

Rollover and Capital Adequacy Requirements

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Abstract

This paper shows theoretically that if bank supervision is weak, capital adequacy requirements provide an incentive for troubled banks with their non-performing loans to refinance their client distressed firms, even those with poor prospects. We also argue that in some cases rollover is desirable because the bank can resolve the debt overhang problem of its clients. Therefore, results such as these indicate that loan rollovers need to be assessed more carefully.

Key words: Rollover; Capital adequacy requirements; Debt overhang

JEL Classification: G21; G28

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Yasuda greatly appreciates the financial support of a grant-in aid from Zengin Foundation for Studies on Economics and Finance, and of the Grant-in-Aid for Scientific Research (C) (No. 25380407) from MEXT.

1. Introduction

This paper aimed to investigate when and under what conditions troubled banks roll over their non-performing loans. We construct a simple model to investigate the relationship between rollover and the capital adequacy requirements. When we investigate loan rollovers, it is important to consider whether financially distressed firms have good prospects or not. If a troubled bank with bad loans refinances financially distressed firms with poor prospects, this behavior prevents the resolution of a prolonged financial crisis. This phenomenon is now known as “Zombies” lending (e.g. Hoshi, 2006, Caballero et al. 2008, Fukuda and Nakamura, 2011).

On the other hand, if the bank refinances financially distressed firms with good prospects, this behavior itself is desirable because these firms are considered as having positive NPV projects (e.g., Konish and Yasuda, 2003). This argument is related to a strand of soft budget constraints (e.g., Berglof and Ronald, 1997). However, the soft budget constraints model assumes that the additional investment is efficient at least ex-post in most cases (see also Mitchell, 2002). Therefore, it isn't necessarily clear why troubled banks refinance the distressed firms with poor prospects. However, this aspect has not been explicitly addressed by previous theoretical research.

Previous research has argued that a “credit crunch” is caused by capital adequacy requirements and that this phenomenon aggravates depression (e.g. Bernanke and Lown, 1991; Ito and Sasaki, 2002). In recent years, both “credit crunch” and “rollover” have been considered important causes of the prolonged financial crises. Naturally this begs the questions: Why do troubled banks roll over their non-performing loans? Is the cause of rollover also related to capital adequacy requirements? Is rollover always undesirable? Therefore, we contribute to the earlier studies by showing that a troubled bank can refinance both types of firms under the capital adequacy requirements.

Further, our argument is closely related to the issue of corporate governance. It is often argued that to prevent loan rollover, it is crucial that corporate governance be restructured. However, the results of this paper indicate that the reinforcement of corporate governance may not be enough, because rollover is desirable from the viewpoint of the shareholders in our model. This is an aspect that has not been pointed out in other studies.

The remainder of this paper is organized as follows. Section 2 presents the basic model.

Section 3 analyzes the conditions of rollover and presents the results. Section 4 concludes.

2. The Model

Our model considers an economy with banks, many potential firms, and a regulator. To deal with the banks with bad loans, we consider two periods with two dates $T=1,2$. Deposits are fully insured by the government and provided infinitely elastic supply at a riskless interest rate. For simplicity, we assume that the riskless interest rate is zero. Therefore, the banks can finance any funds regardless of their soundness.

For simplicity, the worth of a bank's assets is normalized to 1. Each bank collects money through deposits D and equity E and make loans to its client firms. As a result, at the end of $T=1$ the total value of assets becomes $A_1(>1)$ or $(1-\lambda\alpha)A_1$. The latter case means that the credit ratio $\lambda(0 < \lambda < 1)$ of client firm(s) $\alpha A_1(0 < \alpha < 1)$ constitutes insolvency. In another words, the parameter λ reflects the amount of the bad loans. Therefore, we can interpret the former bank as a sound bank and the latter as a troubled bank with bad loans.

The bank only knows whether it faces a bad loans problem or not. If we denote a profit of the sound bank in period $T=1$ by $\Pi_1 = A_1 - 1$, the net worth of the sound bank is $W_H = A_1 - D = E + \Pi_1$. Similarly, if we denote a profit of the troubled bank in period $T=1$ by Π'_1 where $\Pi'_1 = (1-\lambda\alpha)A_1 - 1$ the net worth of the troubled bank is $W_L \equiv (1-\lambda\alpha)A_1 - D = E + \Pi'_1$. Since the relationship $\Pi_1 > \Pi'_1$ holds, this implies $W_H > W_L$. If Π'_1 takes a negative value, then we assume that $-\Pi'_1 < E$ holds. This assumption guarantees that the net worth of the troubled bank is still positive, $W_L > 0$. The troubled bank with bad loans must choose whether to write off or to roll over the loans in default at the end of $T=1$. We assume that when a troubled bank attempts to rollover bad loans, it will succeed with a probability of $p > 0$. We interpret the parameter $1-p$ to be the probability that the bank's attempt to roll over its distressed firms is detected by the regulator. If the bank's attempt to hide defaults "fails", the bank must write off the loan, and the regulator imposes an penalty cost C on the bank. Several of the basic elements of the model resemble features of the model of Corbett and Mitchell (2000).

The regulator also imposes capital adequacy requirements on the banks at the end of $T=1$ because it cannot perfectly detect the amount of the bad loans of the banks. That is, at the beginning of $T=2$, the banks have to meet the capital ratio k , $W_i/A_2 \geq k(i=H,L)$. At the end of $T=2$, the bank's future net worth is realized.

3. Rollover Conditions

In this section, we analyze the effect of capital adequacy requirements on the troubled banks with bad loans. We assume that $X(\geq 1)$ denotes the expected revenues from loans in period $T=2$ per unit of money at the end of $T=1$. Since the sound bank has a net worth W_H at the end of $T=1$, the bank sets the size of assets at the beginning of $T=2$ as $A_{2H} = W_H/k$, because the larger the asset size is, the more profitable the bank is. Therefore, the expected profit of the sound bank in period $T=2$ is given by

$$(1) \quad \Pi_{2H} = XA_{2H} - A_{2H}$$

Throughout the paper, we assume that the bank's goal is to maximize its expected profit. In other words, we explicitly exclude agency problems between bank managers and shareholders. Therefore, if rollover is desirable for the bank managers, this also holds true for the shareholders.

Next, we turn to the troubled bank with bad loans, which writes off or rolls over its non-performing loans. If a bank writes off the non-performing loans, the net worth of its assets becomes W_L at the end of $T=1$ and the bank sets the size of its assets at the beginning of $T=2$ as $A_{2L} = W_L/k$. In this case, the expected profit of the sound bank in period $T=2$ is given by

$$(2) \quad \Pi_{2L} = XA_{2L} - A_{2L}$$

In contrast, if the troubled bank rolls over its non-performing loans, it can keep the same size of net worth as that of the sound bank. The reason for this is that as long as the distressed firm(s) doesn't go into liquidation, the troubled bank can keep the bad loans as the sound ones by paying back the first period loans using the second period loans. Therefore, the bank can set the size of its assets as $A_{2R} = W_H/k = A_{2H}$ at the beginning of $T=2$. In this case, the expected profit of the bank, which rolls over its non-performing loans, is given by

$$(3) \quad \Pi_{2R} = X(A_{2R} - \lambda\alpha A_1) - A_{2R} - M(1-\lambda)\alpha A_1$$

Note that the second term $\lambda\alpha A_1$, which is part of the second period loans, is used by the distressed firm(s) to repay the loans at the end of $T=1$. Therefore, the rest $(1-\lambda)\alpha A_1$ is

used for new investments of the distressed firm(s) in the period $T = 2$. We assume that M denotes the parameter expressing the expected revenues of the bank from the repayments of the new investment. If $M \geq 1$ holds, we can interpret that the distressed firm(s) has non-negative NPV projects because the excess debts (bad loans from the bank's viewpoint) decrease from $\lambda \alpha A_1$ to $\{\lambda - (M - 1)(1 - \lambda)\} \alpha A_1$. Conversely, if $M < 1$ holds, the new projects have negative NPV and this implies that the rollover will cause further losses.

From the above discussion, whether the troubled bank with bad loans writes off or rolls over its non-performing loans at the end of $T = 1$ depends on the sum of the expected profits in two periods. Therefore, if the condition

$$(4) \quad p(\Pi_1 + \Pi_{2R}) + (1 - p)(\Pi'_1 + \Pi_{2L} - C) > \Pi'_1 + \Pi_{2L}$$

holds, the troubled bank with bad loans will roll over its loans to its financially distressed clients.

Note that $A_{2R} = A_{2H}$, the condition (4) is equivalent to

$$(5) \quad (X - 1)\lambda/k + \lambda + M(1 - \lambda) - X - C(1 - p)/p > 0$$

Therefore, we get the following result.

Result. If the condition $(X - 1)\lambda/k + \lambda + M(1 - \lambda) > X + C(1 - p)/p$ holds, the troubled bank will roll over its non-performing loans.

The intuition of the result is as follows. If the troubled bank writes off its non-performing loans, its net worth decreases. As a result, the bank will lose some opportunities for loans because the size of its assets in the period $T = 2$ must shrink under the capital adequacy requirements. Therefore, if the benefits of keeping the size of its assets are larger than the negative effects of the shrinking of those assets, the troubled bank will roll over its non-performing loans. Note that the benefits consist of keeping the benefit of the bad loans at the end of $T = 1$ (we call it "leverage effect" hereafter), and the repayment benefit of the bad loans at the end of $T = 2$. Therefore, the higher the expected revenues M , the more incentive the troubled bank has to roll over its non-performing loans. Note also that the larger the probability p is, and the smaller the

penalty cost C is, the more often rollover will occur.

It needs to be remembered that there is a possibility that these firms may be financially distressed firms, but with good prospects. If this is the case, this behavior is desirable because these firms are considered as having positive NPV projects. This phenomenon implies that continuing the relationship with the same bank can resolve the debt overhang problem (e.g. Myers, 1977). In this sense, it could be the case that the rollover is desirable.

However, the next numerical example shows that the troubled bank can also have an incentive to roll over its financially distressed firms with poor prospects ($M < 1$).

Numerical Example. Set $X = 1.04$, $\lambda = 0.7$, $k = 0.08$, $M = 0.9$, $p = 1$, then the troubled bank will roll over its financially distressed firms with bad prospects.

When bank supervision is sufficiently weak and the leverage effect is large enough, the negative effect of rolling over financially distressed firms with poor prospects is offset, and keeping the same asset size as before is desirable for the bank. Therefore, it depends on the situation whether rollover is desirable or not for the bank. Overall, these results imply that we need to assess loan rollovers more carefully.

Note also that whether rollover is desirable or not, this decision has no conflict with the shareholders. In other words, we can explain the phenomenon of loan rollovers without assuming a lack of corporate governance. Therefore, the result indicates that the reinforcement of corporate governance may not be enough to prevent rollover.

4. Conclusions

We showed that capital adequacy requirements provide the incentive for troubled banks with bad loans to roll over their distressed firms with poor prospects. We also argued that in some cases rollover is desirable because the bank can resolve its debt overhang problem. Therefore, results such as these indicate that loan rollovers need to be assessed more carefully.

Furthermore, our research has shed some light on the arguments of corporate governance. The results of this paper imply that rollover may be desirable from the viewpoint of the shareholders. Hence, we cast doubt on the popular argument that the

reinforcement of corporate governance is crucial to prevent loan rollovers and the resulting banking crises.

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