Partial State-Owned Bank Interest Margin, Default Risk, and Structural Breaks: A Model of Financial Engineering

JYH-HORNG LIN[1],CHING-HUI CHANG[2*] AND ROSEMARY JOU[3]
[1] Graduate Institute of International Business
Tamkang University
lin9015@mail.tku.edu.tw
[2] Graduate Department of Applied Statistics and Information Science,
Ming Chuan University
chchang@mcu.edu.tw
[3] Graduate Institute of Management Sciences
Tamkang University
TAIWAN
893560135@s93.tku.edu.tw

Abstract: Recent reports demonstrate that the grip of nationalism is tightest in banking (Economist, 2009a), and in France and Britain, politicians powering taxpayers' money into ailing banks are demanding that the cash be lent at home (Economist, 2009b). This paper proposes a call option model for bank interest margin and default risk valuation based on an event-dependent, structural break framework under the return of banking nationalization. The primary feature is the existence of the discontinuity and fat tails of asset returns and risks caused by structural changes. We show that an increase in the structural breaks in mean return discontinuity and volatility fluctuation caused by the increasing degree of the bank's partial nationalization increases the bank's interest margin and default risk. We conclude that nationalization may be a high return-volatility structure break.

Key-words: Partial Nationalization, Structural Change, Retail Banking, Interest Margin

1 Introduction

Widespread partial nationalization in 2008-2009 has generated large reports concerning the effect of ownership on

Corresponding Author.

bank performance.[1] For example, the grip of nationalism is tightest in banking (Economist, 2009a). In France and Britain, politicians powering taxpayers' money into ailing banks are demanding that the cash be lent at home (Economist, 2009b). "Northern Rock, a British bank which was nationalized in early 2008 and was originally told to shut its doors to new borrowers and shrink into its book, abruptly changed course in February. It now aims to lend an extra £5 billion in mortgages in 2009, and up to additional £9 billion in 2010 (Economist, 2009c)." These reports demonstrated the product of both market forces and political interference on banks to change their lending courses.

From a financial engineering perspective, the return of bank nationalization raises the need for conceptual frameworks able to link the event-dependent, structural changes to bank operations management and advance our understanding of the associated asset prices and default risks. Moreover, the challenge to better understand bank interest margin decisions to default has been recently invigorated by regulators' guest to embed models of credit risk into partial state-owned bank capital structures and bank-capital requirements (Basel Committee on Bank Supervision, 2001). In this paper, we investigate the optimal behavior of a partial state-owned bank allowed to default and study the bank margin pricing implications in the presence of this event-dependent credit risk related to bank equity capital structure.

Much of the literature follows Merton's (1974) model by explicitly linking the risk of a firm's default process to the variability in the firm's asset price and viewing the market value of firm's equity as a standard call option on the market value of the firm's asset with strike price equity the promised payment of corporate liabilities. Stock and Watson (2002) and Kholodilin and Yao (2006), for example, recognize one possible weakness of the approach that default only occurs at the normal distribution or continuity of asset returns. There is ample evidence on the presence of structural breaks in financial time series, which contribute to the fat tails or discontinuity of financial returns (see, for example, Aggarwal, Incl'an and Lenl,

[1] One of the "bad bank" solutions is partial nationalization, where the government accepts a majority ownership share in a bank in exchange for the bad assets (Mandel, 2009). The three largest U.S. banks, JPMorgan chase, Citigroup, and Bank of America, rely increasingly on a special class of stock, much of its owned by the government, that requires big dividend payouts (Henry, Goldstein, and Farzad, 2009).

1999, and Stock and Watson, 2002).[2] The principal advantage of this structure-change option approach is the explicit treatment of break events. This approach, however, omits a key aspect of bank behavior that structural breaks occur not only in modeling return and volatility but also operations management recognized as the case of the return of bank nationalization. As a result, we argue that these may indeed be significant synergies between structural breaks in return/volatility and in bank operations management.

The return of partial nationalization is of theoretical interest because of the insight it offers into the long-standing debate over whether state-owned banks perform poorly.[3] Understanding the impact of bank partial nationalization is important because political interference related to bank nationalization on profits and risks may be through the presence of state-owned share changes in bank equity capital structure and the presence of fat tails and discontinuity of asset returns and their associated default risks caused by structural changes in lending activities. As we discuss further below, the former can be motivated based on a bank interest margin determination in the spirit of Zarruk and Madura (1992) and Wong (1997), while the latter can be motivated based on structural changes in financial time series in the spirit of Hansen (2001) and Stock and Watson (2002).

In light of previous work, the purpose of this paper is to develop a model of banking firm behavior that integrates the structural changes caused by banking nationalism of the portfolio-theoretic approach with government-owned share conditions and loan rate-setting behavioral mode of the firm-theoretic approach. We show that an increase in the structural breaks in mean and volatility with partial banking nationalization increases the bank's interest margin and default risk. By ignoring the existence of structural breaks, the conventional viewpoint of political interferences undervalues levered equity and default risk by an amount equal to the fat-tail form of the call option valuation.

This paper is organized as follows. Section 2 develops the basic structure of the model. Section 3 derives the solution of the model and the comparative static analysis. The final section concludes.

[2] Both theoretical and empirical studies have tried to identify the proper statistical model for common stocks. Blattberg and Gonedes (1974) provide a comprehensive review of various statistical properties of stock return.

[3] Alternatively, to avoid nationalizing its major banks, the government will insure their riskiest debts. See a recent Britain's bank rescue plan in Lin, Chang, and Lin (2009a) and the Troubled Asset Relief Program of the United States in Lin, Chang, and Lin (2009b).

2 The Model

We consider a single-period ($0 \le t \le 1$), fat-tail distributed call option model of a banking firm. At $t = 0$, the bank accepts D dollars of deposits and provides depositors with a rate of return equal to the risk-free market rate R_D. A partial nationalization is possible where the government has a majority ownership share and private investors have a minority one in the bank. The amounts of equity capital held by the government and the private investors are mK and K, respectively, where $m > 1$. Equity capital $(1+m)K$ held by the bank is tied by regulation to be a fixed proportion q of the bank's deposits, $(1+m)K \ge qD$. The required capital-to-deposits ratio q is assumed to be an increasing function of the amount of the loans L held by the bank at $t = 0$, $\partial q / \partial L = q' > 0$ (see Zarruk and Madura, 1992). The bank is assumed to hold two types of earning assets: open market securities B and loans. The bank acts as a price taker in the open market so that the interest rate on open market securities R is given. The bank faces a downward sloping demand curve for its loans, expressed by $L(R_L)$ and $\partial L / \partial R_L < 0$, and chooses the loan rate R_L, so as to maximize profits. This assumption implies the bank exercises some monopoly power in its loan market. Empirical evidence by Hancock (1986) supports the presence of rate-setting behavior in loan markets.

The value of the bank's equity return at $t = 1$ is the residual value of the bank after meeting all of the obligations:

$$S = \max[0, (1+R_L)L + (1+R)B - (1+R_D)D] \quad (1)$$

s.t.

$$L + B = D + (1+m)K = (1+m)K(\frac{1}{q} + 1)$$

In equation (1), the bank's total costs are only the deposit payment costs. The constraint is the balance sheet constraint which captures the bank's operations management in lending since the total assets on the left-hand side are financed by demandable deposits and equity capital on the right-hand side.

Specifying the objective of equation (1), we apply Black and Scholes' (1973) call options on underlying assets with structural changes and further set R_L to maximize the market value of equity return.[4] In particular, the underlying assets is the risky-loan repayments, $V = (1 + R_L)L$, and the date of structural

[4] Lin, Lin, and Jou (2009a, b), for example, also use the similar conceptual framework.

breaks is known such as the implementation date of partial nationalization of the bank by increasing state-own shares, $\Delta m > 0$, in our model. To do this, we view the market value of the bank's equity as the call option on the market value of V with strike price equal to the promised deposit payments net of the liquid-asset repayments, $Z = (1+R_D)D - (1+R)B$, respectively. We further propose to incorporate structural breaks that default occurs at maturity of the debt. The rational is that as the breaks caused by partial nationalization, the urge to keep the bank operating, it is reasonable to recognize an exclusive case that default occurs prior to the maturity.

Let structural breaks exist in the mean and volatility of V, which is assumed to follow a one-dimensional Brownian motion. The dynamics of V follows:

$$\frac{dV}{V} = [\mu + \alpha(m)M]dt + [\sigma + \beta(m)M]dW \tag{2}$$

where

$$M = \begin{bmatrix} 1, & if \quad \tau \le t \le 1 \\ 0, & otherwise \end{bmatrix}$$

In equation (2), M is a dummy variable, τ is the date of the known structural breaks, μ and σ are instantaneous drift and volatility of V, respectively, and W is a Wiener process. $\alpha(m)$ and $\beta(m)$ are the difference between with and without the bank's structural changes in the mean and volatility of V, respectively. There are three possible cases where equation (2) can be simplified. First, when the structural breaks do not occur $(M = 0)$, or $\alpha(m) = 0$ and $\beta(m) = 0$, V follows a geometric Brownian motion. Second, $\alpha(m) < 0$ and $\beta(m) < 0$ demonstrate the structural breaks in the mean and volatility make V be lower, respectively, meaning bad events. Third, $\alpha(m) > 0$ and $\beta(m) > 0$ stand for good events which can enlarge V.

A possible structural change may be expected to influence the fat tails of loan repayments, $\alpha(m) > 0$ and $\beta(m) > 0$. In this case, distributions of loan repayments have flatter tails and higher centers when compared to a normal distribution, meaning that more of the outcomes are located in the tails rather than toward the center of the distribution. [5] Further, $\partial\alpha / \partial m > 0$ and $\partial\beta / \partial m > 0$ represent structural

[5] It is recognized that fat tails are influenced by customer (borrower) acceptance (see Asosheha, Bagherpour, and Yahyapour, 2008). The details of what drive loan demand are unimportant for our purposes, so this abstraction is sufficient.

changes in the mean and volatility make loan repayments be higher, respectively, meaning good events owning to the partial nationalization. Contrary, $\partial\alpha/\partial m < 0$ and $\partial\beta/\partial m < 0$ stand for bad events which shrink loan repayments. These two alternatives are used in a later section when the comparative static results are derived.

Given condition (2), the expected equity value of the call option with the structural changes in the risk-neutral state of equation (1) can be rewritten as:

$$\hat{S} = \hat{S}(\max[0, V - Z]) \qquad (3)$$

where

$$Z = \frac{(1+R_D)(1+m)K}{q} - (1+R)[(1+m)K(\frac{1}{q}+1) - L]$$

From the neutral-state valuation argument, the call option price S is the value of this discounted at the risk-free net-obligation spread rate $\delta = R - R_D$, that is,

$$S = e^{-\delta}\hat{S} \qquad (4)$$

In a risk-neutral state, $\ln V$ has the probability distribution in the following form:

$$\ln V \sim \phi(\ln V + (\delta - \frac{1}{2}(\sigma+\beta(m))^2), \sigma) \qquad (5)$$

where $\phi(\cdot)$ denotes a normal distribution with fat tails.

This model can tractably disclose the impact of the structural changes caused by the partial nationalization on contingent claim pricing. Specifically, the market value of the bank's equity S is expressed by the Black and Scholes' (1973) formula for call options:

$$S = VN(d_1) - Ze^{-\delta}N(d_2) \qquad (6)$$

where

$$d_1 = \frac{1}{\sigma+\beta(m)}[\ln\frac{V}{Z} + \delta + \frac{1}{2}(\sigma+\beta(m))^2]$$

$$d_2 = d_1 - (\sigma + \beta(m))$$

$N(\cdot) =$ the cumulative density function

In addition, using information in objective (6), we can apply Vassalou and Xing (2004) and define the default probability as follows. The default probability of the bank's equity return is the probability when the value of the loan repayments in less than the value of the net-obligation payments denoted by

$$\begin{aligned} P_{def} &= prob(V \le Z \mid 0) \\ &= prob(\ln V \le \ln Z \mid 0) \end{aligned} \qquad (7)$$

Given the conditions of equations (5) and (7), we can specify the default probability as follows:

$$P_{def} = prob(\ln V - \ln Z + (\delta - \frac{1}{2}(\sigma + \beta(m))^2) + (\sigma + \beta(m)) \le 0)$$

$$= prob(-\frac{\ln\frac{V}{Z} + \delta - \frac{1}{2}(\sigma + \beta(m))^2}{\sigma + \beta(m)} \ge \varepsilon(t=1)) \quad (8)$$

where

$\varepsilon(t=1) = W(t=1) - W(0)$, and $\varepsilon(t=1) \sim N(0,1)$

Accordingly, we can express the distance to default d_3 as

$$d_3 = \frac{1}{\sigma+\beta(m)}[\ln\frac{V}{Z} + (\mu+\alpha(m)) - \frac{1}{2}(\sigma+\beta(m))^2] \quad (9)$$

Default risk occurs when the ratio of V/Z is less than 1, or its log is negative. d_3 tells us by how many standard deviations with structural changes the log of this ratio needs to deviate from its mean in order for default to occur. Notice that although the value of the call option in equation (6) does not depend on $\mu + \alpha(m)$, d_3 does. This is because d_3 depends on the future value of loan repayments which is given in d_1 and d_2 in equation (6).

We use the theoretical distribution implied by Merton's (1974) model, which is the normal distribution with fat tails. In that case, the theoretical probability of default is given by:

$$P_{def} = N(-d_3) = N(-\frac{\ln\frac{V}{Z} + (\mu+\alpha(m)) - \frac{1}{2}(\sigma+\beta(m))^2}{\sigma+\beta(m)}) \quad (10)$$

Probability (10) states a nonlinear stochastic one which mimics the default probability density function of the bank's equity returns with structural breaks. The effect that default risk may have on equity returns is not obvious since equity holders are residual claimants on the bank's cash flows with structural breaks and there is no promised normal return in bank equities.

3 Solution and Results

Partially differentiating equation (6) with respect to R_L, the first-order condition is given by:

$$\frac{\partial S}{\partial R_L} = \frac{\partial V}{\partial R_L}N(d_1) + V\frac{\partial N(d_1)}{\partial d_1}\frac{\partial d_1}{\partial R_L} - \frac{\partial Z}{\partial R_L}e^{-\delta}N(d_2) - Ze^{-\delta}\frac{\partial N(d_2)}{\partial d_2}\frac{\partial d_2}{\partial R_L} = 0 \quad (11)$$

A process in simplifying equilibrium condition (11) is in calculating the cumulative normal distribution with fat tails $N(\cdot)$. In equation (11), we can have

$$\begin{aligned} d_2^2 &= d_1^2 + (\sigma + \beta(m))^2 \\ &\quad - 2d_1(\sigma + \beta(m)) \\ &= d_1^2 - 2(\ln\frac{V}{Z} + \delta) \end{aligned} \tag{12}$$

Further, we follow Hull (1993) and use the numerical procedures to directly calculate $N(d_2)$. One such approximation is

$$N(d_2) = 1 - (a_1 k + a_2 k^2 + a_3 k^3)\frac{\partial N(d_2)}{\partial d_2} \tag{13}$$

where

$k = 1/(1 + 0.33267 d_2)$, $a_1 = 0.436183$,

$a_2 = -0.1201676$, $a_3 = 0.937280$

$$\frac{\partial N(d_2)}{\partial d_2} = \frac{1}{\sqrt{2\pi}} e^{(d_2^2/2)} > 0$$

Using equations (12) and (13), we rewrite the term $\partial N(d_2)/\partial d_2$ in equation (11) as:

$$\begin{aligned} \frac{\partial N(d_2)}{\partial d_2} &= \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(d_1^2 - 2(\ln\frac{V}{Z} + \delta))} \\ &= \frac{\partial N(d_1)}{\partial d_1}\frac{V}{Ze^{-\delta}} \end{aligned} \tag{14}$$

Accordingly, we have

$$V\frac{\partial N(d_1)}{\partial d_1}\frac{\partial d_1}{\partial R_L} = Ze^{-\delta}\frac{\partial N(d_2)}{\partial d_2}\frac{\partial d_2}{\partial R_L} \tag{15}$$

where

$$\frac{\partial d_2}{\partial R_L} = \frac{\partial d_1}{\partial R_L} \neq 0$$

Imposing condition (15) on the equilibrium condition of equation (11), we have the simplified form in the following:

$$\begin{aligned} \frac{\partial S}{\partial R_L} &= \frac{\partial V}{\partial R_L}N(d_1) - \frac{\partial Z}{\partial R_L}e^{-\delta}N(d_2) \\ &= 0 \end{aligned} \tag{16}$$

where

$$\frac{\partial V}{\partial R_L} = L + (1 + R_L)\frac{\partial L}{\partial R_L} < 0$$

$$\frac{\partial Z}{\partial R_L} = [\frac{(R - R_D)(1+m)Kq'}{q^2} + (1+R)]\frac{\partial L}{\partial R_L} < 0$$

The term $\partial V / \partial R_L$ can be rewritten as $L(1 + 1/\eta)$, where

$\eta = (L/(1+R_L))(\partial(1+R_L)/\partial L)$. η is defined as the interest rate elasticity of loan demand. There is $\eta < -1$ since loan demand faced by the bank is $L(R_L)$ where $\partial L/\partial R_L < 0$. We have $1+1/\eta < 0$ and hence $\partial V/\partial R_L < 0$. The term $\partial Z/\partial R_L$ is also negative in sign. Inspection of equation (10) reveals that a necessary condition for the optimal loan rate is that the risk-adjusted value for marginal loan repayments of loan rate equals the risk-adjusted value for marginal net-obligation payments. A sufficient condition for the optimum is that $\partial^2 S/\partial R_L^2 < 0$.

Consider next the impact on the bank's loan rate (and thus on the bank's margin) from changes in the degree of the partial nationalization related to structural breaks in return and volatility of lending. This result is used later when the structure-break event on default risk probability is analyzed. To show this result, we differentiate R_L from equation (16) with respect to m:

$$\frac{\partial R_L}{\partial m} = -\frac{\partial^2 S}{\partial R_L \partial m} / \frac{\partial^2 S}{\partial R_L^2} \tag{17}$$

where

$$\begin{aligned}\frac{\partial^2 S}{\partial R_L \partial m} = &-\frac{\partial^2 Z}{\partial R_L \partial m} e^{-\delta} N(d_2) \\ &+ \frac{\partial V}{\partial R_L} \frac{\partial N(d_1)}{\partial d_1} (1 \\ &- \frac{VN(d_1)}{Ze^{-\delta} N(d_2)}) \frac{\partial d_1}{\partial m} \\ &+ \frac{\partial V}{\partial R_L} \frac{N(d_1)}{N(d_2)} \frac{\partial N(d_2)}{\partial d_2} \frac{\partial \beta}{\partial m}\end{aligned}$$

$$\frac{\partial^2 Z}{\partial R_L \partial m} = \frac{(R - R_D)Kq'}{q^2} \frac{\partial L}{\partial R_L} < 0$$

$$\frac{\partial d_1}{\partial m} = (1 - \frac{d_1}{\sigma + \beta}) \frac{\partial \beta}{\partial m} - \frac{1}{\sigma + \beta} \frac{1}{Z} \frac{\partial Z}{\partial m}$$

$$\frac{\partial Z}{\partial m} = \frac{(1+R_D)K}{q} - (1+R)K(\frac{1}{q} + 1) < 0$$

The first term on the right-hand side of $\partial^2 S/\partial R_L \partial m$ can be interpreted as the mean profit effect on $\partial S/\partial R_L$ from a change in m, the second term can be explained as the variance or risk effect, and the third term can be specified as the structural volatility-break effect.

The mean profit effect captures the change in $\partial S/\partial R_L$, evaluated at the optimal loan rate, due to an increase in m, ceteris paribus. It is unambiguously positive because an increase in m provides a return to a larger equity base. One way the bank may attempt to augment its total returns is by shifting its investments to the liquid assets and away from its loan portfolio at an increased loan rate. If loan demand is relatively rate-elastic, a less loan portfolio is possible at an increased margin.

Before proceeding with the analysis of the variance effect, we explain the term $\partial d_1 / \partial m$ as follows. The term associated with $\partial \beta / \partial m$ on the right-hand side of $\partial d_1 / \partial m$ can be interpreted as the structural break effect, while the term associated with $\partial Z / \partial m$ can be interpreted as the incremental capital effect. The former can be motivated based on a structure-break argument in the spirit of the portfolio-theoretic approach, while the latter can be motivated based on a liquidity-management argument in the firm-theoretic approach. Based on rather general assumptions within the bank interest margin determination framework, it is reasonable to believe that the portfolio-theoretic effect is either reinforced or insufficient to offset the firm-theoretic effect. Thus, we have the result of $\partial d_1 / \partial m > 0$. The variance effect arises because an increase in m increases in the bank's profit by its lending evaluated at the optimal loan rate in every possible state. As usual, the sign of this variance effect is indeterminate. However, equation (17) provides as with a hunch that the variance effect is positive since $\partial d_1 / \partial m > 0$. Intuitively, an incremental state-owned capital implies a higher risk-state of the bank and as a result, the bank raises its loan rate to cut risky lending.

The positive structural volatility-break effect demonstrates the positive impact on the bank's loan rate from a change in m when the break is recognized as a bad event $(\partial \beta / \partial m < 0)$ which shrinks loan repayments at a decreased margin. Since both the variance effect and the volatility-break effect reinforce the mean profit effect to give an overall positive response of the optimal loan rate to an increase in m, we establish the following proposition.

Proposition 1: An increase in the degree of partial nationalization increases in the bank's interest margin when the structural break in volatility is recognized as a bad event.

One immediate application of this proposition is to evaluate the changes in the degree of partial nationalization of lending arrangements proposed as alternatives for future loans. One frequent suggestion is that partial nationalization is possible where the government increasingly accepts a majority ownership share in the bank, for example, in exchange for the bad loans. Under the suggestion, it is reasonable to believe that the bank's lending decreases at an increased interest margin. Accordingly, when structural break in volatility is recognized as a bad event, we can argue that an increase in the partial privatization or a decrease in the partial nationalization increases the bank's lending amount at a decreased margin.

Total differentiating equation (10) evaluated at the optimal loan rate, we can obtain the following expression for how the partial nationalization related at the structural breaks predicts the default probability in the bank's equity return:

$$\frac{dP_{def}}{dm} = \frac{\partial P_{def}}{\partial m} + \frac{\partial P_{def}}{\partial R_L}\frac{\partial R_L}{\partial m} \qquad (18)$$

where

$$\frac{\partial P_{def}}{\partial m} = -\frac{\partial N(d_3)}{\partial d_3}\frac{\partial d_3}{\partial m}$$

$$\frac{\partial N(d_3)}{\partial d_3} = \frac{1}{\sqrt{2\pi}}e^{(-d_3^2/2)} > 0$$

$$\frac{\partial d_3}{\partial m} = \frac{1}{\sigma+\beta}[-\frac{1}{Z}\frac{\partial Z}{\partial m} + \frac{\partial \alpha}{\partial m} - (\alpha+\beta+d_3)\frac{\partial \beta}{\partial m}]$$

$$\frac{\partial P_{def}}{\partial R_L} = -\frac{\partial N(d_3)}{\partial d_3}\frac{\partial d_3}{\partial R_L}$$

$$\frac{\partial d_3}{\partial R_L} = \frac{1}{(\alpha+\beta)R_L}(\frac{R_L}{V}\frac{\partial V}{\partial R_L} - \frac{R_L}{Z}\frac{\partial Z}{\partial R_L})$$

The first term on the right-hand side of equation (18) can be interpreted as the direct effect on the default probability from a change in m, while the second term can be interpreted as the indirect effect through the optimal bank interest margin determination.

The direct effect captures the change in the default probability due to an increase in m, holding the optimal margin constant. Note that $N(d_3)$ increases with d_3. Consequently, the direct effect is governed by the relationship between d_3 and m. The sign of the term $\partial d_3/\partial m$ is determined by the incremental capital effect $(\partial Z/\partial m)$ and the structure-break effects ($\partial\alpha/\partial m$ and $\partial\beta/\partial m$). As stated earlier, there are $\partial Z/\partial m < 0$ and $\partial\beta/\partial m < 0$. The sign of the term $\partial\alpha/\partial m$ is negative since there is $\partial\beta/\partial m < 0$. If both the incremental capital effect and the structural-break volatility effect is insufficient to offset the structure-break mean effect, we have $\partial d_3/\partial m < 0$. The direct impact can be understood by recalling that d_3 is determined by the difference between the log of the V/Z and its mean value in order for default to occur. An increase in m decreases d_3 and consequently increases the default probability when the optimal loan rate remains constant.

The indirect impact arises when every possible state of the optimal loan rate is variant. This indirect effect is positive in sign since $\partial P_{def} / \partial R_L > 0$ and $\partial R_L / \partial m > 0$ shown in Proposition 1. d_3 decreases at an increased optimal loan rate by shifting the bank's investments to the liquid assets and away from its risky loans. Since the indirect effect reinforces the direct effect to give and overall positive response of m to an increase in P_{def}, we establish the following proposition.

Proposition 2: An increase in the degree of partial nationalization increases the bank's default risk in equity return when the structural breaks are recognized as bad events.

4 Conclusion

This paper proposes a framework for bank interest margin and default risk valuation based on event-dependent, structure-break options under the return of banking nationalism and argues that event dependency is an intrinsic characteristic of bank equity and default risk. The standard structure-break option approach ignores the possibility of event-dependent bank equity capital structure and implicitly values bank equity as break-independent processes in the portfolio-theoretic approach. In essence, we can argue that little attention has been paid to the effects of default risk on equity return. Actual bank interest margins and thus bank equities, in contrast, follow event-dependent processes because their payoffs depend on the particular event followed by the underlying asset when structural breaks are realized.

The results of the model show that an increase in the structural breaks in mean return discontinuity and volatility caused by the increasing degree of the bank's partial nationalization reflected by its equity capital structure changes increases the bank's interest margin and its associated with default risk. However, one issue that has not been addressed is the expected disadvantages to having government-owned rivals. The obvious one is unfair competition. Of course, in a loan market without such strict expectations requirements, other factors would affect lending courses. For example, strategic considerations may play a very important role, as would more extreme problems of price variation conjectures. Such concerns are beyond the scope of this paper and so are not addressed here. What this paper does demonstrate, however, is the important role play by political interference in affecting bank lending courses.

***Acknowledgement*:** The second author's research has been supported partially by a research grant from the National Science Council (98-2118-M-130 -002)

References

[1]. Aggarwal, R., C. Incl'an, and R, Leal (1999), "Volatility in Emerging Stock Markets," *Journal of Financial and Quantitative Analysis*, 34, 1, 35-55.

[2]. Asosheha, A., S. Bagherpour, and N. Yahyapour (2008), "Extended Acceptance Models for Recommender System Adaption, Case of Retail and Banking Service in Iran," *WSEAS Transactions on Business and Economics*, 5, 5, 189-200.

[3]. Basel Committee on Banking Supervision (2001), The New Basel Capital Accord, Basel: Bank for International Settlements.

[4]. Black, F., and M. Scholes (1973), "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, 81, 2, 637-659.

[5]. Blattberg, R. C., and N. J. Gonedes (1974), "A Comparison of the Stable and Student Distributions as Statistical Models for Stock Prices," *Journal of Business*, 47, 2, 244-280.

[6]. Economist (2009a), "The Return of Economic Nationalism," *Economist*, February 7th, 9-10.

[7]. Economist (2009b), "Homeward Bound", *Economist*, February 7th, 61-62.

[8]. Economist (2009c), "Exit Right: The Contract between Society and Banks Will Get Stricter," *Economist*, A Special Report on International Banking, May 16th, 5-9.

[9]. Hancock, D. (1986), "A Model of the Financial Firm with Imperfect Asset and Deposit Elasticities," *Journal of Banking and Finance*, 10, 1, 37-54.

[10]. Hansen, B. E. (2001), "The New Econometrics of Structural Change: Dating Breaks in U.S. Labor Productivity," *Journal of Economic Perspectives*, 15, 4, 117-128.

[11]. Henry, D., M. Goldstein, and R. Farzad (2009), "The Fix Has Not Fixed BofA," *BusinessWeek*, February 9, 24-26.

[12]. Hull, J. C. (1993) *Options, Futures, and Other Derivative Securities*, 2nd ed., London: Prentice-Hall International, Inc.

[13]. Kholodilin, K. A., and V. W. Yao (2006), "Modeling the Structural Break in Volatility," *Applied Economics Letters*, 13, , 417-422.

[14]. Lin, J. J., C. H. Chang, and J. H. Lin

(2009a), "Rescue Plan, Bank Interest Margin and Future Promised Lending: An Option-Pricing Model," *WSEAS Transactions on Information Science and Applications*, 6, 6, 956-965.

[15]. Lin, J. J., C. H. Chang, and J. H. Lin (2009b), "Troubled Asset Relief Program, Bank Interest Margin and Default Risk in Equity Return: An Option-Pricing Model," *WSEAS Transactions on Mathematics*, 8, 3, 117-126.

[16]. Lin, J. H., J. J. Lin, and R. Jou (2009a), "Global Diversification, Hedgin Diversification, and Default Risk in Bank Equity: An Option-Pricing Model," *WSEAS Transactions on Mathematics*, 11, 8, 667-678.

[17]. Lin, J. J., J. H. Lin, and R. Jou (2009b), "The Effects of Sunshine-Induced Mood on Bank Lending Decisions and Default Risk: An Option-Pricing Model," *WSEAS Transactions on Information Science and Applications*, 6, 6, 946-955.

[18]. Mandel, M. (2009), "The 'Bad Bank' Solution," *BusinessWeek*, February 9, 27.

[19]. Merton, R. C. (1974), "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*, 29, 2, 449-470.

[20]. Stock, J. H., and M. W. Watson (2002), "Has the Business Cycle Changed and Why?" *NBER Working Paper*, No. 9127.

[21]. Wong, K. P. (1997), "On the Determinants of Bank Interest Margins under Credit and Interest Rate Risks," *Journal of Banking and Finance*, 21, 2, 251-271.

[22]. Vassalou, M., and Y. Xing (2004), "Default Risk in Equity Returns," *Journal of Finance*, 59, 2, 831-868.

[23]. Zarruk, E. R., and J. Madura (1992), "Optimal Bank Interest Margin under Capital Regulation and Deposit Insurance," *Journal of Financial and Quantitative Analysis*, 27, 1, 143-149.