Does Reinsurance Affect Insurers’ Solvency Status and Financial Strength? – Evidence from China Insurance Industry

Abstract:
Reinsurance contributes to the stability of insurance system but also presents to be a primary source of interconnectedness within the insurance sector. This paper focuses how reinsurance arrangement would be related to insurers’ solvency status and financial strengthens. Founded on economic theories, I use empirical data of insurers from China, an emerging market, to test whether the utilization of reinsurance would affect primary insurers’ propensity to go insolvent and their overall financial strengthen. Particularly, I expect to find some support that the reinsurance would reduce insurers’ loss volatility as well as their propensity to go insolvent. Moreover, it also has a positive impact on insurers’ financial performance.

Key Words: Reinsurance, Insolvency Prediction, Financial Performance, Property-Casualty Insurance
### 1. Introduction

Primary insurers are closely connected to reinsurers through reinsurance transactions, and this forms a complicated reinsurance counterparty relationship and network structure. It has been well documented that reinsurers play an indispensable role in that it enhances insurers’ capital allocation, mitigate loss volatility, alleviate insolvency risk and support product innovation. In addition, reinsurance is also an effective tool to help primary insurers meet the stringent regulatory requirements and improve their balance sheets and financial reporting. However, on the other hand, reinsurance is also the primary source of interconnectedness within the insurance industry that acts a transmission mechanism for financial shocks and exposes insurers to contagion risk and systemic risk. Especially after the 2008 financial crisis, the importance and safety of financial institutions, including the insurance sector have received unprecedented attention. As a result, reinsurers’ insolvency risk has become an important concern to both the regulator and primary insurers.

Given the importance of reinsurance, there has been much debate over the effect of reinsurers discussing whether they contribute to the robustness of insurance system, or increase the contagion risk through complicated reinsurance cession and retrocession that might potentially threaten their stability. In this study, I will test whether the utilization of reinsurance would affect the financial strengthens and solvency risk of the ceding insurers, using the empirical data from an emerging market--China.

Insurers’ solvency ratio has been regarded as an important signal to assess their ability to fulfill long-term financial obligations. In China, according to the insurance regulatory committee, solvency ratio is defined as the sum of its actual capital divided by their minimum required capital, which measures the ability of a company to meet its long term debts and obligations. Therefore the solvency ratio provides an assessment of the likelihood for the company to
continue congregating its debt obligations. This is only one of the metrics used to determine whether a company could stay solvent or not. Other solvency ratio measures include debt to equity ratio, total debt to total assets ratio, etc.

Globally, a worldwide trend towards more risk-oriented regulations and governance of insurers’ solvency has gained significant momentum during the last decade. The International Association of Insurance Supervisors has set out a series of insurance core principles (ICPs) to provide high-level guidance of insurance supervision, the European Union has been rolling out the new Solvency II regime, and the U.S. National Association of Insurance Commission is also working on its Solvency Modernization Initiative.

In U.S., the insurance solvency and regulation studies have remained to be a heated topic since the 1990s, along with the development of solvency regulatory system. There are two prominent solvency surveillance mechanisms in the U.S. solvency regulatory system: risk-based capital (RBC) requirements and the financial analysis solvency tools (FAST). These were developed partly as a response to a rash of insolvencies during the 1980s and went into effect in the 1990s. The RBC requirements that were put into effect in 1994 for the property–liability insurance industry were designed to identify insurers with potentially weak capital positions for regulatory intervention purposes. RBC is determined from a formula that attaches weights (or factors) to detailed, risk-related items in the insurer’s financial statements, and the property–liability RBC formula has changed very little over years since its inception. The RBC results have sometimes been used as a financial strength or financial solvency indicator in insolvency studies, and this strain of the literature has found that RBC results have low accuracy in predicting insurer insolvencies (Cummins, Harrington, and Klein, 1995; Grace, Harrington, and Klein, 1998; Cummins, Grace, and Phillips, 1999).
The FAST system, implemented in 1993, consists of 29 financial ratios, which are analyzed by the National Association of Insurance Committee (NAIC) to obtain an insurer’s FAST score. According to prior studies, the FAST system is more dynamic than RBC requirements in that the financial ratios that comprise FAST may change from year to year. The FAST system employs more sophisticated ratio analysis than the previous Insurance Regulatory Information System (IRIS), which consists of 12 financial ratios (Klein, 1995). Insurers do not know the set of ratios that are used to compute FAST scores or the weights that are given to specific financial ratio ranges under FAST. Cummins, Grace, and Phillips (1999) find that a core set of financial ratios used in the FAST system were more accurate and superior to the RBC ratio in predicting insurer insolvencies in the period of 1990 to 1992.

In Europe, with the purpose to unify a single EU insurance market and enhance consumer protection, the EU legislative program implemented Solvency II in all 27 Member States and this introduces a new, harmonized EU-wide insurance regulatory regime. Solvency II will allow greater control of how volatility and exposure are accounted for. As a result, reinsurance can have a more precise and measurable effect on clients' capital requirements. Specifically, tailor-made reinsurance solutions will provide significant benefits for insurers' balance sheets. In addition, the Solvency Capital Requirement is set to ensure that each insurer will be able to meet its obligations over the next 12 months with a probability of 99.5% (i.e., being able to survive 199 out of 200 years). They employ a variety of risk “modules” to calculate the insolvency risk, which include underwriting risk, counterparty default risk and market risk. Solvency II’s standard model establishes an economic balance sheet that determines the value of its own funds by subtracting the best estimate of liabilities, plus a risk margin, from the market value of an insurer’s assets. Solvency II is similar to the banking regulations of Basel II in that they both
have a three-pillar framework.

As for China, since the reopening of the insurance market in the 1980s, its insurance market has been through fast development. To be specific, the annual premium growth rate in the last 10 years has reached 18 percent, and the total annual premium volume exceeded $253 billion in 2012. One of the consequences of the rapid growth is that regulators had to consistently chew over how to improve the existing solvency regulation system such that the market continues to develop in a healthy and sustainable way. Chinese insurers’ solvency regulation has been directed at the discretion of China Insurance Regulation Committee (CIR). It has been working on the second-generation solvency regulation system since 2012 to implement a risk-oriented and factor-based solvency regulation system similar to Europe’s Solvency I regime. In May 2013, CIRC published the conceptual framework of the new solvency system, the “China Risk Oriented Solvency System”, which also adopts the “three-pillar” solvency framework, which is similar to the EU solvency II: the quantitative capital requirements, the qualitative supervisory requirements and market discipline mechanism.

Following the financial crisis, growing emphasis has been attached to the stability and resilience of financial intuitions including the insurance sector. It is an important issue whether insurers could remain sound and solvent during the economic turmoil period. There exist some concerns regarding the possibility of systemic risk triggered by reinsurers. While previous studies tend to believe that the consequence of systemic risk within financial system is small and not severe, the recent financial turmoil has challenged this traditional viewpoint and brought this topic under the spotlight again for further investigation.

Given these increasing concerns, this study will try to seek some empirical evidence regarding the role of reinsurance from China, which is an emerging insurance market. The reason
why I choose to study China’s insurance industry is that China has an open and expanding market, with rapid premium growth and increasing insurance density, which marks it as a representative of the emerging economies. On the other hand, despite its rapid growth, China’s insurance market is still at the early stages of development and is exhibiting the behavior of an emerging market. Relative to the developed and mature markets, China’s insurance market is quite different in terms of market size, growth rate, product features, risk management capabilities, talent management, and internationalization, etc. Therefore I choose to study China insurance market to find out how reinsurance would affect insurers’ solvency status.

The remainder of this paper is organized as follows: Section 2 briefly reviews the relevant literature. Section 3 develops hypotheses. Section 4 describes the data and sample while section 5 outlines the methodology, and section 6 presents the expected empirical results. Section 7 finally concludes the paper with some comments and implications.

2. Literature Review

2.1. Reinsurance Literature

Insurers’ demand for reinsurance has been proved to be important and relevant, both theoretically and empirically. Firms would use internal capital market if it turns out to be less expensive than external capital market. Founded on pecking order theory model, earlier researchers find that internal capital market is less costly than external capital market, and they note that the intermediaries have limited capital and face costs of adding more. (Froot et al., 1993; Froot and Stein, 1998) Also, considering the inflated premium rate, shrinking supply, as well as the increasing demand in the aftermath of major catastrophes events, property and casualty insurers would naturally rely more on internal funds to write more business. (Lin, Yu and Peterson, 2013) Therefore because of costly external financing, reinsurance is meaningful and can assist in maximizing the insurer’s value.
On the empirical side, Mayers and Smith (1990) examine the corporate demand for insurance and find out the purchase of reinsurance by an insurance company is comparable to the purchase of insurance by firms in other industries. They argue that ownership structure, firm size, geographic concentration and line-of-business concentration have significant effects on the demand for reinsurance. Cole and McCullough (2006) examine the effects of firm characteristics as well as the international reinsurance industry on the demand for reinsurance by U.S. insurers, and their findings are generally consistent with the prior literature. They also extend this stream of study to the foreign reinsurance demand by U.S. insurers and find that it is mainly driven by firm size, group affiliation, and organizational form. Powell and Sommer (2007) study the internal capital market and examine reinsurance activities between affiliated and unaffiliated insurers. They conclude that even though the demand for affiliated and unaffiliated reinsurance has some common determinants, the purchase of affiliated reinsurance is associated with some cost-based incentives, such as reducing information asymmetries, and structural incentives that often prevent insurers from accessing external capital.

Besides reinsurance demand studies, some other researches have reviewed the cost and benefits of reinsurance. For example, Cummins et al. (2008) analyze the costs and the benefits of reinsurance for a sample of U.S. P-L insurers. They show that purchasing reinsurance significantly increases insurers’ costs but also significantly reduces loss ratio volatility. The paper concludes that, when purchasing reinsurance, insurers accept higher production costs to reduce their underwriting risk. Weiss and Chung (2004) relate reinsurance to the underwriting cycle in the U.S. property-liability insurance market. They find that non-proportional reinsurance prices are significantly related to capacity and financial quality. It is found that reinsurance prices are positively related to relative policyholders’ surplus, new external capital, and new
internal capital. Cummins and Trainer (2009) review the strengths and weaknesses of reinsurance and securitization as two different tools of risk financing. They argue that the risk warehouse model of reinsurance operates very efficiently for relatively small, mostly uncorrelated risks; but when the magnitude of potential losses and the correlation of risks increase, the traditional reinsurance model may become uneconomical. These prior studies suggest that the utilization of internal capital market is likely to be related to primary insurers’ efficiency and financial performance.

To sum up the above literature, reinsurers, on the top layer of insurance industry, are endowed with better risk management technique and globalized portfolio will be in a better position to mitigate volatility and less vulnerable to external shocks. Cummins (2007) examines empirically the role U.S. reinsurer plays in natural and man-made catastrophic disasters. Also according to this study, reinsurance market is a global market and capital markets respond quickly to new capital needs of reinsurers. Because of this superior capacity to raise quickly new capital, the reinsurance market responded efficiently to large unexpected losses and reinsurance prices began to soften in late 2006 and early 2007 (Benfield, 2007b).

Following the 2008 global financial crisis, which is the third most costly year in insured losses, reinsurers demonstrated again the importance to provide cover for extensive risks. According to the response of Geneva Association,¹ there are no indications whatsoever that insurer has contributed to the systemic issues that many banks are facing today. Insurers and reinsurers have not originated and repackaged subprime mortgages. They did not act as major investors in mortgage-based financial instruments. To the contrary, the insurance industry displayed resilience in the face of adverse market conditions and was in a position to absorb

¹ This is selected from “The Credit Crisis and the Insurance Industry: 10 Frequently Asked Questions” (The Geneva Association, Etudes et Dossiers No.351).
market volatility as an institutional investor with a long-term perspective. In this sense, the insurance sector acted as a stabilizing factor at a time of considerable stress in the global financial system.

Additionally, International Association of Insurance Supervision (IAIS)’s 2009 report—*Reinsurance and Financial Stability* points out that reinsurers, faced with a doubly challenging years from a historically depressed investment environment and a turbulent storm season, returned to an overall positive result in 2008, indicating their strong industry strength. The adverse global environment caused impairment to capital positions; nevertheless the 21% reduction was managed from strong early year positions and did not threaten business viability.

Cummins and Weiss (2011) have examined various dimensions of systemic risk posed by the insurance sector that would spill over to other segments of the economy. They conclude that the possibility of systemic risk caused by the core insurance activities is very limited. This was the first paper using detailed data to provide a concrete statistics analysis to investigate the reinsurance counterparty relationships of both property-liability and life insurers in the U.S.

Park and Xie (2012) analyzed the impact of reinsurers’ credit rating downgrades on the counterparty primary insurers’ rating grade as well as their stock returns. They find out that although the downgrade of reinsurers increases insurers’ likelihood of downgrading and negatively influence insurers’ stock prices, it is unlikely that reinsurers’ default would bring about the rating downgrade or insolvency to primary insurers. Still, their results show that primary insurers’ stock prices react negatively to the downgrade of reinsurers, suggesting a close interconnectedness between the insurance sector and the reinsurance sector. Cummins, Feng and Weiss (2012) analyzed the counterparty relationship between reinsurers and insurers and also relate individual insurance firm’s performance with it. They provide some empirical evidence to
support that the utilization of reinsurance is positively related to all types of firm performance measures including efficiency, ROE, and ROA.

Besides the above research findings, there is also a stream of network studies emerging and rapidly expanding in the finance and insurance literature. Within these studies, the reinsurance counterparty relationship is modeled as a network structure. And among these studies, a general consensus has been reached that there exists a non-linear relationship between reinsurance network linkages and stability. For example, Lin, Yu, and Peterson (2014) investigate the relationship between reinsurer’s network position and their decision-making in the US property-casualty insurance industry. Their pioneering work discovered a nonlinear trade-off between the costs and benefits of reinsurance and solve for the optimal reinsurance ratio. Chen et al. (2015) study the microstructure of reinsurance network and its impact on firm performance. They also discover an inverse U-shaped non-linear relationship between insurer’s network position and its underwriting firm performance, which is quite consistent with the prior work. Acemoglu, Ozdaglar and Tahbaz-Salehi (2013) argues that the extent of financial contagion exhibits a form of phase transition: if the magnitude of negative shocks affecting financial institutions are sufficiently small, a more densely connected financial network enhances the financial stability; but beyond a certain point, dense interconnections serve as a mechanism for the propagation of shocks, leading to a more fragile financial system.

Despite the rich volume of literature on various aspects of reinsurance including its cost and benefits as well as demand and function, the theoretical studies haven’t provided many insights into how the utilization of reinsurance would affect insurers’ failure propensity and their financial strength. Especially that during the recent financial crisis period, the resilience and stability of financial institutions including the insurance sectors has been addressed.
2.2 Solvency Prediction and Regulation Studies

Prior studies have discussed two of the most prevailing systems, which are RBC ratio and FAST scores, in predicting insolvency of U.S. insurers. To illustrate, Cummins, Harrington, and Klein (1995) find the predictive accuracy of the RBC ratio is very low. Grace, Harrington, and Klein (1998) also argue that the overall FAST score performs considerably better than RBC in predicting insolvencies and the addition of the RBC ratio to the FAST-ratio prediction models leads to only modest improvements in predictive accuracy. Based on cash-flow simulation model, Cummins, Grace and Phillips (1999) confirms the findings in prior studies and prove again the risk-based capital ratio and its components provide very low explanatory power in predicting insurer insolvencies. Moreover, the FAST factors tend to dominate the risk-based capital variables and the cash flow simulation variables add significant discriminatory power to the solvency prediction models based on the RBC and FAST systems.

Cheng and Weiss (2012) assess the accuracy of RBC requirements and the FAST ratios in identifying insolvent insurers over a recent sample period, which is 1994 to 2005. They find that the overall accuracy in predicting insolvency using RBC ratio or FAST financial ratios has not declined significantly over the sample period. They also review the influence of catastrophe hurricane exposure and other exogenous factors. Particularly, they find exposure to hurricane-prone areas is significantly related to the chance of insolvency; and macroeconomic as well as industry-wide factors proved to be related to property–liability insurer insolvency propensity. In addition, Leverty and Grace (2012) investigate the CEOs’ influence on firm performance when their firm is in financial distress and their results indicate that managers of insolvent firms are less skilled than their peers and the consequence of their incompetence is economically significant.

Studies of insurer insolvencies are largely involved in the accuracy of the RBC ratio and
the FAST scores in predicting insolvencies (Cummins, Harrington, and Klein, 1995; Grace, Harrington, and Klein, 1998; Cummins, Grace, and Phillips, 1999). However, the literature also includes many studies concerning property–liability insurers’ insolvency prediction using other methods. (Browne and Hoyt, 1995; Kim et al., 1995; Lee and Urrutia, 1996; and Chen and Wong, 2004) Most of these studies use firm-specific data to predict individual insurer’s insolvency (e.g., insurer financial information such as financial ratios), while a few others use only macroeconomic and insurance industry-wide variables (e.g., Browne and Hoyt, 1995).

To sum up, these prior studies suggest that the use of reinsurance is likely to be related to primary insurers’ efficiency and financial performance. However, none of these studies have mentioned the influence of reinsurance or internal capital market on ceding insurers’ solvency status. Plus, very few studies have provided empirical evidence on China’s insurance market, but today, there is increasing data available for researchers to conduct some empirical studies in China. This paper would hopefully fill this gap and contribute to the growing literature on this topic by revealing how reinsurance affects insurers’ insolvency likelihood and their financial performance.

3. Hypothesis Development

3.1. Reinsurance Resilience Hypothesis

As the insurance for insurers, reinsurance plays a fundamental role in the insurance industry, allowing insurers to transfer risk among each other, thereby enhancing risk sharing and risk diversification across different policyholders, product lines and geographical regions, in order to stabilize their earnings and expand their underwriting capacity.

By using reinsurance, the Solvency Capital Requirement (SCR) is reduced because part of the cedent’s underwriting risk is transferred to the reinsurer. And the ceding insurers’ underwriting capacity would also be expanded as a result. According to Solvency II standard
model, the underwriting risk module comprises mainly premium risk, reserve risk and
catastrophe risk. Reinsurance can have a risk-reducing impact on all of these elements because
of its general function, thus we have reasons to believe that the reinsurance cession is a way to
mitigate the minimum required capital level. The more that an insurer cedes, the less their SCR
will be, and less likely that insurer will go insolvent.

There are some prior studies showing how reinsurance affects primary insurers’
insolvency likelihood. Swiss Re (2003) investigates whether reinsurers pose a major risk for their
clients, the financial system, or the economy. The study examines two major channels through
which reinsurance create systemic risk – lack of reinsurance coverage and insolvencies of
primary insurers and banks triggered by reinsurer defaults. This study mainly concludes that
reinsurance insolvencies do not pose a systemic risk because primary insurers spread their
reinsurance cessions across several reinsurers and the probability of reinsurer default is low.

Cummins and Weiss (2011) investigate the reinsurance counterparty relationships of both
property-liability insurers and life insurers in the U.S. by providing both aggregate level and firm
level reinsurance information. They conclude that the concentration of ceded reinsurance
premiums as well as of reinsurance recoverable are relatively high, which indicates that many
primary insurers would be seriously at risk if several large reinsurers were to fail.

Lelyveld et al. (2011) provide an empirical analysis about the effect of reinsurers’ failures
on the stability of Dutch insurers. They model the contagion risk from the direct linkage between
insurers and reinsurers through a reinsurance matrix and conduct scenario analysis to test the
resilience of the Dutch insurance industry to the failure of reinsurers. As a result, they find no
evidence of systemic risk due to reinsurance failure in the Dutch insurance market.

Park and Xie (2014) analyze the impact of reinsurer downgrade on primary insurers’
default risk and consider multiple scenarios where top global reinsurers become insolvent. They find that under an extreme assumption of 100 percent reinsurance recoverable default by one of the top three global reinsurers, only about 2 percent of insurers would be downgraded, and 1 percent of insurers would become insolvent. The chain effect that insolvent primary insurers caused via affiliated and non-affiliated reinsurance transactions was minimal too.

The above theoretical and empirical analyses are quite consistent and convincing. Moreover, if we take this conclusion one step further, it could be safe to infer that the effect of reinsurance on insurers’ insolvency risk is non-negative, if not positive. Based on this, I suggest the following hypothesis:

\[
H1a: \text{The utilization of reinsurance is inversely related to insurers’ insolvency propensity.}
\]

3.2. Financial Strength Hypothesis

Following the financial crisis, an important question is whether reinsurers help to enhance financial stability of insurers or in the other way increase the interconnectedness and uncertainty. Earlier studies have pointed out that, compared with banking system, insurers are victims rather than instigators of the financial crisis. Park and Xie (2014) analyze the impact of reinsurance credit rating downgrades on the primary insurance companies’ credit ratings and their stock returns. They trace the effects of such reinsurer defaults as they flow through the industry, using financial statement data to testify this impact. And they argue that the downgrade of reinsurer would increase insurers’ likelihood of downgrading and would also negatively influence insurers’ stock prices.

Thus there is a growing consensus over the role of reinsurers in terms of stabilizing insurers’ income. For more examples, Garven, Hilliard, and Grace (2014) find that a long-term and focused cedant-reinsurer relationship helps reduce information asymmetries between reinsurance counterparties. As a result, the ceding insurer’s reinsurance utilization, profitability,
and credit quality will increase as the reinsurance tenure increases. Similarly, Cummins, Feng and Weiss (2012) find a positive relationship between reinsurance utilization and firm efficiency. Plus, Chen et al. (2015) document a U-shaped relationship between an insurer’s network position and its performance, whereby the utilization of reinsurance could have a positive impact on insurers’ performance.

Combining those studies and conclusions, I posit the following hypothesis:

\[ H2: \text{The utilization of reinsurance is directly related to insurers’ financial strengthen, as measured its ROA and ROE.} \]

4. Data and Sample

Data for Chinese insurers’ firm-specific characteristics and financial performance data is mainly taken from insurer’s annual financial statement for recent three years. I also use the industry-level data from CIRC. Then I manually collect and clean the firm-level data by clearing the outliers such as excluding firms with negative reinsurance premium ceded or negative net reinsurance recoverable. Data on insolvent insurers will be disclosed to public from CIRC according to their regulatory rules.

The sample period is from 2010 to 2014. Among all 67 property-casualty insurers, there are four listed insurers in China: Ping An, CPIC, PICC and Taiping. In this preliminary study, I mainly rely on the four listed insurers and I will expand the sample in the follow-up versions.

5. Methodology

5.1. Research Method

I will use pooled logistic regression model and pooled OLS regression model to do empirical analysis. In the pooled logistic regression model, the dependent variable is a dummy variable capturing firms’ propensity to go insolvent. It equals to one if the firm goes insolvent in the sample year. The independent variables are firm-specific variables including the key
independent variables about firms’ reinsurance utilization and exposure.

To test Hypothesis 1, I construct the pooled Logistic regression model as follows:

\[ Y_i = \alpha + \beta_1 Uti_{i-1} + \beta_2 X_{i-1} + \mu + \nu + \epsilon_{it} \]  

(1)

Whereby \( Y_i \) is insurers’ insolvency propensity. And \( Uti_i \) represents insurers’ reinsurance utilization.

Then to test Hypothesis 2, I use the following pooled OLS regression models where the dependent variable is defined as the firms’ return on asset and return on equity.

The models are as follows, which is similar to equation (1).

\[ ROA_{it} = \alpha + \beta_1 Uti_{i-1} + \beta_2 X_{i-1} + \mu + \nu + \epsilon_{it} \]  

(2)

\[ ROE_{it} = \alpha + \beta_1 Uti_{i-1} + \beta_2 X_{i-1} + \mu + \nu + \epsilon_{it} \]  

(3)

5.2. Variables Definition

Following the literature and regulation rules from CIRC, I define the main dependent variable: insolvency propensity to be a dummy variable equals to one if an insurer goes insolvent, which means that in the year \( t \), insurers’ solvency ratio fall below 100%.

The key independent variable is reinsurance utilization, which measures the volume of reinsurance used by insurers. It provides direct information about the quantity of reinsurance transactions between a primary insurer and its counterparty reinsurers. It is defined as the ratio of reinsurance premium ceded to the sum of direct premiums written plus reinsurance assumed.

Following the literature, it is hypothesized that reinsurance utilization would exert some positive impact on insurers’ overall financial performance because it provides insurers an upper layer protection against the risk of its own defaulting in the financial crisis periods. Reinsurers are believed to be equipped with better risk management skills, which could help insurers recovering
from adverse shocks.

\( X \) is a vector of insurer \( i \)'s characteristics in year \( t \). The definitions of the dependent variables and control variables are as follows:

First of all: firm size, as measured by the natural logarithm of an insurer’s total admitted assets. Size may play an important role in influencing an insurer’s risk-taking behavior and performance through its effect on investment opportunities and access to capital markets. Large insurers are usually more diversified in terms of business lines and geographical location; therefore they will benefit from economies of scale in risk management and have greater ability in raising capital than small insurers. As indicated in Cummins and Xie (2008), large and more diversified firms are good at gaining economics of scale and reduce the unit cost of production. Moreover, according to the law of large numbers, the expected loss becomes more predictable as the insured pool tends to be larger and more diversified, which requires less capital per policy written from insurers. Previous studies have also found firm size would positively affects P/C insurers’ performance (Cummins and Nini 2002).

Secondly, the organizational form dummy, I define the Stock Dummy to be one if the insurer is operated as a stock insurer. There are two main types of insurers in the insurance industry – stock insurers, owned by stockholders; and mutual insurers, owned by policyholders. We have reasons to believe that stock and mutual insurers need to be treated differently in terms of their reinsurance decisions and insolvency regulation. Firstly, managerial discretion problems differ between stock and mutual insurers.\(^2\) Generally speaking, stock firms have better access to the capital market and can raise capital more easily than mutual insurers. The effect of organizational form on insurers’ underwriting experience and performance is ambiguous. For

\(^2\) Jensen and Meckling (1976) and Jensen (1986) suggest that managers who are not closely monitored and/or whose objectives are not aligned with those of the owners may take distorted actions.
instance, Cummins et al. (1999) and Liebenberg and Sommer (2008) find that mutuals have higher costs than stocks because the former have more difficulties in controlling managerial perquisite consumption. By contrast, Greene and Segal (2004) find no significant difference in accounting profitability between mutual and stock life insurers. In general, prior studies indicate that mutual have a lower insolvency propensity.

Thirdly, I consider the impact of leverage, which is defined as the ratio of the total liabilities to total admitted assets in the insurance context. Leverage can be an indicator of an insurer’s insolvency risk that tends to affect returns and losses. A high debt ratio can worsen the underinvestment problem and increase bankruptcy costs. I expect leverage to be positively associated with an insurer’s insolvency propensity.

Besides, I also add some control variables such as catastrophe risk exposure and Herfindahl Index. Table 1 below briefly summarizes the definition of variables used in this study.

6. Empirical Results

This section presents the empirical results. First of all, I plot the solvency ratio over years for listed insurers, which is shown in Graph1 below.

![Figure 1: Plot of four listed P-C insurers’ solvency status](image-url)
Based on the above plot, we can see that insurers’ solvency ratio fluctuate between 150% and 250% during the sample period, except for PICC, who falls below 150% in year 2010. This indicates that those listed insurers are not troubled much with the solvency-related issues.

Normally, when insurers’ solvency ratio fall below the 100%, they will receive special regulatory scrutiny and be restricted in their business development. There are three ways to improve insurers’ solvency status: to raise capital from secondary market, to issue debt, or to utilize reinsurance, to ensure that they have enough capital. Insurers solvency ratio would also increase as a result of investment income and profit growth.

Below is a plot the trend of four listed insurers’ reinsurance utilization.

![Graph of four listed P-C insurers’ reinsurance utilization](image)

Figure 2: Plot of four listed P-C insurers’ reinsurance utilization

In the follow-up version of this study (probably by the time of presentation), I will present a more thorough data analysis, use the appropriate model to test the hypotheses and then discuss the empirical results and implications.

**7. Conclusion**

This paper intend to present an analysis of the relationship between Chinese insurers’ reinsurance arrangement and firms’ insolvency propensity and financial performance and some
related issues employing appropriate methodologies based on a conceptual framework grounded in finance and insurance theories.

With China gaining more influence in the global insurance community, the Chinese regulators are always actively looking forward to learning from more developed markets and sharing developing experience. Therefore the particular interest of this study is to see how reinsurance utilization would affect insurers’ solvency status and financial strengthen.

For future studies, I will complete the empirical work and continue doing more in-depth studies. Firstly, I will add some more variables or use alternative measures for robustness check. Secondly, I will do sub-sample and sub-period analysis to see whether the pattern is driven by a specified group of insurers or a specified period of time. Thirdly, I want to further analyze the impact reinsurance network position on firms’ solvency prediction. There is still a long way to go into this field before I can fully understand these research questions. I hope that my results would have some practical implications for both insurers and regulators for such an emerging and fast-developing market as China.
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<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
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<tr>
<td>Insolvency Propensity</td>
<td>Percentage of invested assets in common stock and speculative bonds</td>
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<tr>
<td>ROA</td>
<td>Return on assets, net income divided by total assets</td>
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<tr>
<td>ROE</td>
<td>Return on equity, net income divided by equity</td>
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<tr>
<td>Reinsurance Utilization</td>
<td>Lagged incurred losses divided by total premium earned</td>
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<tr>
<td>Firm Size</td>
<td>Natural log of total admitted asset</td>
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<tr>
<td>Leverage</td>
<td>The ratio of total liabilities to total admitted assets</td>
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<tr>
<td>Stock Insurer Dummy</td>
<td>A dummy variable equals to one if the insurer is a stock company and zero otherwise</td>
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<tr>
<td>Catastrophe Risk Exposure</td>
<td>Premiums written from homeowners line in gulf area and coastal states and earthquake line nationwide divided by total premiums written</td>
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<tr>
<td>HHI-Line of Business</td>
<td>Herfindahl index of premiums written by business lines</td>
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