出國報告（出國類別：出席國際會議）

2013 年 風險理論研討會 出席報告

服務學校系所：政治大學風險管理與保險學系

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派赴國家：美國

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摘要

Risk Theory Seminar（風險理論研討會；以下簡稱 RTS）是保險學界最核心、地位最崇高的學術會議。各國風險理論與保險研究頂尖的學者幾乎都曾是 RTS 的成員。RTS 有幾個特色。首先，研討會只有 RTS 會員才能參加。其次，每段時間只有一篇論文發表。每年的年會只錄取最多 10 篇論文。最後，每一篇論文有 75 分鐘的發表時間，當中幾乎一定會有激烈的討論。

取得 RTS 會員資格的規定清楚且沒有例外：在其研討會中發表過論文。個人和共同作者們今年能得到於研討會中發表論文的機會，自然一定得把握。因此，出席這個國際會議的目的有兩個。第一是聽取此領域頂尖期刊之主編、副主編、以及許多可能的審查人的建議，提升我們論文的品質，並提高日後刊登在頂尖期刊的機率。第二是到這個學術會議聆聽最新的高品質工作論文。能夠在這些高品質的文章還未發表時就知道其內容，讓個人（與此報告的讀者們）能跟上國際學術領域的發展最前緣。

目前政治大學商學院的風險與保險研究中心有訂定六個風險管理與保險的重點會議，此研討會為其中之一。未來如果能將相關資源統整，補助國內相關領域的老師們一起去參加，相信更能彰顯提昇國際競爭力的成效。

目次

壹、目的

第一是到保險學界最核心、地位最崇高的學術會議發表論文，聽取此領域頂尖期刊之主編、副主編、以及許多可能的審查人的建議，提升論文的品質，提高刊登在頂尖期刊的機率。這些對個人與共同作者們均有助益，亦能增進本系、院、校在國際上的知名度。

第二是到這個學術會議聆聽最新的高品質工作論文（working paper）。能被此會議接受的工作論文都有相當的品質。根據過去的紀錄，在此會議發表過的論文，多能發表於A級的國際學術期刊，甚至有一些是刊登上A+級。能夠在這些高品質的文章還未發表時就知道其內容，讓個人（與此報告的讀者們）能跟上國際學術領域的發展最前緣。

貳、會議過程

個人與共同作者們於 4/5 下午抵達會議旅館，隨即換裝參加傍晚的 welcome reception。歡迎會中得以跟十幾位國際知名學者寒暄互動、建立關係。印象最深刻的是和一位 *Journal of Risk and Insurance* 的共同主編互動時，發現他很清楚我們的文章內容，也給我一些正面的意見。第一天晚上為了準備隔天的報告，四位共同作者努力到深夜兩點左右，即使出國前已經密集開會了許多天做預備。

第二天早上的第二場論文發表即為我們的文章。由於我們事前有充分的準備，發表時態度謙和、極願意接納與會者的建議，因此有許多學者不吝提供建議，甚至於休息時間都還有學者陸續過來給建議，獲益良多。

整個研討會的十篇文章中，約有一半左右是有劍拔弩張的氣氛的。而且在此研討會的 business meeting 中，還有資深學者重申會員應積極參與討論的義務，可見此研討會之嚴謹性。

十篇文章之報告順序、作者（們）、及其任教學校羅列如下。

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1. 框架效應與人壽保險

   Daniel Gottlieb

   Kent Smetters

   National Bureau Of Economic Research

2. 健康保險市場與醫療過失保險市場之關係 The Relationship between the Markets for Health Insurance and Medical Malpractice Insurance

   J. Bradley Karl, Florida State University

   Patricia Born ,Florida State University

   W. Kip Viscusi, Vanderbilt University

2013/4/6 星期六

3. 雙邊違約風險下之最適擔保 Optimal Collateralization with Bilateral Default Risk

   Daniel Bauer, Georgia State University

   Enrico Biffis, Imperial College London

   Luz Rocio Sotomayor, Georgia State University

4. 保單貼現商品利差之解釋 Explaining the Rate Spreads of Life Settlements

   Ming-Hua Hsieh, National Chengchi University

   Jin-LungPeng,NationalChengchiUniversity

   ChenghsienTsai,NationalChengchiUniversity

   JenniferL.Wang,NationalChengchiUniversity

5. 核保循環是我們的妄想嗎？Underwriting Apophenia and Cryptids: Are Cycles Statistical Figments of our Imagination?

   M. Martin Boyer, HEC Montréal

6. 在損害防阻下的內生訊息與逆選擇 Endogenous Information and Adverse Selection under Loss Prevention

   Richard Peter, Munich Risk and Insurance Center

   Andreas Richter, Munich Risk and Insurance Center

   Paul Thistle, University of Nevada Las Vegas

7. 道德危險與房價 Burning Down the House: Moral Hazard and House Prices

   Michael D. Eriksen, University of Georgia

   James M. Carson, University of Georgia

   Daniel P. Amos, University of Georgia

8. 模糊與資訊不對稱下之競爭保險合約 Competitive Insurance Contracting with Ambiguity and Asymmetric Information

   Rachel J. Huang, National Taiwan University of Science and Technology

   Arthur Snow, University of Georgia

   Larry Y. Tzeng, National Taiwan University

2013/4/7 星期日

9. Arrow-Borch-Raviv 保險模型中的信念異質性 Belief Heterogeneity In The Arrow-Borch-Raviv Insurance Model

   Mario Ghossoub, Universit'e De Montr´eal

10. 外部監督品質與經理人裁量權 External Monitor Quality and Managerial Discretion

    Martin F. Grace, Georgia StateUniversity

    J. Tyler Leverty, University of Iowa

參、會議重點摘錄

1. 框架效應與人壽保險

人壽保險產業規模雖然非常大，但我們對該產業卻知之甚少。大部分的保單實際上最後都沒有給付保險金，而保險公司靠著保戶解約作為賺錢的手段。人壽保險產業也是少數反對自己的商品有次級市場的產業。另外，壽險合約慣有的費用結構與保戶的重分類風險(reclassification risk)誘因並不吻合。以上種種人壽保險產業中的典型現象是無法以傳統的資訊問題解釋的。作者提出一個簡單的框架效應模型，並且試圖為上述的所有現象提供一個簡單的解釋。

2. 健康保險市場與醫療過失保險市場之關係

本文討論健康保險市場與醫療過失保險市場的雙向關係。雖然兩個市場都受到醫療照護體系影響，但過去的文獻僅止於單一市場的研究。本研究利用 NAIC 的健康保險與醫療過失保險的保險人資料來評估兩市場相互影響的程度，並發現相互影響的程度十分顯著。

3. 雙邊違約風險下之最適擔保

本文考慮店頭合約中的雙邊違約風險，並研究信用附約(Credit Support Annex)的最適設計。在交易雙方有交易技術、違約罰則與擔保成本為內生下，本文證明最適設計的信用附約能夠抵消擔保成本與交易對手風險加上預期違約損失。研究結果可以為各種擔保規則中的主要元素提供直覺的說明。

4. 保單貼現商品利差之解釋

本文試圖以一組獨特的資料來解釋保單貼現商品的利差。可能影響保單貼現商品的利差的因素主要有信用風險溢酬、脫退的傾向以及機構投資人的特殊資訊。本文考慮多種死亡率的假設，並加入死亡率改善的模型，試圖將死亡率的影響忠實地反映在保單貼現商品的預期報酬率上。

5. 核保循環是我們的妄想嗎？

核保循環此一現象不論在實務或是學術界都十分受到注意，由於核保循環在驗證保險市場的效率性上有很重要的地位，因此當學者觀察到此一現象時，馬上出現了許多與之相關的研究。本文蒐集過去研究核保循環的實證研究文獻中的結果，以及利用資料庫自行計算，發現這些資料都反映出在統計上核保循環並不存在，這個結果同時表示產險公司的獲利並沒有所謂的規律可言，而且產險市場的訂價方式與競爭市場並無不相容的情形。

6. 在損害防阻下的內生訊息與逆選擇

本文研究在考慮一個保險市場中不同廠商有不同的損害防阻技術，以及存在保戶對損害防阻效率的逆選擇下，內生資訊在保險市場中的價值。作者證明若對所有風險類型加入可觀察的損害防阻行為，則保費風險將會提高。因此若人們可以調整他們的損害防阻行為，進而影響保費，則這項資訊可能是有價值的。本文比較在無損害防阻行為與能夠揭露損害防阻行為兩類情形下資訊的價值變化，以

說明揭露資訊的價值。

7. 道德危險與房價

道德危險可能導致屋主在房價下跌時縱火燒自己家以獲得賠償。本文解釋在何種情形下燒自己家會是有利可圖的，並且提供實證數據說明在 1980-2010 年間意圖縱火、火災與房價之間的關係。另外本文也試圖從過去的資料中尋找出那些城市較可能發生某些特定的「意外」起火事件。

8. 模糊與資訊不對稱下之競爭保險合約

本文考慮被保險人的風險偏好具有模糊性，並在此假設下推導 Rothschild and Stiglitz (1976)的保險合約模型。被保險人同時為風險與模糊厭惡，而保險人為風險中立，但可為模糊厭惡或模糊中立。模糊使得模糊厭惡的被保險人不願意承擔財富的風險，並且最終使得競爭市場均衡出現兩種情形:逆選擇與保額與預期出險頻率呈現正相關，或者是優勢選擇與保額與預期出險頻率呈現負相關。最終的結果視被保險人模糊厭惡對預期效用函數的敏感性而定。

9. Arrow-Borch-Raviv 保險模型中的信念異質性

在傳統的 Arrow-Borch-Raviv 保險模型中，保險人與被保險人對風險的信念(belief)相同。本文嘗試改變保險人與被保險人的主觀信念，並推導在各種不同情形下的最適合約形式。作者證明在一般化主觀信念假設下，以及被保險人對風險的主觀機率分配滿足「警覺」的性質時，一般化的最適合約仍然是具有自負額的形式。

10. 外部監督品質與經理人裁量權

作者研究外部監督限制經理人裁量權的程度。本文以產險公司作為研究對象，

因爲該產業的特性，使得經理人偏誤有一客觀的衡量標準，並且該產業能將外部監督分爲技術知識與獨立性。本文發現經理人利用他們的裁量權來減少費率管制的衝擊，並且進行盈餘管理與節稅。作者發現高品質的外部監督能夠限制經理人裁量權，並且技術知識與獨立性兩者皆可以增進外部監督的品質，但獨立性的效果只在與技術知識結合時有用。

肆、與會心得與建議

RTS是保險學界最核心、地位最崇高的學術會議。RTS是風險理論與保險研究領域的頂尖學者所組成的學術社群，爲此領域最重要且菁英色彩最濃厚的團體。各國風險理論與保險研究頂尖的學者幾乎都曾是RTS 的成員。

RTS 有幾個特色。首先，研討會只有RTS 會員才能參加。其次，每段時間只有一篇論文發表。每年的年會只錄取最多10 篇論文。最後，每一篇論文有75分鐘的發表時間，前20 分鐘的保護傘期間一過，任何人都能隨時提出問題和建議，討論通常會很激烈。

取得RTS 會員資格的規定清楚且沒有例外：在RTS發表過論文的學者才能取得會員資格。這是個人第三年的投稿嘗試，此次獲得接受，對個人與共同作者們的這篇文章實爲一大肯定，亦能增進本系、院、校在國際上的知名度。建議應全額補助能去參加這個研討會的學者們。

伍、個人簡報資料

Explaining the Rate Spreads of Life Settlements

Ming-Hua Hsieh, Jin-Lung Peng,
Chenghsien Tsai, Jennifer L. Wang
National Chengchi University

Introduction

- Life settlements are life insurance policies sold in a secondary market.
- The policyholder involved in a life settlement transaction receives a payment exceeding the surrender value but less than the death benefit.
- The life settlement segment is one of the fastest growing segments among the financial service markets

Life Settlements Market

The Growth of the Life Settlement Market

YEAR	TOTAL FACE AMOUNT SOLD
1998	$200 million
2006	$5.5 billion
2008	$12.95 billion
2009	$7.01 billion

Life settlements are becoming an increasingly popular asset class because they offer good returns

US Life Insurance Markets

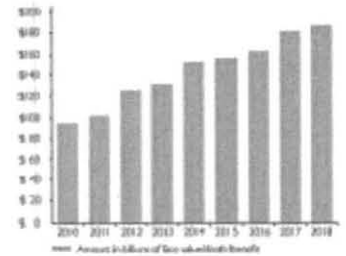
Primary Market

- **88% of universal life insurance policies do not pay out in a claim.**
- **85% of term life insurance policies do not pay out in a claim.**

Secondary Market

- **$180 billion by 2017[1].**

Forecast of US Life Settlement Market Potential[1]



1 Conning 2009

Important Characteristics of Life Settlements:

- Largely uncorrelated performance,
- Potentially attractive risk/return profile,
- Relatively low volatility,
- Superior credit quality.

Previous Research

- Gatzert (2010) gives an excellent review of various settlement products and recent life settlement markets.
- Braun, Gatzert, and Schmeiser (2011) provide a comprehensive analysis of the risk and return performance of life settlements and show that life settlements offer attractive returns with low volatility and uncorrelated with other asset classes.
- Braun, Gatzert, and Schmeiser (2011) suggest that Life settlements can be good investments to life insurance companies since they offer good yields with near-zero betas.
- Wang, Hsieh and Tsai (2011) show that life settlements can be an effective hedging tool to significantly reduce the insurer's mortality risk.

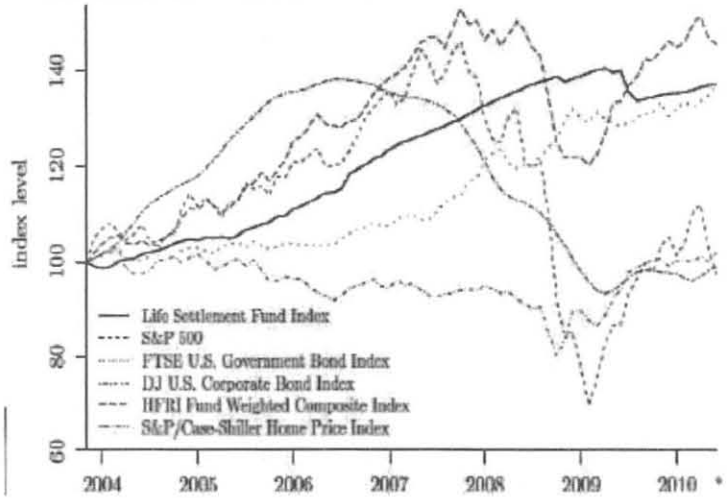
Life Settlements: The New Alternative

- **Demand for the uncorrelated performance of longevity-linked assets is growing.**
- **Institutions are diversifying portfolios and increasing allocations to alternatives.**
- **Supply of longevity-linked assets is increasing.**
- **Longevity market is maturing with large-scale counterparties facilitating transactions.**

Return of the Life Settlements

- Life settlements are becoming an increasingly popular asset class, offering good returns that are largely unaffected by financial crises and market downturns like those of 2000 and 2008.
- With the structure similar to hedge funds, the open-end life settlement funds usually targeted absolute returns of between 8 and 15 percent per annum.
- Life settlements have historically traded about 1,000bps above investment grade corporate bonds of similar maturity.

Return of the Life Settlements



Purpose of the study

- What determine the spreads of life settlements?
  - The determinants of the rate spreads implied by life settlements have not yet been examined, albeit the increasing importance of such products.
  - Identifying the determinants and understanding their relative significance will help current and potential stakeholders assess the values and risks of life settlements.

Return of the Life Settlements

Descriptive Statistics	Life Settlement Fund Index	S&P 500	FTSE U.S. Government Bond Index	DJ U.S. Corporate Bond Index
No. of negative months	9	30	26	33
Sharpe ratio (rank)	0.3327(1)	−0.0274	0.2039(2)	−0.0726
Sortino ratio (rank)	0.4580(1)	−0.0340	0.3282(2)	−0.0978
Calmar ratio (rank)	0.0695(2)	−0.0071	0.0813(1)	−0.0220
Excess return/VaR (rank)	0.2889(1)	−0.0140	0.1970(2)	−0.0553

HFRI Fund Weighted Composite Index	S&P/Case-Shiller Home Price Index	S&P GSCI	S&P Listed Private Equity Index
26	39	33	27
0.1589(3)	−0.1479	0.0079(5)	0.0211(4)
0.2207(3)	−0.1762	0.0104(5)	0.0283(4)
0.0458(3)	−0.0673	0.0022(5)	0.0061(4)
0.1174(3)	−0.0825	0.0049(5)	0.0130(4)

What determines risk premiums?

- Stock Returns
  - CAPM: β
  - APT: the β's associated with some macroeconomic / systematic risk factors
  - Fama and French's factor models: size, book-to-market ratio, momentum, etc.

Determinants of Corporate Bond Yield Spreads

- Default risk (Fons, 1994; Longstaff, Mithal, and Neis, 2005)
- Tax premium (Elton et al., 2001)
- Other components seemingly relating to the determinants of stock risk premiums (Elton et al., 2001)
- Liquidity (Longstaff, Mithal, and Neis, 2005; Chen, Lesmond, and Wei, 2007)

Samples

- Real-case data from Coventry
- Policies purchased from July 2009 to April 2011
- Underlying policies: universal life
- 346 samples

Other Fixed-Income Securities

- Corporate Loans (Santos, 2011)
  - credit quality of borrowers, loan maturity, banks' previous losses
- Emerging Market Bonds (Min, 1998; Alexopoulou, Bunda, and Ferrando, 2009)
  - macroeconomic fundamentals of individual countries
- Catastrophe Bonds (Bantwal and Kunreuther, 1999; Zanjani, 2002; Dieckmann, 2010)
  - Behavior factors (e.g., reluctance of managers to invest in cat bonds), the threats of catastrophes on risk bearers' solvencies

Summary Statistics

	Mean	Median	Sd.	Min.	Max.
Age	75.75	75.58	4.56	63.42	86.75
Gender (male = 1)	0.73	1.00	0.44	0.00	1.00
LE_Coventry	12.97	13.00	2.77	5.92	19.67
Acquisition Cost ($m)	0.46	0.24	0.69	0.02	6.80
Nominal Death Benefit ($m)	4.12	3.00	3.78	0.24	20.00
Rating (~A+, AA-, ..., AAA-~)	1.57	2.00	0.99	0.00	4.00

Modeling: Expected Returns

- Expected Returns of Life Settlements
  - life expectancy vs. bond maturity
  - Internal rate of return (IRR) vs. bond yield

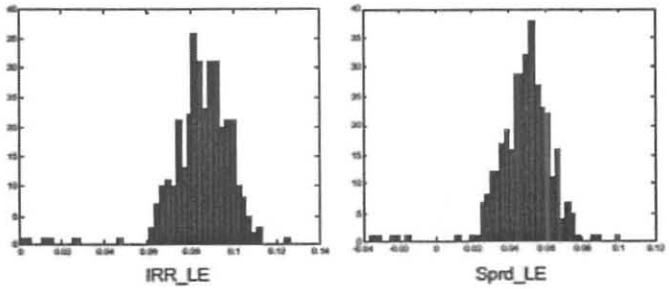
Acquisition Cost =

$$-\sum_t PV(Premium_t) + PV(NDB_{LE}),$$

- NDB_{LE} is the nominal death benefit to be paid at the expected death time

Stone (2006; 2008)

Histograms



Rate Spreads

- the difference between the calculated IRR and the risk-free rate at the inception of the life settlement
  - **Risk-free rates** are the spot rates derived from Treasury STRIPS with maturities being matched with the life expectancy at the funding time

	Mean	Median	Sd.	Min.	Max.
IRR_LE	8.55%	8.68%	1.42%	0.05%	12.62%
Zero Rate	3.67%	3.73%	0.38%	2.47%	5.01%
Spread	4.89%	5.03%	1.53%	-3.60%	10.08%

Possible Determinants: Seller Side

- Behavior Issue: surrender tendency
  - Life settlements can be regarded as substitutes for surrenders. Stronger motivations to surrender insurance policies imply more willingness to enter life settlement transactions. The terms of such transactions will be worse as a bargaining result, which implies higher rate spreads of life settlements.
  - Actuarial reports found that policy year, the account value normalized by death benefit, and healthiness (reflected by life expectancy through age, gender, and smoking) are negatively correlated with surrender rate.

Possible Determinants: Buyer Side

- Bearing mortality rate risks
  - Non-systematic and systematic
- Paying ordinary tax
- Bearing the default risk of the underlying insurer

Underwriting Information

$$LE\_cov = \gamma_0 + \gamma_1 LE_{HMD} + \epsilon$$

	$LE_{Coventry}$
Intercept	3.817^{***} (0.407)
LE_{HMD}	0.838^{***} (0.036)
Adjusted R^2	0.6069

	Mean	Median	Sd.	Min.	Max.
Underwriting Information	0.00	0.02	1.73	-9.83	3.28

Independent Variables

- **Insured:**
  healthiness (indicated by underwriting information to reflect surrender tendency);
- **Policy:**
  policy year (from issued date to funding date), acquisition cost / NDB;
- **Carrier:** rating

	Mean	Median	Sd.	Min.	Max.
ACdivNDB	0.10	0.08	0.06	0.04	0.37
Policy_Year	2.93	2.33	3.30	0.08	23.67

The first regression – certain death time

	Sprd_LE
Intercept	6.092^{***}
Underwriting Information ε	-0.498^{***}
Acquisition Cost / NDB	-11.272^{***}
Policy Year	-0.097^{***}
Rating	0.140
Adjusted R^2	0.212

Considering Tax

2010 ordinary tax rate Head of Household Filing Status	
10% on the income between $0 and $11,950 15% on the income between $11,950 and $45,550; *plus* $1,195 25% on the income between $45,550 and $117,650; *plus* $6,235 28% on the income between $117,650 and $190,550; *plus* $24,260 33% on the income between $190,550 and $373,650; *plus* $44,672 35% on the income over $373,650; *plus* $105,095	67,976-45550=5606 5606*0.25+6235=7636 7636/67976=11.23%

Regression Results - certain death time

	Sprd_LE	Sprd_LE_tax
Intercept	6.092***	4.911***
Underwriting Information ε	-0.498***	-0.408***
Acquisition Cost / NDB	-11.272***	-7.966***
Policy Year	-0.097***	-0.085***
Rating	0.140	0.094
Adjusted R^2	0.212	0.180

Estimating Tax Impact

- Tax rate: 15%
- Tax base:
  - Net death benefit – (sum of previous premium and acquisition cost)
- Acquisition Cost =

$$-\sum_t PV(Premium_t) + PV(NDB_{LE} - Tax_{LE})$$

	Mean	Median	Std. Dev.	Min.	Max.
IRR_LE	0.086	0.087	0.014	0.000	0.126
IRR_LE_tax	0.077	0.078	0.013	0.000	0.112

IRR under uncertain death time

- $AC = -\sum_{t=1}^{\omega} {}_tp_x PV(Prem_t) + {}_{t-1}p_x \times q_{x+t-1} \times PV(NDB_t)$

- Considering Tax

$$AC = -\sum_{t=1}^{\omega} {}_tp_x PV(Prem_t) + {}_{t-1}p_x \times q_{x+t-1} \times PV(NDB_t - Tax_t)$$

$$Tax\ Base_t = NDB - (AC + \sum_{s \le t} Prem_s)$$

Scaling Mortality Rates

- We scale the mortality rate so that the life expectancy equals to the life expectancy provided by Coventry

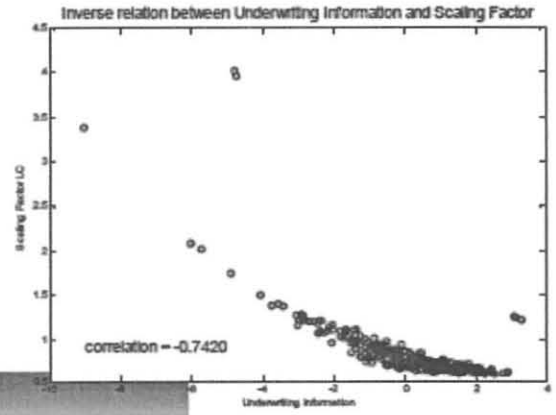
	Scaling Factor
Mean	0.721
Median	0.656
Std. Dev.	0.333
Min.	0.412
Max.	3.608

	Mean	Median	Std. Dev.	Min.	Max.
IRR_LE_tax	0.077	0.078	0.013	0.000	0.112
IRR_q_tax	0.109	0.114	0.029	0.028	0.188

Comparisons on alternative IRRs

NDB	250,000
Carrier Rating SP	AA
Insured Gender	M
Smoking Status	NS
UW Year	2009
Funding Year	2009
Acquisition Cost	30,496
LE at Funding	134
Age	76.83

Scaling Factor and Underwriting Information



Regression Results - uncertain death time

	Sprd_q	Sprd_q_tax
Intercept	14.140***	8.030***
Underwriting Information ε	-1.114***	-0.726***
Acquisition Cost / NDB	-36.001***	-15.72***
Policy Year	-0.089	-0.101**
Rating	-0.225	-0.113
Adjusted R^2	0.200	0.14

Considering Mortality Improvements

- Lee-Carter model

$$\log m_{x,t} = a_x + b_x k_t + \epsilon_{x,t}$$

$$k_t = \mu + k_{t-1} + v_t$$

  - We forecast expected cohort mortality table to replace the static HMD table
  - Simulation: we simulate 1,000 cohort mortality tables. For each policy we calculate IRR for each table, then average the IRRs

	Mean	Median	Std. Dev.	Min.	Max.
IRR_q_tax	0.109	0.114	0.029	0.028	0.188
IRR_LCq_tax	0.097	0.101	0.027	0.024	0.166
IRR_LCq_sim_tax	0.097	0.102	0.027	0.024	0.172

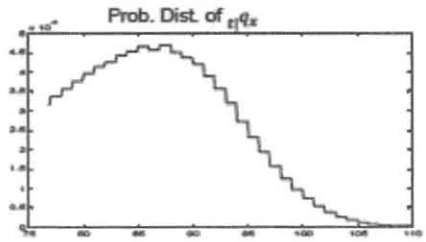
Regression Results - Mortality Improvements

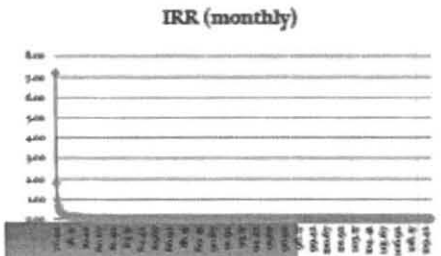
	Sprd_LCq	Sprd_LCq_sim_tax
Intercept	-11.795***	8.030***
Underwriting Information ε	-01.012***	-0.726***
Acquisition Cost / NDB	-28.662***	-15.72***
Policy Year	-0.110**	-0.101**
Rating	-0.131	-0.113
Adjusted R^2	0.167	0.14

IRR distribution

- We compute $IRR_{t/12}$ for t < 110 , i.e., $IRR_{1/12}$ given the policyholder dies at month 1, $IRR_{2/12}$ given the policyholder dies at month 2, and so on
- The distribution of death time t can be obtained from mortality table ($_{t|}q_x$)
- We then obtain expected IRR by $\sum_t {}_{t/12|}q_x IRR_{t/12}$

	Mean	Median	Std. Dev.	Min.	Max.
IRR_q	0.136	0.140	0.037	0.034	0.248
IRR_q_dist	0.663	0.625	0.233	0.202	1.698





Age	Prob(Death)	IRR(monthly)	Premium
76.92	0.0035535	7.20	-3895.61
77.00	0.0035535	1.80	0.00
77.08	0.0033766215	0.97	-3895.61
77.17	0.0033766215	0.65	0.00
77.25	0.0033766215	0.49	0.00
77.33	0.0033766215	0.39	-3895.61
77.42	0.0033766215	0.32	0.00
77.50	0.0033766215	0.27	0.00
77.58	0.0033766215	0.24	-546.88
77.67	0.0033766215	0.21	0.00
77.75	0.0033766215	0.19	0.00
77.83	0.0033766215	0.17	-546.88
77.92	0.0033766215	0.16	0.00
78.00	0.0033766215	0.14	0.00
78.08	0.0033555293	0.13	-546.88

Option's risk premium

Consider a typical Black-Scholes example : call option of underlying with following characteristics $\mu = 10\%$, $\sigma = 40\%$, $r = 3\%$

K/So	1	2	3
Expected Return	30.9%	60.7%	85%

Regression Results - IRR distribution

	Sprd_q_dist_tax	Sprd_LCq_dist_tax
Intercept	78.168***	74.559***
Underwriting Information ε	-7.082***	-6.851***
Acquisition Cost / NDB	-256.341***	-234.544***
Policy Year	-0.105	-0.101
Rating	1.351	1.306
Adjusted R^2	0.299	0.287

IRR distribution with Lee-Carter mortality

- We further consider the IRR distribution under Lee-Carter mortality improvements
  - Compute the death time distribution for each simulated LC mortality table
  - Average all the expected IRR to come up with the final estimate $\sum_{i=1}^{N}\sum_{t=1}^{\omega-x-1} {}_{t/12|}q_x^i IRR_{t/12}$

	Mean	Median	Std. Dev.	Min.	Max.
IRR_q_dist	0.663	0.625	0.233	0.202	1.698
IRR_LCq_sim_dist_tax	0.567	0.535	0.200	0.169	1.455

Regression Results - IRR distribution with Mortality Improvements

	Sprd_LCq_sim_dist_tax
Intercept	74.777***
Underwriting Information ε	-6.870***
Acquisition Cost / NDB	-235.198***
Policy Year	-0.103
Rating	1.378
Adjusted R^2	0.288

Summary of Results

	Expected Sign	SPR LE	SPR LE_ tax	SPR q	SPR q_tax	SPR_ LCq_ tax	SPR LCq_ sim_ tax	SPR q_dist _tax	SPR LCq dist tax	SPR LCq_ Sim Dist tax
Underwriting Information c	—	—	—	—	—	—	—	—	—	—
Acquisition Cost / NDB	—	—	—	—	—	—	—	—	—	—
Policy Year	—	—	—		—	—	—			
Rating	—									

Correlations

	Spread _LE	LE_Coven try	Age	Gender	ACdivND B	Policy_Ye ar	Rating
Spread_L E	1.00	-0.29	0.14	0.04	-0.10	-0.15	0.04
LE_Cov	-0.29	1.00	-0.72	-0.15	-0.53	-0.16	-0.05
Age	0.14	-0.72	1.00	-0.28	0.16	0.03	0.15
Gender	0.04	-0.15	-0.28	1.00	0.14	0.00	-0.13
ACdivNDB	-0.10	-0.53	0.16	0.14	1.00	0.15	-0.04
Policy_Ye ar	-0.15	-0.16	0.03	0.00	0.15	1.00	-0.02
Rating	0.04	-0.05	0.15	-0.13	-0.04	-0.02	1.00

Q & HELP