European Journal of Social Sciences
ISSN 1450-2267 Vol.25 No.4 (2011), pp. 456-464

http://www.europeanjournalofsocialsciences.com

# Cross Sectional Estimation of Loss Reserve for Egyptian Fire Insurance Market

**Yusnidah Ibrahim**
*College of Business, Universiti Utara Malaysia*
E-mail: yibrahim@uum.edu.my

**Tarek Abd Elhamid Ahmed Taha**
*College of Commerce, Tanta University, Egypt*

**Mohd Sobri Minai**
*College of Business, Universiti Utara Malaysia*

**Abstract**

The study's aim is to estimate reported loss reserve using cross sectional regression Data for actuarial reserve estimation techniques is collected from the biggest governmental insurance company's (*Misr* Insurance Company) and for the total market. The tested variables include underwriting premiums, paid claim, reinsurance issued premiums, inflation rate, and the investment rate. The cross sectional regression results show that only underwriting premium, paid claims and inflation rate are significantly related to the loss reserves, where the relationship is positive for underwriting premium and paid claims, and negative for inflation rate.

**Keywords:** Loss reserve, general insurance and regression analysis

## 1. Introduction

One of the major tasks that insurance companies routinely perform is loss reserves estimation. The requirement for loss reserves is due to the delay between the claim event date and the claim settlement date. This delay depends on how long time it takes from the day a loss occurs until the claim is settled and paid out to the policyholders. It may take a long time from the loss event to the reporting of the loss to the company, or it can take a long time from the day of reporting until the company knows the ultimate cost of the claim (Olofsson, 2006).

The Egyptian law as stated in Article (37) from the Act No. 10 in the year 1981, amended by Law No. 91 in the year 1995, set that the Egyptian property and liability insurer must establish the required reserves to meet its liabilities to policyholders and beneficiaries, as follows: i) Unearned Premium Reserve (UPR) ii) Incurred But Not Reported Losses Reserve (IBNR) (iii) The Outstanding Claim Reserve for the reported losses(OCR) and Loss Ratio Fluctuation Reserve.

OCR and IBNR constitute what is referred to as 'loss reserves'. Hence, the overall loss reserve consists of two groups, i.e. the reported (known) claims and the claim losses believed to have been incurred but not yet reported and hence not yet known to the insurer (Liu, 2008). However, in many types of short term general insurance, such as fire insurance, damage claims get settled within a few months of insured events, and therefore IBNR is not normally reported in these segments of insurance

business (Kannan, 2008). In addition, for the short term general insurance, loss reserves represent the biggest component of reported reserves, or technical reserves.

In principles, these reserves must be adequate to meet policyholders' claims (Cheung, 1997). The amount of loss reserve also has important implications for insurers pricing and competitive responses. If the estimate of loss reserves were too low, premiums would be inadequate to support the financial projections of future periods. If the loss estimates were too high, insurance rates may be raised above competitive levels and reduce the periodic income of the insurance company (Douglas, 1999; Calandro & O'Brien, 2004).

Loss reserves in general insurance market are estimated based on actuarial reserving techniques such Chain Ladder Technique (CLT) (Harnek, 1966), Bornhuetter Ferguson Technique (BFT) (Bornhuetter & Ferguson, 1972) and Taylor Separation Technique (TST) (Taylor, 1977). Modified versions of the above techniques which incorporate inflation rates and reinvestment rates have also been suggested to derive a more accurate estimation and allocation of loss reserves. Nevertheless, data required by all these reserve estimation techniques is complex and ambiguous, where it is assumed that the claims paid can be grouped according to accident years and development years, resulting a claim run-off triangle (Panning, 2006).

Considering the importance of loss reserve figures for future planning and decision-making and the complexity and ambiguity of actuarial loss reserve calculation, it is crucial to explore non-actuarial approaches to estimating loss reserve, one of them is the cross sectional regression method. For Narayan & Warthen (2000), regression models for loss reserving are getting increasing attention in actuarial research as they provide an estimate of the variance of loss reserves, along with point estimate.

Previous studies which rely on multiple regression technique in estimating loss reserves (e.g. Harbey, 1994; Eissa, 2001) modeled loss reserves as a function of paid claims, earned premiums, reinsurance issued premium and the surplus of insurance activity . These studies however disregarded inflation rate and investment rate which are theoretically related to loss reserve. Moreover, the inclusion of surplus of insurance activity variable as one potential determinant of loss reserve is improper since arguably loss reserve is one of the determinants of surplus of insurance activity, and not the other way around as hypothesized in these studies.

Apart from forecasting the loss reserve, a regression analysis also allows examination on whether the reported loss reserves and the currently applied loss reserve estimation technique in Egypt incorporates important reserving factors, namely paid claim, inflation rate and investment rate, and are affected by other factors such as underwriting premium and reinsurance issued premium.

This study examines the loss reserves estimation for fire insurance segment within the period from 1981/1982 to 2007/2008. The fire insurance segment was chosen since it is the largest segment within the general insurance sector in Egypt. The analysis is done at a company level based on data from Misr Insurance Company alone and at the industry level based on data from 13 general insurance companies. The focus on *Misr* Insurance Company reflects the insurance industry in Egypt as this insurance company alone controls the biggest share of insurance industry. This company plays an important role in Egyptian general insurance industry by having 80% of general insurance market total asset share for the year 2007/2008. In terms of the insurance premiums, this company controls 60% from total premium of property and liability insurance market in the same period. Moreover, in terms of the percentage of paid claims from total property and liability, the company contributes 93.8% from the total property insurance market paid claims in 2007/2008 (Egyptian Insurance Supervisory Authority, Annual report 2007/2008).

## 2. Loss Reserve Estimation Techniques

In actuarial literature traditionally, three of the most popular loss reserving techniques used by insurance companies are the Chain Ladder Technique (CLT) (Harnek, 1966), Bornhuetter Ferguson

Technique (BFT) (Bornhuetter & Ferguson, 1972) and Taylor Separation Technique (TST) (Taylor, 1977).

The actuarial determination of loss reserves examines the historical claim payments to determine trends so that future claim payments can be estimated. An actuarial method selects development factors based on an analysis of historical claims development factors. The selected development factors are applied to cumulative claims data for each segment of business for each accident or underwriting year for which data not yet developed. This produces an estimated ultimate claims cost. The claim reserve is the difference between the ultimate claims cost and cumulative paid claims. From the various ratios in a development year, the best estimate is selected. The selected ratios are applied to the cumulative claims data to determine the "fitted" claims development triangle. Based on "fitted" claims data the best loss reserve estimate is determined.

CLT assumes the same ratio of development factors for losses on the same adjacent development years. The development ratio can be estimated from previous data by some means measures such as the arithmetic mean. Bornhuetter and Ferguson (1972) introduced an external estimate of ultimate loss into the CLT for each accident year, which solved the problem of instability in CLT. Under the TST, loss development is divided into two components, inflation and real loss development. This technique assumes that the inflation component effects all loss payments made in a given year by the same amount, regardless of the original accident year.

The CLT and BFT are the most popular techniques and are jointly used for reserving purposes. According to Liu (2008), the CLT is used for the claims written in older years which have more information contained in the observed data while the BFT is applied to the claims written in more recent years since judgments and opinions can be introduced to overcome the disadvantage of lack of data (Liu, 2008).

## 3. Previous Related Empirical Studies

Harbey (1994) used of multiple regression technique to estimate the reported loss reserves in Egyptian general insurance market, and supposed that reported loss reserve estimation is affected by two explanatory variables, namely underwriting premiums and paid claims. He formulated a multiple regression model to examine the relationship between loss reserves as a dependent variable with these independent variables. He hypothesized a positive relationship between loss reserves and underwriting premiums and a negative relationship between loss reserves and the paid claim. These hypothesize are tested based on Egyptian general insurance segments during the period of study. He found that the possibility of applying the multiple regression models to some general insurance segments and could not be applied to others without explaining to the reasons for that.

Narayan and Warthen (2000), followed the general approach used by Standard (1985) and Murphy (1994), compared between traditional actuarial methods and three new log-linear regression methods using simulated data to estimate the model parameters using least square method. The purpose of this study was to show that it is viable to use regression methods for estimating reserves. The CLT (with the simple average of development factors) was selected because of its widespread use. They added an inflation factor to bring the past incremental losses to current levels. Error was measured as estimated reserve minus actual reserve. In actuality, the entire matrix of losses was produced during the data simulation, so that ultimate losses were known. The root mean square error and the average absolute deviation of the estimated values versus the actual reserve were used to test the closeness of the reserve estimators to the actual reserve value. Based on goodness of fit for these models the CLT was found to be biased in the direction of overestimating reserves. Narayan and Warthen maintained that the log-linear regression models are viable for loss projections. The regression models were found not to give the best estimate in all situations, but are stable and have the advantage of providing directly the variance of the confidence interval for the reserve estimate.

Eissa (2001) argued that loss reserves are affected by underwriting premiums, paid claims, surplus of insurance activity and reinsurance issued premium. An increase in the amount of underwriting premium is expected to increase the units of risk and the number of claims, and therefore would increase the loss reserves as well. He also assumed that an increase in the amount of paid claims at any year is due to an increase in the number of paid accidents, and this would result in a decrease in the amount of the loss reserves. As with the effect of reinsurance issued premiums on loss reserves, Eissa claimed that reinsurance treaties allow insurance companies to accept risks that would otherwise be rejected, resulting in greater size of the insurance portfolio, which then increases the loss probability and ultimately increases the loss reserves. Based on fire insurance data in *Misr* Insurance Company within the period from 1986 to 1999, he revealed a significant positive relationship between underwriting premiums and loss reserves, and a significant negative relationship between reinsurance issued premiums and loss reserve.

Both studies that relied on multiple regression technique in estimating loss reserves in Egyptian insurance sector (e.g. Harbey, 1994; Eissa, 2001) assumes that loss reserves calculation is Egypt incorporate only paid claims, earned premiums, surplus of insurance activity and reinsurance issued premium, but not inflation rate and investment rate. It has been argued that a more accurate loss reserve estimates should incorporate both of these additional factors, hence these studies fail to examine whether these factors have been accounted in the loss reserve calculation in Egypt.

# 4. Research Methodology

## 4.1. Research Framework

Review of related literature indicates that potential variables that influence the amount of loss reserves are underwriting premiums (UP), paid claims (PCLAIM), reinsurance issued premiums (REINSIPR), inflation rate (INFRATE), and the investment rate (INVRATE).

### Underwriting Premiums

According to Eissa (2001), increasing underwriting premiums is associated with the reported loss reserves since the increase in underwriting premiums is normally associated with the increase in the units of risk, number of claims and hence loss reserves as well. He found that underwriting premiums are positively related with reported loss reserves.

### Paid Claims

The paid claims are the total of claims actually paid up to date during any calendar year (Liu, 2008). Eissa (2001) assumed that if the paid claims increased at any year, the number of paid accidents also increase and resulting in a decrease in the amount of the reported loss reserves. Eissa support this assumption when his study showed that underwriting premiums are negatively related with loss reserves.

### Inflation Rate

According to Mack (1993), D'Arcy et al. (2007) and D'Arcy & Au (2008), it is important to take the inflation rate into consideration in loss reserves estimates. The hypothesis of the stability of the currency value at the present time is not valid where the purchasing power of money is continuing to decline. Estimating loss reserves without inflation adjustment may systematically distort reserves especially when there is a long gap in time between the accident occurrence date and settlement date. Since the future claims settlements may be paid in different economic environment than the one in which the reserve was established, and the value of claims will be affected by the inflation rates.

The relationship between inflation rate and the estimated reserves is hypothesized to be negative since higher inflation theoretically results in higher return on investment and this allows insurers to lower the amount of loss reserve for meeting outstanding losses. In other words, if the

inflation rates increase, the present value of outstanding losses, which represents the major portion of loss reserve, is reduced, especially for long tail segments of business

**Investment Rate**

Similar as in other financial institutions, the value of an insurer's liabilities can be affected by changes in investment rate. The reason for this is that the economic value of liabilities is the discounted value of its future cash flows. Thus based on similar argument as with inflation rate, if the investment rate increase, the economic value of the future cash flows will decrease, and if investment rate decrease, economic value will increase (D'Arcy & Au, 2008.

On the contrary, Bachman (1978) and Weiss (1985) argue that investment rates may also influence loss reserve levels in the positive direction since the insurers might have a tendency to hold up claim payments when investment rates are high to help counteract any deficiency in loss reserves with investment income or merely to obtain a greater total return. It is thus hypothesized that the relationship between interest rate and the estimated reserves will be positive. In this study the following hypothesis is also tested.

**Reinsurance Issued Premiums**

Reinsurance is basically insurances for insurance companies. A property and liability insurer pays a reinsurance fee or premium to transfer certain risks to a reinsurer in order to efficiently balance its risk portfolio, and to prevent catastrophic losses. According to Eissa (2001), the reinsurance issued premiums affects in loss reserves determination, because if the company depends on reinsurance, this will allow it to accept risks which were difficult to accept in the absence of reinsurance. So the researcher expects that if the company depends on reinsurance treaties, so the size of the insurance portfolio will increase that lead to increasing of loss probability and hence the loss reserves increase. He found that there is a positive relationship between loss reserves and reinsurance issued premiums.

### 4.2. Data Analysis

The Multiple Regression Model tested in this study takes the following format:

$$y_i = \beta_0 + \beta_1 UP - \beta_2 PCLAIM + \beta_3 INFRATE + \beta_4 INVRATE + \beta_5 REINSIPR + e \quad (4.17)$$

Where;

$y_i$ **:** loss reserves)

$UP_i$ : Underwriting Premiums for observation i

$PCLAIM_i$ : Paid Claim for observation i

$INFRATE_i$ : Inflation Rate for observation i

$INVRATE_i$ : Investment Rate for observation i

$REINSIPR_i$ : Reinsurance Issued Premium for observation i

$e_i$ **:** Randomized error

The OLS regression model is used to estimate the multiple linear equations parameters. Diagnostic tests are executed to insure the all assumptions for the linear regression model are met. These tests include normality test, multicollinearity, heteroscedasticity, serial correlation and Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO).

### 4.3. Data Collection

Data used to analyze the regression are annual data generated from 12 out of 14 general insurance companies operating in Egypt, of which three (3) are governmental and 11 are commercial. Two (2) commercial insurance companies are excluded from the study due to their recent entrance into the

general insurance market (just for 2 years). The companies that are included have the following track record:

- one (1) company (*Misr* Insurance Company) operating during 1981/1982 – 2007/2008
- three (3) companies operating during 2002/2003 – 2007/2008 (6 years)
- one (1) company 1999/2000 – 2007/2008 (9 years) in 1 company
- seven (7) companies operating during 1994/1995 – 2007/2008 (14 years)

As a result, the total number of cross - sectional observations is 151 for the overall fire insurance industry and 27 for the Misr Insurance company fire insurance segment.

# 5. Findings

## 5.1. Descriptive Analysis

Univariate analysis of the all variables in this section is presented in Table 1:

**Table 1:** Descriptive Statistics of Data for Total Egyptian fire Insurance Market

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| LR | 151 | 37.50 | 93,963.40 | 15,019.28 | 16,469.00 |
| UP | 151 | 0.00 | 180,829.40 | 23,551.67 | 21,545.76 |
| PCLAIM | 151 | 14.00 | 49,965.00 | 8,225.55 | 9,384.99 |
| INFRATE | 151 | 4.20 | 14.10 | 8.90 | 2.36 |
| INVRATE | 151 | 0.00 | 21.30 | 8.69 | 3.58 |
| REINSIPR | 151 | 22.90 | 48,954.00 | 8,823.87 | 9,238.30 |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) | | | | 0.784 | |

An analysis of bivariate relationships between variables was executed based on a Pearson correlation coefficient. The results are shown in Table 2.

**Table 2:** Correlation analysis of the variables in the Total Market Regression Model

| | | LR | UP | PCLAIM | INFRATE | INVRATE | REINSIPR |
|---|---|---|---|---|---|---|---|
| LR | Pearson Correlation | 1 | .903(**) | .908(**) | -.073 | .116 | .816(**) |
| | Sig. (2-tailed) | . | .000 | .000 | .371 | .157 | .000 |
| UP | Pearson Correlation | | 1 | .808(**) | -.020 | .112 | .771(**) |
| | Sig. (2-tailed) | | . | .000 | .810 | .172 | .000 |
| PCLAIM | Pearson Correlation | | | 1 | .017 | .134 | .837(**) |
| | Sig. (2-tailed) | | | . | .837 | .101 | .000 |
| INFRATE | Pearson Correlation | | | | 1 | .166(*) | .049 |
| | Sig. (2-tailed) | | | | . | .041 | .547 |
| INVRATE | Pearson Correlation | | | | | 1 | .066 |
| | Sig. (2-tailed) | | | | | . | .423 |
| REINSIPR | Pearson Correlation | | | | | | 1 |
| | Sig. (2-tailed) | | | | | | . |

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The correlation analysis gives early indication that loss reserves (LR) are significantly related with underwriting premiums (UP), paid claims (PCLAIM), and reinsurance issued premiums (REINIPR). In addition to this, there are also significant correlations observed between the independent variables such as between UP and PCLAIM, UP and REINIPR, REINIPR and PCLAIM. This finding indicates the possible presence of multicollinearity problems that need to be carefully examined.

### 5.2. Regression Analysis

Following similar previous procedures, a regression analysis result as in Table 3 is found. The presence of heteroscedasticity and serial correlation problems is circumvented by fitting the model using White's Heteroscedasticity adjusted S.E.'s, followed by Newey-West adjusted S.E.'s Equal weights, truncation lag= 1.

**Table 3:** Output of regression analysis for Egyptian total fire insurance industry based on White's Heteroscedasticity adjusted S.E.'s and based on Newey-West adjusted S.E.'s equal weights, truncation lag= 1

| Regressor | Coefficient | Standard Error | T- Ratio | P-Value |
|---|---|---|---|---|
| INPT | 3201.7 | 1877.1 | 1.706 | 0.090 |
| UP | 0.356* | 0.047 | 7.524 | 0.000 |
| PCLAIM | 0.863* | 0.144 | 6.007 | 0.000 |
| INFRATE | - 529.835** | 235.550 | -2.249 | 0.026 |
| INVRATE | 33.662 | 99.110 | 0.340 | 0.735 |
| REINSIPR | 0.087 | 0.111 | 0.779 | 0.437 |
| F value = 3.406 (p- value = 0.00)<br>Adjusted R-square = 0.910<br>DW = 1.38 | | | | |

Dependent variable: Loss Reserve (LR)
* denotes significant at 1% level
** denotes significant at 5% level

The value of Adjusted R-squared of 0.910 indicates that 91.0% variation in loss reserve of Egyptian total fire insurance market can be explained by underwriting premium, paid claim and inflation rate.

### 5.3. Regression Equation

Loss reserve estimate using the linear regression model based on Egyptian total fire insurance market data is derived from the regression model in Table 4 involving only the significant variables. The regression equation for estimating the fire insurance loss reserves for the total market can be written as follow:

$$LR = 3362.8 + 0.36621UP + 0.91667\,PCLAIM - 506.3451INFRATE$$

**Table 4:** Ordinary Least Squares Estimation based on Newey-West adjusted S.E.'S, truncation lag=2 for Egyptian Fire Insurance Industry

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| INPT | 3362.8 | 1589.8 | 2.1152[.036] |
| UP | 0.36621 | .052221 | 7.0127[.000] |
| PCLAIM | 0.91667 | .14636 | 6.2632[.000 |
| INFRATE | -506.3451 | 201.3682 | -2.5145[.013] |
| R-Squared | .91242 | R-Bar-Squared | .91063 |
| S.E. of Regression | 4923.4 | F-stat. | F (3, 147) 510.4591[.000] |

## 6. Conclusion

The aim of this study is to apply multiple cross sectional regression model to investigate whether loss reserves can be estimated based on some selected explanatory variables. The variables tested in this section are underwriting premiums (UP), paid claims (PCLAIM), reinsurance issued premiums (REINSIPR), inflation rate (INFRATE), and the interest rate (INTRATE).

Based on the cross sectional data on 12 insurance companies in Egypt, it has been found that the underwriting premium and paid claims have positive significant relationship with reported loss reserves while the inflation rate is negatively related to the reported loss reserves. The analysis also shows that both investment rate and reinsurance issued premiums aren't significantly related to the reported loss reserves.

The positive relationship between paid claim and loss reserves is not as expected. A potential explanation for this finding is that the increase in paid claim is driven by the increasing trend in the size of fire insurance portfolio in Egypt, which also results in the increase in loss reserve.

The negative significant relationship between the reported loss reserves and the inflation rate is as hypothesized. As verified by the positive significant correlation between inflation rate and investment rate, an increase in inflation rate also increases investment rate, causing insurers to lower the level of loss reserve to support future claims on losses currently incurred. Furthermore, it can be argued that an increase in inflation rate also results in a lower demand for general insurance, and therefore reduces the loss reserve. This argument is supported by the negative significant correlation between inflation rate and underwriting premium and the positive relationship between underwriting premium and reported loss reserve.

The insignificance of investment rate suggests that the increase in investment rate reduces the loss reserves but at the same time there is tendency for insurers to hold up more claim payments as claimed by Weiss (1985). The negative and positive effects may have cancelled each other, resulting in insignificant relationships.

As for Reinsurance Issued Premium, even though the correlation analysis shows that it is positively and significantly related to loss reserves, when modeled together with other variables it effect diminished. Arguably its effect on loss reserves has been captured by the underwriting premium as reflected by high significant correlation between these two independent variables.

Last but not least, this study suggests that the regression models derived from this study can be used as an alternative technique to estimate loss reserves for Egyptian fire insurance segment. It is also suggested for future researchers to apply the time series forecasting technique to forecast the loss reserves.

## References

[1] Bornhuetter, R. L. and R. E. Ferguson (1972). The actuary and IBNR. Proceedings of the Casualty Actuarial Society, 59, 181–195.

[2] Calandro, J. and T. J. O'Brien (2004). "A user-friendly introduction to property- casualty claim reserves", Risk Management and Insurance Review, 7, 177-187.

[3] Cheung, D. (1997). Estimating IBNR reserves with robust statistics. Unpublished Ph.D. Thesis. Western Michigan University, U.S.A.

[4] Cheung S, Au A, & Zhang L (2007). Property-liability insurance loss reserve ranges based on economic Value, Casualty Actuarial Society, Fall, 98-128.

[5] D'Arcy, S & A. Au (2008). A Two-factor Approach to Loss Reserve Variability, IAA Joint Colloquium.

[6] Douglas, D. (1999). Comparative analysis of neural networks and traditional actuarial methods for estimating casualty reserve liability. Unpublished Ph.D. Thesis. The University of Texas: U.S.A.

[7] Eissa,F.A. (2001). Using quantitative models to estimate outstanding claims in general insurance in Egyptian insurance companies, Unpublished Ph.D. Thesis, Assuit University, Egypt.

[8] Harbey, G. (1994), Using regression model technique in estimating outstanding claim reserve in property and liability insurance, *Journal of financial and commercial studies,*1.

[9] Harnek, R. F. (1966). Formula loss reserves, Insurance Accounting and Statistical Proceedings.

[10] Kannan, R. (2008). Manual for Estimation of Provision for IBNR and IBNER claims in General Insurance Business, Insurance Regulatory and Development Authority, IDDA.
[11] Liu, H. (2008). Stochastic Claim Reserving for Methods which Combine Information from Multiple Data Sets. Unpublished Ph.D. Thesis. Cass Business School. City University: UK.
[12] Mack, T. (1993). Measuring the Variability of Chain Ladder Reserve Estimates, Casualty Actuarial Society, 1, 101-182.
[13] Narayan, P, and T. Warthen. (2000). A comparative study of the performance of loss reserving methods through simulation, Journal of Actuarial Practices, 8, 63-88.
[14] Olofsson, M. (2006). Stochastic loss reserving testing the new guidelines, Stockholm University, from: http://www.pdfgeni.com/book/loss-reserving-pdf.html.
[15] Panning, W. H. (2006). Measuring Loss Reserve Uncertainty, Casualty Actuarial From, Fall, 237-267, from: http://www.casact.org/dare/index.cfm?abstrID=6252&fuseaction=view
[16] Taylor, G. C. (1977). Separation of inflation and other effects from the distribution of non-life insurance claim delays, ASTIN Bulletin, 9, 219-230.
[17] Weiss, M. (1985). A Multivariate analysis of loss reserving estimates and property-liability Insurers, Journal of Risk and Insurance, 52, 199-221.