Ownership Structure and Reinsurance Decisions: Evidence from the Property Casualty Insurance Industry in China

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Abstract

This study examines the impact of ownership structure on reinsurance decisions in the Chinese property casualty insurance industry. The evidence shows that foreign insurers have higher reinsurance demand than domestic insurers. Specifically, foreign insurers are more likely to purchase volunteer reinsurance. More important, foreign insurers are associated with a higher percentage of facultative reinsurance ratios than domestic insurers. Implementing the compulsory reinsurance ratio in the Chinese insurance market before 2006 is inefficient. Finally, regulation of compulsory reinsurance ratio affected the reinsurance demand in 2006. For example, insurers with a 10 percent compulsory reinsurance ratio in 2004 had significantly different reinsurance demand from that of insurers without compulsory reinsurance after 2006. The overall results of this study indicate that ownership structure and other characteristics of firms' significantly affect the demand for reinsurance.

Keywords: Reinsurance demand, ownership structure, compulsory reinsurance, voluntary reinsurance, facultative reinsurance, treaty reinsurance

Ownership Structure and Reinsurance Decisions: Evidence from the Property

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1.   Introduction

This paper examines the reinsurance decisions in the Chinese property casualty insurance industry.   I focus on decision between compulsory (statutory) reinsurance and volunteer reinsurance.   I also examine the effect of treaty reinsurance on reinsurance decisions compared with that of facultative reinsurance.   Reinsurance is a traditional risk transfer tool in the insurance industry.   Thus, the decision of reinsurance is an important issue regarding insurer solvency.

The Chinese insurance industry has been rapidly expanding.   The total number of direct premiums for property casualty insurance in China ranked sixth worldwide in 2011 (Table 1).   When China joined the World Trade Organization (WTO) in 2001, the Chinese government reduced restrictions on the entry of foreign insurers to the Chinese market.   More important, the tight regulation of policies by the government protected domestic insurance companies before 2001.   In 2012, China had 60 property casualty insurers including 39 domestic insurers and 21 foreign insurers.   The Chinese insurance industry is a particularly interesting issue because insurers are of two types: domestic insurers and foreign insurers.   When China joined the WTO, domestic insures benefited from considerable involvement by competent foreign insurers, who have extensive expertise and excellent reputation.

Previous studies have investigated the relation between organizational structure and reinsurance demand (Mayers and Smith, 1981; Hansmann, 1985; Hoerger et al., 1990; Mayers and Smith, 1990; Adiel, 1996; Garven and Lamm-Tennant, 2003; Cole and McCullough, 2006; Cole et al., 2007; Powell and Sommer, 2007; Cummins et al., 2008; Wang et al., 2008; Garven and Grace, 2011; Ho et al., 2013).   For example,

Mayer and Smith (1990) suggest that the type of organizational is related to reinsurance demand and that mutual insurers purchase more reinsurance than stock insurers. By contrast, Cole and McCullough (2006) find that stock insurers purchase more reinsurance than mutual insurers. These findings suggest that empirical evidence on the relation between organizational structure and reinsurance decision is inconclusive.

Studies have rarely examined ownership structure and reinsurance demand (Wu et al., 2010; Zhao and Wu, 2010). For example, Wu et al. (2010) and Zhao and Wu (2010) find that no significant relation arguably exists between ownership forms (domestic insurers or foreign insurers) and reinsurance demand. Skipper (1997) suggests that foreign insurers have a potentially constructive role in the insurance markets of transition economies and developing countries. Because foreign insurance companies are often a part of larger international insurance professional groups, their risk pooling activities are helpful, particularly they offer great pricing. Moreover, Skipper (1997) also argued that in an ideal world, complete freedom is extended to insurers and reinsurers to provide cross-border insurance services. Therefore, the question of whether the more competitive service quality of foreign insurers more substantially affects reinsurance decisions than the service quality of domestic insurers is a valuable research topic. This study sheds light on this issue in the context of an emerging insurance market.

This paper examines the impact of ownership structure and firms' characteristics on reinsurance decisions in the property casualty insurance industry in China. Foreign insurers have higher reinsurance demand than domestic insurers. Specifically, foreign insurers purchase reinsurance from volunteer reinsurance. More important, foreign insurers are associated with a higher percentage of facultative

reinsurance ratios than domestic insurers. Finally, the implementing the compulsory reinsurance ratio in the Chinese insurance market had been inefficient until 2006. The regulation of without compulsory reinsurance ratio in 2006 influenced the reinsurance demand. For example, insurers with a 10 percent compulsory reinsurance ratio in 2004 had a significantly different reinsurance demand compared with insurers after 2006. The overall results of this study indicate that ownership structure and several characteristics of firms' significantly affect the demand for reinsurance.

This study differs from previous studies in several ways. First, to the best of our knowledge, this is the first study to examine the effect of ownership structure and reinsurance decision on the choice between compulsory reinsurance and voluntary reinsurance in Chinese property casualty insurance industry. Moreover, treaty reinsurance and facultative reinsurance are compared. Second, little evidence of previous studies on the relation between ownership structure and reinsurance demand do not exists (e.g. Wu et al., 2010; Zhao and Wu, 2010). However, I find a positive relation between foreign insurers and reinsurance demand. Third, this paper investigates whether the regulations have significantly changed since 2006, given that implementing of the compulsory reinsurance ratio in the Chinese insurance market was inefficient before that year. Finally, this study examines whether the regulation of without compulsory reinsurance ratio affected the reinsurance demand after 2006. Thus, this paper complements existing literature by providing an alternative perspective.

The paper is organized as follows: Section 2 provides a background on regulation in the Chinese insurance market. Section 3 discusses the hypothesis development. The data and methodology are described in Section 4. Section 5 summarizes the statistical and empirical results. Finally, Section 6 concludes.

2. Background of regulation in Chinese reinsurance market

In 1988, China implemented compulsory reinsurance, which requires each insurer to cede 30% of its business to the People's Insurance Company of China (PICC). The reinsurance department of PICC manages all business concerning compulsory reinsurance. In 1995, China's first insurance law was ratified, lowering the percentage of compulsory reinsurance cession from 30% to 20%. In 1996, PICC initiated reforms that created the People's Insurance Reinsurance Company of China, also known as PICC Reinsurance, which was reorganized and renamed as the China Reinsurance Company in 1999. Before 2003, the China Reinsurance Company was the only reinsurance company in the Chinese insurance market.

According to the China Insurance Regulatory Commission (CIRC), upon the entry of China to the WTO in December 2001, foreign insurance companies were permitted to provide reinsurance services in the form of joint ventures, branches and subsidiaries. In 2003, eight reinsurers had registered branches in China[1]. For example, the Munich Reinsurance Company and the Swiss Reinsurance Company entered the Chinese reinsurance market in 2003 by setting up branches in Beijing, and the General Reinsurance Company followed by establishing its Shanghai Branch in 2004. Thus, since 2004, the reinsurance market has become more competitive.

Under the leadership of CIRC, the regulation of the compulsory reinsurance cession ratio changed when China joined the WTO in 2001. In particular, reinsurance requirements gradually phased out the 20 percent compulsory reinsurance ceded ratio within four years after China's entry to the WTO. Thus, the compulsory reinsurance cession ratio was reduced by 5 percent annually from 2003 to 2006[2]. In 2006, the 20

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[1] In 2011, there are 3 domestic reinsurance companies and 5 foreign reinsurance companies in China.
[2] The compulsory reinsurance cession ratio is 15%, 10%, 5% and 0% in 2003, 2004, 2005, and 2006, respectively.

percent compulsory reinsurance cession ratio was eliminated entirely.

In November 2007, CIRC issued a notification that required primary insurers to review their reinsurance plans annually.   In the selection of reinsurance companies, several criteria need to be met, including credit rating, solvency levels and registered capital.   For example, reinsurance treaty leaders should either be state-owned enterprises or have credit ratings not lower than A- by S&P, A.M. Best, or Fitch or A3 by Moody's (Huang and Tian, 2010).   In addition, according to the Regulations on the Administration of Reinsurance Business by CIRC (2005), insurers have to follow the solvency regulation on foreign reinsurers and the priority of reinsurance arrangement in the domestic insurance market.   The priority of reinsurance arrangements in the domestic insurance market was cancelled by the revised regulation in 2010.   Previous provisions on the Administration of Reinsurance Business, which were deliberated and adopted at the executive meeting of CIRC on April 12, 2010, were promulgated and enforced on July 1, 2010.

3.   Hypothesis Development

This section develops three hypotheses on the effect of ownership structure on reinsurance demand.

Ownership structure and compulsory reinsurance versus volunteer reinsurance

Regulators in China place several restrictions on operations of insurers to protect the domestic insurance industry.   For example, CIRC Regulations on the Administration of Reinsurance Business specifies the compulsory (statutory) reinsurance ceded ratio to be ceded by domestic insurers (that is, China Reinsurance company).   Although compulsory reinsurance may be a harmful arrangement for reinsurance businesses in China's rapidly developing insurance market, insurers have to cede compulsory reinsurance and to pay compulsory reinsurance cost based on

China's regulation. Therefore, compulsory reinsurance restrictions on reinsurance decision may not be significantly different. I infer that there is no relation between ownership structure and compulsory reinsurance decision. Conversely, volunteer reinsurance provides more choices for ceding with others insurers depending on reinsurance pricing, services quality and professional knowhow than compulsory reinsurance.

Skipper (1997) suggests that liberalized insurance markets increase the efficiency of allocation of a country's resources and that foreign insurers introduce sophisticated loss mitigation services to domestic insurance markets. Foreign insurers also provide superior loss prevention and mitigation services to their policyholders. Sun (2003) argued that Chinese domestic insurance companies' operating systems, financial strength, management, technology and expertise are not comparable to foreign insurance companies'. Foreign insurers have valuable advantages in terms of financial strength, technology and management experience. In sum, I infer that foreign insurers purchase more volunteer reinsurance than domestic insures, and thus propose the following hypothesis.

Hypothesis 1a: There is no relation between ownership structure and compulsory reinsurance decision.
Hypothesis 1b: Foreign insurers purchase more volunteer reinsurance than domestic insurers.

Ownership structure and facultative reinsurance versus treaty reinsurance

Reinsurance arrangements are of two basic types: treaty reinsurance and facultative reinsurance[3]. An insurer is contractually bound to cede, and the reinsurer is bound to assume a specified portion of the insured risks by the primary insurer

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[3] According to Article 2 in Regulations on Administration of Reinsurance Business by CIRC, the definition of Treaty reinsurance is an insurer signs a contract in advance with other insurance company and agrees to cover reinsurance for the insurance business it is undertaking in a certain period through other insurance company. Facultative reinsurance is an insurance company established under the approval of China insurance company that it shall cover reinsurance through the latter for the insurance business it is undertaking.

according to their reinsurance contract in the treaty reinsurance. Treaty reinsurance is a normal preparatory reinsurance arrangement that depends on the prior reinsurance contract regardless of the ownership structure (i.e. foreign or domestic). Therefore, there is no relation between ownership structure and treaty reinsurance.

Facultative reinsurance requires negotiation for each insurance contract that is reinsured. In facultative reinsurance, an insurer cedes and a reinsurer assumes all or part of the risk assumed by a specific reinsurance arrangement policy. In contrast to treaty reinsurance, facultative reinsurance focuses on unusual risks, and insurers purchase reinsurance for individual risks when the treaty reinsurance contract is not covered. Foreign insurers have international insurance knowledge, complete professional insurance services, underwriting and claim experiences or capacity for negotiating reinsurance cessions when ceding facultative reinsurance compared with domestic insurers. Foreign insurers purchase a higher percentage of facultative reinsurance than domestic insurers on the basis of the discussion above. Thus, the following hypothesis is offered.

Hypothesis 2a: There is no relation between ownership structure and treaty reinsurance decision.
Hypothesis 2b: Foreign insurers purchase a higher percentage of facultative reinsurance than domestic insurers.

Effect of changes in regulation

Before 2006, the reinsurance market in China had a high concentration of domestic insurers that these firms did not have proper incentives to enhance their reinsurance function. For instance, China Reinsurance enjoys 20% compulsory cession. With the annual decrease in compulsory reinsurance ratio by 5%, the reinsurance market gradually changed, implying that insurers gained more freedom to choose other insurers based on the firm's insured risk and financial situation. After 2006, China still protected domestic insurance companies more than it did foreign

insurance companies.   Several regulations, constraints, and better regulatory environment in favor of domestic insurers may have resulted in the changes in the purchasing reinsurance behaviors of insurers since 2004.   Thus, insurance companies possibly had different demands for reinsurance when the compulsory reinsurance ratio was entirely eliminated by 2006.   This observation leads to the following hypothesis:

Hypothesis 3: Insurance companies have changed their reinsurance demand after the ceded compulsory reinsurance ratio was entirely eliminated by 2006.

4.   Data and Methodology

This section discusses the data and methodology used in this study.

Data

Our sample consists of 51 Chinese property causality insurance companies and 275 firm-years from 2004 to 2011, although the panel is unbalanced because not every firm exists for the entire sample period.   In this study, reinsurers are excluded from the sample to well capture the reinsurance demand, similar to the methodology used by Garven and Lamm-Tennant (2003) and Cole and McCullough (2006).   The reinsurance ratio is calculated as the reinsurance ceded divided by the sum of the direct premiums written and reinsurance assumed.   For the reinsurance ratio, analyzing the effect of compulsory reinsurance and volunteer reinsurance, as well as treaty reinsurance and facultative reinsurance, on the reinsurance demand has no clear significance.   Therefore, compulsory reinsurance ratio, volunteer reinsurance ratio, treaty reinsurance ratio and facultative reinsurance ratio are computed separately. The data for the calculation of reinsurance ratio, as well as the ownership type and the firms' characteristics, are obtained from CIRC.   The effect of the change in regulation when the compulsory reinsurance ratio was entirely eliminated by 2006 is compared with that in 2004.   Three regressions were performed to analyze a particular year

under three subsamples: 2004, 2005 (prior to its implementation), and 2006-2011 (following its implementation in 2006). Further, the effect of the reinsurance demand on facultative reinsurance versus treaty reinsurance is examined, although ceded reinsurance only since 2008 is described. Thus, the subsample from 2008 to 2011 is used to investigate the effects mentioned above.

Methodology

First, a regression model is employed for all samples to investigate the effect of ownership structure on demand for compulsory reinsurance and voluntary reinsurance. To discuss the impact of ownership structure on the reinsurance demand from treaty or facultative reinsurance in future detail, subsample data from 2008 to 2011 is employed. Subsequently, Hausman tests are used to determine whether fixed effect models or random effect models should be used, given that the sample is in the form of an unbalanced panel data. The results of the Hausman Test suggest that random effects should be used for all analyses. More important, reinsurance decisions can be determined by the regulations that eliminated compulsory reinsurance in 2006. Then, Chow test is used to examine the effect on the three subsamples (i.e., 2004, 2005, and 2006-2011) when the 20 percent compulsory reinsurance ratio was gradually phased out.

Reinsurance demand analysis across ownership structure

Regression is used to examine whether ownership structure and reinsurance demand are related when the characteristics of firms are controlled for. The empirical model and variable descriptions are provided below.

Reinsurance Demand Model

$$\mathrm{Re}\,ins\_ratio_{it} = \alpha_0 + \alpha_1 Ownership_{it} + \alpha_2 Risk_{it} + \alpha_3 Bus\_leverage_{it} + \alpha_4 Fin\_leverage_{it}$$
$$\alpha_5 Ln(na)_{it} + \alpha_6 Tax\_ex_{it} + \alpha_7 ROA_{it} + \alpha_8 Herfindahl_{it} + \alpha_9 Long - tail_{it} + u_{it}$$

$$\mathrm{Re}ins\_com\_ratio_{it} = \alpha_0 + \alpha_1 Ownership_{it} + \alpha_2 Risk_{it} + \alpha_3 Bus\_leverage_{it} + \alpha_4 Fin\_leverage_{it}$$
$$\alpha_5 Ln(na)_{it} + \alpha_6 Tax\_ex_{it} + \alpha_7 ROA_{it} + \alpha_8 Herfindahl_{it} + \alpha_9 Long - tail_{it} + u_{it}$$

$$\mathrm{Re}ins\_vol\_ratio_{it} = \alpha_0 + \alpha_1 Ownership_{it} + \alpha_2 Risk_{it} + \alpha_3 Bus\_leverage_{it} + \alpha_4 Fin\_leverage_{it}$$
$$\alpha_5 Ln(na)_{it} + \alpha_6 Tax\_ex_{it} + \alpha_7 ROA_{it} + \alpha_8 Herfindahl_{it} + \alpha_9 Long - tail_{it} + u_{it}$$

$$\mathrm{Re}ins\_tre\_ratio_{it} = \alpha_0 + \alpha_1 Ownership_{it} + \alpha_2 Risk_{it} + \alpha_3 Bus\_leverage_{it} + \alpha_4 Fin\_leverage_{it}$$
$$\alpha_5 Ln(na)_{it} + \alpha_6 Tax\_ex_{it} + \alpha_7 ROA_{it} + \alpha_8 Herfindahl_{it} + \alpha_9 Long - tail_{it} + u_{it}$$

$$\mathrm{Re}ins\_fac\_ratio_{it} = \alpha_0 + \alpha_1 Ownership_{it} + \alpha_2 Risk_{it} + \alpha_3 Bus\_leverage_{it} + \alpha_4 Fin\_leverage_{it}$$
$$\alpha_5 Ln(na)_{it} + \alpha_6 Tax\_ex_{it} + \alpha_7 ROA_{it} + \alpha_8 Herfindahl_{it} + \alpha_9 Long - tail_{it} + u_{it}$$

$$Per\_fac\_ins\_ratio_{it} = \alpha_0 + \alpha_1 Ownership_{it} + \alpha_2 Risk_{it} + \alpha_3 Bus\_leverage_{it} + \alpha_4 Fin\_leverage_{it}$$
$$\alpha_5 Ln(na)_{it} + \alpha_6 Tax\_ex_{it} + \alpha_7 ROA_{it} + \alpha_8 Herfindahl_{it} + \alpha_9 Long - tail_{it} + u_{it}$$

Dependent variables

$Reins\_ratio_{it}$ (total reinsurance ratio) is measured as the ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed (Mayers and Smith, 1990; Garven and Lamm-Tennant, 2003; Cole and McCullough, 2006,; Wang et al., 2008).[4] Demand for reinsurance from compulsory reinsurance and voluntary reinsurance variables are separately discussed. *Reins_com_ratio_{it}* (Reinsurance from compulsory reinsurance ceded) is measured as compulsory reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. *Reins_vol_ratio_{it}* (Reinsurance from volunteer reinsurance ceded) is measured as non-compulsory reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed.

Chinese insurance companies provide disclosure of the reinsurance ceded types,

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[4] Cummins et al. (2008) suggests that reinsurance ratio is defined as the premiums ceded to non-affiliated reinsurers. In addition, an alternative measure of reinsurance is share of written premiums ceded to non-affiliated reinsurers.

namely, treaty reinsurance ceded and facultative reinsurance ceded, which are obtained from CIRC data from 2008. *Reins_tre_ratio*$_{it}$ (Reinsurance from treaty reinsurance ratio) is measured as treaty reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. *Reins_fac_ratio*$_{it}$ (Reinsurance from facultative reinsurance ratio) is measured as facultative reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. *Per_fac_reins_ratio*$_{it}$ is percentage of facultative reinsurance ratio divided by the sum of facultative reinsurance ratio plus treaty reinsurance ratio.

Independent Variables

I classified independent variables into two categories: independent variables of interest and firms' characteristics variables. Independent variables of interest are further categorized into ownership structure variable, risk variable and leverage variables. *Ownership*$_{it}$ (Ownership structure) is the ownership type which is a binary variable that equals 1 if the firm is a foreign insurer, equals 0 otherwise (e.g., Wu et al., 2010; Zhao and Wu, 2010). *Risk*$_{it}$, the proxy of risk is loss ratio. The loss ratio is defined as the ratio of loss incurred divided by premiums earned (Zhao and Wu, 2010). There are two types of leverage ratio are discussed: business leverage and financial leverage, respectively. *Business_Leverage*$_{it}$ (Business leverage) is defined as the ratio of premium divided by surplus (Hoerger et al., 1990; Garven and Lanm-Ternnant, 2003; Zhao and Wu, 2010; Shiu, 2011). *Financial_Leverage*$_{it}$ (Financial leverage) is defined as the ratio of liability divided by assets (Garven and Lanm-Ternnant, 2003; Zhao and Wu, 2010).

Firms' characteristics variables

Previous studies have documented a series of factors affecting reinsurance demand such as firm size, line of business concentration, tax effects (e.g., Mayers and

Smith, 1990; Garven and Lamm-Tennant, 2003; Cole and McCullough, 2006; Cole et al. 2007; Cummins et al., 2008; Wang et al., 2008; Zhao and Wu, 2010; Garven and Grace, 2011). My regressions of reinsurance demand include these variables. I define the firms' characteristics variables as follows: $Ln(na)_{it}$ is proxy for firm size which is the natural logarithm of assets. Tax_ex_{it} is measured as the ratio of tax to total premium income (Zhao and Wu, 2010); ROA_{it} is return on assets. $Herfindahl_{it}$ is line of business concentration as measured by the Herfindahl index $= \sum (PW_i / TPW)^2$, where PW_i is the value of written premiums in line i and TPW is the insurer's total written premiums (Mayers and Smith, 1990; Garven and Lamm-Tennant, 2003 ; Zhao and Wu, 2010; Garven and Grace, 2011); $Long-tail_{it}$ (the percentage of line of long-tail business) is the percentage of premiums written in both enterprise property insurance lines and liability insurance lines to total premiums income. Finally, u_{it} is an error term.

5. Summary Statistics and Empirical Results

This section first discusses summary statistics and then provides empirical results.

5.1 Summary statistics

This section summarizes the statistics, including the means, standard deviations, and minimum and maximum values of all variables. The sample consists of 51 property casualty insurers from 2004 to 2011, although the panel is unbalanced because not every firm exists for the entire sample period. The mean reinsurance ratio is 27.3%, 2.5% of which comes from compulsory reinsurance and 24.7% from volunteer reinsurance. Because reinsurance demand from facultative reinsurance or treaty reinsurance was recorded in individual insurer's financial statements starting in

2008, the observations (N = 157) of facultative reinsurance ratio and treaty reinsurance ratio are less than all sample (N = 275). The average of treaty reinsurance ratio and facultative reinsurance ratio are 17.4% and 5.9%, respectively. The mean percentage of the facultative reinsurance ratio divided by the sum of the treaty reinsurance ratio plus facultative reinsurance ratio is 20%. Overall, most means of the variables in Table 2 are similar to those in previous studies (Zhao and Wu, 2010; Wu et al., 2010).

[Insert Table 2 here]

Table 3 presents the Pearson correlation coefficients among all variables. Variance-Inflation Factors (VIFs) (Neter et al., 1985) are used to diagnose whether there is multicollinearity between variables. The VIFs of all variables in the regressions are lower than 3. Hence, the later regression results of independent variables are not likely to be inversely affected by the presence of multicollinearity. Table 3 shows that the ownership structure ($ownership_{it}$) is negatively related to firm size ($ln(na)_{it}$) (-0.618, significant at less than one percent level), but firm size ($ln(na)_{it}$) is positively related to financial leverage ($Fin\_leverage_{it}$)(0.674, significant at less than one percent level).

[Insert Table 3 here]

5.2 Regression Analysis and Discussions

Table 4 presents the regression results of reinsurance demand from reinsurance ratio, compulsory reinsurance ratio and volunteer reinsurance ratio when the variables of the characteristics of firms are controlled for. The dependent variables are the total reinsurance ratio, compulsory reinsurance ratio and volunteer reinsurance ratio, respectively. The study focuses on compulsory reinsurance and volunteer reinsurance. Ownership structure is positively and significantly related to reinsurance demand,

although this variable is not significantly related to demand from compulsory reinsurance.   In particular, foreign insurers purchase more volunteer reinsurance than domestic insurers.   The possible reason is that all insurers are required to cede compulsory reinsurance by government regulations; thus, there is no relation between ownership structure and compulsory reinsurance.   However, foreign insurers possess more expertise and international experience and thus purchase more volunteer reinsurance than domestic insurers.   This result is consistent with Hypotheses 1a and 1b.

Property casualty insurance companies with a higher ROA ratio are associated with high reinsurance demand whether they opt for compulsory reinsurance or volunteer reinsurance.   Moreover, a large insurance company is associated with low demand for reinsurance, implying that larger insurers purchase less reinsurance. These results are consistent with the findings of Zhao and Wu (2010), who find that ROA is positively related to reinsurance demand, whereas firm size is negatively related to reinsurance demand.   The tax shield is negatively related to reinsurance demand, implying that tax shield benefits reduce reinsurance cost.   Risk (whose proxy of risk is loss ratio), business leverage, financial leverage and the percentage of a long-tail business line are not significantly related to reinsurance demand.

[Insert Table 4 here]

Table 5 shows the regression results of reinsurance demand from treaty reinsurance ratio, facultative reinsurance ratio and the percentage of facultative reinsurance ratio when controlling firms' characteristics variables from 2008 to 2011. Since 2008, information on treaty reinsurance ceded and facultative reinsurance ceded has been listed in individual insurance company's financial statement, as required by

CIRC. The evidence shows that ownership structure is not related to reinsurance demand whether treaty reinsurance or facultative reinsurance is selected. However, foreign insurers have a higher percentage of facultative reinsurance ratio in the sum of the treaty reinsurance ratio and facultative reinsurance ratio than domestic insurers after 2008 because of the following reasons.

First, the market share of foreign insurers in the Chinese insurance market is limited. Thus, the number of foreign insurers that sign any treaty reinsurance with other insurers may be lower than that of domestic insurers based on lacking of the previous long-term cooperation relation. Second, according to the Regulations on the Administration of Reinsurance Business[5], insurers shall prior issue an offer to insurers located in China when insurers ceded for treaty reinsurance or facultative reinsurance with other insurers before 2010[6]. Therefore, foreign insurers have a lower treaty reinsurance ratio than domestic insurers. Third, foreign insurers have extensive professional experience and excellent insurance capacity in the international arena to evaluate risk and to cede facultative reinsurance and thus purchase a higher percentage of facultative reinsurance than of treaty reinsurance. As mentioned above, foreign insurers have a higher percentage of facultative reinsurance ratios than domestic insurers. These results support the Hypotheses 2a and 2b.

Furthermore, business leverage (premium-to-surplus ratio) is negatively related to the treaty reinsurance ratio, because insurers with a high business leverage ratio have high underwriting risk from insured business lines. The reinsurance company

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[5] According to Article 11 in Regulations on Administration of Reinsurance Business by CIRC (2005), direct insurance companies that are in the business of treaty reinsurance and facultative reinsurance shall prior issue an offer to insurance companies located in China while in accordance with the following stipulations: 1.The offer shall be issued to at least two professional reinsurance companies located in China; 2.The total shares ceded from the offer shall not be lower than 50% of the ceded business.

[6] On 30 June 2010, CIRC issued revised Provisions on the Administration of Reinsurance Business (2010 Provisions) that replaced the earlier 2005 Provisions: Abrogating the requirement that primary insurers, when arranging treaty reinsurance and facultative reinsurance, should provide prior to insurers in China.

may not be able to agree with several special business lines under the regular treaty reinsurance contract based on the individual business line scenario. Thus, an insurer with high business leverage is associated with a lower treaty reinsurance ratio. A large insurance company is negatively related to facultative reinsurance, implying that large insurers purchase less facultative reinsurance. Finally, the tax shield is negatively related to reinsurance demand, implying that the tax shield benefits reduce reinsurance cost. These results are similar Table 4.

[Insert Table 5 here]

Table 6 presents the results of reinsurance demand for reinsurance ratio in 2004 and from 2006 to 2011. The effect of the change in regulations on reinsurance demand in the two subsamples is investigated. Models A and B show the results for the different subsamples: for the 2004 sample, with 10% compulsory reinsurance ratio, and for the 2006–2011 sample without compulsory reinsurance ratio. OLS regression is used in Model A, because this model includes data for only one year (2004). Separate regressions were performed to investigate reinsurance demand in the 2004 sample and the 2006-2011 sample. Using without compulsory reinsurance data after 2006 is to examine whether the implementation of the changes in regulations are efficient compared with that in the 10% ceded compulsory reinsurance period in 2004. All coefficients for each variable from were obtained from the regression result on reinsurance ratio after 2006. Subsequently, the actual data for each variable in 2004 were calculated by using all coefficients of prior regression result in 2006, yielding the prediction for the *Reins ratio$_{i,2004}$*. The predict *Reins ratio$_{i,2004}$* (0.258)[7] is less than

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[7] *The Predict Reins ratio$_{i,2004}$=0.328+(0.181)Ownership $_{i,2006-2011}$+(0.006)Risk $_{i,2006-2011}$+ (-0.002)Bus_Leverage $_{i,2006-2011}$+(-0.01)Fin_Leverage $_{i,2006-2011}$+(-0.019)Ln(na) $_{i,2006-2011}$+(-0.215)Tax_ex $_{i,i,2006-2011}$+(0.294)ROA $_{i,2006-2011}$+(0.011)Herfindahl$_{i,2006-2011}$+(-0.016)Long-tail $_{i,2006-2011}$*

the actual reinsurance ratio (0.326).   This result shows that insurers enabled compulsory reinsurance decision to be managed more inefficiently in 2004 than after 2006, when the regulation has changed.   China's compulsory reinsurance ceded regulation is inefficiently implemented, resulting in the purchase of more reinsurance and increasing reinsurance cost compared with the period without compulsory reinsurance.

[Insert Table 6 here]

Table 7 presents the result of the reinsurance demand for reinsurance ratio, compulsory reinsurance and volunteer reinsurance in 2004 (when insurers had 10 percent compulsory reinsurance) and from 2006 to 2011(when insurers had no compulsory reinsurance).   Chow test is used to investigate the effect of the change in structure (i.e. the change in regulation) on the reinsurance demand during the three regressions after 2006.   Consequently, reinsurance demand is significantly changed between 2004 and the period from 2006 to 2011($F = 1.720$, significant at less than five percent level).   Likewise, compulsory reinsurance ratio has also changed significantly from 2004 to 2006-2011 ($F = 6.630$ significant at less than one percent level).   This result implies that the changes in China's regulation in 2006 have significantly affected the reinsurance demand; in particular, the changes have affected compulsory reinsurance.   The results of the comparison between 2005 and 2006-2011[8] and between the 2004 and 2005[9] samples have been examined (not tabulated).   In sum, insurers with a 10 percent compulsory reinsurance ratio in 2004 (with 5 percent compulsory reinsurance ratio in 2005) have significantly different reinsurance

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[8] $F = 4.880$ significant at less than one percent level for compulsory reinsurance and others are not significantly.
[9] $F = 2.29$ significant at less than five percent level for compulsory reinsurance and others are not significantly.

decisions from those of insurers without compulsory reinsurance after 2006. This result supports the Hypothesis 3.

[Insert Table 7 here]

6. Conclusion

The paper investigates the impact of ownership structure on reinsurance decisions in Chinese property casualty insurance industry. In the last 20 years, the Chinese insurance market has rapidly expanded. Chinese regulators have reduced restrictions on foreign insurers to encourage them to enter the Chinese market after China joined the WTO in 2001. Thus, domestic insurance industry has faced severe competition after foreign insurers joined China's insurance market. Therefore, the relation between ownership structure and reinsurance demand is an interesting issue. Specifically, this study focuses on the effect of these variables on reinsurance decisions in choosing between compulsory and volunteer reinsurance and between treaty reinsurance and facultative reinsurance. This paper sheds light on this issue in China's emerging insurance market.

The evidence shows that foreign insurers have higher reinsurance demand than domestic insurers. Specifically, foreign insurers purchase more volunteer reinsurance than domestic insurers. Likewise, foreign insurers are associated with a higher percentage of facultative reinsurance ratios than domestic insurers. A possible reason is that foreign insurers have extensive expertise, excellent reputation, international insurance knowledge, complete professional insurance services, underwriting and claim experiences or capacity for negotiating reinsurance cession than domestic insurers. Furthermore, the implementation of the compulsory reinsurance ratio in the Chinese reinsurance market was inefficient until 2006. Finally, the changes in the

regulation of compulsory reinsurance ratio influenced the reinsurance demand in 2006. For example, insurers in 2004 with a 10 percent compulsory reinsurance ratio had significantly different reinsurance demand from that of insurers without compulsory reinsurance after 2006. Overall, this study indicates that ownership structure and several firms' characteristics significantly affect the reinsurance decisions.

Reference

Adiel, R., 1996, Reinsurance and the Management of Regulatory Ratios and Taxes in the Property Casualty Insurance Industry, *Journal of Accounting and Economics,* 22(1-3): 207-240.

Cole, C. R. and K. A. McCullough, 2006, A Reexamination of the Corporate Demand for Reinsurance, *The Journal of Risk and Insurance,* 73(1): 169-192.

Cole, C. R., McCullough, K. A. and L. S. Powell, 2007, Regulation of Reinsurance Recoverables: protection or protectionism, Working paper. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=922057&rec=1&srcabs=664626

Cummins, J. D., Dionne, G., Gagne, R., and A. Nouira, 2008, The Costs and Benefits of Reinsurance, Working paper. http://portal.business.colostate.edu/projects/ARIA/Shared%20Documents/3e_Cummins_Costs%20and%20Benefits%20of%20Reinsurance2008.pdf

Garven, J. R., and J. Lamm-Tennant, 2003, The Demand for Reinsurance: Theory and Empirical Tests, *Insurance and Risk Management*, 71(2): 217-237.

Garven, J. R., and M. F. Grace, 2011, Adverse Selection in Reinsurance Markets, Working paper. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1911614

Hansmann, H, 1985, The Organization of Insurance Companies: Mutual versus Stock, *Journal of Law, Economics, and Organization,* 1: 125–153.

Ho, C. L., Lai, G. C. and J. P. Lee, 2013, Organizational Structure, Board Composition on Risk Taking in the U.S. Property Casualty Insurance Industry, *The Journal of Risk and Insurance*, 80(1):169-203.

Hoerger, T. J., Sloan, F. A. and M. Hassan, 1990, Loss Volatility, Bankruptcy, and the Demand for Reinsurance, *Journal of Risk and Uncertainty*, 3(3): 221-245.

Huang, X., and Tian, M., 2010, Reinsurance News, China Reinsurance Market Overview, SOA. http://www.google.com.tw/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CDAQFjAA&url=http%3A%2F%2Fwww.soa.org%2Flibrary%2Fnewsletters%2Freinsurance-section-news%2F2010%2Ffebruary%2Frsn-2010-iss67-huang.aspx&ei=WiwoUsKjBo2akAWy0YCQCw&usg=AFQjCNF9fYCAIAMf4o0tLZj67SkTyxIy3g&sig2=Xl3FBKiuwanhoPl4ovB6nA

Mayers, D., and C. W. Smith, 1981, Contractual Provisions, Organizational Structure, and Conflict Control in the Insurance Markets, *The Journal of Business*, 54 (3): 407-434.

Mayers, D., and C. W. Smith, 1990, On the Corporate Demand for Insurance: Evidence from the Reinsurance Market, *The Journal of Business*, 63(1): 19-40.

Powell, L. S. and D. W. Sommer, 2007, Internal versus External Capital Markets in the Insurance Industry: the Role of Reinsurance, *Journal of Financial Services Research,* 31(2-3): 173-189.

Skipper, H. D, Jr., 1997, Foreign Insurers in Emerging Markets: Issues and Concerns, International Insurance Foundation, *IIF Occasional Paper Number 1*. http://iifdc.org/pubs/skipper.pdf

Shiu, Y., 2011, Reinsurance and Capital Structure: Evidence from the United Kingdom Non-Life Insurance Industry, *Journal of Risk and Insurance*, 78: 475-494.

Sun, Q., 2003, The Impact of WTO Accession on China's Insurance Industry, *Risk Management and Insurance Review*, 6(1): 17-35.

Wang, J. L., Chang, V. Y., Lai, G. C. and L. Y. Tzang, 2008, Demutualization and Demand for Reinsurance, *The Geneva Papers on Risk and Insurance Issues and Practice*, 33(3): 566-584.

Wu, L. C., Shen, S. G. and L. Wang, 2010, Reinsurance Demand and its Determinants of the P.R. China's Property Casualty Insurance Industry—Evidence from Panel Data, *Collected Essays on Finance and Economics*, 3(151): 64-70.

Zhao, G. Q. and H. Wu, 2010, The Motives of Reinsurance Decision for the Chinese Property-Liability Insurance Companies—Empirical Analysis Based on Quantile Regression, *Collected Essays on Finance and Economics*, 5(153): 54-60.

Table 1 Top Ten Countries by P/C Direct Premiums Written in 2011

Rank	Nonlife Premiums	Country	P/C Insurance Penetration	P/C Insurance Density
1	$667,107	U.S.	4.44%	$2,126
2	$131,292	Germany	4.26%	$1,615
3	$130,741	Japan	2.98%	$1,026
4	$109,486	U.K.	4.87%	$1,737
5	$98,359	France	4.44%	$1,499
6	$87,319	China	0.77%	$65
7	$79,722	Netherlands	11.30%	$4,765
8	$69,045	Canada	4.97%	$2,013
9	$55,426	Italy	3.04%	$905
10	$51,223	South Korea	3.30%	$1,048

Resource: Casualty Actuarial Society (2012)

Table 2 Descriptive Statistics

Variables	N	Mean	STD	Min	Max
Reins ratio	275	0.273	0.240	0	0.971
Reins_com_ratio	275	0.025	0.093	0	0.807
Reins_vol_ratio	275	0.247	0.234	0	0.971
Reins_tre_ratio	157	0.174	0.070	0	0.837
Reins_fac_ratio	157	0.059	0.174	0	0.668
Per_fac_reins_ratio	157	0.200	0.450	0	1
Ownership	275	0.444	0.498	0	1
Risk	275	0.330	0.209	0	1.401
Bus_Leverage	275	2.894	6.598	0	66.075
Fin_Leverage	275	0.576	0.250	0.018	0.984
Ln(na)	275	7.321	1.375	4.477	11.388
Tax_ex	275	0.011	0.145	-1.517	1.722
ROA	275	-0.128	1.708	-28.322	0.136
Herfindahl	275	0.539	0.209	0.196	1
Long-tail	275	0.353	0.280	0	0.981

Notes: This table presents summary statistics for variables included in this study. Reins ratio is measured as ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_com_ratio is measured as compulsory reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_vol_ratio is measured as non-compulsory reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_tre_ratio is measured as treaty reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_fac_ratio is measured as facultative reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Per_fac_reins_ratio is percentage of facultative reinsurance ratio divided by the sum of treaty reinsurance ratio plus facultative reinsurance ratio. Ownership is the ownership structure variable, which is a binary variable: 1 = foreign insurers, 0 = otherwise. The proxy of risk measure variable is loss ratio. The loss ratio is defined as the ratio of loss incurred plus loss expenses incurred divided by premiums income. Bus_Leverage (business leverage) is measured as the premium income divided by surplus ratio. Fin_Leverage (Financial leverage) is liability to assets ratio. Ln(na) is the natural logarithm of net admitted assets. Tax_ex is defined as the ratio of tax divided by premiums. ROA is net income on admitted assets. Herfindahl is Herfindahl index = $\Sigma(PW_i/TPW)^2$, where PW_i is the value of premiums in line i, and TPW is the insurer's premiums income. Long-tail is percentage of premiums in long-tail lines (enterprise property casualty insurance and liability insurance) to total premiums income.

Table 3 Correlation Coefficients of Variables

Variables|	Ownership	Risk	Bus_ leverage	Fin_ Leverage	Ln(na)	Tax_ex	ROA	Her- findahl	Long -tail
Ownership	1								
Risk	-0.424	1							
	0.000								
Bus_leverage	-0.147	0.222	1						
	0.018	0.000							
Fin_Leverage	-0.482	0.494	0.263	1					
	0.000	0.000	0.000						
Ln(na)	-0.618	0.491	0.155	0.674	1				
	0.000	0.000	0.012	0.000					
Tax_ex	0.020	0.039	-0.014	-0.007	-0.055	1			
	0.745	0.535	0.828	0.909	0.374				
ROA	-0.106	0.224	-0.060	0.048	0.284	-0.075	1		
	0.089	0.000	0.337	0.446	0.000	0.228			
Herfindahl	-0.024	-0.004	-0.111	-0.003	0.092	0.018	0.141	1	
	0.699	0.951	0.075	0.957	0.140	0.775	0.023		
Long-tail	0.014	0.126	0.086	0.084	0.035	-0.041	-0.058	-0.493	1
	0.824	0.043	0.167	0.180	0.581	0.512	0.356	0.000	

Notes: This table presents correlation coefficients. Ownership is the ownership structure variable, which is a binary variable: 1 = foreign insurers, 0 = otherwise. The proxy of risk measure variable is loss ratio. The loss ratio is defined as the ratio of loss incurred plus loss expenses incurred divided by premiums income. Bus_Leverage (business leverage) is measured as the premium income divided by surplus ratio. Fin_Leverage (financial leverage) is liability to assets ratio. Ln(na) is the natural logarithm of net admitted assets. Tax_ex is defined as the ratio of tax divided by premiums. ROA is net income on admitted assets. Herfindahl is Herfindahl index = $\Sigma(PW_i/TPW)\ ^2$, where PW_i is the value of premiums in line i, and TPW is the insurer's premiums income. Long-tail is percentage of premiums in long-tail lines (enterprise property casualty insurance and liability insurance) to total premiums income.

Table 4 Regressions Results of Reinsurance Demand from Reinsurance Ratio, Compulsory Reinsurance Ratio and Volunteer Reinsurance Ratio from 2004 to 2011

Dependent variables	Reins ratio		Reins_com_ratio		Reins_vol_ratio	
Independent Variables	Estimate	P value	Estimate	P value	Estimate	P value
Ownership	0.113 **	0.041	0.004	0.800	0.144 ***	0.008
Risk	-0.015	0.748	-0.033	0.347	-0.038	0.520
Bus_Leverage	-0.002	0.324	0.000	0.947	-0.001	0.581
Fin_Leverage	-0.065	0.197	0.058	0.101	-0.074	0.243
Ln(na)	-0.038 ***	0.009	-0.012	0.117	-0.015	0.381
Tax_ex	-0.126 **	0.019	0.007	0.860	-0.142 **	0.036
ROA	0.383 ***	0.001	0.173 **	0.031	0.245 *	0.099
Herfindahl	0.046	0.393	0.024	0.481	0.023	0.731
Longtail	-0.018	0.576	-0.005	0.850	-0.006	0.892
Intercept	0.528 ***	0.000	0.079	0.142	0.339 ***	0.006
Hausman test	54.8		8.56		30.86	
R-Square	0.251		0.042		0.231	
N	275		275		275	

Notes: This table shows the regression results for reinsurance demand from reinsurance ratio, compulsory reinsurance ratio and volunteer reinsurance ratio on ownership structure and risk from 2004 to 2011. Dependent variables including Reins ratio, Reins_com_ratio and Reins_vol_ratio. Reins ratio is measured as ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_com_ratio is measured as compulsory reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_vol_ratio is measured as non-compulsory reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Independent variables include ownership structures, risk and firms' characteristics variables. Ownership is the ownership structure variable, which is a binary variable: 1 = foreign insurers, 0 = otherwise. The proxy of risk measure variable is loss ratio. The loss ratio is defined as the ratio of loss incurred plus loss expenses incurred divided by premiums income. Bus_Leverage (business leverage) is measured as the premium income divided by surplus ratio. Fin_Leverage (financial leverage) is liability to assets ratio. Ln(na) is the natural logarithm of net admitted assets. Tax_ex is defined as the ratio of tax divided by premiums. ROA is net income on admitted assets. Herfindahl is Herfindahl index = $\Sigma(PW_i/TPW)^2$, where PW_i is the value of premiums in line i, and TPW is the insurer's premiums income. Long-tail is percentage of premiums in long-tail lines (enterprise property casualty insurance and liability insurance) to total premiums income. All models are random effect models. ***significant at 1%, ** significant at 5%, * significant at 10%

Table 5 Regressions Results of Reinsurance Demand from Treaty Reinsurance Ratio, Facultative Reinsurance Ratio and Percentage of Facultative Reinsurance Ratio from 2008 to 2011

Dependent variables	Reins_tre_ratio		Reins_fac_ratio		Per_fac_reins_ratio	
Independent Variables	Estimate	P value	Estimate	P value	Estimate	P value
Ownership	0.072	0.174	0.056	0.112	0.159 **	0.026
Risk	-0.054	0.260	0.010	0.741	-0.085	0.456
Bus_Leverage	-0.003 **	0.016	0.000	0.695	0.002	0.513
Fin_Leverage	0.050	0.404	-0.017	0.663	0.004	0.977
Ln(na)	-0.022	0.253	-0.025 **	0.042	0.023	0.472
Tax_ex	-0.218 ***	0.000	-0.026	0.462	-0.003	0.985
ROA	0.127	0.329	0.039	0.641	-0.129	0.652
Herfindahl	0.074	0.190	-0.024	0.510	0.021	0.860
Long-tail	0.049	0.184	0.005	0.846	0.010	0.899
Intercept	0.252 *	0.081	0.243 ***	0.010	0.713 ***	0.003
Hausman test	33.740		19.540		13.240	
R-Square	0.115		0.225		0.170	
N	157		157		157	

Notes: This table shows the regression results for reinsurance demand from reinsurance ratio, compulsory reinsurance ratio and volunteer reinsurance ratio on ownership structure and risk from 2004 to 2011. Dependent variables including Reins_fac_ratio, Reins_tre_ratio and Per_fac_reins_ratio. Reins_tre_ratio is measured as treaty reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_fac_ratio is measured as facultative reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Per_fac_reins_ratio is percentage of facultative reinsurance ratio divided by the sum of treaty reinsurance ratio plus facultative reinsurance ratio. Independent variables include ownership structures, risk and firms' characteristics variables. Ownership is the ownership structure variable, which is a binary variable: 1 = foreign insurers, 0 = otherwise. The proxy of risk measure variable is loss ratio. The loss ratio is defined as the ratio of loss incurred plus loss expenses incurred divided by premiums income. Bus_Leverage (business leverage) is measured as the premium income divided by surplus ratio. Fin_Leverage (financial leverage) is 1 minus surplus-to-assets ratio. Ln(na) is the natural logarithm of net admitted assets. Tax_ex is defined as the ratio of tax divided by premiums. ROA is net income on admitted assets. Herfindahl is Herfindahl index = $\Sigma(PW_i/TPW)^2$, where PW_i is the value of premiums in line i, and TPW is the insurer's premiums income. Long-tail is percentage of premiums in long-tail lines (enterprise property casualty insurance and liability insurance) to total premiums income. All models are random effect models. ***significant at 1%, ** significant at 5%, * significant at 10%

Table 6 Results of Reinsurance Demand for Reinsurance Ratio in 2004 and over period from 2006 to 2011

Model	Model A		Model	Model B	
Dependent variables: Reins ratio	2004 Sample		Dependent variables: Reins ratio	2006-2011 Sample	
Independent Variables	Estimate	P value	Independent Variables	Estimate	P value
Ownership	-0.196	0.406	Ownership	0.181 ***	0.001
Risk	-0.227	0.580	Risk	0.006	0.897
Bus_Leverage	-0.009	0.680	Bus_Leverage	-0.002	0.117
Fin_Leverage	-0.701 *	0.098	Fin_Leverage	-0.01	0.862
Ln(na)	-0.012	0.857	Ln(na)	-0.019	0.281
Tax_ex	-1.475	0.710	Tax_ex	-0.215 ***	0.002
ROA	1.772	0.398	ROA	0.294 **	0.019
Herfindahl	-0.044	0.889	Herfindahl	0.011	0.844
Long-tail	0.234	0.479	Long-tail	-0.016	0.635
Intercept	0.987 *	0.093	Intercept	0.328 **	0.013
			Hausman test	54.8	
R-Square	0.147		R-Square	0.025	
N	22		N	259	

This table shows the regression results for reinsurance demand from reinsurance ratio on ownership structure and risk in two subsamples: 2004 sample in Model A and from 2006 to 2011 sample in Model B. Dependent variables is Reins ratio. Reins raito is measured as ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Independent variables include ownership structures, risk and firms' characteristics variables. Ownership is the ownership structure variable, which is a binary variable: 1 = foreign insurers, 0 = otherwise. The proxy of risk measure variable is loss ratio. The loss ratio is defined as the ratio of loss incurred plus loss expenses incurred divided by premiums income. Bus_Leverage (business leverage) is measured as the premium income divided by surplus ratio. Fin_Leverage (financial leverage) is 1 minus surplus-to-assets ratio. Ln(na) is the natural logarithm of net admitted assets. Tax_ex is defined as the ratio of tax divided by premiums. ROA is net income on admitted assets. Herfindahl is Herfindahl index $= \Sigma(PW_i/TPW)^2$, where PW_i is the value of premiums in line i, and TPW is the insurer's premiums income. Long-tail is percentage of premiums in long-tail lines (enterprise property casualty insurance and liability insurance) to total premiums income. Model A uses OLS model, because the model includes data for only one year (2004). Model B is a random effect models. ***significant at 1%, ** significant at 5%, * significant at 10%

Table 7 Chow Test Results of Reinsurance Demand from Reinsurance Ratio, Compulsory Reinsurance Ceded and Volunteer Reinsurance Ceded in 2004 and from 2006 to 2011

Dependent variables	Reins_ratio		Reins_com_ratio		Reins_vol_ratio	
Independent Variables	Estimate	P value	Estimate	P value	Estimate	P value
Group 2004	1.097 **	0.024	0.057	0.456	0.919 **	0.048
Ownership 2004	-0.197	0.337	0.007	0.836	-0.125	0.524
Risk 2004	-0.185	0.607	0.007	0.903	-0.285	0.409
Bus_Leverage 2004	-0.013	0.502	-0.003	0.282	-0.009	0.649
Fin_Leverage 2004	-0.666 **	0.057	0.011	0.845	-0.666	0.047
Ln(na) 2004	-0.024	0.691	-0.002	0.871	-0.006	0.914
Tax_ex 2004	-2.571	0.463	0.390	0.484	-1.933	0.564
ROA 2004	2.142	0.239	-0.175	0.545	1.513	0.385
Herfindahl 2004	-0.122	0.660	0.017	0.705	-0.185	0.485
Long-tail 2004	0.298	0.303	0.041	0.371	0.179	0.517
Group 2006-2011	0.404 ***	0.004	0.014	0.530	0.366 ***	0.007
Ownership 2006-2011	0.152 ***	0.000	-0.002	0.699	0.154 ***	0.000
Risk 2006-2011	-0.148 *	0.099	-0.007	0.644	-0.138	0.106
Bus_Leverage 2006-2011	0.002	0.485	0.000	0.865	0.002	0.447
Fin_Leverage 2006-2011	0.228 **	0.015	0.004	0.778	0.216 **	0.016
Ln(na) 2006-2011	-0.050 ***	0.009	-0.003	0.367	-0.045 **	0.014
Tax_ex 2006-2011	-0.161	0.260	-0.004	0.863	-0.164	0.229
ROA 2006-2011	0.595 ***	0.004	0.013	0.695	0.593 ***	0.003
Herfindahl 2006-2011	0.092	0.286	0.021	0.126	0.089	0.283
Long-tail 2006-2011	0.031	0.624	0.001	0.959	0.038	0.532

(1) Ownership 2004 - Ownership 2006-2011 = 0

(2) Risk 2004 -Rsik 2006-2011 = 0

(3) Bus_Leverage 2004 - Bus_Leverage 2006-2011 = 0

(4) Fin_Leverage 2004 - Fin_Leverage 2006-2011 = 0

(5)Ln(na) 2004 - Ln(na) 2006-2011 = 0

(6) Tax_ex 2004 - Tax_ex 2006-2011 = 0

(7) ROA 2004 - ROA 2006-2011 = 0

(8) Herfindahl 2004 -Herfindahl 2006-2011 = 0

(9) Long-tail 2004 - Long-tail 2006-2011 = 0

(10) Group 2004 - Group 2006-2011 = 0

$F_{(10, 239)}$ =	1.720 *		6.630 ***		1.950	
Prob > F =	0.076		0.000		0.164	
N	244		244		244	

Notes: This table shows the chow test results for reinsurance demand from reinsurance ratio, compulsory reinsurance ratio and volunteer reinsurance ratio for two group samples. There are two group samples include 2004 sample and 2006-2011 sample. Dependent variables including Reins ratio, Reins_com_ratio and Reins_vol_ratio. Reins ratio is measured as ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_com_ratio is measured as compulsory reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Reins_vol_ratio is measured as non-compulsory reinsurance ceded divided by the

sum of direct premiums written plus reinsurance assumed. Independent variables include ownership structures, risk and firms' characteristics variables. Ownership is the ownership structure variable, which is a binary variable: 1 = foreign insurers, 0 = otherwise. The proxy of risk measure variable is loss ratio. The loss ratio is defined as the ratio of loss incurred plus loss expenses incurred divided by premiums income. Bus_Leverage (business leverage) is measured as the premium income divided by surplus ratio. Fin_Leverage (financial leverage) is liability to assets ratio. Ln(na) is the natural logarithm of net admitted assets. Tax_ex is defined as the ratio of tax divided by premiums. ROA is net income on admitted assets. Herfindahl is Herfindahl index = $\Sigma(PW_i/TPW)$ ^2, where PW_i is the value of premiums in line i, and TPW is the insurer's premiums income. Long-tail is percentage of premiums in long-tail lines (enterprise property casualty insurance and liability insurance) to total premiums income. ***significant at 1%, ** significant at 5%, * significant at 10%