Active Capital Adjustment or Passive Supervision Constraint?--- The Research on the Influence Factors of Actual Capital and Statutory Capital in Life Insurance Companies

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Abstract：Using the panel data of 46 life and health insurance companies from Public disclosure of information, this paper examines the factors affecting actual capital and statutory capital, and studies their action mechanisms. We find that actual capital can reflect underwriting risk, but not investing risk, while statutory capital can reflect neither underwriting risk nor investing risk. We also find that solvency ratio of 150% not statutory capital can confine actual capital quickly and efficiently. The results show that, life and health insurance companies still can't improve capital structure, and they just maintain the solvency standard passively, so it is necessary to raise the capacity of capital management and risk control.

Key word：actual capital, statutory capital, life insurance company, solvency

Introduction

Capital is more than important for insurance companies. It is mainly because of their mode of liability management where they collect premium upfront and pay out compensation later. To guarantee such a time lag within insurance activities will not harm customers' benefits and companies will be running without bankrupt, insurance companies need to be strong enough in capital. Without capital, insurance companies cannot survive and not to mention develop and standout from competitors.

Ever since 2007, we observe a tendency that life and health insurance companies are dramatically raising capital whatever in terms of amount and frequency. China Insurance Regulatory Commission's (CIRC) reports that 44 insurance companies have raised capital in 2013 with an amount of 64.579 billion RMB and 52 times in total[①]. What motivate insurance companies to hold and adjust capital could belong to one of the following reasons: first, to fulfill the regulatory requirements. Insurance companies without sufficient capital are restricted by solvency requirements in certain aspects, such as executives' compensation and capital utilization; second, to strengthen the leverage for further development. For example, insurance companies will need capital to open branches and to finance research on new type of policies；third, to satisfy external rating agencies. To maintain a high level of rating and even raise current status of rating, insurance companies need to have enough capital that meets the criteria of solvency adequacy ratio. However, what specifically influence life and health insurance companies in capital management and whether by holding capital could companies really get rid of risks are still in doubt.

In 2012, CIRC officially starts China Risk Oriented Solvency System (C-ROSS). 17 supervisory regulations have been issued and both several rounds of quantitative test and consultations have been implemented. C-Ross has a pilot run which parallels current China

[①] Data comes from the website of CIRC.

Solvency System from June 2015.

Considering that strong capital is the key to ensure the solvency, whether the required capital requirement of current solvency system has reflected how well insurance companies need capital as well as how their risk profiles change? The other question is whether the required capital requirement is able to motivate insurance companies in an appropriate and effective way of adjusting capital. Active Capital Adjustment or Passive Supervision Constraint?

Our study aims to fill the blanks over this filed. We are trying to find factors influencing actual capital and required capital as well as figuring out the action mechanisms of capital movement. Simultaneous equations serve as major models throughout the whole quantitative part. There are two specials about this study. First, it is realistically meaningful. On one hand, this article not only tests respectively how well underwriting risks, investment risks, solvency adequacy ratio influence actual capital and required capital for life and health insurance companies, but also analyzes how well required capital binds actual capital, as well as whether required capital reflects risks of companies. All of these analyses give valuable reference to the improvement of C-ROSS as well as provide certain solutions to the companies' capital shortage; On the other hand, the sample data of our study comes from annual information publicly revealed by companies who are required to officially report all the information on their website after 2010. Benefiting from this, the data is typical of the industry and less like to have heterogeneity because of the short interval of the samples we choose. In a nutshell, the sample data could well reflect characteristics of life and health insurance companies for the present.

Hypotheses & Assumptions

Ever since Modigliani-Miller Theorem comes into being, capital structure has always been a popular topic. However, the specific study and research over the insurance industry does not start until recently. Cummins & Sommer(1996)[1] first analyze factors influencing property and casualty insurance companies; Baranoff & Sager(2002)[2] first analyze factors influencing the capital structure of life and health insurance companies as well as the relationship with investment risk and product risks. Then they deep dive to the research of factors that have impacts on capital structure, for example organizational structure and company type (Baranoff & Sager, 2003)[3], product structure (Consiglio, Saunders & Zenios , 2006)[4], required capital (Haan & Kakes, 2011)[5], stability of ownership(Cheng et.al, 2011)[6]. So far, the prevailing research within China is mostly based on business and product structure, as well as qualitative. For example, Zhi Zhuo(2007)[6] researches on the relationship among organizational structure, business model, accounting principles, solvency and capital; Shengzhong Jiang(2012)[7] researches on those publicly traded companies and concludes how badly capital structure suffers from the imbalance of products' structure. Lizhen Wang and Xiufang Li (2012)[8], Lizhen Wang(2012)[9] well as Guiqin Zhao as well as Hong Wu(2013)[10] have all empirically tested factors influencing capital structure of property & casualty insurance companies, and however, rarely have people looked into life and health insurance companies so far.

According to the trade-off theory of capital structure, the optimal capital structure is able to achieve a balance between benefits and costs of financing. When a large amount of loss occur in investment or underwriting business, capital becomes essential for companies' continuing operations. For instance, capital can immediately save companies from financial dilemmas, reduce

probability of default and even indirectly increase public needs for insurance. As for costs of financing, they mostly come from the frictions of the incomplete market. These frictions include but not limit to agency costs and tax costs (Harrington and Niehaus, 2003)[11]. In a word, a perfect solvency framework should not only be able to prevent companies from over debt financing and to reduce the chance of bankruptcy(Koziol & Law-renz，2009)[12], but should also enable companies to run effectively without wasting resources and sacrificing profitability(Kim & Santomero, 1988)[13]. Considering these theoretical references and the tendency of frequent financing activities in China's insurance market recently, we propose following assumptions:

Assumption 1. Solvency of life and health insurance companies is bound by required capital

The goal of financing for life insurance companies is to handle the unexpected loss. Any decision of capital adjustment should be consistent with the change of risk profiles of underwriting and investment since these two blocks of business are supporting insurance companies' development. According to the Transaction-cost economics (Williamson, 1988)[14], the risker of companies' businesses are, the larger amount of capital they will hold for uncertainty. The reason is when companies sell risky products, it is more likely that they could not pay the debt back, and thus debt finance becomes harder and companies then prefer financing by equity. However, Cummins (1998)[15] finds that deposit insurance and insurance guarantee fund stimulate banks and insurance companies to undertake more risks when these companies do not hold much capital. This results a negative correlation between risks and capital. Baranoff(2002) finds that capital is negatively correlated with underwriting risks, but positively correlated with investment risks. However, what Cheng (2011) finds differ from Baranoff's where capital is positively correlated with underwriting risks while negatively correlated with investment in the study. Cheng thinks insurance companies in the seek of high rating would be more likely to hold more capital for higher underwriting risks they have taken in. Still, they would stop taking in more investment risks once they have enough capital. However, regulators would require insurance companies to increase capital at whichever situation, which indicates a conflict between supervision system and practices over the industry. Some researchers have already found out such a conflict and started studying on that. Their study shed light on this article and here comes Assumption 2:

Assumption 2. Required capital and actual capital could truly reflect investment and underwriting risks of insurance companies

Information received by investors and companies is asymmetric, which make it hard to finance by equity, especially for those insurance companies that are small and less known. That is why these companies would rather hold more capital internally as a cushion than finance by the external capital market (Myers and Majluf, 1984)[16]. Nevertheless, large companies would rather hold less capital as a result of easier access of capital market and lower cost of capital they are charged (Titman and Wessels, 1988)[17]. According to pecking order financing theory, undistributed profit is without doubt the first source insurance companies would use for financing, and then is debt financing and equity financing (Gron, 1994)[18]. Undistributed profits mainly come from companies' profitability, and as a result we believe profitability will influence capital of insurance companies.

Assumption 3. Small but profitable companies will hold more capital.

There are two kinds of agency relationships within insurance companies, say owner and administrator, owner and policyholder (Jensen & Meckling, 1976)[19]. In the first agency relationship, administrator would not fully take downward risk while owners hold remaining

equity, which consequently motivates administrators to undertake more risker business. In the second agency relationship, policyholders have a priority of claiming over owners, which at this time motivate owners to increase their benefits at a cost of impairing policyholders' benefits. According to the agency theory, the choice of structure should control agency cost and potentially growing companies will suffer more from agency costs.(Myers, 2001)[20]， and in other words opportunity of growth will influence life and health insurance companies in terms of capital adjustment. Similarly, the heavier proportion of insurers' investment on long-term business, the longer time administrators are able to control, and the more likely they could seek benefits for themselves. This will at the same time impair the benefits of companies and stakeholders (Cummins and Nini, 2002)[21]. Moreover, since profits last longer in long-term business than short-term business, it also harms internal financing (Haan & Kakes, 2011). Thus from the perspective of agency cost, Assumption 4 is proposed here:

Assumption 4. Life and health insurance companies with more potential for growing as well as heavier investment on long-term business will hold less capital.

Empirical Model

I. Variables and Indexes

This article is aim to research factors influencing capital adjustments and mechanism of how required capital acts on actual capital. According to the hypotheses and assumptions in the last part, underwriting risk, investment risk, size of the company, opportunity to grow and profitability mainly drives the adjustment and movement of capital. For ensure empirical results are as accurate as possible, we conduct literature research, group discussion and in-depth interviews before reasonable variables and indexed are selected. These variables are as follows:

1.Actual Solvency Margin (ASM): The existing study mainly uses the ratio of equity divided by the total asset as a metric of actual solvency margin or actual capital amount (Sommer, 1996)[22]. Similarly, this article borrows the idea of the metric with a furthermore replacement of actual capital for equity as a numerator.

2.Required Solvency Margin (RSM): Similar to how we set ASM, required solvency margin is the ratio of required capital divided by the total assets based on *Notice of the Application of Insurance Solvency Regulations* given by CIRC.

3.Size of the company (Size). Large insurance companies are more able to spread risks and accurately predict future loss, and consequently they need relatively low-level capital. This article uses natural logarithm of total asset, which is widely used in many empirical researches as a metric of company's size.

4.Opportunity of Growth (Grow). According to Fama & French (2002)[25], the ratio of market value of assets over book value effectively quantifies the opportunity of growth. However, the market value of many insurance companies' assets in China is difficult to acquired since many of them are not publicly traded. Therefore, this article uses the growth rate of premium (Lizhen Wang, Xiufang Li, 2012) as a metric.

5.Return of asset (ROA). Profitability is another key factor to prevent insolvency of insurance companies where companies are able to strengthen their solvency through internal financing, say financing by the post-tax profits (Kramer, 1996). As a result, this article uses the ratio of profits divided by total assets, or Return of asset, to measure profitability.

6.Underwriting Risk (UR): How to measure underwriting risk varies. Haan & Kakes (2011) use samples' standard deviation of loss ratio; Baranoff & Sager (2002) use the proportion of health insurance's premium; Xiaoping Zeng, Zhaorong Guo(2007)[23] use the weighted average sum of different insurance products' risk coefficients. Since the sample interval in this article is relatively short, the proportion of health insurance premium is slight and the risk coefficients in Taiwan district may differ from that of mainland, we do not incorporate any of the previous indexes. Instead, we are suggested by group discussions and interviewers using a ratio similar to the combined loss ratio in the property & casualty insurance filed. In this ratio, the sum of insurance payout, insurance liability reserve and expenses is the numerator while the revenue of all insurance business is the denominator.

7.Investment Risk (IR): The more volatile insurance company's assets are, the more sensitive assets' prices become, and easier will it go below the capital requirement. Kramer (1996)[24] finds that insurance companies having more risky assets are more likely to go insolvent. This article borrows and then makes a slight adjustment of how Guiqin Zhao and Hong Wu (2013) measure investment risk of insurance companies, and finally uses the proportion risky assets② account for as an appropriate metric here.

8.Reinsurance Ratio (Rei). Ratio of reinsurance equals the ceded premium over total premium. Insurance companies usually use reinsurance to spread risks. Generally speaking, the more frequently do insurance companies use reinsurance, the less capital they need to prevent from insolvency. In this way capital should be negatively correlated with reinsurance ratio. Nevertheless, some reinsurance companies require ceding companies to afford a certain amount of capital, which results in a positive correlation between capital and reinsurance ratio (Haan & Kakes, 2011). This article will test this.

9. Long-tailed business (Ltai). The ratio of insurance liability reserves over payout is able to reflect the long-tailed of long-term liability. From the theory of agency, the capital companies hold will decrease with an increase on the proportion of long-term business.

10. Dummy.In order to reflect different characteristics of companies' business and ownership, this article sets some dummies accordingly. D_1 differentiates health insurance companies from others, D_2 differentiates between local insurance companies and others, and D_3 differentiates between insurance companies with solvency adequacy ratio over 150% and others.

II. Sampling and Modeling

Based on the theoretical reference and the presumed assumptions, this article incorporates three models for the empirical analysis. In the models, ε, δ and τ are 为 random errors. Three models are served for different uses: Model (1) tests the factors influencing actual capital and whether or not required capital is binding actual capital; Model (2) tests whether similar factors in Model (1) influence required capital, which builds a bridge of Model (1) and Model (3); Model(3) finally tests whether required capital is able to reflect risks of insurance companies and moreover analyzes whether investment risk and underwriting risk have been fully taken into account by required capital.

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② Risky assets refer to the sum of held for trading financial assets, financial derivatives, buying back the sale of financial assets, redemptory Monetary Capital for Sale, debt investment, financial assets available for sale, held-to-maturity investment, long-term equity investment, loans and receivables, Loan to policyholder and investment on real estate.

$$ASM_{i,t} = \alpha_0 + \alpha_1 RSM_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 UR_{i,t} + \alpha_4 IR_{i,t} + \alpha_5 Grow_{i,t} + \alpha_6 ROA_{i,t} + \alpha_7 Rei_{i,t} + \alpha_8 Ltai_{i,t} + \alpha_9 D1_{i,t} + \alpha_{10} D2_{i,t} + \alpha_{11} D3_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$RSM_{i,t} = \beta_0 + \beta_1 Size_{i,t} + \beta_2 UR_{i,t} + \beta_3 IR_{i,t} + \beta_4 Grow_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Rei_{i,t} + \beta_7 Ltai_{i,t} + \beta_8 D1_{i,t} + \beta_9 D2_{i,t} + \beta_{10} D3_{i,t} + \delta_{i,t} \quad (2)$$

$$RSM_{i,t} = \gamma_0 + \gamma_1 UR_{i,t} + \gamma_2 IR_{i,t} + \gamma_3 Grow_{i,t} + \gamma_4 D1_{i,t} + \gamma_5 D2_{i,t} + \gamma_6 D3_{i,t} + \tau_{i,t} \quad (3)$$

To do this, we use a dataset of 46 China life insurance companies during 2009-2013. To reduce the bias and enhance the robustness of empirical results, we eliminate those companies that are founded after 2009 and furthermore remove those professional pension companies from our sample set. Besides, we combine some data according to the merger and acquisition in practice. For example, we combine data which collects from Sino-US MetLife Insurance CO.,Ltd. and Liantai Metropolitian Insurance CO., Ltd, and what is more integrate data from AIA CO., Ltd's branch of Shanghai, Beijing, Guangdong, Shenzhen, Jiangsu, Dongguan and Jiangmen.

All of the data comes from company's public release from 2009-2013. The Regulation on the management of insurance companies' public releases does not come out until 2010 and before that it is hard to obtain accurate information like actual capital, required capital and solvency adequacy ratio[③]. What is more, *Grow* causes a decrease on a whole year's data. In spite of that, we do not in addition add data of year 2008 into our sample set for the sake of consistency that is restricted by the new accounting requirement.

A summary of variables' statistical characteristics is described in Table 1. As we could see, *Ltai* is volatile with an evidence of a standard deviation as large as 90.739. Three reasons could account for this: first, new accounting principles cause a fluctuation of companies' reserves; second, companies have different focus on investment and underwriting business; thirdly, insurance periods of main business differ among each company. Other variables, especially *RSM* and *ROA* are robust with the change of individual and the passage of time. In Table 1, The mean and median of *ROA* are both negative since life and health insurance companies usually invest more capital at the front and then enjoy a longer cycle of profitability. Besides, because of those insolvent companies in the dataset, *ASM* and has negative minimums. *Same thing happens in UR and Ltai, but it is because reserve transfers is negative.*

Table 1 Summary of Descriptive Statistics

Variable	Number of Observations	Mean	Median	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
ASM	229	0.117	0.074	0.134	-0.071	0.805	2.863	11.793
RSM	229	0.035	0.035	0.009	0.000	0.072	-0.187	6.737
Size	229	14.154	14.034	1.909	10.279	19.099	0.513	2.935
Grow	183	1.376	1.144	0.879	0.295	8.485	4.080	27.349
ROA	229	-0.016	-0.004	0.034	-0.209	0.053	-1.805	8.377
UR	229	1.017	0.998	0.380	-2.418	2.470	-2.950	32.898
IR	229	0.551	0.566	0.179	0.071	0.896	-0.581	2.897
Rei	229	0.070	0.011	0.230	-0.695	1.635	3.833	24.706
SOL	229	4.022	2.060	7.004	-1.830	61.458	5.456	38.674
Ltai	229	27.550	6.475	90.739	-44.579	988.751	7.212	65.638

[③] Most life and health insurance companies release data of 2009 in their annual reports of 2010, and as a result we could expand the data panel to year 2009.

Empirical Analysis

I. Analysis of Coefficients

Discrete and continuous variables coexist in our models. To prevent multicollinearity from giving bias to the regression, we use Correlation Coefficient Matrix Method and Variance Inflation Factor (VIF) to test the possible existence of multicollinearity before conducting any regression. Result with first testing method is listed in Table2. The lower triangle is output from Pearson test. The last two columns are VIF and tolerances. The maximum correlation coefficient is 0.634 while the minimum is -0.566. The average of VIF is 1.62 and high tolerance of variables both suggest a weak multicollinearity among variables.

Table 2. Correlation Coefficient Matrix Method and VIF

变量	ASM	RSM	Size	Grow	ROA	UR	IR	Rei	Ltai	D3	D2	D1
ASM	1.000											
RSM	-0.124	1.000										
Size	-0.516	-0.025	1.000									
Grow	0.205	-0.086	-0.200	1.000								
ROA	-0.379	-0.072	0.564	-0.123	1.000							
UR	0.204	0.203	-0.125	0.107	-0.309	1.000						
IR	-0.285	0.132	0.388	-0.180	0.252	0.005	1.000					
Rei	-0.099	-0.193	-0.040	-0.019	0.028	-0.425	-0.275	1.000				
Ltai	0.055	-0.086	-0.114	0.077	-0.007	0.101	0.040	-0.150	1.000			
D3	0.292	-0.182	-0.046	0.066	0.039	-0.014	-0.144	0.054	0.050	1.000		
D2	0.350	-0.020	-0.548	0.055	-0.032	-0.011	-0.258	-0.032	0.021	0.228	1.000	
D1	0.309	0.222	-0.226	0.063	-0.361	0.149	-0.034	0.087	-0.094	-0.175	-0.077	1.000
VIF	1.930	1.240	3.000	1.100	2.030	1.430	1.380	1.510	1.090	1.280	1.920	1.490
Tolerance	0.518	0.808	0.334	0.913	0.493	0.698	0.723	0.662	0.915	0.783	0.520	0.671

II. Analysis of Regression Results

We use STATA 11 to conduct regressions on 183[④] samples with a total of 46 life insurance companies during 2009 - 2013. According to risk theory and the theory of capital structure, corporations would prefer holding large amount of capital in order to avoid loss and other following costs caused by the increases on risks. At the same time, the chance of bankruptcy will increase as debt ratio increases, and the increasing cost of finance will offset the benefits of debt finance's tax shields (Cummins & Sommer, 1996). In this way, capital and risks influence each other. Hausman endogenous test finds H statistic is 24.93 and p-value is 0.03，which indicates an endogenous correlation between capital and risk. Based on the above analysis, we use two-stage least squares (2SLS) for regressions with underwriting risk and investment risk's lags as instrumental variables. The results of regression are shown in Table 3. Specifically, G2SLS stands for two-stage least squares with individual stochastic effects while FE2SLS supposes individual fixed effects. Results with two methods are almost the same.

[④] The Empire Life Insurance Co., Ltd is founded in September 2008. Considering it was a start-up company in 2009, we remove its data of year 2009..

Table 3. Regression Results

Model	Model (1)		Model (2)		Model (3)	
Method	G2SLS	FE2SLS	G2SLS	FE2SLS	G2SLS	FE2SLS
Equation	ASM	ASM	RSM	RSM	RSM	RSM
UR	0.197***	0.0736**	0.00203	-0.00268	0.00216	0.0057
	(3.01)	(2.21)	(0.29)	(-0.68)	(0.31)	(1.27)
IR	-0.0449	-0.0369	0.00361	0.00275	0.00208	0.0035
	(-0.72)	(-0.73)	(0.55)	(0.42)	(0.36)	(0.62)
RSM	-3.685***	-3.197***				
	(-3.51)	(-3.67)				
Grow	-0.0052	-0.00268	-0.00129*	-0.00133**		
	(-0.53)	(-0.32)	(-1.95)	(-2.03)		
Size	-0.0200***	-0.0183***	-8.7E-05	-5.5E-05		
	(-2.87)	(-3.13)	(-0.13)	(-0.08)		
ROA	0.363	-0.0418	-0.0265	-0.0416		
	(0.93)	(-0.14)	(-0.83)	(-1.50)		
D3	0.0790***	0.0866***	-0.00286*	-0.00282*	-0.00335*	-0.00333*
	(3.55)	(4.63)	(-1.77)	(-1.76)	(-2.11)	(-2.09)
Ltai	-0.0002	-0.00018	-1.6E-05	-9.9E-06		
	(-1.25)	(-1.26)	(-1.20)	(-0.81)		
D2	0.029	0.0294	0.000683	0.000583	0.000818	0.000939
	(1.36)	(1.62)	(0.32)	(0.25)	(0.49)	(0.54)
Rei	0.0243	-0.05	-0.00266	-0.00549		
	(0.44)	(-1.34)	(-0.51)	(-1.54)		
D1	0.134***	0.150***	0.00518	0.00588	0.00624*	0.00551
	(3.68)	(4.93)	(1.32)	(1.45)	(1.73)	(1.55)
C	0.306**	0.376***	0.0393***	0.0440***	0.0363***	0.0316***
	(2.44)	(3.67)	(3.50)	(4.02)	(4.19)	(5.06)
Num	183	183	183	183	183	183
R^2	0.492	0.573	0.181	0.156	0.158	0.130

Explanatory Note：

(1) ***, **,* indicate a significance level at 1%, 5%, and 10%

(2) We leave out regression results of dummies at different year

1. Underwriting risk (UR) has a positive impact on actual capital, but has no impact on required capital while investment risk does not have any impacts on both actual capital and required capital. The correlation coefficient of UR is 0.197(0.0736), which suggests capital movement correlates with underwriting risk. This is the same as we expect. However, the inference that required capital does not reflect underwriting risk contracts what regulators expect if solvency is well supervised. According to CIRC'S Regulatory Rule regarding Solvency Management of Insurance Company[⑤], required capital should closely correlate with long-term

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[⑤] Required capital for life and heath insurance company is the sum of two parts, say required capital of long-term life and health insurance business as well as short-term life and health insurance business. Specifically, required capital of long-term life and health business with 1 year or above is the sum of (1) 1% of investment linked insurance's liability reserves plus 4% of other life and health insurance's liability reserves (2) 0.1% of risk amount of period life insurance which has a period less than 3 year plus 0.3% of risk amount of others. Calculation for life and health insurance with 1 year or less period can also be applied to that of property & casualty. Required capital for property & casualty is the maximum of (1) 18% of the amount within 100 million RMB that adds net premium and minus sales tax over recent fiscal years as well as plus 16% of amount exceeding 100 million RMB; (2) 26% of the average amount of combined compensation which is under 70 million RMB plus 26% of the amount

insurance liability reserves, risk amount of insurance, premium of short-term life and health policy and insurance compensation. Especially, life and health insurance companies are supposed to have more long-term business, and therefore required capital should reflect the existence of existence of long-term risks if required capital has fully taken risks into consideration. The result showing a non-binding relationship between underwriting risk and required capital is partly because life and health insurance companies during 2009 - 2013 do not underwrite much long-term risks. In that way, total underwriting risk is too small to be significantly impactful on required capital. Let us take Ping An Insurance (Group) Company Of China, Ltd. as an example. In 2011, Ping An has a total premium of 118.967 billion RMB where 43.46% of the premium or top fives all belong to participation insurance. The most popular insurance policy is called "Ping An Wealthy Endowment Life Insurance (Participation, 909) which has a premium of 18.189 billion RMB, accounts 15.29% and has only a duration of 5 year though.

Required capital does not reflect investment risks, which does not surprise us. It is because required capital does not take investment risk into consideration when it is calculated. However, what surprises us is that actual capital is not significantly correlated with the investment risk. Here are some possible reasons. First, how to use capital has been strictly restricted for a long time. Despite that insurers nowadays have more freedom to invest, supervisions over the investment risk are not complete and effective enough. What is more, regulators do not have specific requirements regarding how capital should be used and insurers running after capital set loose to the capital utilization. As CIRC started to authorize certain companies to supervise their capital use on their own in 2014, insurers' arbitrary use of capital will be corrected and there follows a progress towards establishing a multi-level supervision framework of capital use and precaution system of the investment risk.

2. We do not first expect that actual capital is negatively correlated with required capital while positively correlated with solvency adequacy ratio. However, if we take a second look at the solvency adequacy ratios over the recent 5 years during which a lot of insurance companies failed to maintain the ratio of 1000% or above and then dropped to around 200%, we would not be surprised at the empirical results. This is an evidence of the fact that life and health insurance companies are not actively improving their capital structure or setting up appropriate solvency standards based on their risk profiles, but they are being forced to maintain a minimum level of capital. When required capital is relatively high and actual capital is relatively low as well as solvency adequacy ratio is over the required threshold, life and health insurance companies prefer not to raise capital. However, only when solvency adequacy ratio is going to fall below the threshold will companies act correspondingly. ROA, an index for profitability, is insignificantly correlated with actual capital. According to Peking Order Theory，corporates will first choose internal financing. The statistical insignificance of ROA with actual capital directly indicates life and health insurance companies are unable to afford capital adequacy ratio with poor profitability. What is more, it also indirectly indicates an immature yielding performance of insurance companies. It is necessary for insurance companies to enhance profitability and improve companies' solvency.

3. Size of the company is negatively correlated with actual capital, which not only meets our expectation, but also meets that of Titman & Wessels(1988) as well as Haan & Kakes (2011). From the perspective of capital outflows, larger life and health insurance companies are more

exceeding 70 million RMB over the last three years

diversified over business and less likely to have unexpected loss, which is based on Laws of Large Number. As a result, they take it slowly to consume capital; from the perspective of capital inflows, small companies are charger of higher cost, whatever financed with debt or stock shares (Smith, 1997)[26]. To compete against large companies, medium and small companies overemphasize premium growth and size expansion as only leverage, which directs them to run after capital all the time.

4. Health insurance companies hold more capital than life insurance companies do. Commercial healthcare insurance industry does not develop until recent years, and thus it is still at its earlier stage and does not have complete experience data. In that circumstance, it is hard to calculate an accurate morbidity rate, and even harder to identify and evaluate medical risks. Consequently to ensure companies will run continually, healthcare insurance companies are more likely to hold more capital. Besides, according to the transaction cost theory, the incompleteness, inefficiency as well as the unclearness of contracts are why transaction costs exist. Williamson (1985) furthermore categorizes transaction costs into three groups. Classic contracts belong to low risk, neo classic contracts belong to median risks and relationship contracts belong to higher risks. As for the insurance policy, it is a contract in nature. Under different kinds of policies, annuity belongs to classic contracts and life insurance belongs to neo classic contracts while healthcare insurance belongs to relationship contracts (Baranoff & Sager, 2002). This provides a light into why healthcare insurance products are risker than annuity products as well as life products. This article once again empirically demonstrates the same statement.

5. In model (2), only opportunities of growth and solvency adequacy ratio are significantly correlated with RSM. Moreover, R-square is 0.181(0.156). Opportunity of growth has a negative effect on required solvency margin and companies with a strong solvency hold less required capital. Based on model (2) and model (3), required capital does not well reflect the change of underwriting risks and investment risks. However, as growth of premium increases required capital decreases. This indicates that life insurance companies are gradually adjusting their product structures, including the duration and categories, for the sake of less required capital. We could also observe that many short-term and mid-term life insurance products are put into the market recently.

6. Neither opportunity of growth and proportion of long-term business has a significant impact on actual capital. It demonstrates that life and health insurance companies are not severely bothered by the agency issue. Shareholders, administrators as well as policyholders are consistent in benefits. The insignificant correlation also occurs between reinsurance rate and actual capital. It could be explained in two ways: on one hand, life and health insurance companies have a lower reinsurance rate compared to property & casualty insurance companies; on the other hand, reinsurance does not work well in risk diversification. Foreign insurance companies pushed by the growing insurance industry of China also grow and expand fast, which exhausts the capital and demand more. That is why foreign insurance companies do not have more actual capital than local ones.

Robustness Test

To ensure empirical results are as robust as possible, we use two methods to test the robustness. First of them is to weaken the endogeneity of the variables. As what Haan & Kakes (2011) do in their article, we use variables' lags of first order. What is more, we do not use lags of *UR*, *IR* and *Grow* so as to keep the completeness and efficiency of sample data. Tests for model (1) and model (2) are shown in the first five columns of Table. 4[⑥]. The second method is to remove actual capital samples and required capital samples whose percentiles between 5% and 95% change abnormally. Regressions of model (1), model (2) and model (3) after resampling are shown in the last six columns of Table 4. As we could see from Table 4., the regressions are robust and conclusions are consistent which method we chose. It is noteworthy that regression results with first-order lagged variables are more statistically significant. It is because of the removal of both simultaneity bias and endogeneity.

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[⑥] The absence of Model (3) is because UR and IR are major variables in Model(3). We use variables' lags as Instrumental variables.

Table. 4 Robustness Test

Test	Test (1)				Test (2)					
Model	Model (1)		Model (2)		Model (1)		Model (2)		Model (3)	
Method	G2SLS	FE2SLS	G2SLS	FE2SLS	G2SLS	FE2SLS	G2SLS	FE2SLS	G2SLS	FE2SLS
Equation	ASM	ASM	RSM	RSM	ASM	ASM	RSM	RSM	RSM	RSM
UR	0.061*	0.070**	0.003	0.005	0.185***	0.047*	0.0004	0.001	-0.0027	0.0004
	(1.68)	(2.31)	(0.75)	(1.58)	(3.03)	(1.65)	(0.09)	(0.38)	(-0.58)	(0.10)
IR	-0.086	-0.032	0.003	0.005	-0.093	-0.13***	0.0006	-0.002	0.001	0.001
	(-1.36)	(-0.53)	(0.47)	(0.84)	(-1.51)	(-2.74)	(0.12)	(-0.38)	(0.29)	(0.27)
RSM					-2.231**	-1.606*				
					(-2.02)	(-1.87)				
L.RSM	-4.18***	-4.20***								
	(-6.05)	(-6.14)								
Grow	-0.0016	-0.0015	-0.0015**	-0.0014**	0.0007	0.003	-0.0017**	-0.0017**		
	(-0.23)	(-0.23)	(-2.14)	(-2.09)	(0.07)	(0.40)	(-2.46)	(-2.50)		
Size					-0.016**	-0.010*	-0.00004	-0.00004		
					(-2.16)	(-1.76)	(-0.06)	(-0.07)		
L.Size	-0.014**	-0.016**	-0.0002	-0.0003						
	(-2.40)	(-2.56)	(-0.31)	(-0.45)						
ROA					0.0196	-0.671*	0.018	0.021		
					(0.04)	(-1.91)	(0.44)	(0.58)		
L.ROA	0.039	0.030	0.0108	0.012						
	(0.18)	(0.14)	(0.48)	(0.54)						
D3	0.057***	0.06***	-0.003*	-0.003*	0.053**	0.06***	-0.002**	-0.002**	-0.003*	-0.003*
	(3.37)	(3.63)	(-1.95)	(-1.90)	(2.48)	(3.55)	(-2.09)	(-2.00)	(-1.70)	(-1.75)
Ltai					-0.0001	-0.0001	-0.00002	-0.00002		
					(-0.89)	(-0.65)	(-1.38)	(-1.55)		
L.Ltai	-0.00004	-0.00006	-0.00001**	-0.00001**						
	(-0.68)	(-1.00)	(-2.00)	(-2.06)						
D2	0.034*	0.036*	0.0006	0.0006	0.020	0.025	0.002	0.002	0.002	0.002
	(1.85)	(1.84)	(0.34)	(0.32)	(0.98)	(1.52)	(1.13)	(0.98)	(1.55)	(1.57)
Rei					0.031	-0.040	-0.004	-0.004		
					(0.64)	(-1.21)	(-1.03)	(-1.19)		
L.Rei	-0.09***	-0.08***	-0.002	-0.001						
	(-3.47)	(-3.13)	(-0.53)	(-0.38)						
D1	0.152***	0.15***	0.006*	0.006*	0.054	0.046	0.010**	0.010**	0.008**	0.009**
	(4.62)	(4.31)	(1.89)	(1.68)	(1.05)	(1.11)	(2.39)	(2.25)	(2.01)	(2.23)
C	0.402***	0.38***	0.041***	0.039***	0.239**	0.27***	0.043***	0.044***	0.04***	0.04***
	(3.85)	(3.79)	(4.01)	(3.97)	(1.99)	(2.89)	(4.84)	(4.84)	(6.44)	(7.31)
NUM	183	183	183	183	167	167	167	167	167	167
R^2	0.636	0.634	0.246	0.245	0.374	0.525	0.241	0.245	0.105	0.131

Explanatory Note：

(1) ***, **,* indicate a significance level at 1%, 5%, and 10%

(2) We leave out regression results of dummies at different year

Conclusions and Suggestions

This article conducts an empirical research on what Influence actual capital and required capital as well as how it works. To do this, we use data publicly released by 46 life insurance companies. Empirical results are robust enough. As a whole, the capital structure of life insurance industry needs to be optimized. Besides, capital cannot effectively prevent all kinds of risks, such as investment risk and underwriting risk. What is more, supervision over capital needs to be more concise. Conclusions and suggestions are as followed:

First, change of actual capital reflects the change of underwriting risk, but does not reflect that of underwriting risk. This to some extent indicates that life and health insurance companies do not pay equal emphasis on investment risk as they do on underwriting risk. To be detailed, actual capital does not move accordingly with the change of investment risk. As China's financial market becomes far more mature and integrated with international market, channels to allocate insurance capital expand. Insurance policy with investment characteristic is going to outperform traditional business that primarily protects the safety of life, especially for life insurance companies that deal with long-term liabilities all the time. From our perspective, life and health insurance companies, on one hand, need to balance the profitability and safety of insurance fund. They should carefully think of how to invest and allocate money in a way so as to resist unexpected investment loss; on the other hand, insurance regulators need to be stricter with supervision and enhance industry-level precaution system to prevent investment risks from passing across different industries and districts.

Second, required capital neither reflects underwriting risk, nor investment risk. In Solvency I, the binding between required capital and actual capital is only based on reserve and risk amount of insurance, and does not take any underwriting risk, which is a fatal weakness for Solvency I. As a regulatory requirement, required capital should be able to effectively reflect mortality risks, disability risks, withdrawal risks, longevity risks, and loss ratio risk in health insurance as well as cost risks. In terms of that, Solvency II has rooms for improvement.

Third, solvency adequacy ratio instead of required capital has an effective binding on actual capital. This fits what we observe from the development of life insurance. Taking the shortage of capital and the speedy consumption of capital, life insurance companies cannot spontaneously maintain an optimal amount of capital, instead, they are forced or driven by the regulation such as solvency adequacy ratio to hold capital. At the moment, financing by stock market or debt are two major methods for finance while profits contribute little. The demand for capital as companies expand blurs the severity of poor profitability for most companies. Insurance companies should optimize their business mode of growth an improve profitability. With this method they could enhance the strengths and bring the capital structure compatible with their own risk profiles.

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