行政院國家科學委員會專題研究計畫 成果報告

以間斷式障礙選擇權數值模型評價具有破產成本之存款保險
研究成果報告(精簡版)

計 畫 類 別 ：個別型
計 畫 編 號 ：NSC 99-2410-H-009-014-
執 行 期 間 ：99 年 08 月 01 日至 100 年 07 月 31 日
執 行 單 位 ：國立交通大學財務金融研究所

計 畫 主 持 人 ：王克陸

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 100 年 10 月 31 日

中文摘要：　文獻中存款保險之討論有一個問題：大部分之保險評價模型都假設連續之時間資料，但 FDIC 只在固定的時間監管銀行。本研究中我們使用延伸之障礙選擇權數值模型架構，考量間斷型之資料狀況，將銀行資本規範實務納入結構模型中考慮，進而分析存款保險之介入點金額是否影響公允之保險定價。本研究對保險費率與監管政策之關係提供新的瞭解，同時確認破產成本在存保定價中是不可忽略之重要因素。

英文摘要：　The pricing literature of deposit insurance has a drawback that most models are in continuous time while the FDIC monitors the banks periodically. In this study we discuss an adapted barrier pricing model with discrete monitoring of banks. The practice of bank capital regulation is embedded in our structural model. The numerical results show that varying the regulatory barrier is capable of determining a fair insurance premium. This numerical method could offer a new insight into the relationship between the insurance premium and the supervision policy. Furthermore, the influence of the bankruptcy costs on deposit insurance cannot be ignored.

行政院國家科學委員會補助專題研究計畫成果報告

（以間斷式障礙選擇權數值模型評價具有破產成本之存款保險）

計畫類別：個別型計畫
計畫編號：NSC 99-2410-H-009-014-
執行期間： 2010 年 8 月 1 日至 2011 年 7 月 31 日

執行機構及系所：國立交通大學財務金融研究所

計畫主持人：王克陸
共同主持人：
計畫參與人員：戴慈、呂孟柔

成果報告類型(依經費核定清單規定繳交)：■精簡報告

本計畫除繳交成果報告外，另須繳交以下出國心得報告：
□赴國外出差或研習心得報告
□赴大陸地區出差或研習心得報告
□出席國際學術會議心得報告
□國際合作研究計畫國外研究報告

處理方式：除列管計畫及下列情形者外，得立即公開查詢
■二年後可公開查詢

中　華　民　國　100 年 10　月 31 日

A discrete barrier option model for deposit insurance valuation with bankruptcy costs

摘要

文獻中存款保險之討論有一個問題：大部分之保險評價模型都假設連續之時間資料，但 FDIC 只在固定的時間監管銀行。本研究中我們使用延伸之障礙選擇權數值模型架構，考量間斷型之資料狀況，將銀行資本規範實務納入結構模型中考慮，進而分析存款保險之介入點金額是否影響公允之保險定價。本研究對保險費率與監管政策之關係提供新的瞭解，同時確認破產成本在存保定價中是不可忽略之重要因素。

關鍵詞：存款保險定價、障礙選擇權，數值分析，寬容政策

Abstract

The pricing literature of deposit insurance has a drawback that most models are in continuous time while the FDIC monitors the banks periodically. In this study we discuss an adapted barrier pricing model with discrete monitoring of banks. The practice of bank capital regulation is embedded in our structural model. The numerical results show that varying the regulatory barrier is capable of determining a fair insurance premium. This numerical method could offer a new insight into the relationship between the insurance premium and the supervision policy. Furthermore, the influence of the bankruptcy costs on deposit insurance cannot be ignored.

Key words: deposit insurance premium, barrier option, numerical analysis, foreclosure policy

報告內容

一、前言

The importance of deposit insurance is undeniable during the recentfinancial turmoil. Many governments impose the deposit insurance system byextending the full coverage of deposits to all depositors in order to stabilize thebanking system. However, how this insurance can be properly priced is always anissue for bankers and policy makers.Beginning in 2005, the new Federal Deposit Insurance ReformAct requiresFDIC to set the new risk rating system. However, with the new assessment rates, FDIC faces difficult challenge to dealwith the financial tsunami caused by the subprime mortgage crisis. Due to thebankruptcy of many financial institutions, FDIC was forced to take over the problembanks, provide the rescue money for the depositors. The insurance fund for thedeposits was soon to be exhausted.It is interesting to note that FDIC must adjust the assessment rate for the currentfinancial situation. The right pricing formula is still a difficult issue underchanging environment with complicated policy variables.

二、研究目的

Using a simple extended structural approach, this study considers the realprovisions of the FDIC regulations and takes into account the coverage limitation ofthe deposit insurance. It focuses on the determination of fair deposit insurancepremium for FDIC under different financial conditions and varied regulatory policiesfor forbearance. The contribution of our numerical method is that it can provide thesupervisory agencies the exact barrier policy for taking over the financial institutions.The closure policy in capital regulation will be affected by the insurance premium andthe bankruptcy costs.

三、文獻探討、

There are two different approaches in pricing the deposit insurance. Duffie,Jarrow, Purnanandam and Yang (2003) adopted the reduced form models in valuingthe insurance premium.Structural forms, which are typically based on asset values and assetvolatilities, are used by most researchers (Black and Cox, 1976; Leland, 1994;Anderson and Sundaresan, 2000; Brockman and Turle, 2003; Episcopos, 2008).In particular, a path-dependent barrier option has been utilized in depositinsurance valuation problem (Brockman and Turtle, 2003). The value of the bankequity is given by a down-and-call option with barrier as the critical point to failure.In contrast, FDIC’s contingent asset value can be viewed as a down-and-in

option andits obligation to pay the deposits can be viewed as a European put option written onthe asset of bank (Episcopos, 2008). As an insurer to the depositors of the bank if thebank fails, FDIC would receive insurance premium to cover the loss of funds.Previous literature has discussed the importance of the bankruptcy cost,including direct cost (Warner, 1977; Altman, 1984; Weiss, 1990; Franks and Torous,1994; Branch, 2002) and indirect cost (Altman, 1984; Andrade and Kaplan, 1998;Cutler and Summers, 1988; Rajan, 1996). These papers concluded that the directbankruptcy cost to be 3% to 4.5% of the firm's market value and indirect one to behigher than 10%. For financial institutions, due to systemic risk, it is generallyconsidered that the overall costs of bank failures are higher than the costs of failuresin other industries. According to Gendreau and Prince (1986), direct cost of bank'sbankruptcy amounts to 6% of the liabilities.

四、研究方法

The equity value is priced as a down-and-out call (DOC) by BT model withsimplifying assumptions like no dividends, no taxes, no bankruptcy cost, no insurancepremium, constant volatility and continuous monitoring. BT model is difficult toconsider all the real implications of bank regulation.

$$DOC(H,X) = VN(a) - Xe^{-rT}N(a-\sigma\sqrt{T}) - V\left(\frac{H}{V}\right)^{\eta}N(b) + Xe^{-rT}\left(\frac{H}{V}\right)^{\eta-1}N(b-\sigma\sqrt{T})$$

where V is the current market value of bank asset, X is the promised payment todepositors in T years, H is the closure barrier, N is the standard normal cumulativedistribution function, and r is the risk free rate of interest, and

$$a = \begin{cases} \dfrac{\ln(V/X) + (r+\sigma^2/2)T}{\sigma\sqrt{T}} & X \geq H \\ \dfrac{\ln(V/H) + (r+\sigma^2/2)T}{\sigma\sqrt{T}} & X < H \end{cases}$$

$$b = \begin{cases} \dfrac{\ln(H^2/VX) + (r+\sigma^2/2)T}{\sigma\sqrt{T}} & X \geq H \\ \dfrac{\ln(H/V) + (r+\sigma^2/2)T}{\sigma\sqrt{T}} & X < H \end{cases}$$

$$\eta = (r/\sigma^2) + 1/2.$$

The residual of bank's asset would be equal to

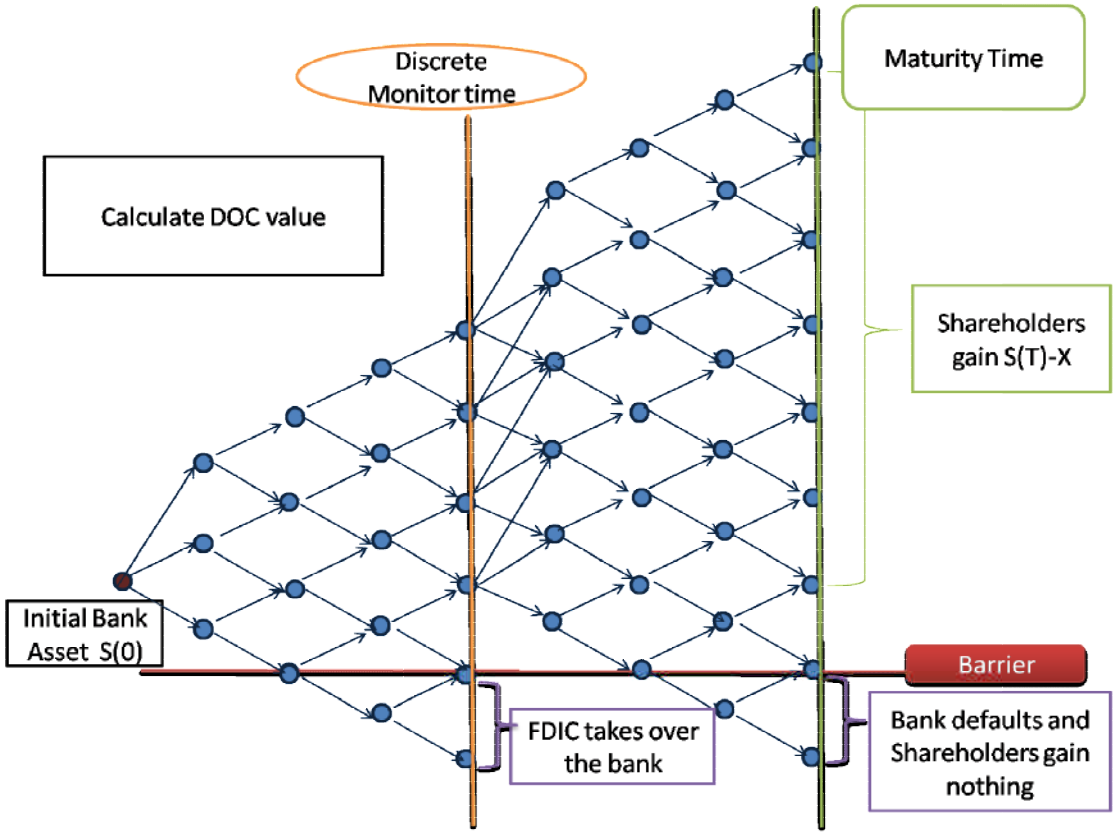
$$V - DOC(H,X) = V - C(X) + DIC(H,X) = Xe^{-rT} - P(X) + DIC(H,X)$$

where C(X) is a European call option and P(X) is a put with exercise price X, DIC (H,X) is a down-and-in call (DIC) with barrier H. The first term is the present value forthe insurants (the depositors) under the full insurance; the last two terms are the

totalvalue of FDIC which profits DIC(H,X) by taking over the failure bank with loses,P(X), due to insurance payment for depositors at maturity date.

Our model, the extended structural approach, is an extension of BT model withconsideration of regulation limitation. First of all, the bank asset is monitoreddiscretely only at regular time for financial reporting or announcements. The conceptof the stair tree (Dai, 2009) is utilized for monitoring the bank asset at discrete timeand to deal with situations in which the bank fails or not is based on the closurebarrier. A sample of extended structural approach is illustrated in Figure 1

Figure 1



The structure of the tree and the probability of the branches to the nodes areequal to the stair tree. In Figure 1, initial bank asset S (0) is the beginning node of thetree, connecting with a trinomial tree and then joining to a series binomial tree untilnext discrete monitor time. At monitor time, FDIC would take over the bank if thebank asset is under the barrier, thus the shareholders holds nothing when bank failures.At the maturity date, promised payment is provided to the insured depositors. Shareholders gain the residual value of bank asset after paying the deposits.

Episocopos (2008) extends the BT model by adding constant bankruptcy cost andinsurance premium. However, bankruptcy cost and insurance premium should dependon the asset values and the barrier. The bankruptcy cost incurs when banks

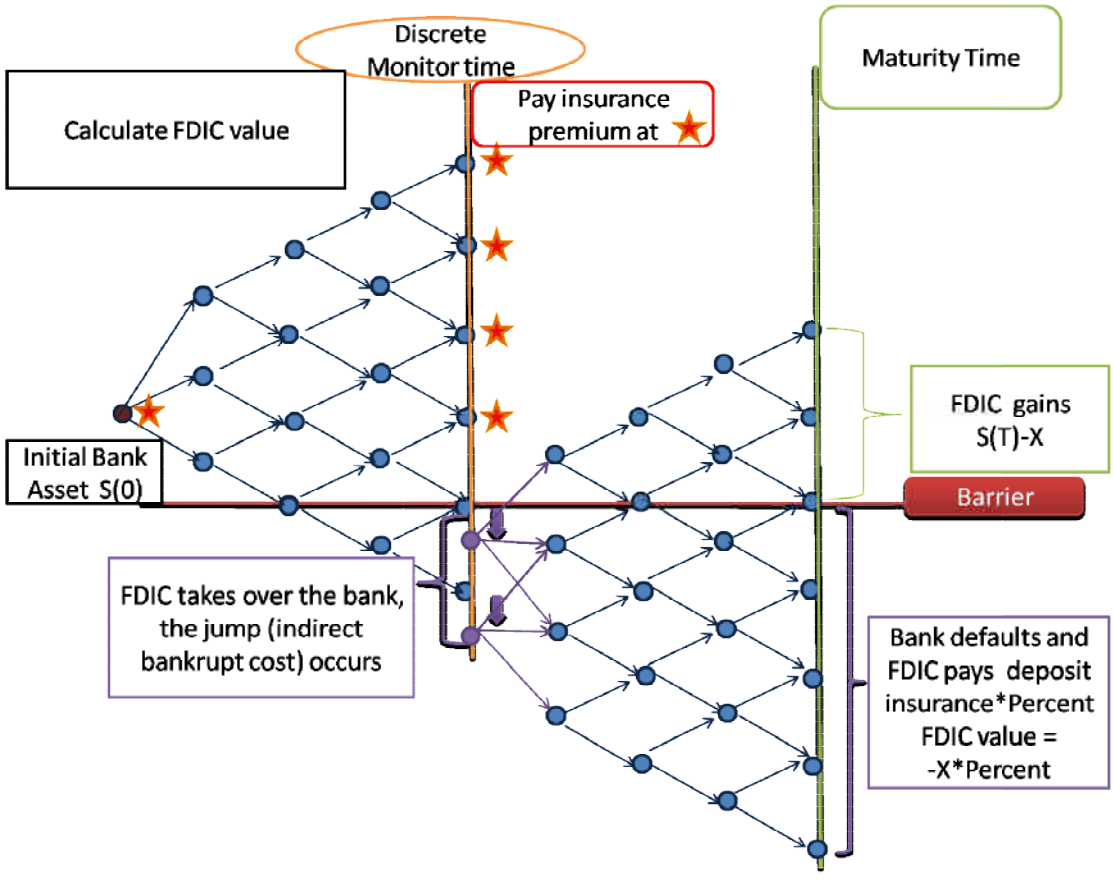
default. Inthe receivership, FDIC only gains a proportion of the bank's asset at the time of itsclosure because of the cost in the liquidation process. Moreover, in the provision ofthe insurance contract, FDIC stipulates that insured financial institutions should payinsurance premium quarterly to protect the deposits. In reality, FDIC can receiveinsurance premium until the bank fails. Therefore, the value of insurance premium isdependent on bank's asset and closure barrier. Thus, the value of FDIC is given by

$$DIC(H,X) \quad IP(H) \quad P(X) \quad BC(H,X)$$

where BC (H, X) is the bankruptcy cost which depends on the bank asset and theclosure barrier H, IP (H) means the insurance premium paid when the bank asset isabove the barrier.

Figure 2 provides the numerical model to value FDIC, considering the insurancepremium and bankruptcy cost:

Figure 2



Therefore, the FDIC value is equal to

$$IP(H)+DIC(H,X)-(P(X)+IBC(H)+DBC(X))$$

where IBC is the indirect bankruptcy cost and DBC is the direct bankruptcy cost. Thesum of IBC and DBC is the total bankruptcy cost. Because of a grace period

offinancial institutions in general, even if the bank's asset falls under the closure barrier,the liquidation would not happen until the date of payment for depositors. Therefore,the indirect bankruptcy cost occurs when bank fails at the monitoring time and thedirect bankruptcy cost occurs only at maturity date.

五、結果與討論（含結論與建議）

Figure 3 and Figure 4show the property of convergence in our extended structural model can accurately generate the value of barrier option in bank capital regulation (Episcopos, 2008).Compared with the same parameters in Table 4, the value of down-and-out call options in our numerical approach converges on 15.885 (computed by linear regression) which close to the value of its closed-form formula (15.8853); the convergent value 0.5508 of failure probability of banks is also the same as its closed-form value 0.5508 calculated by BT model.

Figure 3

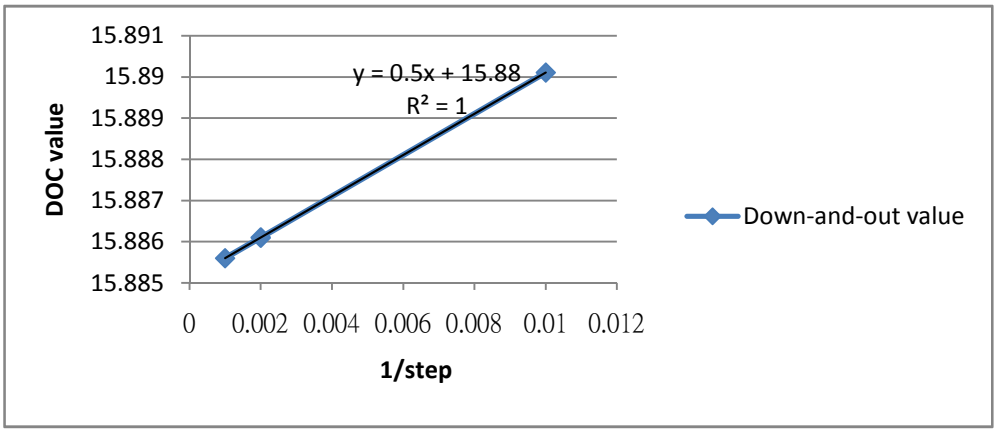
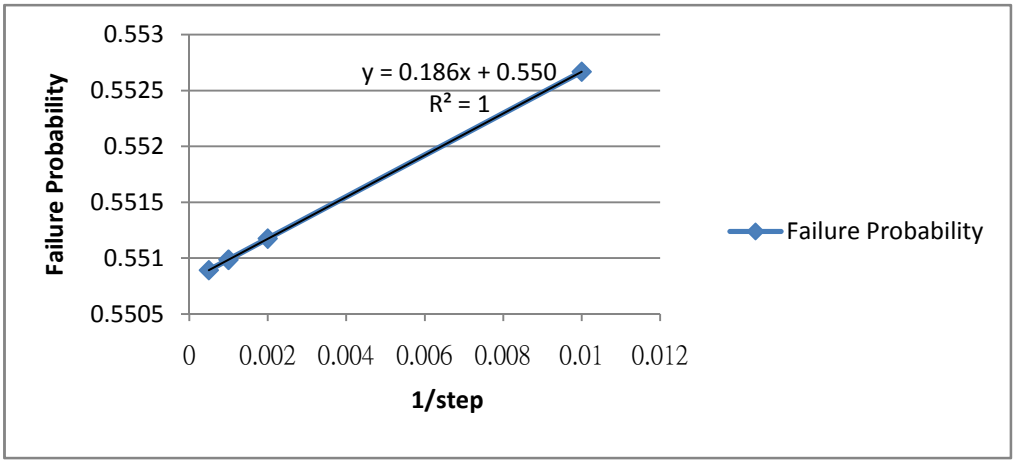


Figure 4



The parameters analysis is summarized in Table 1, concluding our numerical results and our benchmark, BT model.

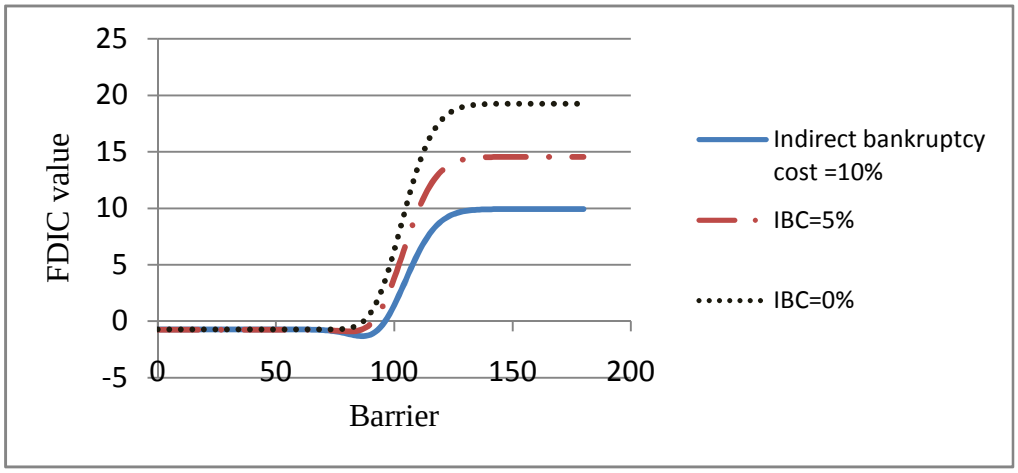
Table 1

Implement BT model by extended structural approach				Closed-Form Value of BT model				
parameters	Down-and-out cal (Equity value)	failure prob.	Down-and-in call -European put (FDIC value)	down-and-out call (Equity value)	failure prob.	Down-and-in call -European put (FDIC value)	European call	European put
General	15.885	0.4720	2.6795	15.8853	0.4720	2.6794	19.9886	1.4239
V 9	8.756	0.6956	4.8085	8.7559	0.6956	4.8087	15.7856	2.2209
10	15.885	0.4720	2.6795	15.8853	0.4720	2.6794	19.9886	1.4239
10	22.083	0.3127	1.4819	22.0829	0.3127	1.4817	24.4573	0.8927
11	27.751	0.2027	0.8136	27.7510	0.2027	0.8136	29.1132	0.5485
H 8	19.661	0.2163	-1.0964	19.6610	0.2163	-1.0964	19.9886	1.4239
8	18.638	0.3036	-0.0734	18.6379	0.3036	-0.0733	19.9886	1.4239
9	15.885	0.4720	2.6795	15.8853	0.4720	2.6794	19.9886	1.4239
9	10.121	0.7095	8.4432	10.1213	0.7095	8.4433	19.9886	1.4239
σ 0.	18.222	0.0845	0.3425	18.2221	0.0845	0.3425	18.6309	0.0662
0.	15.885	0.4720	2.6795	15.8853	0.4720	2.6794	19.9886	1.4239
0.	14.186	0.6775	4.3786	14.1862	0.6775	4.3784	22.5101	3.9454
0.	13.156	0.7817	5.4085	13.1559	0.7817	5.4087	25.4849	6.9203
T 0.	13.487	0.3633	0.9023	13.4871	0.3633	0.9022	15.2883	0.8990
1.	15.885	0.4720	2.6795	15.8853	0.4720	2.6794	19.9886	1.4239
1.	17.873	0.5225	4.6627	17.8730	0.5225	4.6633	24.1838	1.6475
2.	19.616	0.5524	6.6985	19.6168	0.5524	6.6974	28.0373	1.7230
r 0.0	12.787	0.5508	1.6022	12.7872	0.5508	1.6022	16.6994	2.3101
0.1	15.885	0.4720	2.6795	15.8853	0.4720	2.6794	19.9886	1.4239
0.1	19.223	0.3965	3.3136	19.2231	0.3964	3.3132	23.3752	0.8389
0.2	22.720	0.3269	3.5944	22.7208	0.3269	3.5934	26.7857	0.4715

*General means the original parameter values, unless stated otherwise: Current market value of bank asset V=$100, promised payment to depositors X=$90, Regulation barrier for closure rule H=$90, Asset volatility σ =0.2, Interest rate r=0.1, Regulation horizon T= 1 year.

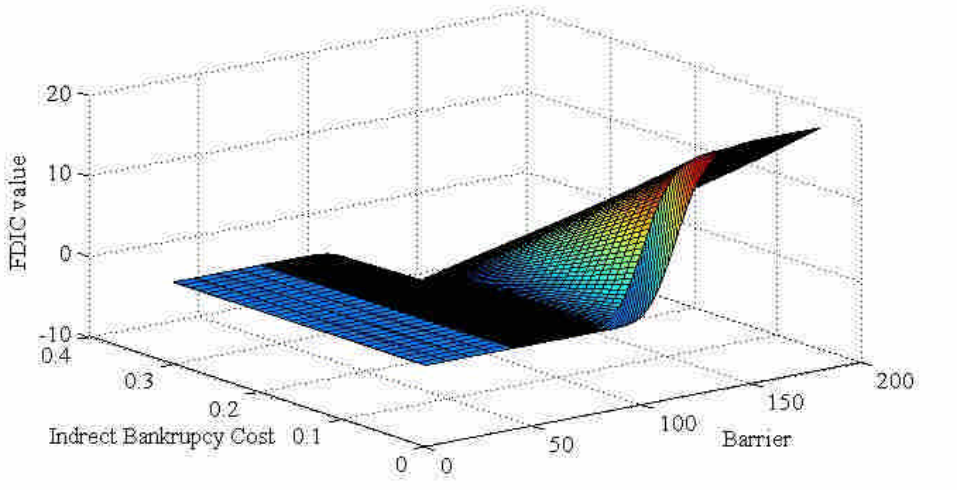
Figure 5 shows that the effect of the indirect bankruptcy cost on FDIC value is significant if barrier is big enough. When supervisory policy is strict with financial institutions, the indirect bankruptcy occurs easily,leads to sudden decline of the bank's asset and then causes the loss of FDIC's value. In figure 6, we can observe the obvious concave of FDIC's value at the barrier close to the promised payment for insurance depositors as indirect bankruptcy cost increasing. The barrier can protect FDIC from loss because of the bank asset is easily sufficient to pay insurance deposits; however, it also causes indirect bankruptcy cost, thus bank asset decline suddenly. Therefore, if barrier is close to the promised payment, the loss from indirect bankruptcy cost would be larger than the profit from easily taking over the bank asset.

Figure 5



The parameters are the same as the general case in Table 1 except direct bankruptcy cost 6%, the percent of insurance payment 90% and monitor quarterly.

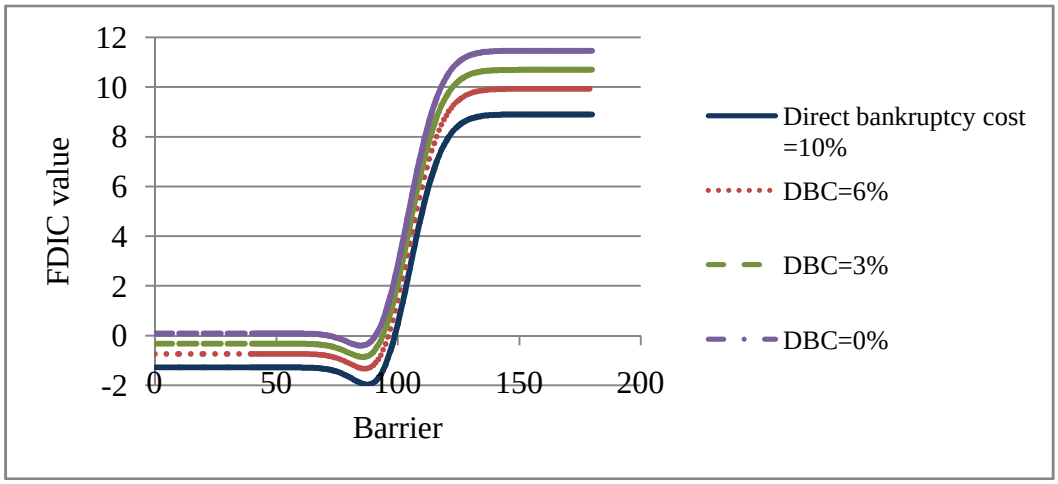
Figure 6



The parameters are the same as the general case in Table 1 except monitor quarterly.

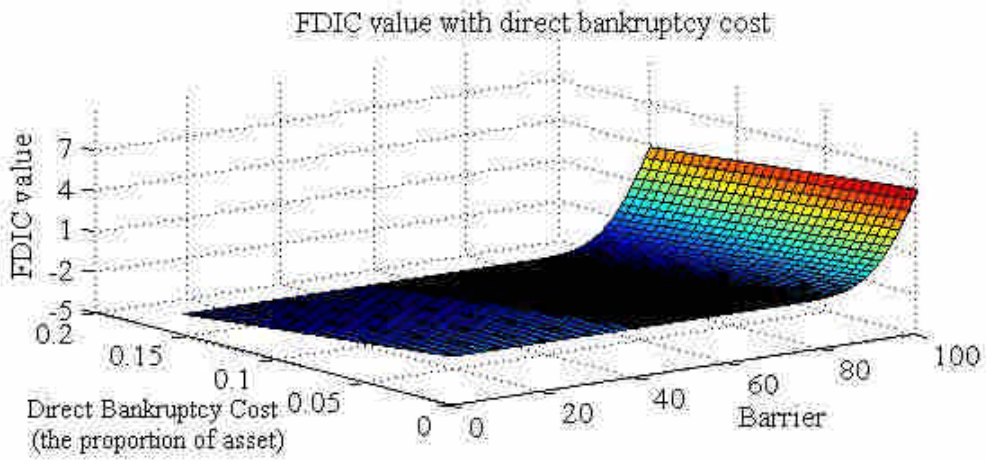
The influence of direct bankruptcy on FDIC's value presents in figure 7 and figure 8. Due to direct bankruptcy happening only at maturity date, the FDIC's value declines simultaneously as the direct bankruptcy cost(DBC) increases. The concave of FDIC's value in figure 10 results from the effect of indirect bankruptcy cost (IBC)rather thanthe direct bankruptcy cost (DBC).

Figure 7



The parameters are the same as the general case in Table 4 except indirect bankruptcy cost 10%, the percent of insurance payment 90% and monitor quarterly.

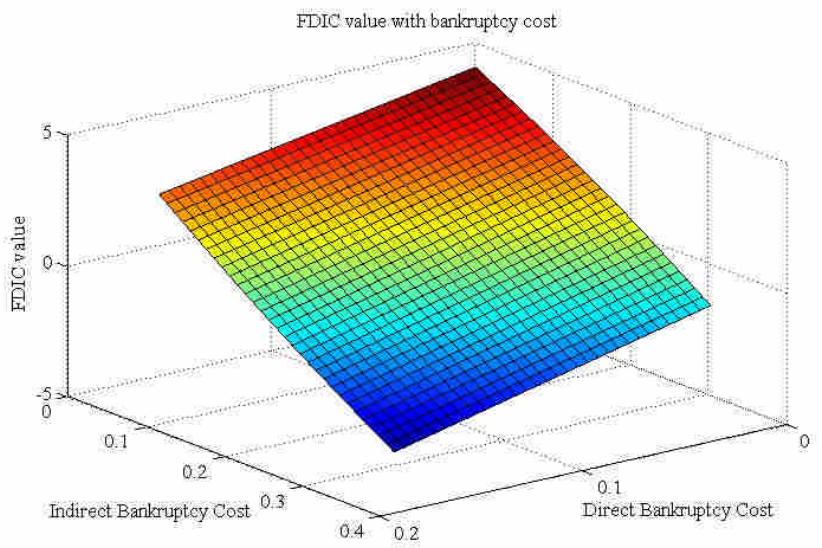
Figure 8



The parameters are the same as the general case in Table 4 except monitor quarterly.

The total influence of bankruptcy issue represents in Figure 9. In sum, either the indirect bankruptcy cost or the direct one, bankrupt factor is negative correlation to FDIC's.

Figure 9



The parameters are the same as the general case in Table 1 except monitor quarterly.

Our structural tree model not only can implement the barrier options underdiscrete monitoring, but also can calculate the value of deposit insurance consideringpractical policy issues. This approach can fit in FDIC's regulation environment andendogenize the maximum coverage to depositors. This variable has become one of themost important policy instruments to deal with the crisis of financial institutions.The numerical results manifest the importance of the bankruptcycosts in FDIC supervision. Increasing regulatory barrier not only leads to the transferof the wealth from stockholders to the insurer, but also contributes to enormousindirect bankruptcy costs to insurer. It is conjectured that the forbearance of closurepolicy is essential to protect the deposit insurance system.

六、參考文獻

Allen, L. and A. Saunders, 1993, Forbearance and Valuation of Deposit Insurance as aCallable Put, *Journal of Banking and Finance* 17, 629–643.

Altman, E. I., 1984, A Further Empirical Investigation of the Bankruptcy CostQuestion, *Journal of Finance* 39, 1067-1089.

Anderson, R., and S. Sundaresan, 2000, A Comparative study of structural models ofcorporate bond yields: An exploratory investigation, *Journal of Banking andFinance* 24, 255-269.

Andrade, G. and S.N. Kaplan, 1998, How Costly is Financial (not Economic)Distress?Evidence from Highly-leveraged Transactions that Became Distressed, *Journal ofFinance* 53, 1443-1493.

Black, F. and J. Cox, 1976, Valuing Corporate Securities: Some Effects of BondIndenture Provisions, *Journal of Finance* 31,351-367.

Black, F. and M. Scholes, 1973, The Pricing of Options and Corporate Liabilities,*Journal of Political Economy* 81: 637-659.

Bloecher, E. P., G. A. Seals, and R. D. Vilim, 2003, Options for Pricing FederalDeposit Insurance, *FDIC Banking Review* 15, No. 4.

Branch, B., 2002, The Cost of Bankruptcy: A Review, *International Review ofFinancial Analysis* 11, 39-57.

Brockman, P. and H.J. Turtle, 2003, A Barrier Option Framework for CorporateSecurity Valuation, *Journal of Financial Economics* 67, 511-529.

Cutler, D. and L. Summers, 1988, The Costs of Conflict Resolution and FinancialDistress: Evidence from the Texaco-Pennzoil Litigation, *Rand Journal ofEconomics* 19, 157-72.

Dai, T.-S., Efficient Option Pricing on Stocks Paying Discrete or Path-DependentDividends with

the Stair Tree, *Quantitative Finance*, forthcoming.

Duan, J.-C., A. Moreau and C. Sealey, 1992, Fixed-rate Deposit Insurance andRisk-shifting Behavior at Commercial Banks, *Journal of Banking and Finance* 16,715–742.

Duan, J-C.and M. T. Yu, 1999, Capital Standard, Forbearance and Deposit InsurancePricing under GARCH, *Journal of Banking and Finance* 23, 1691-706.

Duffie, D., R. Jarrow, A. Purnanandam, andW. Yang, 2003, Market Pricing of DepositInsurance, *Journal of Financial Services Research* 24, 93-119.

Episcopos, A., 2008, Bank Capital Regulation in a Barrier Option Framework,*Journal of Banking and Finance* 32, 1677-1686.

FDIC, 2006, Rules and Regulations, Federal Register Vol. 71, No. 230.

Flakenheim, M., and G. Pennacchi, 2004, The Cost of Deposit Insurance for PrivatelyHeld Banks: AMarket Comparable Approach. *Journal of Financial ServicesResearch* 24, 121-148.

Franks, J. and W. Torous, 1994, A Comparison of Financial Recontracting inDistressed Exchanges and Chapter 11 Reorganizations, *Journal of FinancialEconomics* 35, 349-370.

Gendreau, B. C. and S. S. Prince, 1986, The private cost of bank failures: somehistorical evidence, *Federal Reserve Bank of Philadelphia Business Review*.

Kane, E. J., 1986, Appearance and Reality in Deposit Insurance Reform, *Journal ofBanking and Finance* 10, 175-188.

Leland, H., 1994, Corporate debt value, bond covenants, and optimal capital structure,*Journal of Finance* 49, 1213-1252.

Merton, R. C., 1973, Theory of Rational Option Pricing, *Bell Journal of Economicsand Management Science* 4: 141-183.

Merton, R. C., 1977, An Analytic Derivation of the Cost of Deposit Insurance andLoan Guarantees, *Journal of Banking and Finance* 1, 3–11.

Merton, R. C., 1978, On the Cost of Deposit Insurance When There Are SurveillanceCosts, *Journal of Business* 51, 439–452.

Pennacchi, G., 1987a, A Reexamination of the Over- or Under-pricing of DepositInsurance, *Journal of Money, Credit, and Banking* 19, 340–360.

Pennacchi, G., 1987b, Alternative Forms of Deposit Insurance: Pricing and BankIncentive Issues, *Journal of Banking and Finance* 11, 291–312.

Pyle, D., 1986, Capital Regulation and Deposit Insurance, *Journal of Banking andFinance* 10, 189-202.

Rajan, R., 1996, Why Banks have a future: an economic rationale, *Bancad'ItaliaThemi di Discussione October 1996*.

Warner, J., 1977, Bankruptcy Costs: Some Evidences, *Journal of Finance*, 32,337-347.

Weiss, L. A., 1990, Bankruptcy Resolution: Direct Cost and Violation of Priority ofClaims, *Journal of Financial Economics* 27, 285-314.

國科會補助計畫衍生研發成果推廣資料表

日期:2011/10/31

國科會補助計畫	計畫名稱: 以間斷式障礙選擇權數值模型評價具有破產成本之存款保險
	計畫主持人: 王克陸
	計畫編號: 99-2410-H-009-014- 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：王克陸	計畫編號：99-2410-H-009-014-
計畫名稱：以間斷式障礙選擇權數值模型評價具有破產成本之存款保險	

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	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%		
國外	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%	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%		

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。)	無

	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)

The numerical results show that varying the regulatory barrier is capable of determining a fair deposit insurance premium. This numerical method could offer a new insight into the relationship between the insurance premium and the supervision policy. Furthermore, the influence of the bankruptcy costs on deposit insurance cannot be ignored.