & Economics, 22 (April 1979), 55-89.

- Keeler, Theodore. "Domestic Trunk Airline Regulation: An Economic Evaluation." Study on Federal Regulation. Committee on Governmental Affairs, U.S. Senate. Appendix to Vol. VI, Framework for Regulation. Washington, D.C.: U.S. Government Printing Office, 1978.
- Long, J.D. and D.W. Greg, eds. Property and Liability Insurance Handbook. Homewood, Ill.: Richard D. Irwin, Inc., 1965.
- MacAvoy, Paul, ed. Federal-State Regulation of the Pricing and Marketing of Insurance. Washington, D.C.: American Enterprise Institute, 1977.
- Moore, Brian C. "The Effects of Chronic Inflation on a Property/Casualty Insurance Company." Best's Review: Property/Casualty, March 1980, p.22.
- "The Outlook for the Property/Casualty Insurance Industry." Best's Review: Property/Casualty, November 1976, p.10.
- "The Overload on the Nation's Insurance System." Business Week, 6 September 1976, pp. 46-50.
- "Review and Preview." Best's Insurance Management Reports, 31 December 1979.
- Stewart, Barbara D. "The Next Cycle: How Bad Will It Be?" National Underwriter: Property/Casualty, 12 October 1979, p.35.
- "Understanding the Underwriting Cycle." National Underwriter: Property/Casualty, 4 January 1980, pp. 15-16.
- Stewart, Richard E. "A Look at the Risk Money Game." National Underwriter: Property/Casualty, Part 1, 18 January 1980, p. 29; Part 2, 25 January 1980, p. 21.
- "Profit, Time and Cycles." Speech before Casualty Actuarial Society, May 1979.

Strain, R.W., ed. Property-Liability Insurance Accounting.  
I.A.S.A., Santa Monica, Ca.: The Merritt Company, 1976.

Walker, Peter. "Looking Behind the Property/Liability Bloodbath."  
Best's Review: Property/Casualty, November 1975, p. 21.

Walter, James E. "Regulated Firms Under Uncertain Price Change:  
The Case of Property and Liability Insurance Companies."  
Journal of Risk and Insurance, 46 (June 1979), 5-22.

Weberman, Ben. "Here We Go Again?" Forbes, 28 April 1980, pp.  
34-35.

Webb, B. L., J.J. Launie, W. P. Rokes, and N. A. Baglini.  
Insurance Company Operations. Vol. 1. Malvern, Pa.: American  
Institute for Property and Liability Underwriters, 1978.