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DEPARTMENT OF FINANCE

PERFORMANCE OF PROPERTY AND CASUALTY INSURANCE THROUGH UNITED
STATES RECESSIONS

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ABSTRACT

This paper analyzes the performance of property and casualty insurers during periods of major U.S. recessions. An industry overview is presented to provide historical context to the insurance space – a sector that has had little change in over 200 years. The research considers the performance of 15 domestic property and casualty insurance carriers that offer wide-ranging insurance products. To isolate operational differences between insurance companies of varying scale, the research categorizes three peer groups by total admitted assets. Specifically, the study examines collective performance of insurers since 2000 through the lens of financial data, such as revenue, investment income, net income, and stock price. Correlation analysis between several performance metrics and economic indicators was used to gauge the strength and direction of relationships during recession. Cross sectional regression analysis was conducted to help understand the relationships between many variables affecting company performance during recession. The analysis considers the role of leverage, underwriting performance, and investment performance as key influencers of profitability during periods of recession. Additionally, the paper characterizes the relationship between the fixed income market and insurer performance by comparing the returns of a synthetic fixed income portfolio and insurers' stock price.

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Chapter 1

Introduction and Industry Overview

Regulation, large balance sheets, and product complexity for years have characterized the insurance industry – a space that has had little change in decades.¹ Insurance is a modern device based on a longstanding human behavior that is as old as ancient society: strength in numbers. For ages, any alleviation from day to day hardship was likely to come from the community. Merchants of Babylon observed bottomry contracts as early as 4000-3000 B.C., under which loans were granted to merchants with the provision that if a shipment were lost at sea then the loan did not have to be repaid.² Thus, the interest on the loan covered the insurance risk. Bottomry was also practiced by Hindus in 600 B.C. and was adopted in ancient Greece as early as the 4th century B.C. Under ancient Roman law, bottomry contracts were recognized as an article of agreement and funds were deposited with a moneychanger. Augustus Caesar compensated merchants from state coffers for ships lost at sea, while private means of indemnification were found by creative use of a ‘sea loan,’ which was forgiven in the event that goods were lost in transit.

Any discussion of the early development of insurance would be remiss without reference to Lloyd’s of London. In the 1680s, Edward Lloyd’s coffeehouse on Tower Street, London adopted the ancient concept of insurance and produced financial contracts dedicated to ships and their cargo.³ Edward Lloyd initially supplied patrons with shipping updates, but soon became

¹ Source: McKinsey & Company, 2017

² Source: Encyclopedia Britannica, 2017

³ Source: Insurance Journal, 2011

recognized as the most likely place to find underwriters for marine insurance. With the growth of British sea power, Lloyd's became the dominant insurer of marine risks and later added fire and other property risks to the repertoire.⁴

Before a merchant or financially interested party would entrust his goods to a sea captain for shipment, he wanted to assure that there would be some financial protection if the cargo ended up at the bottom of the ocean.⁵ The appeal to have financial protection from the risk of a contingent, uncertain loss in exchange for premium is a lasting desire of rational humans that has continued to develop in modern day.

The global insurance industry has grown to massive scale and is comprised of \$23.1 trillion in assets globally.⁶ To contextualize this magnitude, the global premiums written by insurance and reinsurance companies today are more than \$4.7 trillion. For comparison purposes, consider that over 6% of the world's gross domestic product. Thus, the economic importance of insurance to modern economies cannot be denied.⁷

In light of the most recent financial crisis, insurance has become a heavily monitored – and often scrutinized – industry in the public eye, especially after the bailout of AIG in 2008. Post 2007 financial crisis, most of the new regulation, however, focused on the banking industry. In fact, the Wall Street Reform and Consumer Protection Act (Dodd-Frank) gives little attention to the insurance industry. Title V outlines two major areas of change: the creation of the Federal Insurance Office within the Department of the Treasury and state-based insurance reform, which

⁴ Source: Encyclopedia Britannica, 2017

⁵ Source: Insurance Journal, 2011

⁶ Source: Insurance Information Institute, 2016

⁷ Source: OECD Insurance Statistics, 2018

applies mostly to reinsurance and non-admitted insurance.⁸ Today, insurance companies continue to be primarily regulated by the states in the U.S.

The intense effects of the 2007 recession were widespread, leading to a liquidity crunch worldwide and depleted corporate cash flows. Consumer confidence was shaken and demand for products and services was abysmally low.⁹ Still, property and casualty insurers that had operated for decades seemingly weathered the crisis, displaying resiliency. A key question is then raised: to what extent are insurers impacted by recession? As researcher Manoj Kumar explains, insurance companies have historically “thrived on investment income” in addition to core underwriting activities. Additionally, insurance reporter Stephanie Swilson highlights the impact of demand when businesses are low on cash. However, it can be reasonably argued that insurers experience fewer claims in a less active economy. The purpose of this thesis is to characterize how the performance of the property casualty insurance industry is affected during periods of recession in the United States.

⁸ Source: Every CRS Report, 2016

⁹ Source: Insurance Professional, 2009

Chapter 2 Literature Review

Since the 2007-2008 financial crisis in the United States, the research community at large has actively sought to understand key forces driving recession. Scholars regard the financial crisis as a systematic event, where problems in one sector of the economy, in this case housing, spread to other sectors and a general decline in asset values and real economic activity ensues.¹⁰ Because the crisis began in the financial services industry, the role of financial institutions, namely large banks, in the economy has become a particular area of close study. In 2008, stress in the U.S. banking system spread through international funding markets, creating a liquidity crunch for banks globally. In a dissertation by Shekhar Aiyer, the effect of a global banking system on domestic credit supply is studied. The analysis demonstrates the magnifying effect globalized banking had on economic contraction.

In addition, since one of the major firms that played a role in the crisis was an insurance company (American International Group), intense speculation has been raised about whether the insurance industry is a major source of systematic risk.¹¹ That is, scholars have oriented their research around U.S. insurance firms as a contributing factor to systemic risk and recession. A study by Cummins and Weiss (2014) evaluates systematic risk based on financial analysis of the insurance industry, its role in the economy, and the interconnectedness between insurers. The primary conclusion is that the core activities of U.S. insurers do not pose systematic risk because “insurers are not sufficiently large or interconnected with other firms.”

¹⁰ Source: Cummins, Weiss, 2014

¹¹ Source: Harrington, 2009

Other studies have verified this assertion; including Harrington's (2009) study of systemic risk in insurance, focusing on the federal bailout of AIG. He claims, "the AIG crisis was heavily influenced by the credit default swaps written by AIG Financial Products, not by insurance products written by regulated insurance subsidiaries." The article suggests that systemic risk is relatively low in insurance markets compared with banking, especially for property and casualty insurance, in part because insurers hold greater amounts of capital in relation to their liabilities, reducing their vulnerability to shock. Further, the Geneva Association (2010) verifies that insurers did not have a significant influence in the financial crisis aside from "monolines and insurers' noncore activities." Grace (2010) demonstrates with statistical tests on insurer stock prices that AIG was systemically important but that insurers are generally not a significant source of systemic risk. Baluch, Mutenga, and Parsons (2011) observe the role of the insurance industry in the financial crisis with a concentration on European markets. The authors contend that systemic risk is lower in insurance than in banking but has grown due to increased noncore activities. The general consensus is that systematic risk is relatively low in the insurance industry in comparison to other sectors, such as banking. Other researchers, like Marovic, Njegomir, and Maksimovic (2010), offer a global perspective on the industry's relationship with regulators, rating agencies, and capital markets. Their study emphasizes the adverse impact credit insurers experience in Europe during recession.

A second reason for additional analysis on the U.S. property and casualty space is that prior research has focused on disability, unemployment, and other non-property insurance lines during recessionary periods. In Maestas, Mullen, and Strand (2015), the relationship between labor market conditions and the number of U.S. Social Security Disability Insurance (SSDI) applications is examined. The study unveils a strong relationship between dramatic increases in

the unemployment rate and increased SSDI applications, attributable to unfavorable economic conditions from the Great Recession. Another article by Keegan, Thomas, Portela, and Normand (2014) examines the initial responsiveness of health expenditures to financial crisis and whether recession severity can be considered a predictor of health expenditure growth. They find, overall, an initial counter-cyclical response in health spending across regions and evidence of a negative relationship between recession severity and changes in certain health expenditures.

Additional research has been conducted on the relationship between equity markets and insurance performance. An article by David Cummins and David J. Nye examines the stochastic characteristics of property and liability insurance combined ratios. The methodology revealed that about half of the distributions tested can be adequately described by normal distribution, while “the other half exhibit non-zero skewness or non-zero kurtosis.” The findings indicate that mean variance models should not be used for insurance decisions without validating normality or determining the impact from the departure of normality. The paper also tests the correlation between insurance combined ratios and the rate of return on the market portfolio of common stocks and finds no significant relationships exists between these variables. An earlier work by Raymond G. Schultz also demonstrates that insurance companies from 1926-1955 relied heavily on investment operations in achieving their total profits.

Since prior literature has established that insurers pose insignificant systematic risk and core activities have not historically contributed to economic recession, additional research is needed to observe how insurers are conversely impacted during contractionary periods. In large part, thorough research has been published on the role insurers have to the onset of recession and less focus has been placed on how insurers are operationally affected over the course of recession. While the fall of bulky financial institutions during the most recent financial crisis has

prompted scholars to analyze their influence on economic health, perhaps equally as important is how such institutions are able to withstand economic fallout. Much of the media attention and literature on the impact of recession in the United States relates to the consumer, small businesses, regulators, and central banks. Further, current literature relating to insurance and recession emphasizes health, disability, life, and credit insurance offerings during periods of economic contraction. As a result, I will focus the study on how the performance of property and casualty insurers is affected by recession within the United States market. In addition, previous studies have tested the relationship between equity markets and insurer performance. However, given the industry's significant exposure to bond markets, the study will also test the relationship between insurer performance and fixed income.

Chapter 3

Data and Methodology

Sample Selection

The research begins with classifying insurance companies and selecting firms to include in the analysis. The scope of the research is narrowed to U.S. based, property and casualty insurers. The sample set is comprised of fifteen stock companies in each of the nine lines of insurance. The sample was stratified into three peer groups based on total admitted assets in 2016. The sampling calls for such grouping because insurance researchers often attribute different operational goals to these categories. Within these divisions, a selection screen was applied for the availability of continuous data on each company. Further, the companies were selected by simple random sampling. As a result, the sample set includes companies of all sizes and product lines. The following is a description of the three insurance tiers:

Tier One

The competitive landscape in the insurance industry has remained static with a group of prominent insurers occupying significant market share. Within the property and casualty space, for example, State Farm Automobile Insurance has been the largest insurer by direct premiums written, holding over 10% of the market share, for the past decade.¹² Further, seven insurers have maintained a position in the top ten ranking of property and casualty insurers by market

¹² Source: Insurance Information Institute, 2018

share since 2008. Similar patterns are exhibited across insurance lines with the same players maintaining share across markets.

Table 3-1 Top P&C Insurers by Market Share

Market Share	Company	Direct Premiums Written ¹³
10.20%	State Farm Mutual Automobile Insurance	\$62,189,311
5.4	Berkshire Hathaway Inc.	33,300,439
5.3	Liberty Mutual	32,217,215
5	Allstate Corp.	30,875,771
3.9	Progressive Corp.	23,951,690
3.9	Travelers Companies Inc.	23,918,048
3.4	Chubb Ltd.	20,786,847
3.2	Nationwide Mutual Group	19,756,093
3.2	Farmers Insurance Group of Companies	19,677,601
3	USAA Insurance Group	18,273,675

For the purposes of this research, tier one insurers are classified as having total assets of \$100 billion or greater. The sample of companies selected for this category are the following: Allstate Corporation, Chubb Limited, Travelers Companies, Progressive Corporation, and Hartford Financial Services Group.

Tier Two

Middle-market insurance companies actively offer insurance lines to mid-sized businesses. Insurance providers that serve middle-market clients position themselves to understand and meet their customers' needs better than large providers. A distinguishing characteristic of middle market accounts is that they typically do not employ full-time risk professionals and, as a result, client contact is maintained with either the business owner, CEO or CFO.¹⁴ As a result, the insurance arrangement is likely built on personal or business relationships

¹³ Source: NAIC data sourced from S&P Global Market Intelligence and Insurance Information Institute, 2018

¹⁴ Source: Bizfluent, 2017

between the broker and the client. Thus, account servicing is one of the major keys to retaining middle market accounts. Another important characteristic of the middle market is segmentation. According to Greenwich Associates, no one broker has more than 5% market share. Further, approximately 20% of the middle market actively considers swapping agents at a given time, indicating fierce competition.¹⁵ In this research, tier two insurers are designated as having \$10 billion to \$100 billion in total assets. The companies that were chosen are CNA Financial Corporation, W.R. Berkley Corporation, Alleghany Corporation, Markel Corporation, and The Hanover Insurance Group Inc.

Tier Three

There is still a substantial number of small, independent insurers selling insurance in limited geographic regions. However, large national carriers account for a greater share of markets, relegating these insurers to niches they are better positioned to serve.¹⁶ A small insurer for example, may focus their insurance offering to serve nonstandard customers, who may exhibit a high-risk profile. Because of their poor credit score or past performance record, a nonstandard consumer can find obtaining a policy from a large carrier challenging or infeasible. As a result, smaller insurance companies have the power to charge higher premiums to compensate the higher risk profiles of nonstandard customers. These policies are often highly customizable and provide a greater degree of flexibility in their acceptance of high-risk applicants. In addition, most companies charge additional fees and require individuals to stay with a nonstandard policy for a certain amount of time before they can move to a standard provider.¹⁷ In this study, tier three insurers have total assets between \$10 million and \$10 billion.

¹⁵ Source: Greenwich Associates, 2017

¹⁶ Klien, 2015

¹⁷ Source: Insurance Journal, 2015

The companies randomly selected for this group are American Financial Group, Horace Mann Educators Corporation, ProAssurance Corporation, First Acceptance Corporation, and Kingstone Companies Inc.

Economic Environment

The study focuses on the performance of property and casualty insurers over 16 years, from 2000 to 2016. Within this period, the United States experienced two economic recessions, which the National Bureau for Economic Research describes as “a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and whole-retail sales.”¹⁸ The 2001 recession in the United States was largely a residual effect of the “Internet Bubble” that had been building throughout the 1990s, as well as the economic disturbances propagated by the fallout from September 11, 2001. Economist Kevin Kliensen notes that the relatively short duration of the 2001 recession is certainly a unique characteristic that distinguishes it from other post-World War II recessions. Another distinctive feature was its mildness through the lens of real GDP. Economic data indicates that GDP rose 0.2 percent from the first quarter of 2001 (the peak quarter) to the fourth quarter of 2001 (the trough quarter).¹⁹ Economists also observed that the severity of a recession significantly influences the magnitude of the recovery. That is to say, an intense recession tends to be followed with a robust recovery, but a mild recession is likely to be followed by a mild recovery. Thus, applicable to my analysis is also the recession that began in 2007 given the intensity of the downturn. The root of the 2007-2009 recession was mostly a

¹⁸ Source: The National Bureau of Economic Research, 2008

¹⁹ Kliensen, 2003

housing market bubble that expanded with excessive credit lending by banks during 2004 and 2005. Encouraged by opportunistic interest rates, banks granted substantial subprime mortgage lending by extreme use of securitization. After a prolonged run-up in housing prices, the bubble popped and home values plummeted, leaving thousands of borrowers unable to pay their loans. Tied to these loans were financial instruments that were later discovered to be of little value and banks were not able to compensate even a half of their subprime mortgage related debt.²⁰ The resulting liquidity crunch in the U.S. transformed into a financial crisis, and subsequently a global financial crisis as a result of interconnectedness. The recession was officially declared over in 2009 and a moderate recovery has ensued since. In fact, economic recovery has slowly maintained course for nearly a decade – the third longest economic recovery to date. Thus, tracking insurers’ performance from 2000 to 2016 encompasses wide-ranging economic environments during periods of both moderate and intense recessions, both short and prolonged recoveries.

Hypothesis and Process

I hypothesize that the property and casualty insurers operating in the top segment of their peer group by total admitted assets will be the most affected by recession in the United States, followed by the middle tier and the bottom tier respectively. I anticipate all insurers’ performance to suffer in terms of premiums written, net income, combined ratio, and investment income, with top tier insurers experiencing the most headwind. Specifically, I predict real GDP to be a strong indicator of performance for all insurance carriers and to display moderate correlation with financial statement data, like revenue and net income. Leverage, as measured by total debt to equity and the debt ratio, is also believed to be a strong

²⁰ Marovic, Njegomir, and Maksimovic (2010)

predictor of performance in recession. In terms of stock price, I expect the average price of all peer groups to reflect the health of the broader stock market as measured by the S&P 500. Further, I anticipate the performance of an insurance company to be moderately correlated with fixed income yields in the broader market.

To analyze the performance of property and casualty insurance companies during periods of U.S. recessions, key drivers for performance were first identified. Revenue, net income, stock price and financial ratios were designated as initial performance indicators. A widely reported and applied industry metric for insurance companies is the combined ratio. This metric provides insight on an insurance company's profitability by measuring the premiums an insurer earns relative to the total payout to claims and claims expenses. The calculation for the combined ratio is found in Equations - Ratio Analysis.

Equations - Ratio Analysis

$$\text{Combined Ratio} = \frac{\text{Incurred Losses} + \text{Expenses}}{\text{Earned Premium}}$$

$$\text{Expense Ratio} = \frac{\text{Total Underwriting Expenses}}{\text{Total Premium}}$$

$$\text{Debt Ratio} = \frac{\text{Total Debt}}{\text{Total Assets}}$$

$$\text{Debt to Equity Ratio} = \frac{\text{Total Debt}}{\text{Total Shareholders Equity}}$$

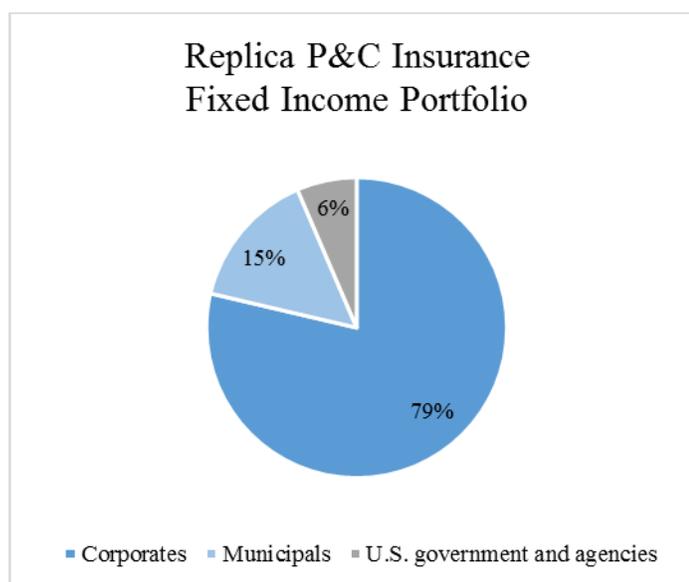
The combined ratio can alternatively be computed as the sum of the loss ratio and the expense ratio. An insurer with a ratio below 100 percent is considered to be making underwriting profit, while a ratio above 100 percent means that the insurer is paying out more in claims than it is receiving from premiums. The difference between the combined ratio and 100% represents underwriting income as a percentage of premiums earned, or underwriting margin. However if a combined ratio is above 100 percent, a company still has the potential to be profitable because the ratio does not include investment

income.²¹ Additionally, combined ratios can be computed for individual lines of insurance and isolated for the effect of catastrophe losses. For the purposes of the report, the total combined ratio for the firm as reported in accordance with Generally Accepted Accounting Principles was used to measure underwriting performance. The total debt and debt to equity ratios were used to gauge the level of leverage among companies. To isolate the performance of the companies' investment portfolios, total investment income served as an important indicator.

To benchmark company performance and analyze the relationship between economic contraction and the profitability of insurers, market data was included in the analysis. Specifically, real GDP served as an economic indicator, while the S&P index fund (SPY) provided market insight. Additionally, a synthetic bond portfolio that replicates the popular fixed income allocation among property and casualty insurers was constructed. As insurance companies collect premium from customers, they partly invest these assets to earn a return. Since the insurance business is liability-driven, insurers have high exposure in their investment portfolios to bonds. Fixed income gives the insurer the ability to conduct asset-liability management by way of matching the duration of their assets to the duration of their liabilities. Insurance analysts have observed a common allocation among property and casualty fixed income portfolios, which is found in Figure 3-2.

²¹ Source: Motley Fool, 2018

Figure 3-1 Replica P&C Insurance Fixed Income Portfolio



To create a benchmark that replicates the yield profile of such an allocation, a weighted index was formed using the iShares Investment Grade Corporate Bond Fund (LQD), the iShares Agency Bond ETF (AGZ), and the Nuveen Bloomberg Barclays Municipal Bond ETF (TFY). The synthetic fixed income portfolio acted as a performance benchmark to examine the relationship between yields and insurer performance.

Equation - Synthetic Fixed Income Index

$$r_{replica} = .79 \times r_{LQD} + .15 \times r_{TFY} + .06 \times r_{AGZ}$$

The second step in the study was data collection from a variety of resources. Through Mergent Online, a global company database, company specific data was obtained. The data included quarterly and annual revenue and net income figures for all companies in the data set. To attain quarterly stock closing prices, data was pulled from Mergent Online's peer analysis tool. Data to calculate leverage ratios was collected from the Wharton Research Data Services Compustat Database. In addition, information for each insurer's combined ratio and total debt to equity ratio was acquired from the respective 10-Ks of each company for the years 2000 to 2016. All of the data was then compiled by year, peer group, and

metric. After organizing the information, the select figures were separated into their appropriate categories by total admitted assets previously described.

Additional market data was collected for comparison analysis. The average industry-wide combined ratio for the given timeframe was attained from A.M. Best, a news, credit rating, and financial data company. Additionally, for the construction of a synthetic fixed income benchmark, historical returns of LGD, AGZ, and TFI were obtained from the Mergent Online database.

Next, computations were completed. Average total premiums for each peer group were calculated to illustrate the underwriting strength of insurers during the economic cycle. To provide insight on profitability, average net income for each peer group was computed. To measure firm leverage, the debt to equity ratio was calculated for each year by dividing total debt by total equity. The debt ratio was calculated as total debt divided by total assets. In addition to financial statement data, closing stock prices were incorporated in the analysis to illustrate market performance. Closing prices were isolated for each quarter and the average quarterly returns were taken for each peer group and benchmarked to the SPY and the Synthetic Fixed Income Index. To characterize the relationship between insurance performance and U.S. recession, correlation analysis was conducted. Specifically, correlation between the average combined ratio for each peer group and real GDP was computed. Further, to analyze the relationship between insurer's profitability and the bond market, correlation was calculated between the historical returns for each peer group and the Synthetic Fixed Income Index.

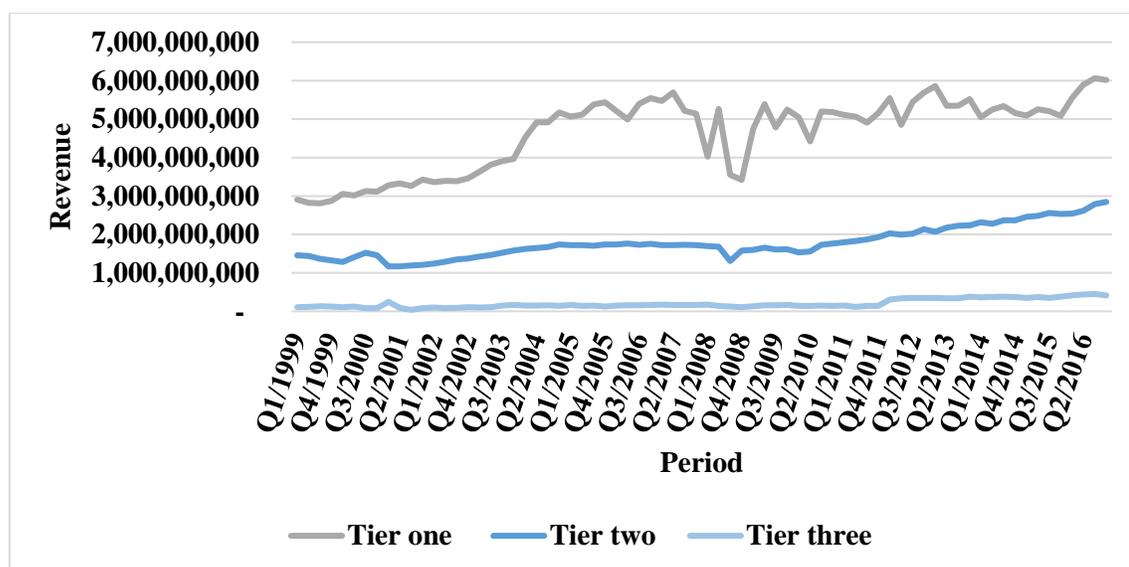
To provide greater understanding of the relationship between several independent variables and net income during recession, cross sectional regression analysis was performed. The test incorporated the combined ratio, leverage ratios, mortgage allocation percentage, and investment income as predictor variables and a multivariable regression model was formed. Additionally, R Squared was computed to determine how well the model fits historical data. All the data and calculations were then visually represented before observations and conclusions were draw.

Chapter 4

Results and Observations

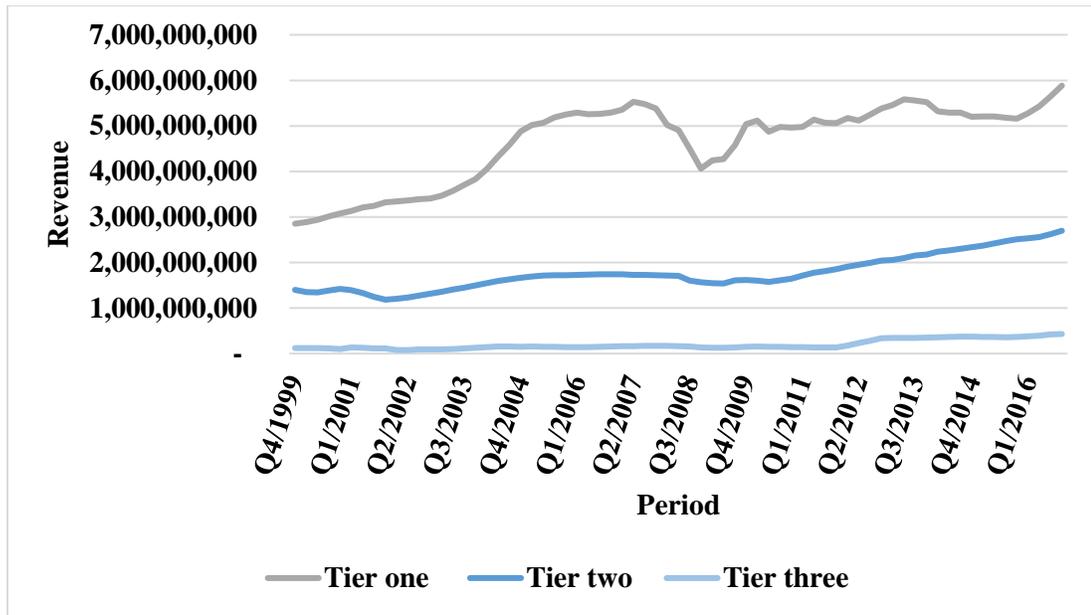
Performance

Figure 4-1 Average Quarterly Revenue by Peer Group



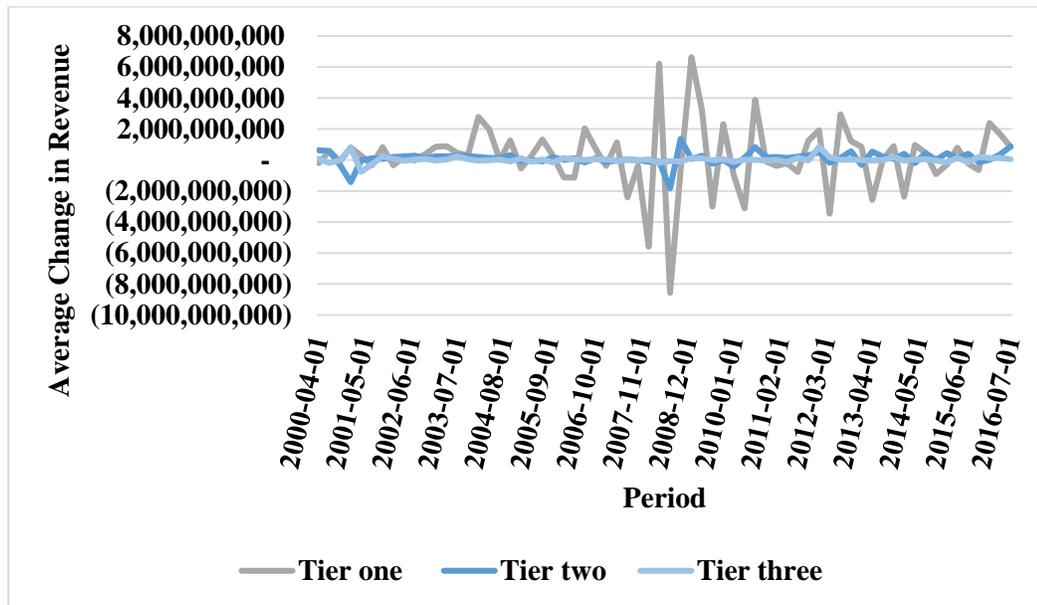
After initial observation, quarterly revenue results show little volatility in the first half of the time window. Revenue during these quarters remained fairly constant, indicating that the 2001 recession in the U.S. had little impact on the three peer groups' underwriting ability. In the second part of the decade, revenue demonstrated greater volatility, specifically by tier one insurers. To reduce the internal volatility due to seasonality, quarterly moving averages were computed and graphed in Figure 4-2.

Figure 4-2 Quarterly Revenue Moving Average by Peer Group



Revenue especially shows a downward trend among top tier insurers in the closing quarters of the most recent financial crisis. However, the revenue of second and third peer groups remained steady, showing underwriting stability during economic contraction.

Figure 4-3 Average Change in Revenues

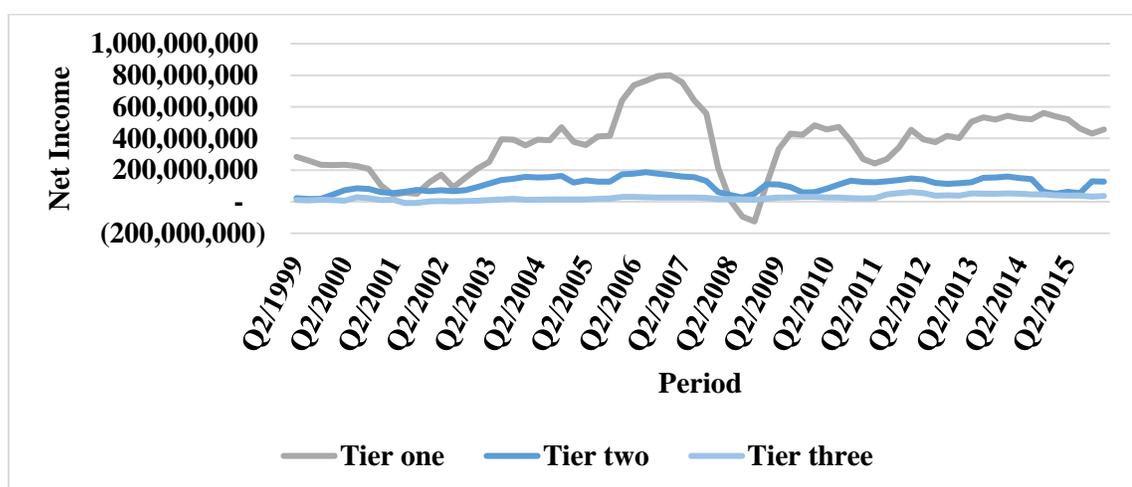


Third tier insurers exhibited the most muted growth throughout the period, producing minimal premium growth. While top tier insurers accomplished the most premium growth, their performance appears to display greater affects from the broader health and cyclicalality of the economy. Based on the correlation analysis between the change in real GDP and average peer group revenues, tier one insurers in fact display a slim correlation with economic output. Tiers two and three, however, display lower correlation coefficients with real GDP.

Table 4-1 Correlation Analysis - Revenue

	Revenue		
Correlation Coefficients	Tier one	Tier two	Tier three
Change in RGDP	0.225	0.171	0.147

Figure 4-4 Quarterly Moving Average Net Income by Peer Group



Similar patterns are exhibited by the three peer groups' net income results as that of revenue. Top tier insurers display both the greatest volatility in net income and apparent downward trends during periods of recession. In fact, the adverse impact among tier one is so severe that the average net income drops below that of both other groups only during periods of recession. The correlation analysis between quarterly changes in real GDP and the peer group's net income results in a moderately positive correlation. Notably, the correlation for group one's net income and real GDP is stronger than its

correlation between revenue and real GDP. After 2009, when NBER officially declared the end of the recession, top tier insurers quickly regained momentum.

In contrast, tiers two and three express little to no correlation between their bottom line and changes in real GDP. These peer groups appeared insulated from declines in economic activity and fared better than their tier one counterpart during the financial crisis. They also displayed smoother income in subsequent periods.

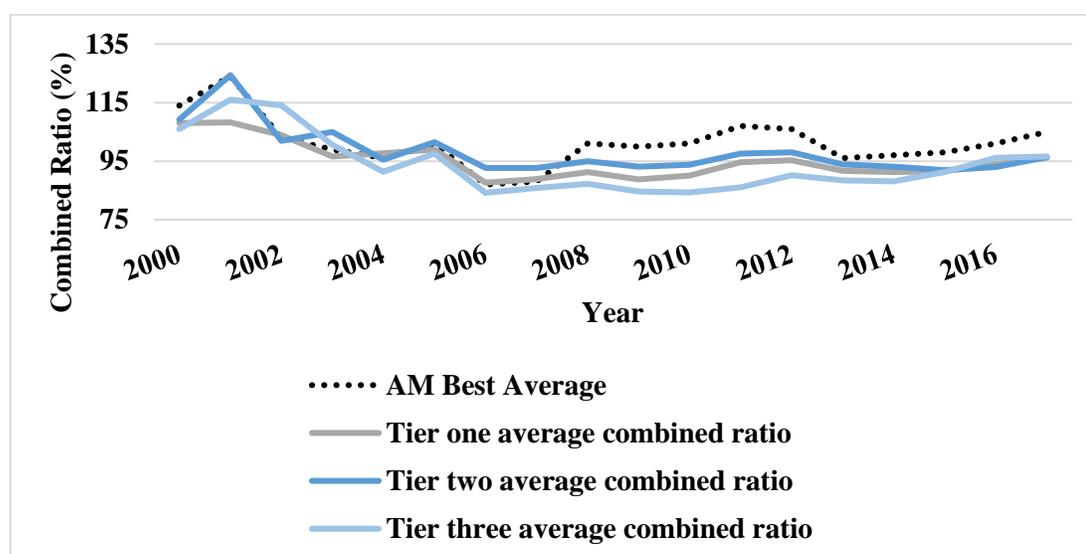
Table 4-2 Correlation Analysis - Net Income

	Net Income		
Correlation Coefficients	Tier one	Tier two	Tier three
Change in RGDP	0.392	0.091	0.112

Underwriting

To determine drivers that attributed to the performance results, the study analyzed the two main components of a property and casualty insurer's total income: underwriting income and investment income. The main indicator used in the study for underwriting income was the combined ratio.

Figure 4-5 Average Annual Combined Ratio by Peer Group



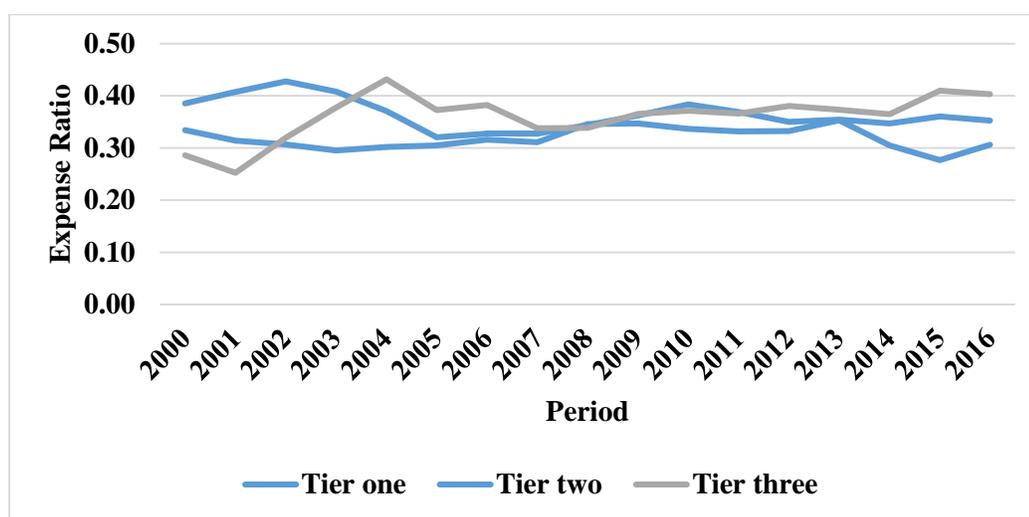
At first glance, the average combined ratios of all three peer groups and the A.M. Best industry-wide combined ratio were remarkably constant throughout most of the timeframe, hovering just above or below 100%. This initially indicates the slim margin for profitability of the underwriting business and the relative stability of the operation. Even more, the combined ratios show no visible impact from recessionary periods. For all peer groups, the combined ratios in the most severe year of financial crisis, 2007, was below 100%, indicating that their core underwriting business maintained profitability. Further, the correlation coefficients between changes in real GDP and each peer groups' average combined ratio clearly indicate a lack of correlation, with tier one insurers displaying the highest correlation coefficient of an anemic 0.23.

Table 4-3 Correlation Analysis - Combined Ratio

	Combined Ratio		
Correlation Coefficients	Tier one	Tier two	Tier three
Change in RGDP	0.230	0.023	0.132

The combined ratio is a function of an insurer's expense ratio and loss ratio. To provide insight on how insurers managed expenses directly relating to underwriting activity, the average expense ratio of each peer group is sequenced in Figure 4-6. During the most recent recession, the expense ratio for each peer group marginally trended upwards, but demonstrated stability in the following years.

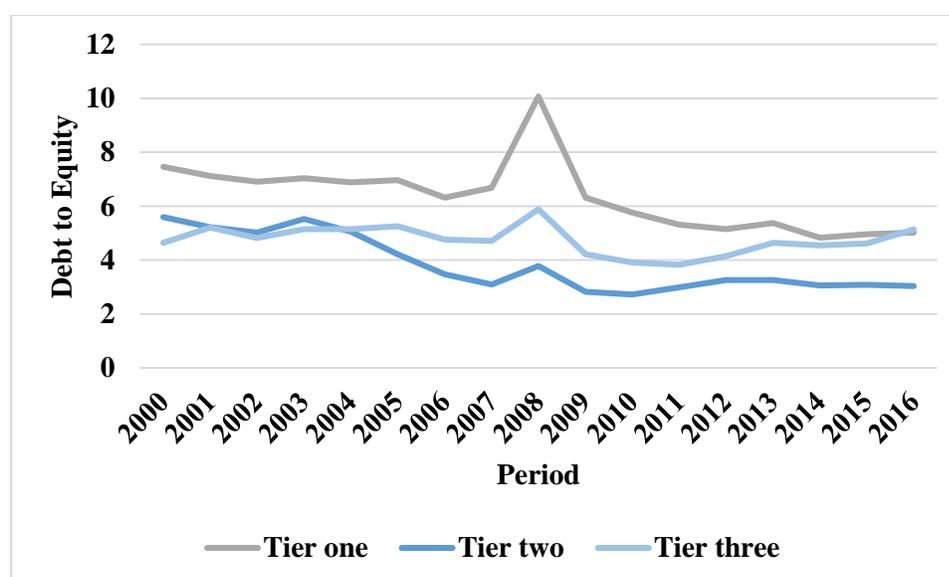
Figure 4-6 Average Expense Ratio by Peer Group



Investments

The other source of income for insurers is the income they receive from invested premium. The importance of investments to insurers stems from the fact that insurance companies are balance-sheet-driven businesses.²² Here, leverage becomes of importance, as insurers are cautious to time the duration of their invested assets to the duration of their liabilities. The study examined leverage through the debt ratio and the debt to equity ratio.

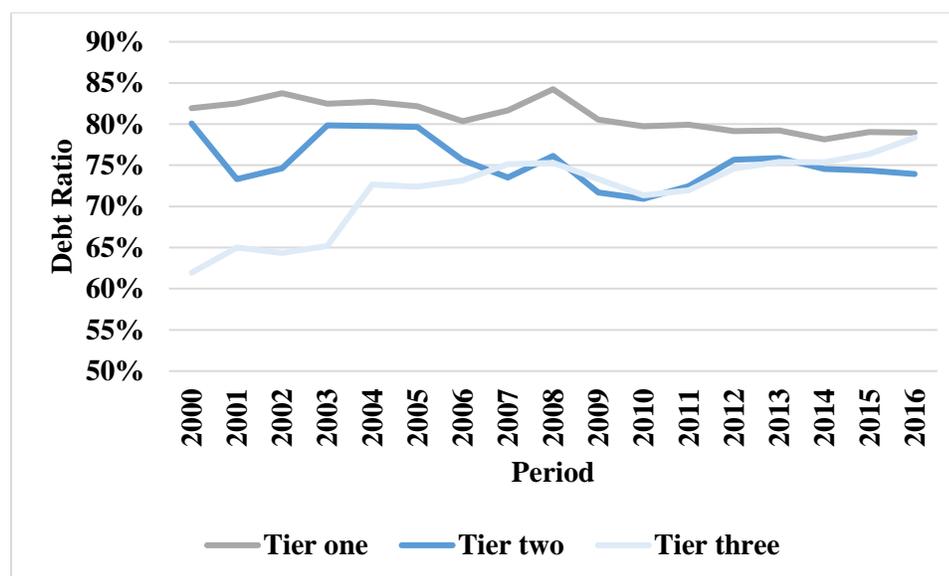
Figure 4-7 Average Debt to Equity Ratio by Peer Group



Leverage, as indicated by the debt to equity ratio, was clearly highest among tier one insurers, especially during the 2007-2008 financial crisis. Additionally, leverage spiked for all peer groups during the recession, meaning that the relative value between debt and equity increased significantly. The average debt ratio tells a similar story, with tier one insurers demonstrating the highest leverage. Further, both metrics show that tier three companies levered up and above tier two insurers before the financial crisis. The change in relative value between assets and liabilities, however, was more muted for all peer groups throughout the timeline.

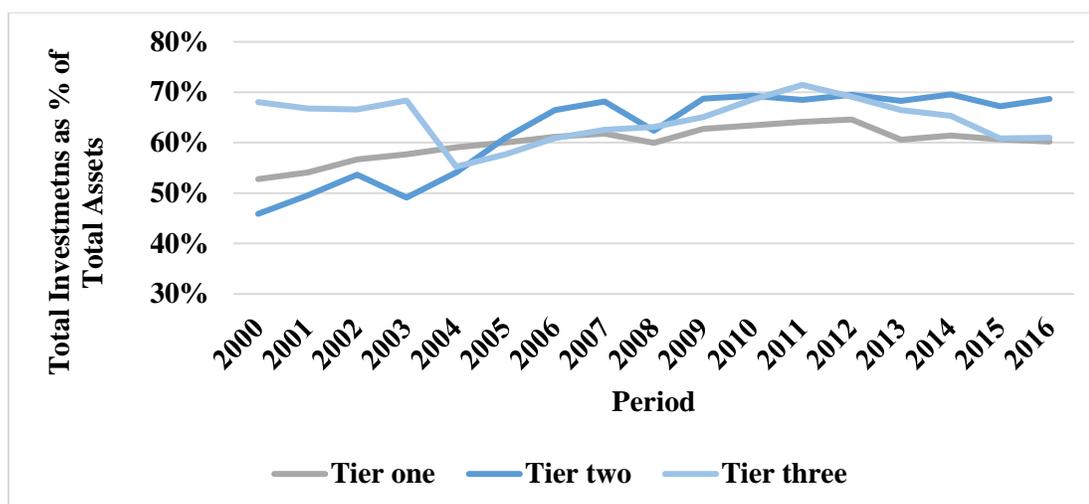
²² Source: Understanding an Insurer's Balance Sheet, 2007

Figure 4-8 Average Debt Ratio by Peer Group



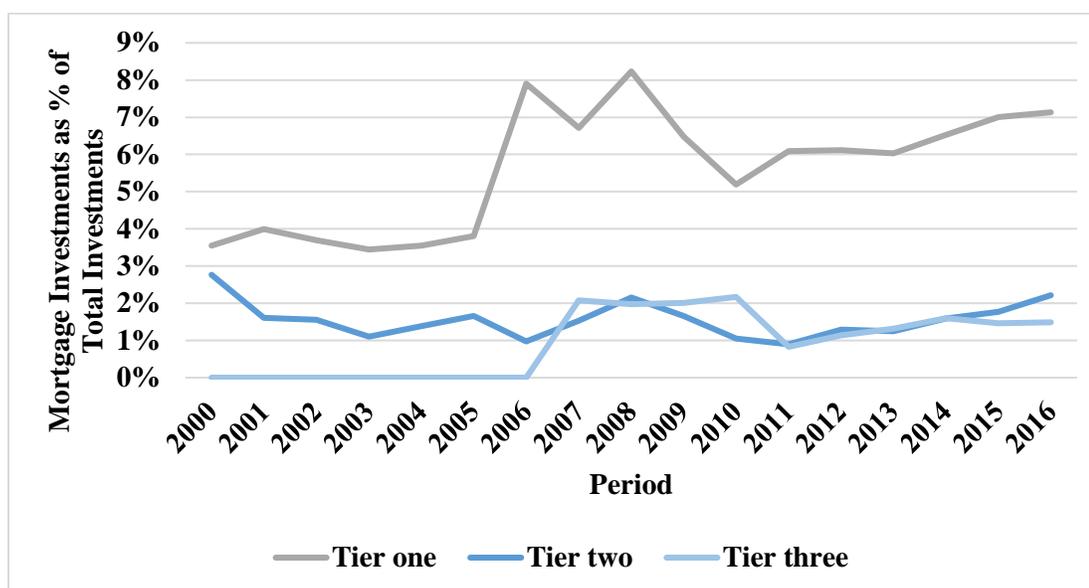
To measure the reliance each peer group places on investment income, a ratio of total investments to total assets was computed for each year. The results in Figure 4-8 indicate all property and casualty insurers allocate a similar percentage of their assets to their investment portfolios, generally 70-85% of assets. That said, investments have historically been a significant component of insurance companies' balance sheets and operations. In the early part of the decade from 2000-2002, all insurers exhibited an increased allocation of assets to their investment portfolios. Later, during the 2007 recession, the value of investments relative to the value of total assets for tier one insurers took a slight dip, whereas the relative value increased for groups two and three. Overall, the allocation of assets to investments appears to be unaffected by recession, with solely tier one insurers showing a slight reduction in relative value.

Figure 4-9 Total Investments as a Percent of Total Assets



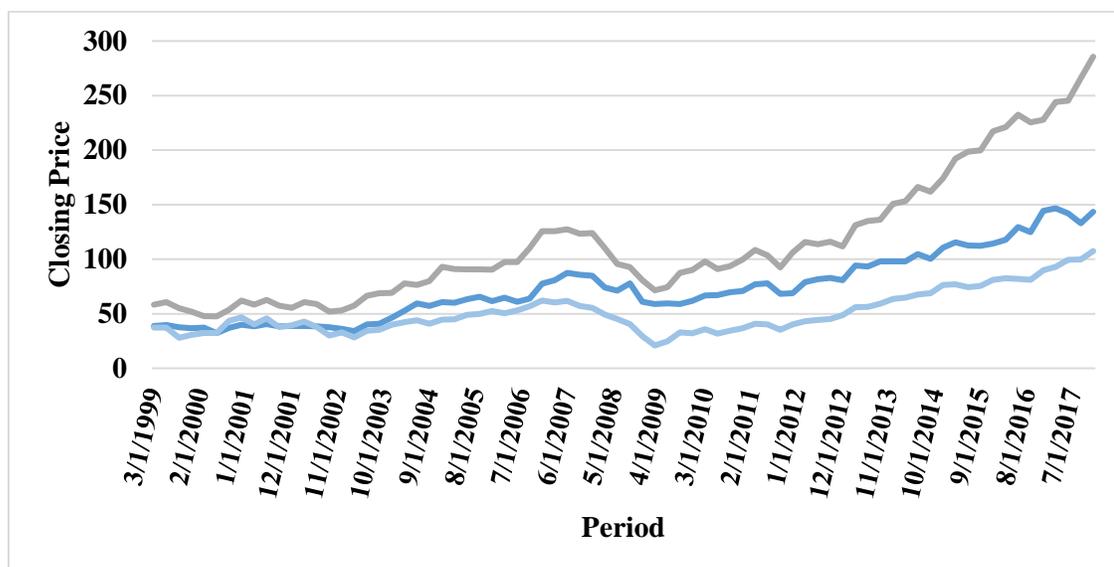
Perhaps more importantly is the asset allocation of the investment portfolio. After breaking down the asset allocation of each insurer's investment portfolio, a large disparity lies in allocation to mortgages among the peer groups. Tier one companies drastically increased their allocation to mortgages in 2005 and 2006, leading up to the financial crisis, whereas tier two and three firms had little to no exposure to the asset class. After the close of the 2007-2008 recession, all peer groups have ramped allocation to mortgages.

Figure 4-10 Mortgage Investments as a Percent of Total Investments



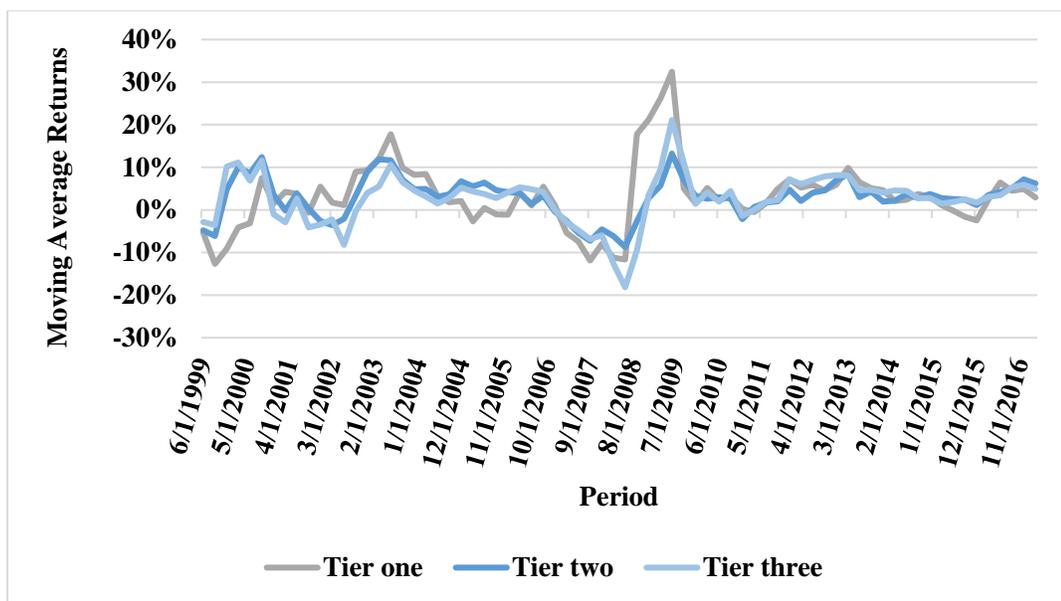
Stock Price

Figure 4-11 Average Quarterly Closing Price by Peer Group



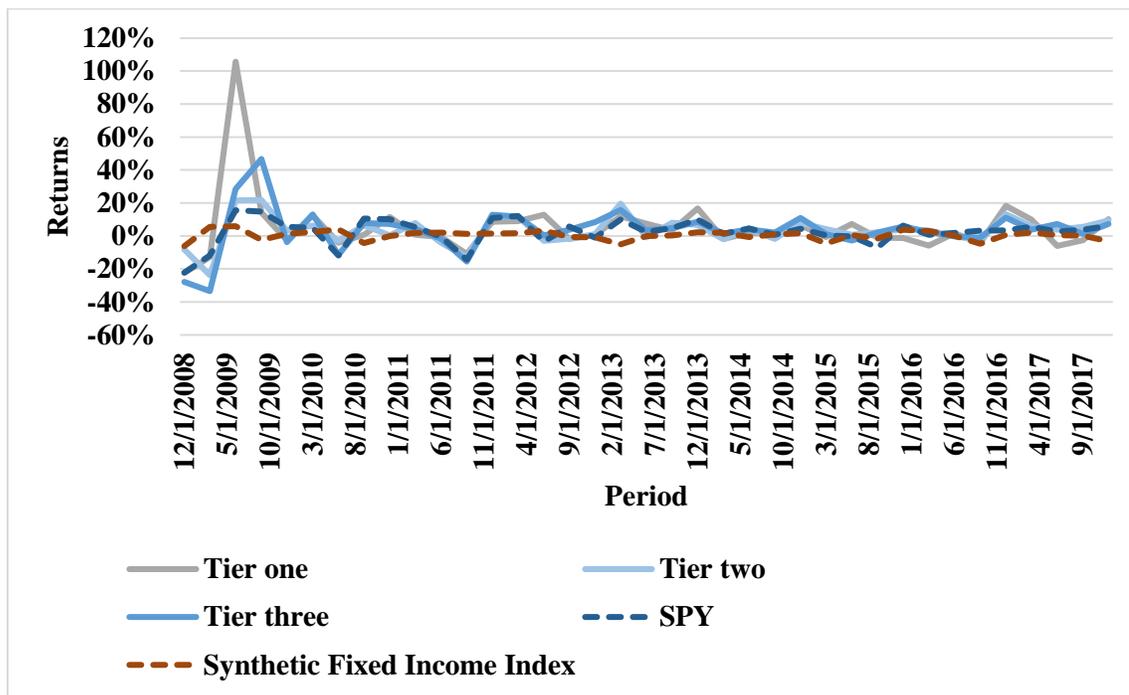
The stock price averages of all three peer groups were significantly impacted during the financial crisis of 2007-2008 and lost substantial value in the economic fallout. Average returns for all groups display near-identical movement and distinctly represent the health of the broader market during periods of recession. In fact, correlation analysis between each basket of insurers and the S&P 500 index reveals a moderate to strong, positive correlation by all groups, with tier three companies displaying the highest correlation followed by tier two and tier one insures respectively (Figure 4-12).

Figure 4-12 Moving Average Quarterly Stock Returns by Peer Group



Additionally, while the quarterly stock returns for all insurers reflect downward trend during recession, the returns also demonstrate extreme recovery in quarters following recession. Robust recovery is particularly displayed by companies with greater total admitted assets.

Figure 4-13 Average Quarterly Returns by Peer Group with Benchmarks



Also noteworthy is the recovery of insurance returns in relation to the broader market post-recession. All three baskets display stronger recovery than the broader market and subsequent return to normalcy. The correlation analysis between groups two and three returns and the synthetic fixed income index, however, reveal negligible correlation. Conversely, tier one displays moderately positive correlation in their stock returns with the fixed income index.

Table 4-4 Correlation Matrix of Returns

	Tier one	Tier two	Tier three	SPY	Synthetic FI Index
Tier one	1.00	0.57	0.57	0.52	0.33
Tier two	0.57	1.00	0.84	0.64	-0.13
Tier three	0.57	0.84	1.00	0.76	-0.04
SPY	0.52	0.64	0.76	1.00	0.04
Synthetic FI Index	0.33	-0.13	-0.04	0.04	1.00

Cross Sectional Regression Analysis

The preceding analysis focused on holistic performance indicators for insurance companies during periods of U.S. recession. Insurer performance was bifurcated into two baskets: investment income and underwriting income. Correlation analysis was conducted between both investment income and underwriting income metrics and economic indicators to gauge the strength and direction of relationships during recession. Correlation analysis, however, is limited to pairs of variables and does not indicate causal relations. That said, several forces undoubtedly act on company performance at one time. With this in mind, cross sectional regression analysis was conducted to help understand the relationships between many variables affecting company performance during recession.

In general, the multivariable regression equation of y , a dependent variable, on independent predictor variables x_1, x_2, \dots, x_k is given by:

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + \dots + b_kx_k$$

The analysis designated the change in net income as the dependent variable and incorporated six independent variables that collectively gauge three broad categories: investment performance, underwriting performance, and the level of company leverage. The two variables relating to underwriting performance are the combined ratio and expense ratio, while the two variables measuring leverage are the debt ratio and the debt to equity ratio, and the two variables characterizing investments are the mortgage allocation percentage and investment income. To capture the predictive power of these independent variables on the change in net income during recessionary periods in the U.S., the change in net income from years 2007 to 2008 was regressed with pre-crisis data. The multivariate analysis produced the regression output found in Figure 4-14.

Figure 4-14 Regression Output

	<i>Coefficients</i>
Intercept	-14.0769
Expense Ratio	19.6571
Combined Ratio	-0.0368
Investment Income	0.0006
Mortgages Allocation	-43.5183
Debt to Equity	-1.0755
Debt Ratio	18.8059

From the regression output, a multivariate regression model was formed to predict the change in net income during recessionary periods in the U.S.:

$$y = -14.0769 + 0.0006x_1 - 0.0368x_2 - 43.5183x_3 - 1.0755x_4 + 18.8059x_5 + 19.6571x_6$$

Where:

$$y = \text{Net Income}$$

$$x_1 = \text{Investment Income}$$

$$x_2 = \text{Combined Ratio}$$

$$x_3 = \text{Allocation Percentage to Mortgages}$$

$$x_4 = \text{Debt to Equity Ratio}$$

$$x_5 = \text{Debt Ratio}$$

$$x_6 = \text{Expense Ratio}$$

To measure the strength of association between net income and the given predictor variables, R Square, or the coefficient of determination, was computed and the results are found in Table 4-5. R Square measures the proportion of the variability in y that can be explained by x variables. Thus, an R Square of 100% indicates that the model explains all the variability of the response data around its mean, and a result of 0% indicates that the model explains no variability of the response data around the mean. The coefficient of determination from the regression was 84.43%, indicating the six independent variables have relatively strong predictive power over the change in net income during economic recession. To account for the number of terms in the model, the adjusted R Square was computed to be 72.75%.

Table 4-5 Regression Statistics

<i>Regression Statistics</i>	
Multiple R	0.9188
R Square	0.8443
Adjusted R Square	0.7275

The relative explanatory strength of the included variables on the change in net income validates the importance of prior analysis that tracked these variables during recession. By observing how these variables behave during recession, insights are gained on how insurance companies perform.

Chapter 5

Conclusion

While the 2007-2008 financial crisis may have primarily been a banking crisis, it had visible effects on property and casualty insurers. However, the research results signify that the impact was not collectively the same for all insurers. Recession had the strongest impact among insurers that held greater total admitted assets, demonstrated by the tier one peer group in the analysis. Thus, the hypothesis that the property and casualty insurers operating in the top segment in their peer group by total admitted assets will be most affected by recession in the United States is accepted. However, the notion that all insurer's performance suffers in contractionary periods is false. In fact, the study finds that insurers operating in the lower segment of the sector demonstrate remarkable resiliency during economic downturn, particularly in their core business activities.

The disparity of impact among insurers can be explained by the very nature of the property and casualty business. The profitability of property and casualty companies can be divided into two sources: underwriting profits and investment income. The study focused on the core underwriting performance with the combined ratio and expense ratio as key drivers in the analysis. The trend analysis for insurers' combined ratio indicated relative strength through the financial crisis. This suggests that the core operating activities of property and casualty insurance companies are largely unaffected by economic slump. However, the overall profitability of firms, in terms of net income, clearly suffered for top tier insurers holding greater assets. A logical conclusion is then that the erosion in profitability was relegated by investment income, the

noncore source of income for insurers. Since companies with fewer total assets also displayed relative strength in their bottom line through recession, it could be the case that they rely less on investment income or have higher risk adversity. Thus, investment income demonstrates greater co-movement with the health of the broader economy than underwriting income, and those insurers who have greater reliance on investment income are increasingly influenced by economic cycles.

These observations have two main implications: 1) investors, out of elevated fears from the financial crisis, may have overlooked insurers' fundamental strength of core operation during recession, causing a steep sell-off of insurance stock and sharp correction in following quarters and 2) insurers should focus on their core operating activities of underwriting risk to reduce exposure to economic downturn. The appeal to hold a high-returning portfolio is logical for insurance companies. Actively investing premium gives insurers the opportunity to earn investment income to offset claims and claim expenses. However, when investing premiums, insurers must closely examine the relationship between return and several sources of risk; namely price risk, risk of loss (claims), risk of default, and interest rate risk.

A rational conclusion is that recession in the U.S. has a greater impact on those insurers who experiment with more opportunistic investments, like residential or commercial mortgage-backed securities, private equity funds, structured products, and alternatives. As the study illustrates with insurers' allocation to mortgages, tier one insurers had greater allocations to riskier assets leading up to the crisis. This suggests that tier one insurers, who managed greater total assets, had aggressive investment policies and were not well diversified, which produced investment portfolios with higher exposure. The findings submit that insurers should demonstrate discipline in their asset-liability management when matching their investment portfolio with their

liabilities. This will require insurance managers to improve risk management procedures and express conservatism in their investment strategies.

That said, the evidence further suggests that the core insurance activities during U.S. recessions had a stabilizing, rather than destabilizing, influence on the system holistically. Perhaps loss of confidence and increased demand for safety tends to be a positive demand driver for insurance products, counteracting the decline in real activity and household wealth during recession. The research indeed suggests “financial crisis” does not necessarily impose disaster on property and casualty insurance companies, as their equity valuations often outperform the market in recovery periods.

The study was constrained on a number of fronts. Implications from the analysis cannot be extended to other, non-property and casualty insurers. Due to the nature of the risk underwritten, life insurers, for example, typically hold long dated investment horizons because they hold longer-term liabilities. Separate research must be applied to account for different underwriting characteristics among insurance lines. Limitations to the study also include the inherent distinction between correlation and causation; correlation must never be interpreted as causation.

Appendix A

Figure 0-1 Total Reserves by Peer Group

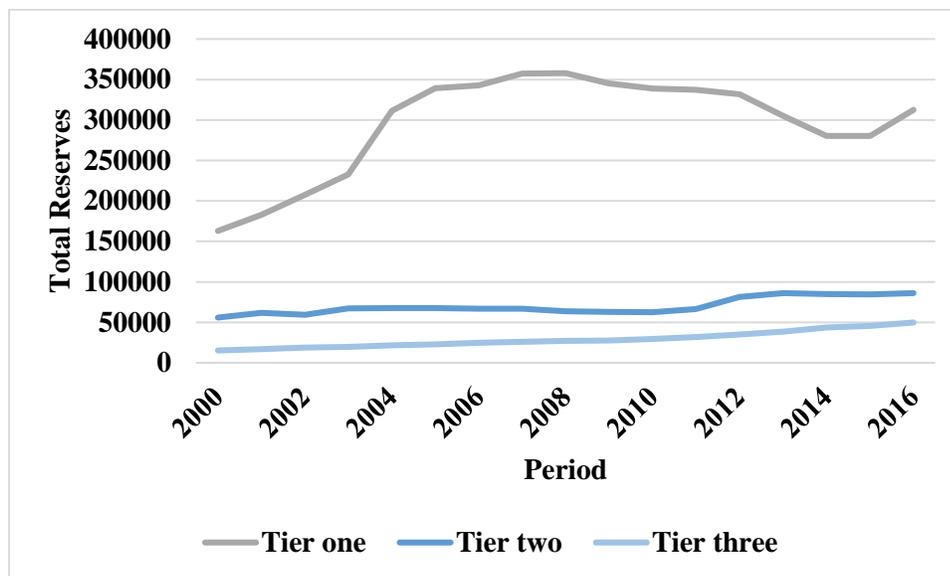
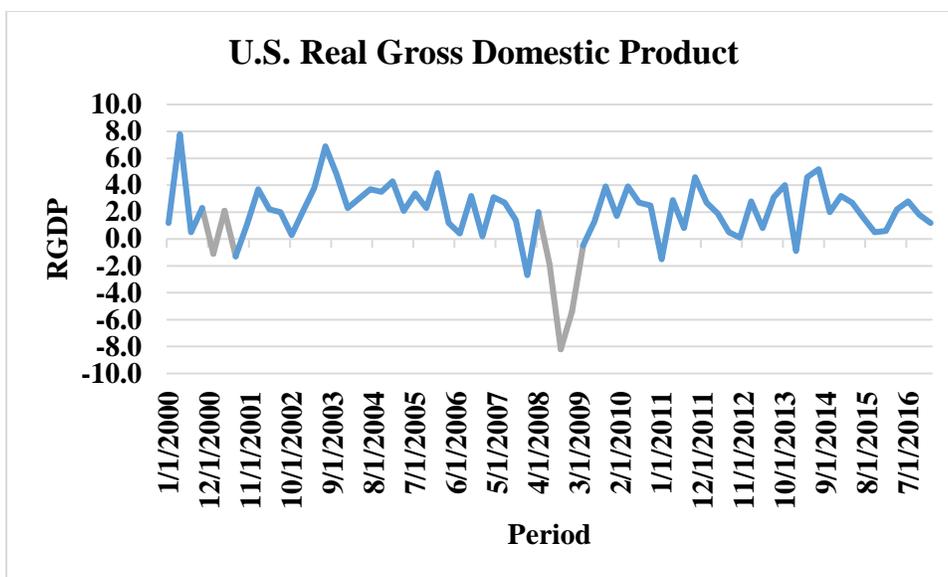


Figure 0-2 Real GDP, Quarterly, Seasonally Adjusted²³



²³ Source: Federal Reserve Economic Data, 2018

Works Cited

- Aiyar, Shekhar. "From Financial Crisis to Great Recession: The Role of Globalized Banks." *The American Economic Review*, vol. 102, no. 3, 2012, pp. 225–230. JSTOR, JSTOR, www.jstor.org/stable/23245533.
- Baluch, Faisal, et al. "Insurance, Systemic Risk and the Financial Crisis." *The Geneva Papers on Risk and Insurance. Issues and Practice*, vol. 36, no. 1, 2011, pp. 126–163. JSTOR, JSTOR, www.jstor.org/stable/41953129.
- Cummins, J. David, and David J. Nye. "The Stochastic Characteristics of Property-Liability Insurance Company Underwriting Profits." *The Journal of Risk and Insurance*, vol. 47, no. 1, 1980, pp. 61–77. JSTOR, JSTOR, www.jstor.org/stable/252682.
- Cummins, J. David, and Mary A. Weiss. "Systemic Risk and the U.S. Insurance Sector." *The Journal of Risk and Insurance*, vol. 81, no. 3, 2014, pp. 489–527., www.jstor.org/stable/24548080.
- Dandrea, Stephanie. "Fashion Retail Performance Through United States Recessions." Penn State University, 2013. Thesis Archive.
- Eanes, Bethany. "What Is Middle Market Insurance?" Bizfluent, 26 Sept. 2017, bizfluent.com/info-7998492-middle-market-insurance.html.
- "Facts and Legends of Insurance Industry History." *Insurance Journal*, Associated Press, 10 Jan. 2011, www.insurancejournal.com/magazines/features/2011/01/10/185786.htm.
- Grace, Martin F. "The Insurance Industry and Systemic Risk: Evidence and Discussion." *SSRN Electronic Journal*, 2010, doi:10.2139/ssrn.1593645.
- Greene, Mark Richard. "Insurance." *Encyclopedia Britannica*, Encyclopedia Britannica, Inc., 18 July 2017, www.britannica.com/topic/insurance/Historical-development-of-insurance.
- Harrington, Scott E. "The Financial Crisis, Systemic Risk, and the Future of Insurance Regulation." *The Journal of Risk and Insurance*, vol. 76, no. 4, 2009, pp. 785–819. JSTOR, JSTOR, www.jstor.org/stable/20685274.
- Haefeli, Daniel, and Patrick Liedtke. "Insurance and Resolution in Light of the Systemic Risk Debate." *The Geneva Association*, 1 Feb. 2012, www.genevaassociation.org/sites/default/files/research-topics-document-type/pdf_public/2012_insurance_and_resolution_in_the_light_of_the_systemic_risk_debate_0.

- “Insurance Regulation: Background, Overview, and Legislation in the 114th Congress.” EveryCRSReport.com, Congressional Research Service, 30 Dec. 2016, www.everycrsreport.com/reports/R44046.html.
- “Insurance Spending.” Organization for Economic Co-Operation and Development, 1 Jan. 2018, data.oecd.org/insurance/insurance-spending.htm.
- Keegan, Conor, et al. “Measuring Recession Severity and Its Impact on Healthcare Expenditure.” *International Journal of Health Care Finance and Economics*, vol. 13, no. 2, 2013, pp. 139–155. JSTOR, JSTOR, www.jstor.org/stable/24571822.
- Klien, Robert. “The Structure and Performance of the Insurance Industry.” Research Gate, 1 Jan. 2015, www.researchgate.net/publication/270506455_The_Structure_and_Performance_of_the_Insurance_Industry.
- Kumar, Manoj. “Impact of Recession on Insurance Industry.” *Insurance Professional*, 1 Feb. 2009, www.einsuranceprofessional.com/artrecession.html.
- Maestas, Nicole, et al. “Does Disability Insurance Receipt Discourage Work? Using Examiner Assignment to Estimate Causal Effects of SSDI Receipt.” *The American Economic Review*, vol. 103, no. 5, 2013, pp. 1797–1829. JSTOR, JSTOR, www.jstor.org/stable/42920630.
- “Major Players Rankings By Line.” Insurance Information Institute, 20 Feb. 2018, www.iii.org/publications/a-firm-foundation-how-insurance-supports-the-economy/driving-economic-progress/major-players-rankings-by-line.
- Moody, Michael. “Battling for the Middle Market.” *Mid-Sized / Regional Brokers Gaining Market Share of Institutional Commissions in U.S. Equities* | Greenwich Associates, Rough Notes Company, Inc., 1 Jan. 2017, www.roughnotes.com/rnmagazine/2010/september2010/2010_09p030.htm.
- Nambiar, Mahendra, and Christopher Stevens Diez. “Word Insurance Report 2016.” Capgemini, 1 Jan. 2016, www.capgemini.com/gb-en/service/world-insurance-report-2016/.
- Parodi, Pietro. *Pricing in General Insurance*. CRC Press, Taylor & Francis, 2015.
- Raisbeck, Murray. “Venture Capital Funding in Insurtech.” KPMG, 7 Sept. 2017, home.kpmg.com/xx/en/home/insights/2017/09/venture-capital-funding-in-insurtech.html.
- Rejda, George E. *Principles of Risk Management and Insurance*. 10th ed., Pearson Education, Inc., 2008.
- Schulte, Paul. “The InsurTech Asteroid: Is Extinction of Traditional Insurance Inevitable?” Schulte Institute, Aug. 2016. IND-X Advisors Limited, www.schulteinstitute.org/wp-content/uploads/2017/05/InsurTech-FINAL.pdf.

- Schultz, Raymond G. "Investment Income and Casualty Insurance Profits." *The Journal of Insurance*, vol. 26, no. 3, 1959, pp. 33–39. JSTOR, JSTOR, www.jstor.org/stable/250336.
- Tanguy Catlin, Johannes-Tobias Lorenz, Christopher Morrison, and Holger Wilms. "Facing digital reality." *McKinsey & Company Insights on Financial Services* (2017). www.mckinsey.com/industries/financial-services/our-insights/facing-digital-reality+<http://www.oecd.org/finance/insurance/oecdinsurancestatistics.htm>.>
- "The NBER's Recession Dating Procedure." The National Bureau of Economic Research, 8 Jan. 2008, www.nber.org/cycles/jan2003.html.
- Vladimir Njegomir & Boris Marović & Rado Maksimović, 2010. "The Economic Crisis And The Insurance Industry: The Evidence From The Ex-Yugoslavia Region," *Economic Annals*, Faculty of Economics, University of Belgrade, vol. 55(185), pages 129-162, April - J.
- Wells, Andrea. "Nonstandard Auto Insurance Market Is Not For Everybody." *Insurance Journal*, 14 Apr. 2015, www.insurancejournal.com/news/national/2015/04/13/364065.htm.
- Yan, Choon, et al. "InsurTech and FinTech: Banking and Insurance Enablement." Academic Press, www.sciencedirect.com/science/article/pii/B9780128104415000117.

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