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AN EMPIRICAL ASSESMENT OF THE EFFECTS OF CAPITAL REQUIREMENTS ON BANKS' LOAN PORTFOLIOS IN INDONESIA

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インドネシアにおける自己資本比率規制が、銀行の貸し出しポートフォリオに与える影響をバンクローンの需給を考慮に入れ分析したもので、今後のアジア諸国の金融政策にたいする示唆を含んだ研究成果であり、経済政策学会中部部会のワーキング・ベーパにふさわしい内容を持っている。

AN EMPIRICAL ASSESMENT OF THE EFFECTS OF CAPITAL REQUIREMENTS ON BANKS' LOAN PORTFOLIOS IN INDONESIA

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ABSTRACT

This paper analyzes the impact of capital requirements on the bank's loan portfolio and monetary policy in Indonesia. To investigate the impact of capital requirements on the behaviour of bank's loan portfolio, this study uses Stiglitz and Greenwald model of loan market to describe how the behaviour of banks under a competitive banking system determine their supply of loans and how the capital requirements may have the role in explaining bank's loan portfolio. Using disequilibrium model, we find the capital requirements have a negative effect in explaining the supply of bank's loan. The imposition of capital requirement to protect and maintain the stability of banking sector has also contributed to a decrease in banks' willingness to supply loans.

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Keyword: Capital Requirement, Bank's Loan Portfolio.

JEL : G32, G21,

1. INTRODUCTION

Since 1988, many countries' central banks have imposed capital adequacy requirements upon the banks' asset portfolios by adding a traditional leverage requirement to the banks' "risk based" requirement so that bank capital would be determined by "risk weighted" measures of total assets (Vanhoose, 2007). With the implementation of Basel II, more risk-sensitive capital standards have been introduced by central banks to hinder the severe market distortion and the arbitrage behavior of banks. Capital requirements are believed to play an important role in maintaining bank soundness, rational risk taking behavior, and bank competitiveness (Zhu, 2007). In addition to its advantages, the presence of capital adequacy requirements also has raised concerns about the nexus of monetary policy and bank regulation. Though it is potentially important for financial stability, the imposition of a capital adequacy requirement can cause monetary policies and prudential policies to have different purposes, and it has the potential to amplify business cycles. (Cecchetti and Li, 2005).

While monetary authorities aim to ensure that there is sufficient lending available to encourage or maintain high and stable economic growth, financial system regulators have always worked to minimize the risks that cause a reduction in loan capabilities. During a recession, when the bank's capital tends to deteriorate, banking authorities will insist that banks have sufficient capital and that they reduce lending limits in order to minimize the decline asset value. When this occurs, an expansionary monetary policy geared to stimulate real economy growth through reduced interest rates may become less effective. Higher capital requirements could make banks safer, but at the same time, they could also increase the bank's cost to make the loan and could reduce expected profits, which in turn will constrain the number of loans a bank makes. This situation has been observed in the Indonesian economy, where the potential negative impacts of capital requirements on bank loan growth appears relevant—especially after the 1997 Asian financial crisis, which has likely continued to the present day.

After the 2008 global financial crisis, banks, the main source of financing in the Indonesian economy, still are not considered to be the optimal institutions to perform intermediary functions to the real sector. Banks are behaving carefully when setting the credit growth target, and they still tend to prefer short-term placements or liquidity in the form of Government Bonds (henceforth: SUNs) and Bank Indonesia Certificates (known in Indonesia as Sertifikat Bank Indonesia, henceforth: SBIs). In addition, banks tend to manage and maintain high Capital Adequacy Ratios (henceforth: CARs) that are far above the regulatory requirement of 8%. This situation has been the norm in Indonesia since the 1997 currency crisis, where the CAR of banks has been maintained at 17%.

During the 1997 currency crisis, Indonesian banks attempted to satisfy banking regulations by having a minimum capital of 8%, and 4% of the total non-performing loans (henceforth: NPLs) are considered to be one of the reasons for the banks' reluctance to provide loans (Juda et al., 2001).

Yudistira (2003) also finds evidence that regulatory capital affected the change in the Indonesian banks' decisions of whether to provide loans and that the amount of bank loans are determined by bank capital. In a crisis situation where the risk is very high, it can be understood that the imposition of capital requirements to protect and maintain the stability of the banking sector may cause banks to be less willing to provide loans. However, in recent situations in which the risk should have been declining, the question is raised of whether the capital requirement is still one of the causes of less lending and whether it can be used as an excuse for why banks do not lend at the optimal level.

This paper attempts to provide evidence of the impact of bank capital requirements on bank loan market portfolios in Indonesia. This study employs the Stiglitz and Greenwald model of loan markets to describe how the behavior of banks in a competitive banking system determines their willingness to provide loans and how the capital requirement may play a role in explaining bank loan portfolios. Using an empirical estimation, we employ the disequilibrium model framework of the loan market by considering the Stiglitz and Greenwald model to explain bank loan behavior. This study's findings supplement existing literature by providing empirical data to help determine the role that capital requirements play in bank lending in Indonesia.

The remaining sections of the paper are organized as follows: Section 2 provides a theoretical review of the impact of capital requirements and a bank loan portfolio analysis. Section 3 presents the empirical results of the capital requirement impact on bank loan behavior. Finally, a summary and a future study recommendation are presented in Section 4.

2. THEORETICAL REVIEW

2.1. Literature Addressing Capital Requirements on Bank Loan Behavior

The existing literature suggests several ways in which capital regulations may alter bank loan behavior and the efficacy of monetary policy—often with conflicting results and little consensus. In general, the discussion in the literature can be divided into two groups1). The first group, beginning with Basel I in the 1980s and continuing to Basel III, argues that capital requirements are important in order to strengthen bank capital, improve the efficiency and competitiveness of banking, and promote financial stability against systemic crises2). This argument is further supported because a financial crisis recently occurred, and capital requirements can be justified as a key mechanism for limiting significant risk taking by banks on the upside of the business cycle while also serving as a buffer for banks to continue lending on the downside of the business cycle (Peydro, 2010).

The second group argues that higher capital causes bank profits to decrease and leads to less lending, particularly to small- and medium-sized firms. In addition, Eichberger and Summer (2004) stated that the effects of capital requirements on financial stability are ambiguous. There has been no

clear answer provided in the literature that states how much capital is required to maintain financial system stability or to avoid financial crises. Arguments for capital requirements are generally based on risk behavior and on macroeconomic implications finding a predominantly negative impact of bank capital shock on bank loan availability and on bank lending channels of monetary policy3). Higher capital requirements will lead to fewer bank loans, increased liquidity, a credit crunch, and a reduction in economic output. (Blum and Hellwig, 1995; Furfine, 2001; and Diamond and Rajan, 2000).

From the literature survey conducted by Bario and Zhu (2008), we found that despite the voluminous studies regarding the impact and role of capital requirements on a bank's lending and monetary policies, there are many empirical studies that reflect the existing debate, especially for emerging countries like Indonesia4). To the best of our knowledge, there is only one empirical study (by Yudistira (2003)) that focused on an analysis of the impact of bank capital requirement in Indonesia. Yudistira's study found that regulatory policy influences the behavior of Indonesian banks and that the banks choose to decrease their balance sheet activity during capital shocks. An empirical study by Agung et al. (2001) addresses the existence of a credit crunch in Indonesia and finds that the capital to asset ratio is a proxy for the capital adequacy ratio and that it has a significantly positive role in explaining and determining bank lending behavior. This study also suggests that the credit extended by banks with low capital tend to grow at a slower rate than banks with a higher capital ratio.

In a crisis situation where the risk remains high, it is understood that the imposition of capital requirements to protect and maintain the stability of the banking sector may contribute to a decrease in the supply of bank loans. Whether this situation still applies to Indonesia is central a question that this study will address. In particular, we will explore whether the regulation of capital requirements still limits the number of new bank loans.

2.2. Bank' s Loan Portfolio: Model of Loan Market

Before describing the empirical analysis of the role of capital requirements on bank loan portfolios, it is necessary to understand the behavior behind bank loan decisions. This study refers to the model of the loan market in the ideal banking system as proposed by Stiglitz and Greenwald (2003) to address the risks of bankruptcy and asymmetric information. This model describes how the behavior of banks in a competitive banking system affect loan supply when there are no transaction costs and deposits are fully insured and subject to reserve requirements.

The model divides the bank's maximization profit problem into two period models. Components of the bank assets are assumed to consist of loans and bonds, while the liabilities consist of deposit funds and capital. A bank with capital determines its loans (N) and government securities (M), the amount of deposit funds (D), and interest rate charged for loans (r). The deposit interest rate is

assumed to be equal to the interest rate of government securities (ρ)[1], so there is no incentive for banks to hold government securities. The function of bank's gross return of loans defines as

$Y = f(N, r, e, \Theta)$, ...(1)

where

Y = the expected return of banks loans

N = total loans

r = loans interest rate

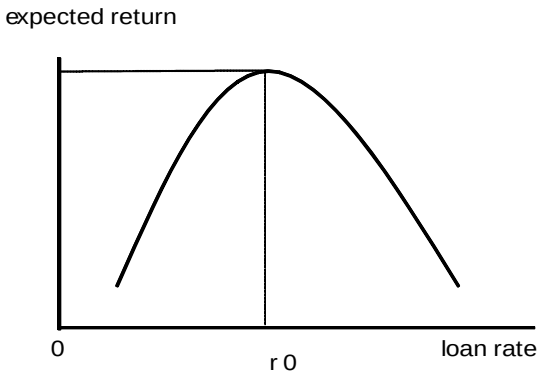
e = cost on screening and monitoring

Θ = economic condition or state of business cycle.

Y and N are assumed to have a positive relationship. The model shows that the more the amount of loans that banks lend, the greater the risk of default. Therefore, we can define $Y_N > 0$ and $Y_{NN} \leq 0$.

The variable r is the loan interest rate. An increase in the loan interest rate does not necessarily raise the gross return of banks because higher loan interest rates may have a higher probability of default due to imperfect information (Stiglitz and Weiss, 1981). The relationship between loan rates and expected returns is given by a concave function (see figure 1) due to asymmetric information in the loan market.

Figure 1: Relationship Between Banks' Expected Return and Loan Rates



With perfect information, an increase in the loan interest rate increases the banks' expected returns. In reality, an increase in the loan interest rate may encourage borrowing firms to take a more risky project with a high return in order to set off the increase in the loan interest rate. Therefore, an increase in the loan rate may increase the probability that borrowers do not repay their loans. When there are high interest rates, only those borrowers with high-risk projects are prepared to accept a high interest loan, while borrowers with low-risk projects might not submit loan applications. Accordingly, the

[1] In the case government bond is used as monetary instrument in money market, we may consider it as policy rate. As the deposit interest rate is assumed to be equal to the interest rate of government securities, we can consider the government securities rate as a proxy of cost of fund. In this model, we may assume as well that banks will not use money market fund to finance their loan.

average quality of the debtor will decrease, and as a result, the expected profitability and value of the banks' assets will decline.

With asymmetric information, there is an interest rate that maximizes banks' expected returns from their borrowers, which is shown as r_0 in figure 1. The expected return from loans is greater than zero (EYr > 0) as long as banks impose loan interest rates below r_0 so that the borrower can repay the loan. At EYr < 0, when the interest rate charged is higher than r_0 the borrower may be unable to repay the loan at this rate.

The variable e has a positive relationship with the amount of loans, but there is exist a fixed cost that limit bank to extend loans. Then, we can define Ye > 0 and Yee<0. The variable Θ is an economic condition that can be defined as a proxy of undiversifiable risk portfolio. The model assumes that Y_Θ >0 occurs when the business cycle is in a prosperous stage when banks are encouraged to provide more loans. Given the economic condition, the expected gross return of bank loans is determined by only three variables (N, r, e). In reality, we may include other determinants such as capital adequacy requirement and collateral requirement that for the time being are also omitted.

On the liabilities side of the balance sheet, banks initially have a net worth of (a_t). Naturally, banks invest through loans from deposits and use as little of their own capital as possible. With a reserve requirement (k) for deposits, bank investments (B) financed by deposits (D) can be written as

$D(1-k)=B$ ……(2)

Considering the reserve requirement as a "tax" (τ)[2] on deposit, we can defines as

$1+\tau = 1/\ (1-k)$ ……(3)

Then total repayment to depositors could be written as

$D\rho = B\rho(1+\tau)$ ……(4)

Taking into account the existence of the bankruptcy risk and the cost of monitoring and screening (e), the net worth of banks at the end of the period can be defined as:

$a_{t+1} = \max\{Y + M(1+\rho) - B(1+\rho(1+\tau)) - e, 0\}$ …(5)[3]

If B>0 and considering the balance sheet of bank, we can define B as:

$B = N + M - a_t$ …….(6)

When (6) is substituted for (5), the result is:

$a_{t+1} = \max\{Y(N, r, e, \Theta) + M(1+\rho) - [N + M - a_t](1+\rho(1+\tau)), 0\}$ ….(7)

[2] An effective tax implied by reserve requirement as an opportunity cost for banks

[3] In contrast with Stiglitz-Greenwald model, we consider the cost of monitoring should not be part of bank's balance sheet, but as a negative factor of bank net worth. Therefore we put "e " in equation 5 and omit it from equation 6.

From equation 7, we can see that if $a_{t+1} < 0$, the banks will go bankrupt. The decision problem of a bank can be formulated by assuming that the bank is risk neutral and that bankruptcy costs exist[4].

If Θ in equation 1 is defined as a prosperous condition, then there will be another condition, which we define as $\hat{\Theta}$. If and only if $\Theta \leq \hat{\Theta}$, the banks will go bankrupt. We may define the probability of a bank going bankrupt as $F(\hat{\Theta})$. If c is the cost of bankruptcy, the maximization problem of banks over their loan portfolio is:

$$\max \quad Ea_{t+1} - cF \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(8)$$

$$\{N,M,r,e\}$$

s.t.

$$N \leq N^{d}(r,e) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

Solving the maximization problems in (8) and (9), we can find the determinants of the optimal decisions of a bank for the supply of loan (N*), the loan interest rate (r*) as a function of bank net worth (a), the government securities rate (ρ),and the bankruptcy cost (c) as follows[5]:

$$\begin{aligned} N^{*} &= \Phi^{N}(a,\rho,\tau,c) \\ r^{*} &= \Phi^{r}(a,\rho,\tau,c) \\ e^{*} &= \Phi^{e}(a,\rho,\tau,c) \end{aligned} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(10)$$

$M^{*} = 0$[6]

Regarding the optimal decision for the supply of loans, we can show that $\frac{\partial N^{*}}{\partial a} \geq 0$; $\frac{\partial N^{*}}{\partial \rho} < 0$.

According to equation (8),), the equilibrium of bank decisions to make loans is when the difference between expected marginal returns and the cost of capital of loans is equal to the marginal bankruptcy costs and can be written as follows

$$\left(\frac{\partial Y}{\partial N} - (1 + \rho(1 + \tau)) \right) = c \frac{\partial F}{\partial N} \quad \ldots\ldots\ldots(11)^{7}.$$

A reduction in bank net worth increases the probability that the banks will default on their obligations to repay their depositors. An increased probability of default causes an increase in the marginal bankruptcy costs, which then leads to less lending activity, and therefore, $\frac{\partial N^{*}}{\partial a} \geq 0$.

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[4] We may see from other methods in which bank is risk averse and without bankruptcy risk. The bankruptcy cost depends on a number of factors such as changes in economic conditions and the scale of the firm. Further discussion sees Stiglitz and Greenwald, 2003.

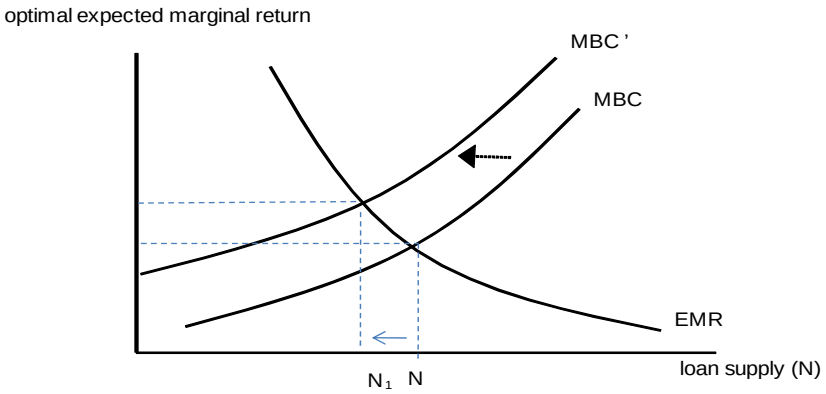
[5] We may include other parameters, such as capital adequacy requirement and collateral requirement. Practically, we may face a difficulty to measure a general collateral requirement as each bank has its own criteria in determining the size of collateral.

[6] In a competitive banking system, bank never borrows to buy government bonds, therefore M should be equal to zero.

[7] This paper defines $\left(\frac{\partial Y}{\partial N} - (1 + \rho(1 + \tau)) \right)$ as expected marginal return to lending EMR, which assumes will decrease as the amount of loans increase. As for the term of $c \frac{\partial F}{\partial N}$ that defines as marginal bankruptcy cost is refer to the marginal change in expected bankruptcy costs (MBC) due to a change in the amount of lending. The difference between both terms defines as optimal expected marginal return for simplicity.

Figure 2 describes how a decrease in bank net worth decreases loan supply from N to N1 by a shift leftward in marginal bankruptcy costs. Note that the effect of $\frac{\partial N^*}{\partial a}$ depends on the net worth. The impact of changes in bank net-worth is not symmetric to loan decisions. If net worth is large, a decrease in bank net worth decreases the loan supply. When net-worth is already small, then an increase in net worth may hardly increase the loan supply.

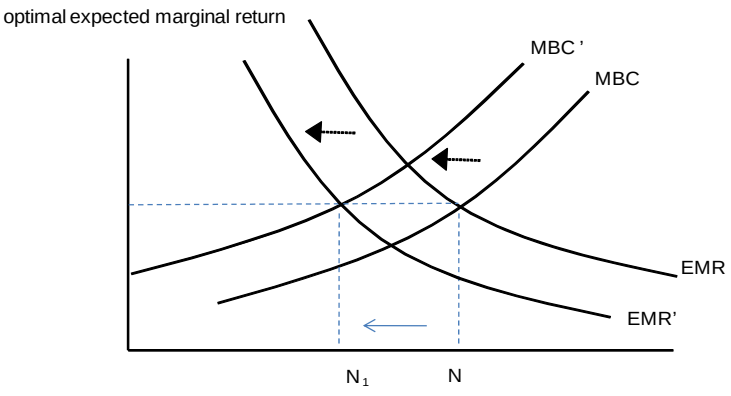
Figure 2: The Impact of a Reduction in Bank Net Worth on Loans



In the case of government securities, an increase in the government securities rate will increase the cost of the funds. This increase in cost reduces bank net cash flow, which further reduces the expected marginal returns on loans (henceforth: EMR) and increases the marginal bankruptcy risk for the banks (henceforth: MBC). A reduction in loan activity results and is explained as $\frac{\partial N^*}{\partial \rho} < 0$.

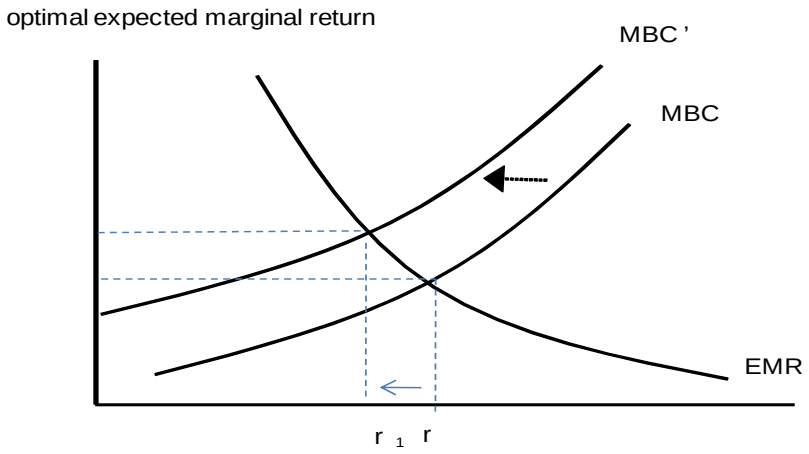
Figure 3 explains how an increase in the cost of bank funds due to a higher ρ leads to a smaller loan supply by shifting the expected marginal return curve and the marginal bankruptcy cost curve leftward.

Figure 3: The Impact of an Increase in ρ on Bank Loans



In the case of bank optimal decision making on loan rates over bank net worth changes, we find $\frac{\partial r^*}{\partial a} > 0$. A reduction in bank net worth leads to a decreased loan supply. Normally, fewer loans cause the interest rate charged by banks to increase with the fixed demand of the loan. However, an additional factor exists when there is a great risk of bankruptcy. An increase in the loan rate increases the bankruptcy risk because banks may become more risky borrowers with a higher probability of default. In addition, banks that have a lower net worth have an increased probability of going bankrupt at the level of the loan supply. An increase in loan interest rates reduces the cash flows of borrowers, which leads to a decline in borrower net worth and to additional increases in of the default rate. Therefore, banks will reduce loan interest rates as bankruptcy costs increase (i.e., $\frac{\partial r^*}{\partial a} > 0$). Figure 4 shows that a decrease in bank net worth reduces the loan interest rates charged from r to r1, as the risk of bankruptcy increases and shifts the marginal bankruptcy cost curve leftward [8].

Figure 4: The Impact of Bank Net Worth Reductions on Loan Interest Rates



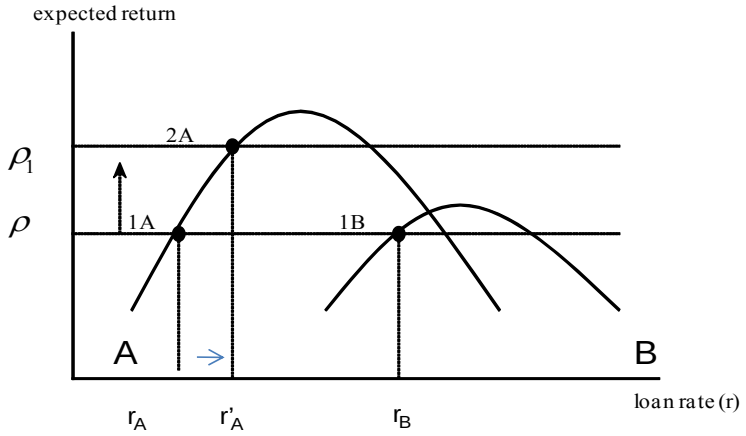
In addition to the optimal decision by banks on loan interest rates in response to changes in the government securities rate, we may show two possible bank decisions as $\frac{\partial r^*}{\partial \rho} > 0$ or $\frac{\partial r^*}{\partial \rho} < 0$. Normally, an increase in the government securities rate increases the cost of funds and, therefore, the loan interest rate, which is the case for $\frac{\partial r^*}{\partial \rho} > 0$. However, recall figure 1 where, due to asymmetric information, the higher interest rate did not necessarily increase the gross return of banks

[8] In figure 4 expected marginal return can be define as $\frac{\partial Y}{\partial r}$ that assumes will decrease as the loan rate increase (see figure 1)

because higher loan rates may increase the probability of default and decrease the asset value of the bank loans, hence $\frac{\partial r^*}{\partial \rho} < 0$.

Figure 5 describes how banks determine their loan rate for two types of borrowers with different risks, represented by curves A and B, in response to an increase in the government securities rate. Let us assume that the risk of A is lower than the risk of B. At competitive equilibrium, the expected return for the loan to type A borrowers must be equal to the expected return of the loan to type B borrowers ($\rho_A = \rho_B$).The value of is the threshold cost of funds above which no type B borrowers can borrow. At ρ , type A borrowers can borrow as much as they need at the interest rate r_A , while the interest rate charged for type B borrowers is r_B and the demand for type B loans may not be fully satisfied [9]. Note that $r_A < r_B$. When there is a higher cost of capital due to an increase in the government securities rate ρ_1 , type A borrowers receive loans at $r_A^{'}$, while type B borrowers are rejected by the bank. From this case, we find that due to rationing, average loan interest rates may be lower after an increase in the government securities rate (ρ).

Figure 5: The Impact of Higher Government Securities Rates on Loan Rates



2.3. Determinant Variables of Loan Markets for the Indonesia Case: A Lesson from the Asian Financial Crisis

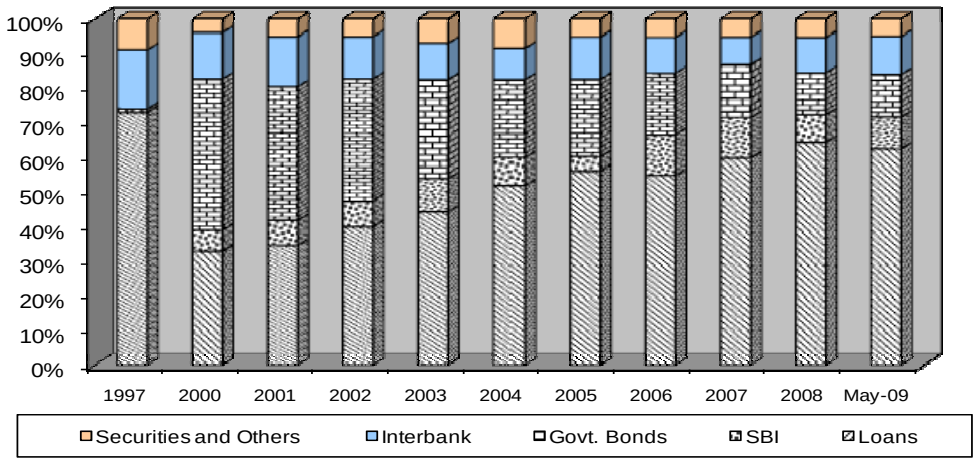
The optimal decision of a bank as defined by equation 10 has a number of interesting characteristics that provide insight into bank loan market behavior in Indonesia. This section evaluates some important determinants of the Indonesian bank loan market based on the Stiglitz and Greenwald model.

Banks in Indonesia may hold some liquid assets such as SBIs and government bonds. Prior to the crisis, approximately 70% of bank portfolios were comprised of loans, and less than 10% were liquid

[9] Assume there is no transaction cost

assets (with SBIs comprising 1% and other securities comprising 9%), as seen in figure 6)[10]. In the aftermath of the 1997 crisis, government bonds and central bank securities dominated bank balance sheets. Although the amount of credit continues to increase, the amount of government bonds and central bank securities still comprise a large percentage of bank portfolios, amounting to Rp 263,13 trillion for government bonds and Rp 195,40 trillion for SBIs at the end of May 2009.

Figure 6: Bank Balance Sheet Composition



This behavior is explained by Stiglitz and Greenwald's model by introducing the "benefit" of holding central bank or government securities. If funds are not readily available for banks in the money market at the government bond rate during high-risk or crisis situations, then banks will need to keep a certain amount of government securities and SBIs to maintain liquidity. Therefore, the bank maximization problem in equation (8) can be written as:

$$\max \quad Ea_{t+1} - cF + \lambda_{t+1} M_t \quad \text{.....(12)}$$

where λ_{t+1} is the shadow price or rate of liquidity of government or central bank securities at time t+1. The solution of M*, which in the previous model was rated 0 can be written as

$$M^* = \Phi^M(a, \rho, \tau, c) \quad \text{.....(13)}$$

Under normal conditions, banks will place their funds in government bonds or SBIs as long as the returns are greater than or equal to the cost of the funds and taxes on deposit (defined as $\rho\tau$), i.e., $\lambda_{t+1} \geq \rho\tau$. During the crisis period and afterwards, the cost of the fund and bankruptcy costs have

[10] Before the Asian 1997, there is no government bond in Indonesia and the Central Bank of Indonesia uses SBI as monetary instruments to maintain liquidity in money market. At that time there is no incentive for banks to hold SBI in an significant amount.

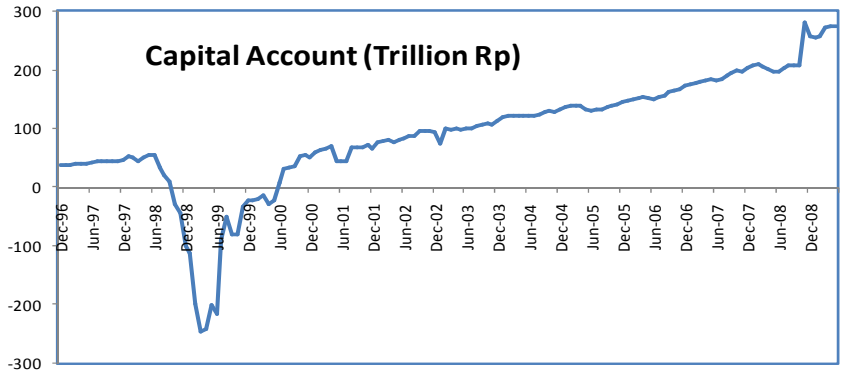
determined banks' decisions over M. As long as the perception of bankruptcy costs remained high, banks put or maintained their funds in government securities and SBIs in large amounts, which caused a decrease in lending.

2.3.1. The Impact of the Reduction in Bank Net Worth on Bank Loans in Indonesia

During the 1997 financial crisis, the deterioration of the borrowers' creditworthiness reduced their ability to repay existing loans and to obtain new loans, which increased the firms' bankruptcy risks. The crisis caused many firms to be unable to repay their loan obligations. This situation led to an increase in NPLs that in turn hurt bank revenues.

At the same time, the banking system in Indonesia faced severe liquidity problems that were initially due to both increased burdens to service external debts and a decline in international banking relations, which was exaggerated by mass deposit withdrawals as public confidence eroded. This situation worsened bank performance, eroded bank capital, and hurt the ability of banks to serve as financial intermediaries in the economy.

Figure 7: Bank Net Worth in Indonesia



Furthermore, the high interest policy in place during the crisis period exacerbated borrower distress over their debt, which caused an increase in the number of non-performing loans held by the banks and led to a further decrease in capital. The impact of the high interest rates also reduced bank revenue due to an increase in the negative spread between deposits and loan rates. This situation decreased bank revenues and led to negative bank capital in an amount of -Rp98.5 trillion in 1998 (Juda et al., 2001). The negative bank net-worth continued until mid-2000, with the lowest value of -Rp244.6 trillion occurring in March 1999 (figure 7).

The decrease in bank net worth increased the likelihood of default. That is, the bank marginal bankruptcy costs increased, and they resulted in a decreased supply of loans as described in 6[11].

[11] This fact relate to second proposition of Stiglitz and Greenwald model. In this study we do not explain in detail about their proposition rather just put forward some important issue in explaining Indonesia case.

Bernanke and Lown (1991) described this situation as a capital crunch, where the decrease in the banks' net worth reduced their ability and willingness to provide loans. Although the level of bank net worth has been positive on an aggregate basis with the completion of the recapitalization program, the requirement of a minimum 8% Capital Adequacy Ratio (CAR) following a BIS standard is believed to limit the banks' willingness to provide loans. In addition to capital adequacy ratio, bank efforts to increase the quality of assets through a reduction in NPLs is also believed to be a cause of bank reluctance and risk-aversion, and therefore, the supply of loans still is not considered to be fully recovered in order to finance the growth of the economy.

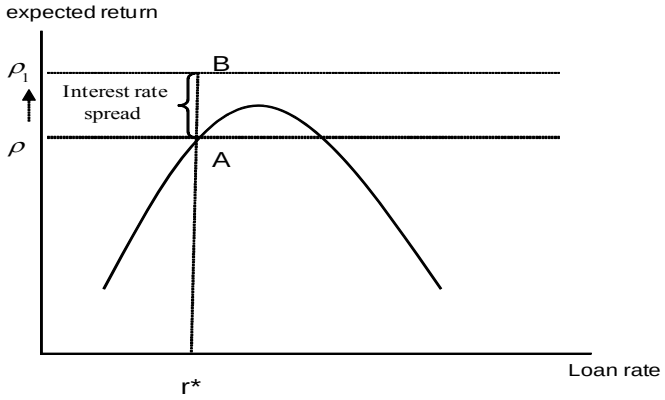
2.3.2. The Impact of Monetary Policy on Bank Loans.

When the Indonesian economy was in a recession due to the financial crisis, the risk of bankruptcy for the both borrowing firms and the banks increased. Many firms went into distress mainly because banks were more risk averse. At this time, a high interest rate could have worsened the risk of default for the existing loans, which in turn could have reduced the ability and willingness of banks to provide loans due to a feared increase in the number of non-performing loans16). Therefore, a tight monetary policy might have amplified the credit crunch in Indonesia. This is the example case of $\partial N / \partial \rho < 0$.

The effects of a tight monetary policy on bank loans can be explained in two ways: income effects and substitution effects. Because banks in Indonesia hold SBIs, government bonds and some liquid assets, a tight monetary policy with increased interest rates for SBIs may result in positive net worth for banks. However, in a period of crisis, income from SBIs cannot increase in net worth due to an increase in the non-performing loan problem. Low net worth leads to an increase in bankruptcy costs. Interestingly, a higher return on SBIs discouraged the banks' willingness to provide loans and led to a higher negative substitution effect in the availability of loans. Banks tended to put their funds into safe portfolios such as government bonds and SBIs instead of providing loans.

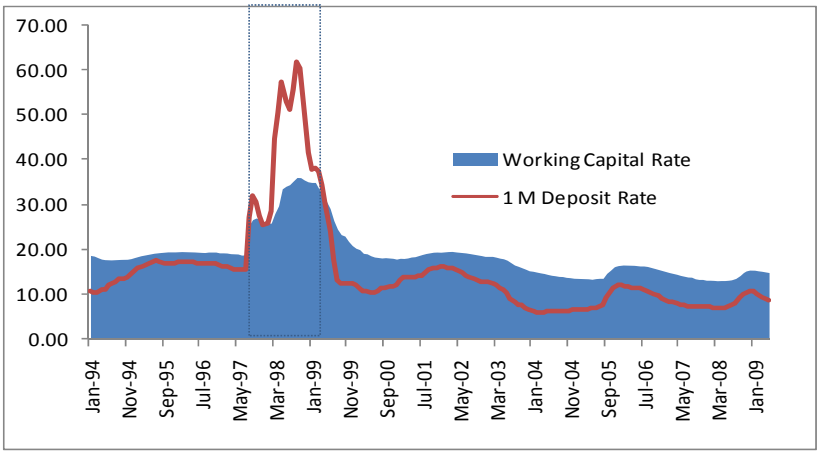
The impact of the tight monetary policy on bank loans also affects interest rates. Following the standard monetary approach, a tight monetary policy increased the bank costs for funds, which led to an increase in the loan rate. This is not necessarily the case in the rationing model. Recall that $\partial r^* / \partial \rho < 0$, an increase in the cost of funds due to tight monetary policies, may lead to lower average loan interest rates.

Figure 8: The Impact of Monetary Policy on Loan Interest Rates Due to Higher Costs of Fund



During the crisis period, banks could not increase their loan rates because doing so would have led to increased defaults by their borrowers. A liquidity constraint, however, should cause banks to increase their deposit rates in order to attract additional deposits. If deposit rates are considered to equal the cost of funds, then there would be a spread in the negative interest rate. Figure 8 illustrates that an increase in the cost of funds was not followed by an increase in the loan rate, which caused a negative interest rate to spread. This spread is described as the difference between point B and point A. This explanation is consistent with the observation in figure 9 that the loan interest rate is lower than the deposit rate during the crisis period.

Figure 9: Loan and Deposit Rates



An increase in the cost of funds that resulted in a negative spread may have caused loans to no longer be profitable. However, banks still may have continued to lend for cost adjustment reasons. Note that a loan is a long-term relationship and that banks cannot recall existing loans immediately. However, an increase in fund costs can be viewed as a temporary shock that increases the loan rate and may not be the best choice for banks to maintain profitability because it could affect a borrower's ability to repay the loan and therefore affect bank net worth due to a decrease in the loan values.

Furthermore, the two borrower illustrations demonstrate that an increase in the cost of funds due to a tight monetary policy caused more severe credit rationing for some groups of borrowers, particularly for

small- to medium-sized borrowers. For highly leveraged borrowers, as was the case in Indonesia, higher interest rates reduced net cash flows and increased the probability of default, worsening the non-performing bank loans, which in turn led to a decrease in bank net worth and caused banks to become more risk averse. This situation induced banks to tighten their credit criteria. Some groups of borrowers, such as small- to medium-sized firms, which formerly were able to receive loans, failed to receive new loans, leading to a more severe credit rationing[12].

Unlike at the start of the crisis when there was a loose monetary policy for credit rationing, the lowered interest rates did not immediately help restructured firms receive new loans or restore the banks' willingness to provide additional loans because the banks still considered the risk of bankruptcy to be high. Banks still could not predict the bankruptcy risk and are reluctant to bear the risk; therefore, the unwillingness of banks to supply loans remains. A loose monetary policy after the crisis ended did not significantly increase the loan supply and lead to a low number of bank loan portfolios.

2.3.4. The Impact of Capital Requirements on Bank Loans

Following the BIS standards, Bank Indonesia, the banking regulator, imposed a capital adequacy ratio (CAR) that all bank placements be related to a risk premium (risk-related asset). Imposing a CAR will cause additional constraints to bank net-worth that must satisfy

$$a \geq N * Z_N + M * Z_M \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(14)$$

where is the net worth requirement of per unit outstanding loans (N) and central bank or government securities (M). We assume that there is only one premium imposed [13]. By including this constraint with the solution for the bank maximization problem in equation (8), bank decisions on the supply of loans may be determined by $\frac{\partial N^*}{\partial Z_N} < 0$. Due to net worth constraints, the ability of banks to extend loans decreases and causes a reduction in loan availability [14].

The imposition of a CAR encouraged banks to be more careful when providing loans and caused banks to put their funds into safe placements with zero risk, such as government or central bank securities. Therefore, the marginal expected return of loans decreases and leads to a decrease in loan supply. This situation might cause a decrease in bank net-worth. The imposition of a CAR to comply with the BIS regulation might discourage the banks' willingness to provide loans.

[12] This situation refers to red-lining situation as explained in the Stiglitz and Greenwald model.
[13] In practice in Indonesia, the loan differentiate based on good loan and bad loan, and bad loan also divide into some categories such as loan under special mentioned, doubt loan, and bad loan. Each category have different premium that can be considered as tax on net worth.
[14] This is related to sixth proposition of Stiglitz and Greenwald model that stated increasing the capital requirement lead to a reduction in the supply of loans

3. EMPIRICAL ANALYSIS

3.1. Does the Capital Adequacy Ratio have a Role in the Bank Loan Market in Indonesia

This section discusses the empirical tests used to investigate the role of the capital adequacy ratio as one determinant of the bank loans market in Indonesia. We employ a disequilibrium framework of the loan market in order to investigate the determinants of demand- and supply-side loans by considering Stiglitz and Greenwald's model on the supply side. Employing a disequilibrium model will also allow us to investigate the position of the supply and demand of loans.

Previous analyses of loan markets in Indonesia that use the Stigltiz and Greenwald model provide us with factors that may influence the supply side behavior of the loan market, such as bank net worth, loan rates, non-performing loans, monetary policy, and the capital adequacy ratio. In this study, we include the capital adequacy ratio, non-performing loans, interest rates, and monetary policy as determinant variables of the supply side of loans in Indonesia. Considering the possible relationship with the capital adequacy ratio and with non-performing loans, we neglect bank net worth as an explanatory variable[15].

3.1.1. Research Specification

We use the disequilibrium model employed by Pazarbasioglu (1997), Ghosh (1999) and Agung et al. (2001). We use real term variables (nominally deflated by CPI)[16].
The model is defined by:

$$L_t^D = \beta_0 + \beta_1 Y_t + \beta_2 r_{l,t} + \beta_3 Exchange\,rate_t + \beta_3 Stocks_t + \varepsilon_t \quad (15)$$

$$L_t^S = \alpha_0 + \alpha_1 Y_t + \alpha_2 lcap_t + \alpha_3 r_{d,t} + \alpha_4 r_{SBI,t} + \alpha_5 CAR_t + \alpha_6 npl_t + \alpha_7 dummy_t + \varepsilon_t \quad (16)$$

$$L_t = \min(L_t^D, L_t^S) \quad (17)$$

where L_t^D is the demand function of bank loans, L_t^S denotes the supply function for bank loans, and (L_t) denotes the actual loan that can be expressed as the smallest loan supply or loan demand.

In the demand equation (15), we include three main variables of economics: output, loan rate, and exchange rate (US dollars in rupiah). Y_t denotes the gross domestic product (GDP) as a proxy for output. A higher output means that greater numbers of loans are required. ($r_{l,t}$)is the weighted average of working capital loan interest rates. The interest rate is expected to have a significant role with a negative sign. Considering the importance of exchange rates as one of the causes of the crisis in

[15] Juda et all (2001) used capital to asset ratio as a proxies of capital requirements variable.
[16] The base year for CPI is 2007=100.

Indonesia, we include the nominal exchange rate ($Exchange\,rate_t$) in the demand of loans. We expect the nominal exchange rate to have significant impact and a negative sign.

In the loan supply equation (16), we include variables that directly affect the supply of loans, as was explained in the Stiglitz and Greenwald model. Lending capacity ($lcap_t$)is used as a measurement of the most important bank resources [17]. ($r_{d,t}$)is a weighted average of 1 month deposit rates and is a proxy for the cost of loanable funds (CoLF)[18]. A higher cost of loanable funds means that higher loan interest rate was charged by the banks, causing a greater supply of loans. The SBI rate ($r_{SBI,t}$) captures the impact of the monetary policy on the loan supply. Following Stiglitz-Greenwald's model, we assume that a tight monetary policy reduces the supply of loans and vice versa. Therefore, the expected sign is negative. (CAR_t)is the capital adequacy ratio and is a proxy for prudential regulations by banks on the capital requirement, which is suspected as one factor that stimulates a reluctance by banks to provide loans as explained in the Stiglitz and Greenwald model. Considering that the capital requirement had still been a matter of debate until recently, we use this model to find the appropriate sign for capital requirements in the bank loan supply equation. In this study, we also include the non-performing loans ratio (npl_t),as an additional variable to describe the bank's internal condition that is expected to have a negative sign. We also include a dummy variable in order to capture differences in the behavior of bank loans for the periods before, during and after the crisis[19].

All variables included in the equations are in the log form except for the interest rate, the capital to asset ratio and the non-performing loans. Equation 17 illustrates how the actual loan (L_t) can be expressed as the minimum of loan supply or loan demand function. The coefficients of equations (15) and (16) are estimated using the maximum likelihood method with the likelihood function (L) as follows:

$$L = \prod_t \left\{ g_1(L_t)[1 - G_2(L_t)] + g_2(L_t)[1 - G_1(L_t)] \right\} \tag{18}$$

where $g_1(L_t)$ and $g_2(L_t)$ denote the probability of the actual loans belonging to supply and demand, respectively, and are assumed to follow a normal distribution. $G_1(L_t)$ and

[17] Lending capacity defines as total liabilities minus bank's capital minus required reserve minus cash in vault. Reserve requirement calculates as the summation 5% of demand deposit, time and saving deposit, foreign exchange account, foreign liabilities and government account.

[18] There are two reasons why we employ 1month deposit rate as a proxies of cost of fund. First, most of third party funds in the banks are concentrated in time deposit, of which around 70% are in the 1 month deposit. Second, the movement of time deposit rates, particularly during and after crises, is mainly driven by the 1 month rate that reflecting the short term confidence level in banks and the mood of depositors about the overall economic condition.

[19] We consider the period 1994 to July 1997 as the pre-crisis period with dummy= 0, August 1997 until the end of observation =1 as the period crisis and afterward. If we assume the crisis ended in January 2007 by considering the fact that the distribution of loan by banks has exceeded the target set as mentioned in 2007 Economic Report in Indonesia, and give the value for the period of January 2007 to the end of observation with dummy= 0, the direction and significance of the regression result do not change.

$G_2(L_t)$ denote their corresponding cumulative density functions. To estimate the equation, we employ an iterative procedure following Berndt, Hall, Hall and Hausman (BHHH). If $L_t^D > L_t^S$, then the actual quantity of loans (L_t) on the supply side is constrained, and if $L_t^D < L_t^S$, then the actual quantity of loans (L_t) on the demand side is constrained.

The data are the monthly observations from January 1994 to May 2009. The source of the data is the Central Bank of Indonesia and the Statistic Central Bureau

3.1.2. Estimation Results

The estimation results are shown in table 1. Significant residual variance (σ^2) in both demand and supply functions reflects that the model is reasonably well specified (Kim, 1999). In the loan demand equation, all coefficient signs for variables are consistent with the postulated hypotheses. GDP has a positive and significant coefficient, which shows that the greater the output, the greater the demand for loans. The interest rate is significant and negatively related to the demand real loans. Higher loan interest rates reduce the interest rates for companies that apply for loans. The exchange rate has a negative and significant coefficient, meaning that the exchange rates depreciate, leading to a decrease in loan demand. This finding is also consistent with the fact that the currency crisis was responsible for the economic crisis due to the large exposure of foreign debt by firms. The economic crisis caused many companies to go bankrupt, and therefore, they could not service their loans to the banking industry. The bankrupt companies caused an increase in the number of non-performing loans for banks, and the banks suffered losses as a result.

Table 1: Estimation Result

Variable	Estimation 1		Estimation 2	
	Coefficient	t-statistic	Coefficient	t-statistic
Demand				
Constant	8.032	4.224***	7.858	4.236***
GDP	1.016	5.641 ***	1.029	5.788 ***
Loan Rate	-0.030	- 6.899***	-0.030	- 6.997***
Exchange Rate	-0.541	- 6.583***	-0.538	- 6.753***
σ^2	0.216	14.871***	0.217	15.237***
Supply				
Constant	-6.743	-17.271***	-6.822	-6.299***
Loan Capacity	1.469	52.817***	1.474	55.103***
Deposit Rate (CoLF)	0.009	3.955***	0.009	5.134***
CAR	-0.004	-5.524***	-0.003	-10.818***
SBI Rate	-0.006	- 3.435** *	-0.006	- 3.743***
Non Performing Loan Ratio	-0.0005	-0.519		
Dummy Crisis	-0.311	-23.401***	-0.312	-23.889***
σ^2	0.046	11.474***	0.045	11.861***
Log Likehood	202.71		202.60	
Number of Observations	185		185	

Note : *** = significant at 1%, ** = significant at 5%, * = significant at 10%

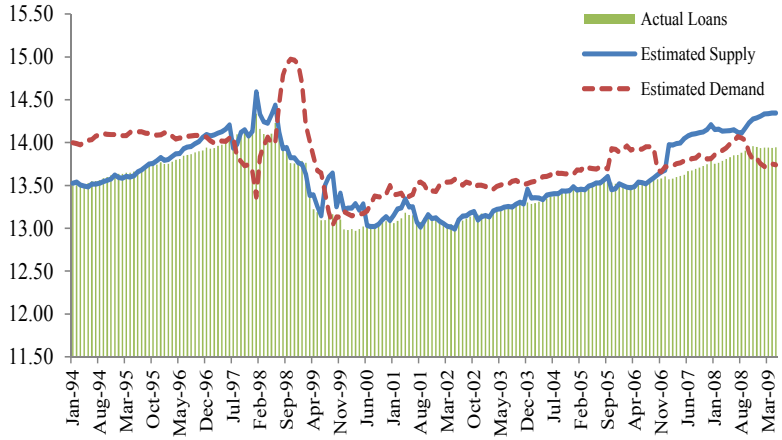
In the supply function, all coefficient signs are consistent with the expected hypothesis, and, except for non-performing loans, have a significant t-statistic. The bank loan capacity is significant and positively related to the real supply of loans. This result confirms that the lending decisions of banks rely heavily upon their ability to mobilize deposits, which is the primary component of lending capacity. The deposit rate has a positive sign, which shows that higher loan rates are associated with an increased number of bank loans. The SBI rate has a negative and significant explanatory power in the loan supply function that is consistent with the analysis of Stiglitz and Greenwald's model. This finding also supports the bank lending hypothesis that monetary policy has the power to affect the supply of bank loans, which supports the existence of the bank lending channel. The variable NPLs has a negative sign but is insignificant. The negative sign can be interpreted to mean that higher NPLs prompt banks to limit credit expansion. This factor is believed to have increased significance after Bank Indonesia set a maximum target of 5% NPLs for banks by the end of 2001. However, the existence of bank restructuring efforts that succeeded in reducing the level of non-performing loans was at or below 3%, which means that the influence of the NPL variable on the real supply of loan equation is insignificant. Eliminating NPLs from the loan supply equation does not affect the direction and significance of other variables, as seen in estimation 2.

The CAR, the main interest variable of this study, has a negative role in explaining the supply of loans. Higher capital requirements constrain bank net-worth and lead to a decreased supply of loans.

From this finding, we may suspect that banks in Indonesia behave in a risk-averse manner as opposed to a risk-taking manner. This result also implies that the imposition of a capital adequacy ratio that constrains bank net worth negatively affects bank loans. This finding supports Stiglitz-Greenwald's statements that a decrease in bank net worth causes a decrease in loans.

The economic crisis, which is represented by a dummy variable, has a significant negative impact in influencing the supply of bank loans. The negative sign is consistent with expectations, considering that the economic crisis is usually associated with a high risk of bankruptcy and, therefore, a reduced interest and willingness by banks to provide loans, as was explained in Stiglitz-Greenwald's model.

Figure 10: Result of Estimated Demand and Supply of Loans



We fit the regression results of the estimated supply and demand of the loan functions in the same graph and obtain the supply and demand of loans in Indonesia. Figure 10 shows that before the 1997 Asian Financial Crisis, there was an excess demand for loans in Indonesia. However, at the beginning of the crisis there was an excess supply. This finding may be due to a large depreciation in the exchange rate that led to an increase of foreign currency loans in rupiah. Another possible reason for this finding is that private banks and conglomerates tried to rescue related third-party companies by providing them with loans and using the banks as a vehicle to gain liquidity. State-owned banks may have been especially guilty of nepotism by providing loans to state-owned and other large companies.

We found there to be a marked and sustained excess demand in the loan market from the middle of 1998 on, which means that the actual credit supply was constrained. This finding is consistent with the previous studies by Ghosh and Ghosh (1999) and Agung et al (2001) that found there was a credit crunch or credit rationing due to supply constraints caused by a sharp decline in supply of bank loans. The decreased supply of loans may be attributed to a number of factors including the deterioration of bank net worth, a tight monetary policy, pessimistic bank profit forecasts due to economic shock from the financial crisis, and the implementation of prudential regulations. Prudential regulations, such as

the capital adequacy ratio requirement following the Basle Capital Accord in the recessionary period, are also believed to have reduced the willingness of banks to lend and may have even exposed the government to greater losses due to a recapitalization program with equity injection in order to meet the requirements of the regulation (see McLeod and Fane, 2001). The negative sign of the CAR in the estimation result of loan supply also supports this hypothesis.

In the post-crisis period (from 2007 to the end of observation), the loan market in Indonesia is characterized by excess supply, which indicates that the low amount of lending growth is due more to the weaker demand for loans than it is to the supply. This condition is most likely related to an improvement in the supply of loans as a result of the banking recovery program. However, the demand for credit remained weak during this time as a result of the crisis.

IV. Conclusion

This paper provides evidence of the impact of bank capital requirements on bank loan portfolios in Indonesia. Using the disequilibrium model framework of loan market behavior by considering Stiglitz and Greenwald's model, we find capital requirements to have a significant negative impact on the supply of bank loans. Increased capital requirements constrain bank net worth and lead to fewer loans. This finding is supported by one of Stiglitz-Greenwald's statements that a decrease in bank net worth leads to a reduction of loans.

This paper contributes an additional empirical finding to the long debate on the role of the Capital Adequacy Ratio. Considering that the data in this study are aggregated with the simple method, further studies, particularly those that analyze individual data banks, may provide better evidence and a more detailed perspective.

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