

Price Indexes for Property and Casualty Insurance

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Producer Price Index
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I. Abstract

One of the most challenging aspects of developing a price index for insurance is that of defining the industry output. There are two concepts of output that are widely used by statistical agencies in the United States. This paper will focus on the output concept and pricing methodology chosen by the Bureau of Labor Statistics.

II. Introduction

This paper builds upon information from previously written papers by several economists from the U.S. Bureau of Labor Statistics. Contained in the following pages is a detailed recounting of the property and casualty insurance industry in the United States of America. Topics of discussion include 1) output definition, 2) types of services, 3) sample design, 4) publication structure, 5) pricing methodology, 6) technical concerns, 7) analysis of time series data, and 8) changes in the industry.

The first step in developing a pricing methodology for service sector industries is to agree on the conceptual definition of output. For the insurance sector, is it “pooling of risk” or “transfer of risk”? Pooling of risk defines the insurer as an intermediary between various policyholders where the insurer’s function is to collect premiums and disburse them to claimants. The policyholders retain the risk in this model. In the transfer of risk model, the insurer assumes the risk and must pay out for all claims even if they exceed the anticipated level. The second step is operationalizing the conceptual definition. This is the process of identifying actual products of the industry that truly represent the output and whose price is measured in a manner consistent with the output concept. If the output is “pooling of risk”, then the payment of fees to the insurer (premiums less claims) represents the output. If the output is “transfer of risk”, then the output is represented by premiums or premiums plus rate of return on investment¹.

The modified Laspeyres Index is designed to estimate a fixed-input output price index model. To keep output fixed in most industries, quality adjustment is necessary as goods and services are periodically modified to adjust for technological or style changes. The adjustment process involves factoring out the cost for any changes made to the product. In the realm of insurance, fixed quality may well refer to adjustment for additional features added to a policy but it also refers to holding underlying risk constant. This is a very different quality concern. Additionally, risk assumption could be valued in nominal terms or in replacement goods terms. The latter valuation implies a built in escalator mechanism to keep pace with the cost of home or auto repair.

The price index, to be truly useful, should reflect the price of representative actual transactions occurring monthly in the marketplace. Yet this goal often conflicts with the constant quality goal. If we priced an actual auto insurance policy over time, the make,

¹ Sherwood, Mark, “Output of the Property and Casualty Industry,” Centre for the Study of Living Standards Conference on Service Sector Productivity and the Productivity Paradox, April 1997

model and model year of the vehicle would remain unchanged. Do we preserve our constant quality assumption if we are repricing a new car in year one, a year old car in year two, a two year old car in year three, etc. Or should we substitute in year two to a replacement new car and reprice that for the next 12 months? The former methodology allows us to price an actual policy. The latter methodology removes us from the realm of the actual and introduces estimation methods. This complicates the mission of assuring that the price truly represents actual current transactions.

III. Definition of Industry Output/Types of Services

A. Definition of industry outputs

The primary output of the property and casualty insurance industry is the assumption of risk (transfer of risk from the policyholder) and financial intermediation. In this industry, financial intermediation is the investing of someone else's money with the goal of partially offsetting the size of the premium payment.

The policy underwritten by the insurer represents the unique output. The policy lists the coverages for which restitution would be made to the policyholder to cover claims. The amount of risk being transferred to the insurer is clearly stated in terms of covered benefits (and benefits not covered) and it obligates the insurer to pay claims for all such occurrences. So, the output is the transfer of the risk of financial loss from the policyholder to the insurance company.

B. Types of services

The output can be further defined by the specific types of property and casualty insurance coverage. The major service lines follow:

- Private passenger auto insurance
- Homeowner's insurance
- Commercial auto insurance
- Commercial multiple peril insurance
- Worker's compensation insurance
- Medical malpractice insurance
- Product liability insurance
- Inland marine insurance
- Surety insurance
- Fidelity insurance

IV. Business Model

A. Industry organization

Companies in the P&C industry are either operated privately or by the government. Those owned privately represent the largest share of the market and include stock companies, mutual companies and “other institutions.”

Stock companies, which represent the largest share of this industry's transactions, operate in a similar fashion as other corporations; that is, they are operated to yield a profit to the shareholders and are managed by a board of directors, which serves at the discretion of the shareholders.

Mutual companies, on the other hand, are operated solely for the benefit of policyholders, as those buying a policy from a particular mutual company become a proportionate owner of that company. In other words, the policyholders, as owners, benefit from the payment of dividends, increased policy benefits, and/or reduced premiums when the company does well.

The final private sector insurance provider includes enterprises that are owned by "other institutions," such as reciprocal or inter-insurer associations. These nonprofit associations are mutual in the sense that each policyholder in the arrangement is insured by all the others which, in turn, insure them to a stipulated extent. The members in such an association are represented by a professional management team upon whom they have all individually conferred complete power to manage the affairs of the organization. Insurance companies will band together as self-insurers to form an organization that is chartered and licensed as an insurer in at least one state. These arrangements are known as risk retention groups. Lloyds is a corporation formed to market services of a group of underwriters. This group does not issue insurance policies as a whole. Instead several different underwriters will assume part of each risk.

Most companies in this industry are part of a much larger aggregation called an insurance “group.” An insurance group refers to all companies that are affiliated with each other through the same ownership.

B. Identification of operating units

In 2002, there were approximately 296 insurance groups representing 2630 individual insurance companies (many of these companies are not affiliated with a larger group) in operation, according to the National Association of Insurance Commissioners. This number is inclusive of the company headquarters only. Generally, insurance companies operate branch offices throughout the country or within a certain region.

C. Government regulation

Due to the nature of their business, insurance companies are subject to intense supervision. First, the service provided by the insurer is paid for in advance, and its value lies in its future

performance. Therefore, it is of great importance that the insurer is financially sound and able to carry out its contract in the event of a loss. Second, there is a temptation for insurers to be overoptimistic about future losses, and some may turn to price competition to attract new business. Thus, a basic need is to see that insurers charge prices that are adequate. Finally, given the complexity of the business, the general public is not well versed in insurance terms, principles and contract provisions. As a result, regulators have the task of eliminating unsound and/or unethical practices from the insurance business.

The major responsibility for regulation lies with the individual states. Although P&C insurance laws and regulation differ in detail from state to state, they are similar in approach. Each state must monitor the premiums that each company charges, and impose taxes and issue licenses associated with the selling of insurance. In addition, each state must make interstate competition between insurers equitable. Also, states must assure that insurers meet solvency requirements, and are able to settle claims.

In monitoring insurance premiums, the state assures that premiums are "adequate, reasonable and fairly discriminatory." The essential loss and expense information required for the development of premiums for most lines of insurance is gathered by rating bureaus. The rates generated by this information are advisory only. In most states, insurers are not required to file and use these rates, as individual insurers are free to modify them in any way acceptable to the insurance commissioner who receives the filing.

In collecting revenue from P&C insurers, the state may impose premium taxes and/or franchise taxes. Under premium taxes, the state subjects insurers to a tax of about 2% on gross premiums, less return premiums. This method of tax calculation is viewed by many insurers as being unfair, since written premiums often result in a loss. The franchise tax, on the other hand, is a less controversial, fixed tax. It may be reduced, however, depending upon the extent to which the insurer invests its funds within that same state.

Other fees that the state imposes include license fees and special charges. License fees are charges that the state imposes for each line of service that an insurer underwrites. A P&C insurer may write any line of insurance except life insurance, though some insurers circumvent this by creating subsidiaries. Special charges are taxes related to insurer organization, the filing of reports and papers, and the licensing of agents and brokers. In addition to licensing agents and brokers, states also define the legal status of agents and brokers, outline their duties and qualifications, and prescribe an examination that must be passed to gain a license.

Finally, to assure insurers remain adequately solvent, states typically regulate the investments of each insurer. This is important because insurers must remain solvent enough to pay claims should an unexpected catastrophe occur. As a rule, insurers must usually invest an amount equal to the minimum capital requirement in (1) federal, state, or municipal bonds, or (2) bonds or notes secured by mortgages or deeds of trust on improved unencumbered real estate. In some states, certain classes of public utility or other high-grade bonds may be used to meet this requirement.

D. Public ownership/government subsidization

1. Public ownership

Unlike private sector companies, government-operated companies have a relatively small share of the P&C insurance market, though they do provide insurance at both the federal and state levels. In general, the government will not assume risk-bearing functions in areas adequately served by private companies. Rather, it becomes involved with and offers insurance services only when certain lines are not being offered sufficiently by the private sector. For example, the government currently provides terrorism insurance, federal crop insurance, nuclear energy insurance, flood insurance, and some workers compensation insurance.

2. Government subsidization

Since the early 1980's, the U.S. government has provided crop insurance subsidies through the Federal Crop Insurance Corporation. Producers pay a portion of the premium plus a small administrative charge, and the government pays the balance. The percentage paid by the government depends on the level of coverage, and declines as coverage increases.

On November 26, 2002, the Terrorism Risk Insurance Act legislation became effective. For five years, private insurance companies and the government will share the risk of future losses from terrorism. For losses above a company's deductible, the federal government will cover 90% and the company will cover 10%.

V. Sample Design

A. Sample frames

1. Stratification variables

The current sample is explicitly stratified by line of insurance. The stratification variables correspond directly to the categories by which companies report financial data to the state insurance commissions.

2. Alternative frames

The National Association of Insurance Commissioners aggregate Insurance Expense Exhibit (IEE) was selected for this industry's frame. This frame contains 2,926 insurance companies, which were then aggregated into 296 insurance groups. An insurance group is a corporate headquarters unit and each individual subordinate operating company. The frame was explicitly stratified by line of insurance, providing one record for each line of insurance that each insurance group sells.

B. Identifying the sample unit

Each sample unit represents a single line of insurance aggregated to the insurance group level. For those sample units not affiliated with a group, the sample unit is identified as a line of insurance for a single company.

C. Reporter burden issues

The most significant burden for reporters occurs during data collection. Considerable time must be spent selecting policies and identifying the numerous price determining characteristics.

Subsequently, repricing is only requested on an annual or semi-annual basis, depending on the time period covered by each selected policy. **Premiums are typically set on an annual basis, so they are considered good prices for a twelve month period. Therefore, policies are priced on their respective anniversary (or renewal) dates and prices are held unchanged until the next pricing period.**

Burden is further reduced by spreading repricing throughout the year. **Disaggregation by anniversary date is performed such that the selected policies are renewed in different months. Ideally, the reporter will price only one policy in a given month.**

VI. Industry Recordkeeping Practices

A. Data availability

Pricing data for all of a group's individual companies can be obtained at the group headquarters. Due to the nature of mandatory financial reporting to the state insurance commissions, the requested price components are readily available.

B. Composite goods and bundling of services

The only service bundling that occurs in the P&C industry is that of combining multiple types of coverage under a single insurance policy. One such policy is that which combines private passenger auto and homeowner's coverage for a single premium. Another type is the commercial multiple peril policy, which combines several types of coverage. For example, one policy may provide commercial auto, worker's compensation, and product liability coverage.

VII. Publication Structure and Relationship to CPC

A. Publication structure

524126	Direct Property and Casualty Insurance Carriers
524126P	Primary services
5241261	Private passenger auto insurance
5241262	Homeowners insurance
5241263	Commercial auto insurance
5241264	Non-auto liability insurance
524126402	Medical malpractice insurance
524126403	Product liability and other non-auto liability insurance
5241265	Commercial multiple peril insurance
5241266	Workers compensation insurance
5241267	Other property and casualty insurance
524126SM	Other receipts

B. Why the structure was chosen

This structure reflects the major lines of insurance provided by companies in this industry. Also, it closely matches the categorization used by companies to report revenue and other financial data in their annual statements.

C. Relationship of the structure to the CPC

The publication structure for the P&C insurance industry corresponds to the Central Product classification (CPC) Ver.1.1 Group 7133.

- 7133 - Non-life insurance services (excluding reinsurance services)
- 71331 - Motor vehicle insurance services
- 71332 - Marine, aviation, and other transport insurance services
- 71333 - Freight insurance services
- 71334 - Other property insurance services
- 71335 - General liability insurance services
- 71336 - Credit and surety insurance services
- 71339 - Other non-life insurance services

VIII. Pricing Methodology

A. Methodology chosen

The operational definition of assumption of risk plus financial intermediation is premium plus rate of return on investment. Investment income is crucially important to the industry and greatly affects their pricing decisions and its inclusion should yield a smoother statistic that would facilitate the regulatory decision-making process. Companies may well reduce premiums when the rate of return increased in response to competitive pressures, as well as raise premiums when the rate of return is lower.

Thus, the price can be expressed as

$$\text{Price} = \text{Premium} (1 + r)$$

where r is the annual return on the invested portion of the premium for the particular line of insurance that is being priced. This rate is stated as a percentage of all premiums paid.

There are mutual companies whose policyholders are also the stockholders of the company. These companies typically pay out a dividend rebate to the policyholders on an annual basis. In such cases, the dividend would be subtracted from the premium to obtain a net transaction price. This price can be expressed as

$$\text{Price} = \text{Premium} (1 + r) - \text{Dividend}$$

The unique output to be priced is the policy issued by the insurance company. The policy lists the occurrences and coverages for which restitution would be made to the policyholder in case of damages. The amount of risk being transferred to the insurer is clearly stated in terms of covered events (and events not covered) and it obligates the insurer to pay claims for all such occurrences. So the output is a contract transferring financial coverage liability from the asset holder to the insurance company.

Insurance companies are asked to provide actual policies selected by probability where the premium determining characteristics are held constant while the policy is repriced on an annual basis. Once an actual policy is selected, its price determining characteristics are identified and held "frozen" to permit monthly pricing of the same unique item. The following policy characteristics are common in most property and casualty insurance lines:

1. Type of property/casualty description - This lists the characteristics of the insured property.
2. Type of coverage - This includes physical damage coverage and liability coverage.
3. Dollar limit of coverage - This is the maximum amount of money the insurer is legally obligated to pay in the event of a claim.

4. Coinsurance clause - The percent of the value of the property to be reimbursed by the insurer.
5. Deductible - The insured bears the first part of any loss covered by the policy up to a specified amount.
6. Length of policy period – This is the time frame for which the policy is in effect.
7. Perils covered – These are the specific risks that the insurer assumes.
8. Location of the insured property – Risks vary by geographic location.
9. Past loss experience – Premiums generally are lower if the insured has a past record of making fewer claims.
10. Valuation of insured property – This can be either the actual cash value of the property, which adjusts for depreciation, or the replacement cost.
11. Valuation of risk exposure – This is a valuation for liability coverage.

The insurance company estimates the current premium for this frozen policy by using current charges applied to the policy characteristics of the actual policy. This premium remains unchanged until the policy is priced again the following year.

The major difference in repricing a frozen policy versus repricing an actual policy is that the insured may modify the policy over time. For example, an auto policyholder could add a teenage driver in year two of the policy, increase the liability, or reduce the deductible. Such a change in the repriced item violates the Laspeyres assumption of fixed quality. By freezing the policy characteristics, the fixed quality assumption is realized.

In order to hold inflation-sensitive characteristics constant, periodic adjustments are made to account for inflation. For homeowners insurance, the dollar limit of coverage is adjusted annually to account for construction price inflation. The assumption is that the policyholder is insuring to secure a constant flow of services from the insured property. If there is price inflation affecting the cost of repair or replacement of the damaged property, the coverage limit should be escalated to reflect this increase. This adjustment is made annually on the anniversary date of the policy. This reflects what actually occurs – where the company makes these coverage adjustments at the time of policy renewal. As the index is tracking several thousand policies selected on a probability basis, there is a spread of policy anniversary dates throughout the year. This yields a smoother behaving index than making this adjustment for all repriced items at one time.

The source to be used for the escalation is dependent upon the insurance company. If the company cannot make a recommendation as to how the inflation-sensitive policy characteristics should be adjusted, PPI decides the appropriate index to use. For example, the E. H. Boeckh Building Cost Index is used to escalate the coverage limit for homeowners insurance. A different procedure will be used for Workers Compensation Insurance. The

workforce in the group is held constant (same number of people in the same jobs), but the wage rates are adjusted to account for general wage inflation. In this case, the Bureau of Labor Statistics' Employment Cost Index is used.

The investment rate of return is calculated by all insurance companies as a percentage of the premium. An annual report is prepared by all companies which includes this calculation. The report provides the investment rate of return by insurance line calculated as a percent of premium. As with the inflation-sensitive policy characteristics, the rate of return is updated annually for each item on the policy anniversary date.

B. Alternative methodologies

Currently, the Bureau of Economic Analysis defines output as the pooling of risk in the National Income and Products Accounts. Using this output definition, the price would be expressed as

$$\text{Price} = \text{Premiums} - \text{Claims}$$

The decision to abandon the pooling of risk model was made only after extensive research and discussion with the industry. The operational definition of assumption of risk plus financial intermediation was premium plus rate of return on investment. While there was initial reluctance among industry representatives to accept the rate of return price component, they ultimately agreed with our definition. The difficulty was of a practical nature in that the state regulatory authorities were accustomed to thinking of premium as equaling price. The introduction of an official price series based on a different price definition introduced uncertainty to the industry. Eventually, there was the realization that investment income was crucially important to the industry and greatly affected their pricing decisions and its inclusion should yield a smoother statistic which would facilitate the regulatory decision-making process. Companies may well reduce premiums when the rate of return increased in response to competitive pressures, as well as raise premiums when the rate of return was lower.

C. Limitations in chosen methodology

Insurance companies are able to provide meaningful premium estimates as long as they continue to sell the selected types of policies. However, one limitation is new item bias that may be introduced as new insurance regulations or mandated coverages become effective.

IX. Technical Concerns

A. Quality adjustment

The fundamental issue in pricing insurance services over time is the ability to identify and adjust for changes in risk. For changes in explicitly endogenous risk factors such as changes in coverage or deductibles, companies have suitable cost data to allow for meaningful cost based quality adjustment. However, for changes in exogenous risk factors that go beyond the scope of policy negotiations, such as an increased incidence of theft or a severe hurricane season, company specific data would not be sufficient to definitively quantify risk. Only outside data sources will be able to identify short-term vs. long-term changes in risk.

Such an outside data source is used in the quality adjustment of private passenger auto insurance where risk changes occur even though the age of the insured auto remains the same. To keep the age constant, the model year of the auto is updated once a year to the next model year. For example, a 1996 Honda Accord is changed to a 1997 model. However, changing the model year can also move the auto into a different risk category known as a symbol group. Insurance companies are unable to assess this risk change on their own, but a valuation can be obtained from Insurance Services Office (ISO). This organization pools risk information industry-wide, producing data which is broader in scope than any that one company could gather on its own. The ISO assigns autos to symbol groups based on their risk characteristics. For PPI purposes, the ISO provides the value of risk change for every auto included in the index. The ISO monitors the symbol group that is assigned to an auto and the particular risk associated with that symbol group. When an auto moves into a different symbol group, ISO assigns a value to the risk change that occurs. This value is then used to explicitly quality adjust the premium used in the PPI. Therefore, the risk changes are not reflected in the index as price changes.

However, it is not always clear that we would know when a shift in underlying risk truly occurred. Over the past few years, claims for mold damage have increased significantly. Has the climate changed such that there is increased risk of mold? Are policyholders just making more claims against their homeowner's policy? Decisions must be made in real time, and sufficient data simply may not be available in the current month to identify and quantify the effect of these changes. Mold has always existed, but until 2001, mold was not a factor in the homeowner's insurance market. However, public anxiety over major lawsuits in Texas and California have led to an increase in claims due to water damage (mold was only covered by policies if it was related to a covered peril such as a burst pipe). As a result, the increase in costs has driven premiums upward. Do we quality adjust these premium increases that occurred to help cover the higher claims since 2001? In the PPI, it has been treated as an increase in utilization as there has been no observable shift in weather patterns to indicate a change in risk.

B. New item bias

Another issue is the new item bias that can be present in pricing frozen policies. However, this bias may be especially problematic when pricing a frozen policy. Over time, this policy may no longer be representative. Mandated coverages may change or new insurance products may be introduced. Although bias may not be as prevalent when following an actual policy, it can occur if the general population has changed their preferences for the type of insurance product that they purchase or if the policy represents a smaller portion of the company's business.

The PPI program has developed a "directed substitution" procedure to reduce new item bias. This procedure captures evolutionary changes to a current product or service that did not exist when the sample was selected. Periodically, each company will be contacted in order to review the insurance products included in the sample. The existence of these evolutionary changes in the industry will be identified and disaggregation will be performed to determine if a substitution should be made from the current product to an evolutionary product or to add the new feature to the description of the current product. Producer cost based quality adjustment will then be attempted to adjust for these changes.

C. Impact of customization on the pricing methodology

Every line of P&C insurance has the potential to be customized to some extent. Though some lines, such as Private Passenger Auto, offer standard policies, there is always the possibility of customization given the high degree of variability in the item being insured. In addition, the policyholder, in most cases, is not only able to determine how much coverage is needed, but is also able to include/exclude certain options under that coverage.

Since insurance companies do not sell the exact same policy every month, it is impossible to obtain an actual transaction price each month. Thus, it is appropriate to price the "frozen" or hypothetical policy once a year.

X. Survey Vehicles

A. Methods used to secure cooperation and survey data

Field economists from the BLS regional offices obtain cooperation through a personal visit to the sampled insurance company. The field economists disaggregate the company's output and select unique items by using probability sampling techniques.

B. Methods used to reprice

Once the field economist completes data collection, repricing data is submitted by a designated company official via a mail or fax survey. Repricing coincides with the renewal date of the policy selected for pricing.

C. Strategies used to secure and maintain data quality

The BLS maintains confidentiality through the use of secure computer systems. In addition, strict confidentiality guidelines are followed by the PPI analysts who review the data.

The PPI analyst is able to maintain the quality of the data by investigating any abnormalities that are reported. The analyst will contact companies regarding any significant price change or change to the existing service.

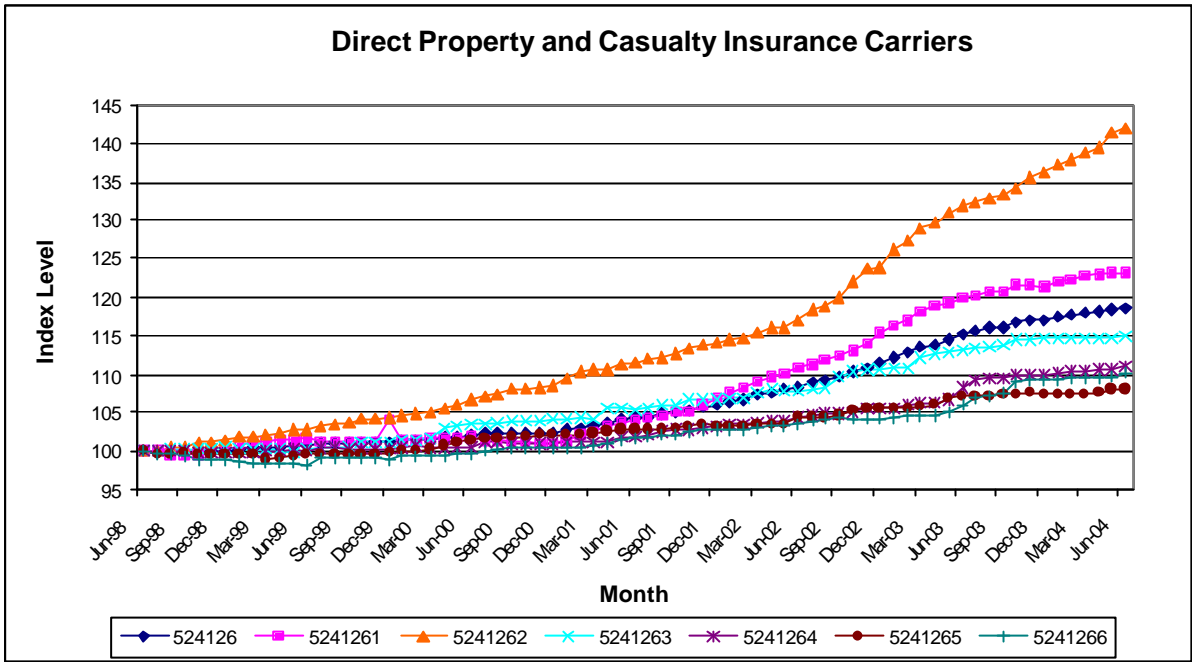
XI. Time Series Data and Analysis of Published Indexes

Premiums in this industry have been steadily rising for the past several years after a period of consistently lower premiums. Increases in Private passenger auto insurance (5241261) are due primarily to higher medical and repair costs. The cost to repair damaged vehicles is outpacing the rate of inflation. In addition, higher awards in liability cases are driving premiums upward.

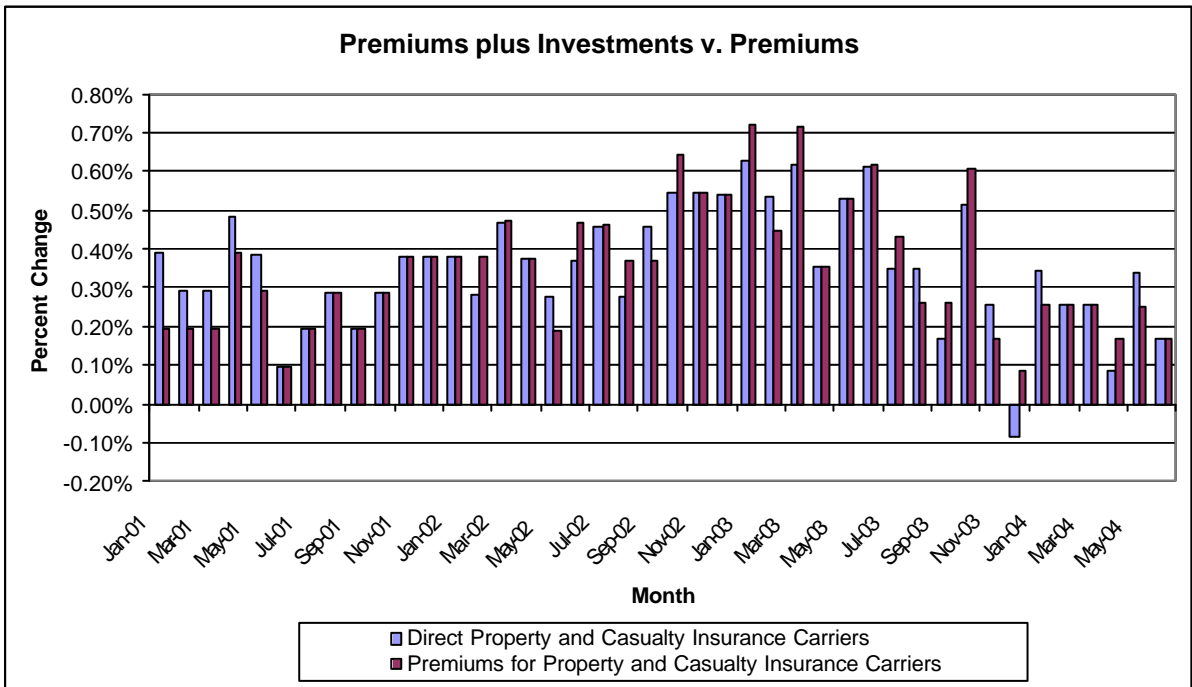
Homeowner's insurance (5241262) has been rising due of a large number of natural disasters. Losses are the most important driving force in homeowner's premiums. In the southern states, claims relating to mold damage has caused insurance premiums to increase significantly. California, Arizona, and especially, Texas have been affected the most severely².

In a period when insurance premiums were already rising, the events of September 11, 2001 affected the insurance industry dramatically. Heavy losses from the terrorist attacks in New York City are forcing insurers to raise rates in order to build up insurance capacity. However, the impact is falling primarily on the reinsurance market. Since reinsurance is excluded from this index, by definition, the effects on index movement have not been significant.

² Insurance Information Institute



An index that reflects only the changes in premiums is also calculated using the same premium data reported for the primary industry index. The two indexes are compared in the graph below.



To compare these two indexes accurately, it is important to note that the earned rate on investments reported in the primary index is reported on a lagged basis. The earned rate on investment is calculated annually (April) for the previous year. For example, in 2002, investment returns dropped to the lowest level since 1995 as interest rates were at 40-year lows. This decrease in earnings would have been captured in the earned rate for 2002, but would not be reflected in the index until it was available in April 2003.

XII. Evaluating Changes in the Industry

The Terrorism Risk Insurance Act 2002 voided all terrorisms exclusions that were in force for all commercial P&C policies. For these policies, new endorsements (or riders) have been filed that define the mandated coverages. For those policyholders that decline the new coverage, there are endorsements that reinstate the terrorism exclusions.

The advent of new underwriting tools is helping insurers to better estimate the risk of future claims. One such tool is credit scoring, which enables insurance companies to differentiate between low- and high-risk policyholders, allowing them to charge the appropriate premium for the assumed risk. Most companies now use credit scoring, which is fostering competition in the industry and providing the consumer with more choices³.

These significant changes have become important price determining characteristics that must now be captured to enable companies to estimate an accurate premium.

XIII. Conclusion

This paper clearly demonstrates that the chosen methodology closely approximates the conceptual model of the assumption of risk. Despite limitations such as new item bias, the indexes produced accurately reflect price movement in the industry. However, directed substitution and routine index maintenance procedures will allow the industry analyst to make adjustments for changes in industry regulation and mandated coverages. In addition, industry pricing and record keeping practices enable respondents to report prices with the least amount of burden.

³ Insurance Information Institute.