FACTORS INFLUENCING DEMAND FOR REINSURANCE

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Abstract

Specificity of insurance companies' business model with inversion of business process in which they base insurance pricing on assumed losses and not on the real ones, exposes this financial institutions to underwriting or actuarial risk.

The most important method of underwriting risk management is reinsurance which provides insurance companies with stabilization of loss experience, increase of underwriting capacity, protection of catastrophic losses and technical assistance in the underwriting activities. This paper investigates the factors that influence insurance companies' demand for reinsurance. Both insurers-specific and the reinsurance industry-specific factors are analysed. The empirical analysis is based on panel data consisting of all insurance companies in Croatian insurance market in the period from 2003 to 2011. The results show that demand for reinsurance is determined by product diversification, profitability, loss volatility as well as by price of reinsurance and the financial strength of reinsurance industry.

Key words: demand, reinsurance, insurers' specific factors, reinsurance industry characteristics

JEL Code: G22, G32, D00

Introduction

Besides the risks that insurance companies share with other financial institutions, such as financial risk, operational and strategic risk, the insurers are exposed to specific risk which is related to their underwriting activities. This risk encompasses the variation of actual losses from those assumed in time of insurance pricing. Additionally, some of the risks that insurers underwrite are too large for them to retain. In order to reduce loss exposures, insurance companies transfer part of the risks to other risk underwriters. The most important way they manage the risk is by transferring it to reinsurers. This enables insurance companies to stabilize loss experience and increase their underwriting capacity, and it provides them with protection of catastrophic losses and technical assistance in the underwriting activities.

According to reinsurance agreements the reinsurer does not assume all of the loss exposure of the insurance company but the company retains part of the risk. In that sense, it is important to investigate the factors that determine the company's decision regarding the size of the risk retention and the amount of the risk that would be transferred to third parties. In other words, it is important to determine the factors that influence demand for reinsurance. Existing theoretical considerations and empirical examinations of reinsurance demand dominantly highlight insurers-specific characteristics as those most important for insurance companies' decision to rely on reinsurance. Part of the studies encompasses reinsurance industry level factors, as well, but they are carried out in developed economies (Cole & McCullough, 2006, Lei & Schmit, 2010). Thus, the main aim of this paper is to analyse both insurers-specific factors as well as factors at reinsurance industry level that determine Croatian insurers' demand for reinsurance. The analysis is based on the panel dataset consisting of all insurance companies that were active in the Croatian insurance market in the period from 2003 to 2011. Generalized Method of Moments (GMM) estimator for dynamic panel models is applied. Besides contribution to the literature of reinsurance demand in the context of undeveloped insurance market, the paper could make contribution to insurance companies' decision makers in the field of actuarial risk management.

The paper is structured as follows. The first section gives theoretical considerations and variables. It is followed by description of data and the methodology. The third section discusses the empirical results. The fourth section concludes.

1 Theoretical considerations and variables

Prior studies find that firm specific characteristics such as degree of product diversification, size, ROE and loss volatility[1] were proven to be important in explaining the variation in the use of reinsurance among insurers. Cole and McCullough (2006) hypothesize that an insurer that is less concentrated in terms of business mix or having greater **product diversification** is expected to reinsure more. More specifically, reinsurers provide real services to the ceding companies such as claims handling and pricing. Consequently, if insurers issue policies in multiple lines of business, they may have a higher incentive to purchase more reinsurance

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[1] These variables were included in the model according to the relevant literature and taking into account Croatian legislative framework currently in force (Insurance Act, Official Gazette No 151/05, 87/08, 82/09, 54/13 and Ordinance on the methodology for the calculation of insurance companies'/reinsurance companies retention levels in tables of maximum coverage and on the calculation of maximum probable loss, Official Gazette 100/09).

because the more reinsurance they purchase, the more services the reinsurers provide (Wang, Chang, Lai, & Tzeng, 2008). In some cases, reinsurers have a comparative advantage over insurers due to specialized knowledge and/or economies of scale whereas the extent of this comparative advantage is thought to be linked to the line of business concentration of the insurer. If an insurer is less concentrated in terms of business mix it is likely to benefit from the expertise and real services of the reinsurer. Cole and McCullough (2006) study, supporting real services hypothesis, suggests that the more focused the insurer is relative to line-of-business, the less reinsurance it will demand. Similarly, Adams (1996) finds that multiproduct entities reinsure more than firms operating in a narrow range of specialised product lines although the author expected that the incidence of reinsurance was likely to be higher in more specialised companies than in multiproduct companies (ceteris paribus).

Mayers and Smith (1990) and Adams (1996) argue that residual claimants in smaller insurance companies are less able to bear the strain of financing new business and/or sustaining unexpectedly large claims than their counterparts in large insurers. Consequently, small insurance firms are expected to use reinsurance in order to enhance their risk-bearing efficiency, reduce the volatility of their cash flows, and so mitigate bankruptcy risk. In this way, reinsurance can also help to protect the distribution of future payoffs for the owners of small insurance firms. Thus, in this research, the authors include the **size** variable in order to test the hypothesis that smaller insurers are more likely to purchase reinsurance. Above mentioned studies, as well as that of Cole and McCullough (2006), Lei and Schmit (2010) and Reissaus and Wambach (2005), find the evidence supporting expected bankruptcy costs hypothesis that size negatively impacts the purchase of reinsurance, though Carneiro and Sheriss (2005), find no significant impact of size on reinsurance demand.

Moreover, this study examines the potential effect of **profitability** on the demand for reinsurance. Insurers that are more profitable are able to better absorb large unexpected losses and to face financial pressures and therefore it is expected that more profitable insurers will demand less reinsurance. Kader, Adams, and Andersson (2010) and Adams, Hardwick, and Zou (2008) find negative and statistically significant correlation between profitability and reinsurance.

Finally, in order to explain reinsurance demand, we employ **loss volatility** variable expecting that if an insurer has a positive loss development, then the insurer is likely to demand more reinsurance in an effort to mitigate potential financial constraints. The

hypothesis that high loss volatility raises the demand for reinsurance was proven by Hoerger, Sloan, and Hassan (1990).

Besides of insurers-specific factors, it is expected that demand for reinsurance is influenced by reinsurance industry level factors. As a general demand theory postulates, reinsurance demand should be determined by **reinsurance price**. It is expected that as the reinsurance price increases, demand for reinsurance will decrease. Since most of the insurance companies in Croatia transfer their risks to reinsurance companies abroad, the price formed in global reinsurance market is relevant in this study. According to Cole and McCullogh (2006) combined ratio could be used as the proxy for reinsurance price. Since combined ratio is inversely related to traditional measure of the reinsurance price (inverse of loss ratio) it is expected that it will positively influence demand for reinsurance. Besides using it as an indicator of the reinsurance price, the combined ratio expresses performance (combining both loss ratio and expense ratio) of the global reinsurance market, too.

In addition to the price, **financial strength** of the reinsurance companies could be influential factor of the reinsurance demand. Precisely, although reinsurance provides insurers with underwriting risk transfer, it exposes insurance companies to credit risk. As the financial strength or capital of reinsurance companies increases, the credit risk related to reinsurance for insurance companies will be lower. Alternatively expressed, with higher level of reinsurance companies' capital the probability of their failure will be reduced and the demand for reinsurance will increase. Since in this study we use gearing ratio of reinsurance industry as an indicator of capital position (according to IAIS, 2012), we expected this variable is negatively related to demand for reinsurance.

2   Data and methodology

In order to estimate the impact of various factors that may have important role in explaining insurers demand for reinsurance, authors created two groups of demand determinants. The first group i.e *insurers-specific* determinants comprised insurers' size, diversification[2], return on equity and loss volatility, while the second group i.e. *reinsurance industry-specific*

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[2] In our study line of business concentration or product diversification is measured with the Herfindahl Index. Insurance companies in Croatia can conduct business in 23 lines of insurance but, due to the extremely small value of gross written premium achieved in some lines (i.e. a small share in the portfolio), we aggregated these lines in six main lines that are presented by personal accident insurance, health insurance, insurance of land motor vehicles, motor vehicle liability insurance and other.

determinants referred to combined ratio and gearing ratio. Concise description of the variables and their expected effect on insurers' demand for reinsurance is given in the table 1.

Tab. 1: Variables in the reinsurance demand model

Variables	Description	Expected sign
Demand for reinsurance (D)	Premiums ceded to reinsurance divided by total insurer's premiums.	---
Product diversification (DIVER)	$HHD = \sum_{i=1}^{N} P_i^2$ where Pi is the percentage of an insurer's premiums written on product line i.	+/-
Size (SIZE)	Natural logarithm of total gross written premium.	-
Roe (ROE)	Insurer's after tax annual profit divided by its total equity.	-
Loss volatility (VOLAT)	$(losses_t - losses_{t-1}) / losses_{t-1}$, where losses represents insurer's losses in the respective year.	+
Combined ratio (COMB)	Sum of expense ratios and claims ratios.	+
Gearing ratio (GEAR)	Recoverables compared to total available capital.	-

Source: Compiled by authors

All data that were necessary for the calculation of the variables presented in Table 1 were collected from different sources. In particular, data of individual insurer used in the research were obtained from: 1) various issues of *Insurance and reinsurance companies in Croatia* and *Croatian insurance market* published by Croatian Insurance Bureau; and 2) *Annual reports* published by Croatian Financial Services Supervisory Agency. Also, data at the *reinsurance industry level* were collected from the various issues of *Global Reinsurance Market Report (GRMR)* and *Global Insurance Market Report* (2012) published by International Association of Insurance Supervisors.

Aiming to include a dynamic component in the analysed model, the authors used a lagged dependent variable as an explanatory factor while applying Arellano and Bond (1991) linear dynamic panel data estimation on the following model:

$$D_{it} = \alpha + \delta D_{i,t-1} + \sum_{f=1}^{F} \beta_f X_{it}^{f} + \sum_{r=1}^{R} \beta_s X_{it}^{r} + \varepsilon_{it} \qquad \varepsilon_{it} = v_i + u_{it} \qquad (1)$$

where D_{it} is the insurers i demand for reinsurance at time t, with $i=1,\ldots,N$, $t=1,\ldots,T$; α is a constant term, $D_{i,t-1}$ is the one-period lagged insurers demand for reinsurance, δ is the speed of adjustment to equilibrium, $x_{it}^{'}$'s are the explanatory variables (namely, X_{it}^{f} denote firm i.e. insurers-specific variables while X_{it}^{r} denote reinsurance industry-specific variables), ε_{it} is the disturbance, with v_i the unobserved insurance-specific effect and u_{it} the idiosyncratic error.

Validity of overidentifying restrictions of model 1 can be tested by Sargan test, while first-order and second-order serial correlation in the first-differenced residuals can be verified using m_1 and m_2 Arellano and Bond (1991) test statistics.

3   Research results

Table 2 provides insight into descriptive statistics of analysed variables. It is interesting to note that data from this table indicate on the presence of insurers ranging from complete specialization (HHD=10 000) to those who diversify their business in a significant proportion. Also, although the average value of the insurers' premiums ceded to reinsurance amounts 10.3%, some insurers ceded their premium to reinsurance in a much larger proportion (up to 76.6%).

Tab. 2: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
D	207	10.2872	13.511	0	76.5969
DIVER	216	5980.772	3152.808	1940.33	10000.00
SIZE	216	11.5918	1.8376	4.8752	14.9923
ROE	214	-1.3373	32.4537	-329.14	70.02
VOLAT	192	1.3864	4.4994	-1	30.2741
COMB	216	98.1991	7.5095	87	113

| GEAR | 216 | 62.5648 | 15.9658 | 35 | 87 |

Source: Compiled by authors

A pair wise correlations matrix is presented in Table 3. Most of the correlation coefficients show weak correlation between independent variables. The highest correlation coefficients between variables amounts -0.5779, however, this value is still below 0.7 (the level at which the problem of multicollinearity may occur when estimating parameters).

Tab. 3: Pair wise correlations matrix

	D	DIVER	SIZE	ROE	VOLAT	COMB	GEAR
D	1.0000						
DIVER	-0.3405	1.0000					
SIZE	-0.0200	-0.5779	1.0000				
ROE	-0.1535	0.0645	0.2051	1.0000			
VOLAT	0.0681	0.1930	-0.3442	-0.0643	1.0000		
COMB	0.1016	0.0119	-0.0428	-0.0301	0.0039	1.0000	
GEAR	-0.1159	0.0371	-0.0014	-0.0545	-0.1125	-0.1714	1.0000

Source: Compiled by authors

Results of the dynamic panel model estimation are presented in Table 4. It is obvious that Sargan test confirms validity of over-identifying restrictions. Furthermore, insignificant p-value of m_1 and $m2$ tests indicates the absence of first-order and second-order autocorrelation in first-differenced errors.

Tab. 4: Determinants of reinsurance demand – a dynamic panel model

Variables	Coef.	Std. Err.	P>z
D_{t-1}	0.01317	0.006021	0.029
DIVER	0.00055	1.72E-05	0.001
SIZE	0.19121	0.214713	0.373
ROE	-0.02233	0.001597	0.001
VOLAT	0.02671	0.014171	0.059
COMB	0.11266	0.003358	0.001
GEAR	-0.08629	0.002855	0.001
Cons	-1.97326	2.124956	0.353

No. of observations	123
Sargan test (p-value)	0.6703
Arellano-Bond (m_1) (p-value)	0.1741
Arellano-Bond (m_2) (p-value)	0.6937

Source: Compiled by authors

With the exception of the size variable, all estimated parameters are aligned with the authors' expectations. However, the size variable is not statistically significant. The same evidence is found in the study of Carneiro and Sheriss (2005). Among insurers-specific factors the authors find that product diversification and loss volatility are positively related to demand for reinsurance while the opposite is true for insurance companies' profitability.

The variable product diversification (DIVER) is measured with the Herfindahl Index. The higher the value of this variable is, the greater the insurer's focus on certain line-of-business. Therefore, its significant and positive influence on reinsurance demand can be explained by the fact that a reinsurance contract offers a mechanism to increase the diversification of risk for insurers. From the risk diversification point of view, insurers with a higher concentration in a given line of business may have a higher incentive to purchase more reinsurance. Moreover, as stated in Cole and McCullough (2006) as well as in Wang et al. (2008), high levels of concentration may prompt greater demand for reinsurance.

Furthermore, the profitability variable – ROE - plays significant role in explaining reinsurance demand. Its negative sign suggests that insurers that earn more profits are better able to face financial pressures and thus demand fewer reinsurance contracts. Moreover, similar explanation can be assigned to the loss volatility variable. Specifically, one of the main advantages of reinsurance to the primary insurer is that it lowers the probability of bankruptcy in periods of unexpectedly high loss volatility (Hoerger et al., 1990). Therefore, higher loss volatility, which is expected to affect the probability of bankruptcy, affects the insurer in a way that it demands more reinsurance contracts.

When reinsurance industry-specific factors are taken in account, reinsurance price negatively affects demand for reinsurance, what is in accordance with the essential microeconomics theory. The same finding is confirmed by Cole and McCullough (2006). Furthermore, in line with the theoretical considerations, financial strength of global reinsurance companies (the opposite of the gearing ratio) positively affects demand for reinsurance since it reduces credit risk related to reinsurance.

Conclusion

This paper investigates factors that influence demand for reinsurance in Croatia adding contribution to the literature on reinsurance demand in emerging markets as well as to insurance companies' decision makers in the field of actuarial risk management. The study encompasses both insurers-specific and reinsurance industry-specific factors.

According to the results, demand on reinsurance is influenced by product diversification, profitability and loss volatility of insurance companies as well as by reinsurance price and the financial strength of reinsurers. Contrary to the expectation, size of insurance companies does not significantly determine reinsurance demand.

In the decision making of underwriting risk transfer to reinsurance market, insurance companies should take into consideration product range. As the production is more concentrated the more risk should be reinsured. The same is true for loss volatility. Conversely, higher profitability would enable insurers to retain more risk. Additionally, decision on buying reinsurance protection should take into consideration reinsurance price and the capital of reinsurance companies.

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