

# 行政院國家科學委員會專題研究計畫 成果報告

## 風險與財務再保險的使用動機及再保險的使用與清償能力的關係

### 研究成果報告(精簡版)

計畫類別：個別型  
計畫編號：NSC 99-2410-H-004-235-  
執行期間：99年08月01日至100年10月31日  
執行單位：國立政治大學風險管理與保險學系

計畫主持人：許永明

計畫參與人員：碩士班研究生-兼任助理人員：謝佩文  
碩士班研究生-兼任助理人員：張翎鈺  
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報告附件：出席國際會議研究心得報告及發表論文

公開資訊：本計畫涉及專利或其他智慧財產權，2年後可公開查詢

中華民國 101 年 01 月 18 日

中文摘要：財務再保險已逐漸成為人壽保險公司所使用的風險管理工具之一。本研究利用英國人壽保險公司 2002 至 2008 年的資料，以 logit 與 tobit 迴歸，嘗試想要找出影響壽險公司使用財務再保險的決定。結果發現：稅的凸性、有沒有販售分紅保單、公司型態、成長機會、盈餘的波動性等因素，與壽險公司使用財務再保險有關。本文係首先找出影響壽險公司使用財務再保險的決定之研究。

中文關鍵詞：財務再保險，決定因子

英文摘要：Over the years, financial insurance has gradually become one of risk management tools used by life insurers. Using data from SynThesys Life from 2002 to 2008 and logit and tobit regressions, we have identified several factors that are related to the use of financial reinsurance. They include tax convexity, with-profit business, organizational form, growth opportunities, and earning volatility. The main contribution of this project is to first identify factors that have influence on the use of financial reinsurance.

英文關鍵詞：financial reinsurance, determinants

行政院國家科學委員會補助專題研究計畫  成果報告  
 期中進度報告

風險與財務再保險的使用動機及再保險的使用與  
清償能力的關係

What motivates insurers to use risk and financial reinsurance  
and the relation between reinsurance use and insurer solvency

計畫類別： 個別型計畫  整合型計畫

計畫編號：NSC 99-2410-H-004-235

執行期間：99年8月1日至 100年10月31日

計畫主持人：許永明

共同主持人：

計畫參與人員：張紋幸、謝佩文、邱美菁、張翎鈺、曾湘吟、  
陳聖茵

成果報告類型(依經費核定清單規定繳交)： 精簡報告  完整  
報告

本成果報告包括以下應繳交之附件：

赴國外出差或研習心得報告一份

赴大陸地區出差或研習心得報告一份

出席國際學術會議心得報告及發表之論文各一份 (另附)

國際合作研究計畫國外研究報告書一份

處理方式：除產學合作研究計畫、提升產業技術及人才培育研究計畫、列  
管計畫及下列情形者外，得立即公開查詢

涉及專利或其他智慧財產權， 一年  二年後可公開查詢

執行單位：政治大學風險管理與保險學系

中 華 民 國 一 百 零 一 年 一 月 十 七 日

## **Introduction**

The purpose of this study is to examine what motivates life insurers to use reinsurance. We further wish to examine whether life insurers use financial reinsurance for solvency purposes. Since the motivations of using risk reinsurance are well documented in the literature (e.g., Hoerger, Sloan, and Hassan, 1990; Garven and Lamm-Tennant, 2003; Shiu, 2011), this report will focus on the results of financial reinsurance.

Financial reinsurance also facilitates regulatory capital and earning management. Unlike risk reinsurance, however, financial reinsurance transfers less underwriting risk to the reinsurer. At the time of the financial reinsurance arrangement, the insurer transfers its loss reserves (liabilities) at their expected future book value and pays reinsurance premiums (equal to the present value of the transferred reserves) to the reinsurer. Due to the discounting effect, these transactions would lead to the insurer's surplus relief and improve its reported free asset ratio (Adiel, 1996). At a fixed time in the future, the reinsurer repays the insurer. The repayment depends on the initial reinsurance premiums, accumulated investment income, and the profit profile of the business reinsured under the financial reinsurance contract (Adiel, 1996). In this respect, financial reinsurance serves as a financing instrument for a life insurer. Moreover, when setting up policy reserves and/ or provisions for guaranteed bonuses, the actuary generally makes overly prudent assumptions, resulting in a high likelihood of future profits. However, under the prudent Accounts and Statements Rules, there is no value ascribed to future profits and accordingly they are not regarded as admissible assets in the regulatory accounts (Philpott, 2008). The life insurer may arrange financial reinsurance to partially recognize these profits by reinsuring its potentially

profitable business with a reinsurer and immediately receives a large amount of initial ceding allowance.

In 2008, the U.K. life insurance sector generated a premium volume of £184.995 billion (US\$ 342.759 billion), ranking first in the Europe and third in the world (Swiss Reinsurance Company, 2009). During the eight-year period of our analysis (2002-2008), the U.K. has witnessed a significant improvement on the supervision of the use of financial reinsurance by insurers. In 2002, the Financial Services Authority (FSA), the U.K. insurance industry regulator, published the Consultation Paper 144 (Financial Services Authority, 2002), entitled 'A new regulatory approach to insurance firms' use of financial engineering', to seek comments on its proposed new approach to supervise the financial engineering use by insurers (including friendly societies and Lloyd's). The U.K. life insurers and friendly societies have been required by the FSA to report their use of financial engineering arrangements in the regulatory returns. These reporting changes came into effect from the financial year ending on or after 31 December 2002.

## **LITERATURE REVIEW**

The motivations of using reinsurance have been documented in the literature. Several reasons have been proposed. For example, insurers use reinsurance to reduce financial distress costs (e.g., Cole and McCullough, 2006; Powell and Sommer, 2007), reduce agency costs (Mayers and Smith, 1982; MacMinn, 1987), ensure availability of funds for future investment opportunities, use real services provided by reinsurers (Cole and McCullough, 2006), reduce expected taxes (Doherty, 2003), increase income level (Adams, Hardwick, and Zou, 2008). As described previously, both risk and financial

reinsurance transactions increase earnings, though in different ways. Adams, Hardwick, and Zou (2008). These arguments have been presented in the proposal. To save space, they are not repeated here.

### **Data and Research Methodology**

We collect data from SynThesys Life from 2002 through 2008. Following prior research, we use several data selection criteria. We first delete firms from our sample whose reinsurance assumed account for more than 75% of total premium written (Cole and McCullough, 2006; Powell and Sommer, 2007). The reason is obvious because these insurers actually serve like reinsurers. We also exclude insurers that are affiliated with a parent firm because these insurers may prefer reinsure their business with their affiliated firms (Mayers and Smith, 1990; Garven and Lamm-Tennant, 2003; Powell and Sommer, 2007). This may bias our results. We further delete insurers with non-logic values such as non-positive total admissible assets Table 1 shows the summary statistics of the variables that are used in our study.

### **Empirical Framework and Results**

We first use a logit regression model to identify what motivate life insurers to use financial reinsurance. We then use a tobit regression to identify what factors have influence on the use of financial reinsurance.

Table 2 presents the results for a logit regression. The Chi-square value is significant at the 0.01 level, indicating a goodness of fit of the model. We find that life insurers with higher tax convexity and having with-profit business are more likely to use financial reinsurance. We also find that stock life insurers with fewer growth

opportunities and lower earning volatility are less likely to employ financial reinsurance.

The tobit regression results are also shown in Table 2. Consistent with the logit results presented above, we find that life insurers with higher tax convexity and having with-profit business use more financial reinsurance. We further find that stock life insurers with fewer growth opportunities and lower earning volatility use less financial reinsurance.

It is worth noting that solvency is not significantly related to the use of financial reinsurance in both logit and tobit regressions. This finding indicates that life insurers do not financial reinsurance for solvency purposes. Another possible reason is that life insurers use so little financial reinsurance that its use does not affect its solvency level.

## **Conclusions**

Using data from SynThesys Life from 2002 to 2008, we have identified several factors that are related to the use of financial reinsurance. They include tax convexity, with-profit business, organizational form, growth opportunities, and earning volatility. The main contribution of this project is to first identify factors that have influence on the use of financial reinsurance.

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**TABLE 1**  
Description of Variables

Variable	Description
Endogenous variables	
Financial reinsurance participation	1 for insurers using financial reinsurance; 0 for insurers without using financial reinsurance
Financial reinsurance extent	The ratio of financial engineering adjustments to direct business written plus reinsurance assumed
Explanatory variables	
Dependent variable (-1)	The lagged dependent variable by one year
Leverage	The ratio of direct premiums written to surplus
Firm size	The natural logarithm of total admissible assets, deflated using the RPI (inflation) into 1985 prices
Growth opportunities	Change in natural logarithm of total admissible assets
With-profit business	1 for insurers with with-profit business, 0 for insurers without with-profit business
Line-of-business concentration	A Herfindahl index of line-of-business concentration using premiums written in line of business by the insurer
Solvency	The solvency margin expressed as a percentage of the premium income
Tax convexity	The excess of marginal tax rate (= top rate if prior year's net operating loss= 0 and current year's taxable income>0; =0 otherwise) over the annual effective tax rate (= total tax expense ÷ annual taxable income)
Organizational form	1 for stock insurers; 0 for mutual insurers
Profitability	The ratio of pretax profit to surplus
Earning volatility	The natural logarithm of the absolute value of the coefficient of variation of pretax profit up to the preceding year
Level of new business	The ratio of new business written to total business
Liquidity	The ratio of the sum of cash, stocks, and bonds to total admissible assets

**TABLE 2**  
Descriptive Statistics

Variable.	Min	Max	Mean	S.D.
Financial reinsurance participation	0	1	0.00344	0.18233
Financial reinsurance extent	0	0.00702	0.00262	0.00186
Leverage	0.00018	9.75282	1.93345	1.49371
Firm size	3.97075	18.30677	11.66280	2.80395
Growth opportunities	-7.91348	1.117373	0.00345	0.47893
With-profit business	0	1	0.36250	0.48115
Line-of-business concentration	0.37940	1	0.91585	0.16174
Solvency	0.50410	5.39360	1.19954	0.41814
Tax convexity	0	1	0.16398	0.35453
Organizational form	0	1	0.24107	0.42816
Profitability	-195.23800	8.7285	-0.27681	8.27627
Earning volatility	0.00001	573.9972	18.58544	101.6384
Level of new business	0	0.91081	0.999352	9.75130
Liquidity	0	1	0.17829	0.25175

**TABLE 3**  
Effects of Leverage on Financial Reinsurance

Dependent Variable= Financial reinsurance						
Independent Variable	Expected Sign	Participation (Logit)		Extent (Tobit)		
		Coefficient	Standard Error	Coefficient	Standard Error	
Constant		-5.81867	1.06727***	-0.15621	0.00387***	
Leverage	+	-0.00001	0.00001	0.00001	0.00001	
Firm size	+/-	0.00074	0.00052	0.00006	0.00001	
Growth opportunities	+ -	-0.00012	0.00005**	-0.00001	0.00001**	
With-profit business	+	1.80348	0.83633**	0.00464	0.00231**	
Line-of-business concentration	+/-	-0.00134	0.00740	-0.00003	0.00020	
Solvency	-	-0.00024	0.00049	-0.00001	0.00001	
Tax convexity	+	0.00030	0.00010***	0.00001	0.00001**	
Organizational form	+	-1.81366	0.83181**	-0.00467	0.00230**	
Profitability	-	0.00090	0.00357*	0.00002	0.00009*	
Earning volatility	+	-0.00047	0.00012***	-0.00001	0.00001***	
Level of new business	+	0.00124	0.00740	0.00003	0.00020	
Liquidity	-	-0.00018	0.00013	-0.00001	0.00001	
Chi-squared		38.47498***				
<i>Pseudo R-squared</i>		0.20088				

Notes: \*\*\*, \*\*, and \* represent statistical significance at the 0.01, 0.05, and 0.1 levels, respectively

## **SELF-EVALUATION**

The project period is from 1 August 2010 to 31 October 2011. It was satisfactorily conducted. I have written a draft paper based on the results obtained and will submit it to an international journal for publication consideration.

What I Have Learned from Attending the 2010 New Zealand Applied Business  
Education Conference and Visiting Eastern Institute of Technology

Content

Aim

Process

What I have learned

Suggestion

## What I Have Learned from Attending the 2010 New Zealand Applied Business Education Conference

### 1. Aim

The aims of this trip to New Zealand are two-fold: (1) to attend the 2010 New Zealand Applied Business Education Conference held at the War Memorial Conference Center, Napier, Hawke' s Bay, New Zealand; (2) to visit Eastern Institute of Technology, the university that hold this conference. This conference was annually hosted by Eastern Institute of Technology in September every year. In this conference, I presented my paper and received feedbacks and comments on my paper from conference participants. I also wish to know the programs offered by Eastern Institute of Technology for international students and establish a preliminary contact and relation with this University.

### 2. Process

I flew to New Zealand, via Hong Kong, from Kaohsiung on the afternoon of September 26, 2010 and arrived on the next day. I attended the 2010 New Zealand Applied Business Education Conference. The conference's venue is the War Memorial Conference Center, Napier, Hawke' s Bay. The first day of the conference started with the welcome speech from Mr. Chris Collins, CEO, Eastern Institute of Technology, and keynote speech from Professor Steve Wheeler from University of Plymouth, UK.

My paper was scheduled to present on the second day of the conference. The theme of my session is “Management and Business Research”, chaired by Professor Mathew James. In this session, there were 4 papers in total. During and after my presentation, a number of insightful comments are given by the participants. For instance, Dr. Djavlonbek Kadirov from Eastern Institute of Technology suggested me to try multinomial probit regressions for the models. I responded to his comments saying that the dependent variable measures is ordinal and therefore ordered probit regressions are more suitable in this case. We also had some discussion about the research methodology. Another participant commented on the ratings given by rating agencies. Besides, there were other two conference participants offering their comments on my paper. I had noted down all these comments and will discuss with my co-author to examine their feasibility and suitability. Overall, I believe that these opinions are instrumental in enhancing the readability of the paper and the chance of getting it accepted.

I also attended other sessions of the conference such as “Teaching, Learning, and Education”, “Finance, Accounting, and Regulation”, and “Current Issues in Management”. Papers presented in the “Teaching, Learning, and Education” are mainly related to teaching/learning methods. This was the first time I attended formal academic research conference sessions related studies on how to improve students’ learning experience. In the “Finance, Accounting, and Regulation” session, we saw some interesting topics, such as “Ethics Education in Business Schools: A Review” and “Issues in Recognizing Volunteers’ Contributions in Financial Statements”. In the session of “Current Issues in Management”, several papers are presented such as “New Teaching and Learning Approaches to Meet Industry’s Needs”. Overall, the

papers presented in these sessions were quite interesting and insightful.

I also met with Professor Mark Neal who hosted my visit to Eastern Institute of Technology. He also introduced me to Professor Ian Ritchie, Dean International Business and Faculty of Business and Computing. Professor Ritchie kindly showed me around the campus of the University and introduced the features of their programs offered for international students. He also introduced me to Ms. Christine Wright, International Center Manager, and Ms. Dan Zhu, International Marketing Manager-North East Asia. Through their presentations, I was able to have a more clear understanding about this University.

Eastern Institute of Technology, a government-funded Institute of Technology, is established in 1975. This University had 9,000 students as of the end of 2009. Among them, there were 396 international students from across the world, including 55 from India, 44 from Korea, 33 from Japan, 27 from China, 23 from UK, 21 from Saudi Arabia, 14 from Thailand, and 79 from other countries. In their statistics, it is not clear that how many students are from Taiwan because they classify Taiwan and Hong Kong in the same category of “China” . However, according to Professor Ritchie and Ms. Zhu, there were some Taiwanese students studying at Eastern Institute of Technology. There are five faculties in this University, including Business and Computing, Art and Social Sciences, Science and Technology, Health and Sports Science, and Maori Studies. Professor Ritchie especially mentioned the strengths of their Business and Computing Faculty. Five related programs are offered, including Bachelor of Business Studies, Graduate Diploma in Professional Accounting, Graduate Diploma in Business, New Zealand Diploma in Business, and Diploma in Applied Business. Academic support is well provided for international students. They

also have a very good English Training Center which offered courses for general English, English for Academic Purposes and IELTS preparation. This University is also one of 13 IELTS Examination Centers in New Zealand. The University also has good links with other Universities both in New Zealand and other countries. In addition, I also introduced our University to them and promised to host them when they are next in Taiwan.

### 3. What I have learned

On the whole, the topics of concurrent sessions of this conference are mainly relevant to business and management education. I believe that conference participants had enjoyed a stimulating and fruitful discussion. In particular, I benefited from the comments provided by conference participants and will consider including their comments when I revise the paper.

During the visit to Eastern Institute of Technology, I was acquainted with several Professors and Staff from Eastern Institute of Technology and managed to preliminarily establish personal friendship with them. I believe that this would be instrumental in enhancing two Universities' possible cooperation in the future, such as exchange students or language training programs.

### 4. Suggestion

The University may consider encouraging faculty to visit foreign universities while attending conferences abroad. By doing so, our University would have more contacts and closer relations with foreign universities. We then can discuss with them about further bilateral cooperation and exchange programs to benefit us all. I am sure that this would be very helpful in achieving the internationalization of our University.

# 國科會補助計畫衍生研發成果推廣資料表

日期:2012/01/02

國科會補助計畫	計畫名稱：風險與財務再保險的使用動機及再保險的使用與清償能力的關係
	計畫主持人：許永明
	計畫編號：99-2410-H-004-235- 學門領域：財務
無研發成果推廣資料	

99 年度專題研究計畫研究成果彙整表

計畫主持人：許永明		計畫編號：99-2410-H-004-235-					
計畫名稱：風險與財務再保險的使用動機及再保險的使用與清償能力的關係							
成果項目		量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）	
		實際已達成數（被接受或已發表）	預期總達成數（含實際已達成數）	本計畫實際貢獻百分比			
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力 （本國籍）	碩士生	4	2	100%	人次	
		博士生	1	1	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	1	1	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力 （外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

<p>其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)</p>	<p>已完成論文初稿，將於修改後投稿國際期刊。</p>
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	成果項目	量化	名稱或內容性質簡述
科 教 處 計 畫 加 填 項 目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與(閱聽)人數	0	

# 國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

達成目標

未達成目標（請說明，以 100 字為限）

實驗失敗

因故實驗中斷

其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文： 已發表  未發表之文稿  撰寫中  無

專利： 已獲得  申請中  無

技轉： 已技轉  洽談中  無

其他：（以 100 字為限）

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限）

In this research, we find that convexity, with-profit business, organizational form, growth opportunities, and earning volatility. The main contribution of this project is to first identify factors that have influence on the use of financial reinsurance.

To my best knowledge, this study is the first research that examines life insurers' motivations for using financial reinsurance. I intend to combine the risk and financial resinsurance results in one paper to enhance its probability of getting accepted.