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Do PeerMarket Monitors Discipline Banks?

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Abstract: Repeated "crises" in the banking institutions have shown information asymmetry in the pricing of risker assets and even institutions that should have mature risk monitoring systems fail to detect and price accordingly to prevent systemic risk. The paper explores the reason behind this. During non-crisis period, peer market discipline was relied on since it is found empirically that there exists monitoring incentive of wholesale debt holder. However, the market discipline could be ineffective due to moral hazard and less lender accountability of short-term wholesale lender. Specifically, this paper presents a stylized model, in which borrowing banks tend to choose a higher share of "bad" assets to maximize their net expected return. Moreover, the model also shows that the effectiveness of monitoring will diminish as the maturity shortens.

Keywords: Market Discipline, Moral Hazard, Lender Accountability

JEL: G01, G21, G38

I. Introduction

Many empirical studies (Flannery and Sorescu, 1996; Furfine, 2001; Sironi, 2003; Covitz et al., 2004; Ashcraft and Bleakley, 2006; Evanof et al., 2007; King, 2008; Covitz, Hancock, and Kwast, 2004; Evanoff, Jagtiani, and Nakata, 2007) have found that the market itself has "monitoring incentives and capability". Such monitoring incentives and capability are reflected in how financial institutions and other institutional investors identify the risk level of financing banks and implement corresponding differential risk pricing.

Although the "effectiveness" of price signal has been challenged in the aftermath of financial crisis, it does not prevent the regulators to roll back regulations by relying on market discipline. For example, the 1999 Gramm-Leach-Bliley Act, also called the Financial Services Modernization Act, requiredthat the spread or risk premium of the subordinated debt market be referred to reflect market investors' assessment of the risk situation of financing banks.It is worth mentioning that the 1999 Act repealed part of the Glass–Steagall Act of 1933designed to prevent the financial disaster of 1929~1933 by imposing barriers in the market among banking companies, securities companies and insurance companies that prohibited any one institution from acting as any combination of a commercial bank, an investment bank, and an insurance company, the latter two charged for developing shadow banking. Market discipline tended to be necessary because following the 1999Act,

financial products and services became increasingly complex and opaque as the financial sector has continued to compete and develop. In the meantime, regulators with only traditional monitoring tools feel powerless in contrast to market investors and financial institutions who are viewed as having more incentives and capability for peer supervision individually or as an entire industry

However, the truth is not really as the then regulators wanted to believe. There are at least three reasons for undermining monitoringincentives. First,government-intervened regulation caused the problem of"too big to fail" (e.g., Rochet and Tirole, 1996; Dinger and Hagen, 2012). Market investors lack monitoringincentives for systemically important financial institutions and believe that once these institutions encounter difficulties, the government will implement rescue measures to avoid the spread of the crisis to other banks or the entire economy. Second, for non-systemic financial institutions, the monitoringincentives of market investors arealso diminished by the explicit and implicit deposit insurance systems of various countries (Zhang and She, 2008). Third, although both as risk monitors, government oriented regulators such as the central bank,the banking regulatory commissionanddeposit insurance corporations have the number of beneficiaries (enormous depositors)much larger than that of market investors and are therefore expected to have more incentive to monitor. Thus, investors tend to rely on government-led monitoring authoritiesto perform risk monitoringthatthey should have undertaken, whichcauses a "free rider problem".

Evenif the price signal of market discipline is validated, the former empirical resultscannot explain the large number of bankruptcies and bad debts of banks inthe subprime mortgage crisis. In other words, although the market has "monitoring incentives", the assumption involved in the market disciplinevalidation, i.e., the amount ofthe market financing cost can influence the market risk behaviour, may not be valid, eventually causing market discipline to fail. This paper aims to confirm this interpretation by illustrating in a model that the monitoringincentivesdo notnecessarilylead to market discipline. Specifically, evenifrisk-sensitive investorspricerisk, the signal of an increasingfinancial cost cannot prevent the borrowing banks from investing in high-risk assets.

We also show in this paper that banks tend to choose a higher share of short-term relative to long-term interbank funding, so that lender accountability can be largely avoided. This is consistent with Rochet and Tirole (1996)'s arguments as"Lender accountability requires interbank loans to be medium- or long-term loans, so lenders cannot fly by night and escape their monitoring obligation."This argument is proved again in our way of derivation that when bad assets are much riskier, increasing the share of short-term interbank funding will induce banks to take on more risk

II. Historical Origin and Theories

The market discipline of the banking industrydrew the attention of policymakers duringthe savings and loan associations crisis from the 1980s to the early 1990s. During this period, approximately 2,900 deposit and loan institutions were forced to close or receive assistance, causing huge deficits for the deposit insurance institutions that provided them with insurance.The academics and regulators begin to question the flaws of the deposit insurance system itself, which was initially designed to avoid large-scale bank failures such as those caused by runs on banks because of a major panic in the Great Depression. However, since the implementation of the deposit insurance system in 1933, although it could effectively stop a systematic run, the system's overall commitment to depositors also induced banks to invest assets in high-risk economic activities. These activities are socomplex and advancedwith the improvements of financial engineering and technology that the cost for monitoring and supervision by regulators become increasingly unaffordable.

As a result, US regulators studied a series of reforms to the deposit insurance system[1]. For example, the X Act of the Financial Institution Reform, Recovery, and Enforcement Act of 1989 (FIRREA) was passed by the US Congress in 1989. It requires the Treasury Secretary to coordinate with relevant government departments and private sector representatives to discuss the idea of including market discipline as another channel to complement regulatory policies.The consensus among the economists who developed the reform plans was that they should set a ceiling on deposit insurance coverage and introduce the power of the market itself to limit the risk behaviour of banks. The underlying logic was that only after risk exposure expands would investors have the driving force to supervise the potential risks of banks' assets and obtain risk-matched returns, i.e.,monitoring bodies of market discipline must have monitoringincentives.

However, not all investors have incentives. The key monitoring authorities of market discipline should be "wholesale debt holders" who have a large risk exposure but are not included within the scope of the deposit insurance.The reason for this is twofold.First, it is difficult for small depositors to reflect the effectiveness of market discipline. Although retail deposits have always been the main source of funds for commercial banks, the risk exposure of individual deposit holders is very limited due to the widespread dispersion of funds among small and medium-sized depositors. Such investors tend to be "free riders", relying on other investors to monitor the risk decisions of banks. Coupled with the fact that they benefit fromthe safety net of the national deposit insurance system, they have few monitoringincentives. Second, the equity investors of banks have limited monitoring incentives, and their incentives, analogous to a call option model,are not fully consistent with regulators'incentives. In this call model, if debtors do not price risks, then in the absence of risk costs, the interests of equity investors are consistent

withthose of bank managers, and they tend to increase risks to maximize the value of options (Bliss 2004).However, because equity investorsare the permanent holders of a bank's future net cash flow and the appearance of closure risk would affect the present value of future dividends, the monitoringincentives of equity investorswill increase as the loss ofthe present value of future dividends increases. In short, before the appearance of any loss inpresent value, the monitoringincentives of equity investors are different fromthose of banking regulatoryauthorities. However, if bond investors price risks, then the increase in risks will be accompanied by an increase in interest costs and a decrease in net profits.At this time, equity investors need to considerboth risksand returns, and theirmonitoring incentiveswill beconsistent withthose of debt investors and regulatory authorities.

In addition to monitoring incentives, the monitoring bodies also need to have monitoringcapability, which includes the ability to grasp effective information and the technology todistinguishrisks. In January 2001, the Bank for International Settlements proposed Pillar 3 of the Basel Capital Accord, requiring borrowing banks to publicly disclose their capital adequacy ratio and various risk exposures to the market. In 2002, the Sarbanes-Oxley Act passed by the US emphasized the accuracy and reliability of information disclosure and established legal safeguards for effective monitoring by market investors. Regarding inspection and monitoring skills, empirical research often adopts the risk sensitivity test to determine whether market investors perform differential pricing for the amount of risks of borrowing banks. For a long period of time, there has been disagreement in empirical research overwhich tools' market price can more accurately reflect the risk nature of financing bodies among various wholesale debt tools. The empirical studies in the 1980s focused on certificates of deposit (CDs), but the results of these studies are not consistent.Some data samples show that CD interest rates can significantly reflect the risks revealed in bank accounting statements, whereas others show theopposite (Baer and Brewer, 1986; Avery, Belton, and Goldberg, 1988; Hannan and Hanweck, 1988; James, 1989). In the 1990s, the focus shifted to subordinated debt. There are two reasons for this shift. First,the subjects of raised funds for subordinated debtare institutions or individual investors with greatrisk exposure.Second, the claim rights ofsubordinated debtcome after those ofother claim investors and come before those of preferred stock and common stock investors.Subordinated debt investors cannot obtain the excess returns of banks but bear great default risks.Theoretically,thesebond holdershave the strongest monitoring incentives.Empirical studies show that these investors are also capable of identifying risks—the risk premium of subordinated debt has a significant correlation with the various risk indicators of borrowing banks, and this correlationincreases year after year as the implicit guaranteeof the government weakens and the information transparency of financing banks increases (Flannery and Sorescu, 1996;Covitz, Hancock, and Kwast,

2004;Evanoff, Jagtiani, and Nakata, 2007). In addition to subordinated debt, Rochet and Tirole (1996) argue that the participants in the interbank market of banksplaya role of mutual monitoring under specific conditions (longer duration;no government commitment to rescuing borrowing banks) and that interbank financingcan supplement capital, which is verified in empirical studies on developing countries (Dinger and Hagen 2009).However, because the interbank capital of developed countries is mainly shortterm, participants do not have sufficientmonitoringincentivesduring normal period before 2008 crisis[2].

It should be noted thatthe validation ofthe monitoringcapability of "wholesale debt holders"in empirical research can only reflect that market discipline is partially effective.If regulators mistakenly take this as a basis for judging market discipline, there will be a large error. In fact,following the financial crisis,various Western countries have introduced laws to strengthen the government-led regulatory system, which also indicatesthe existence ofsuchan error. However, regulators should realize that this error does not mean that the risk sensitivity test in previous studies is not related to market disciplinebut, instead, that the recognition of risk sensitivity is only a sufficient but not necessary condition for the validation of market discipline. The key for market disciplineto play an effective role is whether market monitoringcan ultimately restrain the risk behaviour of borrowing bodies.However, previous studies are less concerned with the validity test of "discipline after the event". The reason may be twofold. On the one hand,previous research believes thatthe price signals of risk differentiationthat emerged in discipline before the event are often taken by regulators as a basis to implement regulation(such as Gramm-Leach-Bliley Actnoted above).Regulators' regulatory behaviour of "monitoring after the event"can also help the market achieve the desired effect of "discipline after the event". However, these studies ignore the essential reasonwhy regulators use market discipline.With the continuousinnovation and complexity of financial products, market investors, particularly financial institutions, have more technological advantage for risk identification than the regulatory authorities, and interventions byregulators will reduce the endogenous motivation for market monitoring. On the other hand, the previous literature believes that the influence of "discipline before the event" or investors' risk sensitivity to the financing cost is sufficient to make borrowers adjust corresponding the risk behaviour.The following argument shows that thisassumption may not necessarily hold.

III. Model Assumptions

This section develops a simple model that demonstrates that the monitoring incentives of lenders (represented by the pricing on counterparty risk and liquidity risk) can still fail to prevent the borrowing banks from investing in riskier assets under certain circumstance. To focus on the relationship between

interbank borrowings and the lending decisions of banks, the model assumes that banks have no equity and finance all assets of size 1 by interbank borrowing of the same size. It is also assumed that each bank invests a portfolio of assets that contain only interbank loans.Further assumptions are made as follows regarding to monitoring counterparty risk, monitoring liquidity risk and objective of interbank loans.

A. Monitoring counterparty risk

Depending on their riskiness, the portfolio assets can be categorized as "good" assets and "bad" assets. The return of a "good" asset is R_G with the probability of Π_G in case it repays and 0 otherwise; the return of a "bad" asset is R_B with the probability of Π_B in case it repays and 0 otherwise. "Good" assets have a higher net present value than "bad" assets:

$$R_G\Pi_G - 1 > R_B\Pi_B - 1,\ \Pi_G > \Pi_B \tag{1}$$

However, to attract investment, "bad" assets have a higher return than "good" assets:

$$1 < R_G < R_B \tag{2}$$

Lenders of interbank transactions have the incentives and the technology to screen the assets owned by the borrowing banks. When pricing the portfolio loan of size 1, they charge more for the proportion of "bad" assets than the proportion of "good" assets and require a total repayment of:

$$\delta d_G + (1-\delta) d_B \tag{3}$$

$$1 < d_G < d_B,\ 0 \le \delta \le 1$$

where d_G denotes the funding required for the share lending to "good" assets, d_B denotes the funding required for the share lending to "bad" assets and δ denotes the share of assets screened as "good"[3]. Therefore, if δ, i.e., the share of the "good" assets, is high/low, a borrower is charged less/more repayment. In addition, the net expected return of "good" assets in a case in which the borrowing banks repay is higher than that of "bad" assets:

$$(R_G - d_G)\Pi_G > (R_B - d_B)\Pi_B \tag{4}$$

Despite of that, to attract investment, the net return of "good" assets is lower than that of "bad" assets (otherwise "bad" assets are optioned out by the interbank market, which is generally proved to be the opposite by the current financial crisis); thus the banks are still attracted to invest in "bad" assets:

$$R_B - d_B > R_G - d_G > 0 \tag{5}$$

The three equations of (2), (4) and (5) should yield that NPV for bad assets have a positive value.

(B) Monitoring liquidity risk

Depending on the maturity of assets, the portfolio assets can be further categorized as "good" long-term assets, "good" short-term assets, "bad" long-

term assets, and "bad" short-term assets. The share of total long-term assets is Φ, whereas the share of total short-term assets is 1-Φ. However, to focus on the banks' behaviour in choosing riskiness, the returns and expected returns of the total "good"/"bad" assets (denoted by $R_{G,}R_{B,}R_{G}\Pi_{G,}$ and $R_{B}\Pi_{B}$) are not affected by Φ.

For the sake of simplicity, it is assumed that the banks' assets and liabilities have the same maturity structure. Therefore, Φ represents the share of long-term borrowing, and 1 – Φ represents the share of short-term borrowing. The term structure of the interbank borrowing rate is $1<d_s<d_l$, where d_s denotes a short-term return rate and d_l denotes a long-term return rate. Denoting the cost for financing long-term and short-term "good" assets as $d_{GL}$and d_{GS}, respectively, and denoting the cost for financing long-term and short-term "bad" assets as d_{BL} and d_{BS}, respectively, d_G and d_B can be expressed as:

$$d_G = \Phi d_{GL} + (1-\Phi)d_{GS} = \Phi(d_{GL} - d_{GS}) + d_{GS} \quad (6)$$

$$d_B = \Phi d_{BL} + (1-\Phi)\, d_{BS} = \Phi(d_{BL} - d_{BS}) + d_{BS} \quad (7)$$

where $d_{BL} > d_{BS} > 1$, $d_{GL} > d_{GS} > 1$ as long-term loans are required for higher repayment than short-term loans.

(C) Objective of interbank loans

It is assumed that the fundamental goal of bank lendingis to make profitable loans with minimal risk.However, during non-crisis period, the interbank loans are considered cash equivalents since they can be sold in the market easily and at low cost. Therefore, we only consider profitability for the credit process decision making.

There is only one time period of concern. This is when lending banks decide the investment portfolio given interbank funding. And the paper isspecifically interested in the banks' investment decision of δ, or the share of "good assets" relative to "bad assets" as well as Φ, the share of "long-term assets" relative to "short-term assets"depending on whether the banks' net expected return (NER) will be maximizedgiven counterparty risk and liquidity risk are monitored. The interbank funding is provided on the basis that the NER from the portfolio investment by the borrowing banks is greater than 0.

Proposition 1: Interbank borrowing banks tend to choose a lower δ, i.e., a higher share of "bad" assets, to maximize their NER if $\Pi_G - \Pi_B < \Pi_G\, \Pi_B$, the difference in probability of "good" assets and "bad" assets to repay is not larger than the probability that both assets will repay:

Proposition 2*:* Banks can always increase their NER by increasing Φ, the share of their short-term interbank borrowing relative to long-term interbank borrowing. If $\Pi_G - \Pi_B < \Pi_G\, \Pi_B$, then there is a positive relationship between the share of short-term interbank borrowing and the tendency of borrowing banks to take more risk when they try to maximize their NER.

IV. Proof of Propositions

The investment decision made by banks depends on whether they consider that the transaction will have a positive banks' NER. However, banks' investment contains a portfolio of both "good" assets and "bad" assets, as illustrated in the table below. Banks' NER must be calculated separately under the four scenarios.

Table 1
Probability of repayment and default

Bad *Good*	*Repay* *Probability:* Π_B	*Default* *Probability:* $1-\Pi_B$
Repay Probability Π_G	***1.*** All (both "good" and "bad") assets repay. Probability: $\boldsymbol{\Pi_G\,\Pi_B}$	***2.*** "good" assets repay and "bad" assets default. Probability: $\boldsymbol{\Pi_G\,(1-\Pi_B)}$
Default Probability $1-\boldsymbol{\Pi_G}$	***3.*** "Bad" assets repay and "good" assets default. Probability: $\boldsymbol{(1-\Pi_G)\Pi_B}$	***4.*** All assets default. Probability: $\boldsymbol{(1-\Pi_G)(1-\Pi_B)}$

1. All (both "good" and "bad") assets repay. Probability: $\Pi_G\,\Pi_B$

$$NER_{S1} = \left[\delta(R_G - d_G) + (1-\delta)(R_B - d_B)\right]\Pi_G\Pi_B$$

2. "Good" assets repay and "bad" assets default. Probability: $\Pi_G\,(1-\Pi_B)$

$$NER_{S2} = \left[\delta(R_G - d_G) + (1-\delta)(0 - d_B)\right]\Pi_G(1-\Pi_B)$$

3. "Bad" assets repay and "good" assets default. Probability: $(1-\Pi_G)\Pi_B$

$$NER_{S3} = \left[\delta(0 - d_G) + (1-\delta)(R_B - d_B)\right](1-\Pi_G)\Pi_B$$

4. All assets default. Probability: $(1-\Pi_G)(1-\Pi_B)$

$$NER_{S4} = \left[\delta(0 - d_G) + (1-\delta)(0 - d_B)\right](1-\Pi_G)(1-\Pi_B)$$

Because the NER must be greater than 0, in scenario 4 in which the NER is less than 0, banks will not make interbank investment. For the other scenarios:

(1) Under the scenario that all assets repay, a bank will be able to obtain interbank loans if:

$$\left[\delta(R_G - d_G) + (1-\delta)(R_B - d_B)\right]\Pi_G\Pi_B > 0$$

$$\Rightarrow \delta > \frac{R_B - d_B}{(R_B - d_B) - (R_G - d_G)} > 1$$

However, this is impossible because $0 \le \delta \le 1$.

(2) Under the scenario that "good" assets repay and "bad" assets default, a bank will be able to obtain interbank loans if:

$$\left[\delta(R_G - d_G + d_B) - d_B\right]\Pi_G(1 - \Pi_B) > 0$$

$$\Rightarrow \delta > \frac{d_B}{R_G - d_G + d_B}$$

(3) Under the scenario that "bad" assets repay and "good" assets default, a bank will be able to obtain interbank loans if:

$$\left[-\delta(R_B - d_B + d_G) + (R_B - d_B)\right](1-\Pi_G)\Pi_B > 0$$

$$\Rightarrow \delta < \frac{R_B - d_B}{R_B - d_B + d_G}$$

Therefore, we must study the following two cases for δ:

(A) $\frac{d_B}{R_G - d_G + d_B} < \delta \leq 1$

In this case, a bank will be able to obtain an interbank deposit if only the "good" assets repay. The first-order derivative of the NER is:

$$\frac{\partial NER}{\partial \delta} = (R_G - d_G) + d_B > 0$$

Therefore, the NER is increasing in δ. The local maximum for the interval $(\frac{d_B}{R_G - d_G + d_B}, 1]$ is at 1:

$$NER_{local\ \max}(\delta = 1) = (R_G - d_G)\Pi_G(1-\Pi_B)$$

(B) $0 \leq \delta < \frac{R_B - d_B}{R_B - d_B + d_G}$

In this case, a bank will be able to obtain an interbank deposit if only the "bad" assets repay. The first derivative of the NER is:

$$\frac{\partial NER}{\partial \delta} = -[(R_B - d_B) + d_G] < 0$$

Therefore, the NER has a negative relationship with and is decreasing in δ. The local maximum for the interval $[0, \frac{R_B - d_B}{R_B - d_B + d_G})$ is at 0:

$$NER_{local\max}(\delta=0)=(R_B-d_B)\Pi_B(1-\Pi_G)$$

Comparing the local maximum in the two cases gives:

$$(R_B-d_B)\Pi_B(1-\Pi_G)-(R_G-d_G)\Pi_G(1-\Pi_B)$$
$$=[(R_B-d_B)-(R_G-d_G)][\Pi_G\Pi_B-(\Pi_G-\Pi_B)]$$

Because $R_B-d_B>R_G-d_G>0$, the first term of the multiplication is greater than zero. The comparison depends on the second term.

If $\Pi_G-\Pi_B<\Pi_G\Pi_B$, i.e., the difference in probability of "good" assets and "bad" assets to repay is not larger than the probability that both assets will repay, then $NER_{local\ max}(\delta=0)>NER_{local\ max}(\delta=1)$ and banks will chooseä=0, i.e., invest all in "bad" assets to maximize their NER.

However, if $\Pi_G-\Pi_B>\Pi_G\Pi_B$, i.e.,the difference in probability of "good" assets and "bad" assets to repay is larger than the probability that both assets will repay, then $NER_{local\ max}(\delta=0)<NER_{local\ max}(\delta=1)$ and banks will choose δ = 1, i.e., invest all in "good" assets to maximize their NER.

Therefore, under the monitoring mechanism through risk pricing, borrowing banks still tend to choose a lower δ, i.e., a higher share of "bad" assets, to maximize their NER if:

Specifically, they will choose a δ in the interval relative to a δ in the interval.

Proof of Proposition 2: The relationship between the maturity of interbank loans and the risk-taking behaviour of borrowing banks can be studied by inserting equation (6) (7) into the NER expressions in Proposition 1 above.As shown in the proof of Proposition 1, banks will successfully obtain interbank loans in two scenarios; thus, it is only necessary to analyse NER_{S2} and NER_{S3} as below:

(1) $\dfrac{d_B}{R_G-d_G+d_B}<\delta\le 1$, only "good" assets repay:

$$NER_{S2}=\left[\delta(R_G-d_G)+(1-\delta)(0-d_B)\right]\Pi_G(1-\Pi_B)$$
$$=\Pi_G(1-\Pi_B)\{\delta\{R_G+\phi[(d_{BL}-d_{BS})-(d_{GL}-d_{GS})]+d_{BS}-d_{GS}\}$$
$$-\phi(d_{BL}-d_{BS})-d_{BS}\}$$

The first derivative is: $\dfrac{\partial NER_{S2}}{\partial\phi}=(\delta-1)(d_{BL}-d_{BS})-\delta(d_{GL}-d_{GS})$

which is always negative because δ – 1<0, $d_{BL}>d_{BS}$, δ>0, and $d_{GL}>d_{GS}$. Hence, the*NER* is decreasing in Φ, and banks will reduce the share of long-term interbank loans to maximize the *NER*. Because δ has a positive

relationship with *NER* for the interval $(\frac{d_B}{R_G - d_G + d_B}, 1]$, the implication is that Φ has a negative relationship with δ in maximizing the NER. This means that borrowing banks will maximize the NER by decreasing the share of long-term interbank loans and increasing the share of "good" assets.

(2) $0 \le \delta < \frac{R_B - d_B}{R_B - d_B + d_G}$, only "bad" assets repay:

$$\begin{aligned} NER_{S3} &= [\delta(0 - d_G) + (1-\delta)(R_B - d_B)](1-\Pi_G)\Pi_B \\ &= (1-\Pi_G)\Pi_B\{-\delta\{R_B + \phi[(d_{GL} - d_{GS}) - (d_{BL} - d_{BS})] + d_{GS} - d_{BS}\} \\ &\quad + R_B - \phi(d_{BL} - d_{BS}) - d_{BS}\} \end{aligned}$$

The first derivative is: $\frac{\partial NER_{S3}}{\partial \phi} = (\delta - 1)(d_{BL} - d_{BS}) - \delta(d_{GL} - d_{GS})$

which is always negative because δ–1<1, $d_{BL} > d_{BS}$, δ>0, and $d_{GL} > d_{GS}$. Hence, the *NER* is decreasing in Φ, and banks will reduce the share of long-term interbank loans to maximize the NER. Because δ has a negative relationship with *NER* for the interval $[0, \frac{R_B - d_B}{R_B - d_B + d_G})$, the implication is that Φ has a positive relationship with δ in maximizing the NER. This means that borrowing banks will maximize the NER by decreasing the share of long-term interbank loans and reducing the share of "good" assets.

Overall, banks can always increase their NER by increasing the share of short-term interbank loans. If $\Pi_G - \Pi_B < \Pi_G \Pi_B$, then there is a positive relationship between the share of short-term interbank borrowing and the tendency of borrowing banks to take more risk when they try to maximize their NER.

V. Conclusion

The introduction of market discipline into existing regulatory mechanisms is based on the results of empirical research finding that wholesale massive investors are perceived as more technologically superior to regulatory authorities in risk monitoring and that they are able to identify the risks of borrowing banks and develop differential pricing. This advantage can help regulators reduce costs, decrease losses from deposit insurance, and ultimately reduce the increased government assistance cost and taxpayer burdens because of bank failures.

However, there may be large errors ifregulators rely solely on the monitoring of market investors before the event to judge the existence of market discipline. The model results described above show that even if investors have incentives for monitoring before the event, financing bodies may still choose a portfolio with high risks to achieve NER maximization, and the monitoring effect will be weakened with a decrease in the loan period. The model results also indirectly reveal that the meaning of market discipline is only partially interpreted and that its validity is based on the assumption that the differential risk pricing of investors changes the financing cost and can ultimately influence therisk reduction of financing bodies.

Since 2008, the global banking crisis has led us to the realization that the market has not achieved risk discipline for a long period of time and has urged variouscountries to strengthen themode of government-ledmonitoringfollowing the crisis. For example, the US Dodd-Frank Act added the "Consumer Financial Protection Agency" and the "Financial Stability Committee"on the foundation of the many existing regulatory authorities to strengthen the government's regulation of the market. However, with the gradual recovery of the financial industry and the real economy in recent years, the regulation prevents financial institutions from"innovation" and taking on new risks. Therefore, the regulatory mechanism dominated by government agencies will continue to experience pressure from financial sector in favour of easing the "trammels". However, the model of this paper implies the regulations such as 2010 Dodd Frank Bill created in the aftermath of financial crisis that macroprudentially protect consumers, should not be rolled back.

Notes

1. See Gilbert (1990) for details summarizing and comparing various reform plans of the deposit insurance system in the 1980s.
2. The situation is reversed as after the financial crisis beginning in 2008, the amount of interbank financing in the US has dropped precipitously indicating it's not a top choice for liquidity for asset/loan purchases anymore.
3 As suggested by the previous studies (Dinger & Hagen 2009 for example), the lenders have the technology to screen the assets of borrowing banks, their assessment in the asset profile of borrowing banks is correct.

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