Banking Competition and Effectiveness of Monetary Policy Transmission: ATheoretical and Empirical Assessment on Indonesia case

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Abstract

This study compares banking behavior towards monetary policy rate changes in two different markets, i.e. a market in absence of collusive (a more competitive market) and a collusive market (a less competitive market). It expands Monti Klein model of monopolistic bank by incorporating Capital Adequacy Requirement (CAR) ratio as a measure to promote resilience of banking system.

Empirical assessment by utilizing Lerner index as a competition measure on Indonesia banking industry over the periode of 2001-2012 supports theoretical finding in loan market, where a competitive bank is significantly more responsive in adjusting its loan rates to changes in monetary policy rate, implying bank competition may enhance effectiveness of monetary policy transmission in loan market. However, competition is not a significant factor affecting responsiveness of a bank's deposits rate toward monetary policy changes. This less competitive pressure in deposits market may be attributed to Indonesia banking system having a relatively high liquidity. Moreover, we find that imposition of macroprudential measure of CAR does not significantly alter the transmission mechanism in both deposits and loan markets, implying there is no trade off between promoting a more resilient banking system and effectiveness of monetary policy transmission to banking industry.

Keywords: bank intermediation, monetary policy transmission, bank competition

1. Introduction

One of the central bank's main roles is to maintain price stability through monetary policy. This stability requires a well functioned and stable financial system as financial system represents the transmission of monetary policy with commercial banks are the central bank's hub with the financial system. The monetary policy is said to be effective if it were to change bank's ability and willingness to issue deposits and channel loans (Cecchetti & Kohler, 2012), a view that is particularly applied in a bank based economy.

There are several channels of which a monetary policy will affect financial sector. One is interest rates channel, where the central bank utilizes its policy interest rate to affect market interest rates to ensure intermediation function (fund collecting and channeling) of financial sector runs smoothly to stimulate economy growth. How much and how long it will take for a commercial bank to adjust its retail interest rates (loan and deposit interest rates) as a response to monetary policy interest rate movement will indicate the effectiveness of monetary policy transmission.

However, a commercial bank' rates sensitivity in response to monetary policy rate changes may be affected by many factors. As the central bank may have twin objectives in terms of pursuing both price and financial (banking) stability, it will impose prudential capital regulation to ensure commercial banks will have adequate capital against unexpected losses that may arise due to riskiness of their

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business activities. The deteriorating impact of the latest financial global crisis has created a sense of importance of having higher capital for a more resilience and stable banking system.

Nevertheless, it indeed expensive for banks to raise capital that it may affect banks' behavior towards risks as well as business strategy in maximizing profit. Assessment result of macroeconomic impact of stronger capital requirement by Macroeconomic Assessment Group-BIS (2010) indicates that stronger capitalized banking leads to lower amount of loan thus reduces the economy output.

Moreover, market structure may be regarded as an important factor in pursuing banking stability, even though existing literatures still have bi-polar conclusion on the relationship between banking stability and competition.

One view regards banking competition leads to a more stable banking system. It argues that in a more concentrated and lower degree of competition, a bank may have privilege in charging higher loan rates leading to higher profit. However, during downturn phase of business cycle, higher loan rates may lead to higher probability of default for borrowers, thus increasing credit risk for the bank and causing instability in banking system at the end. This argument is supported by Boyd et al.(2006) using a cross-sectional sample of about 2,500 U.S. banks in 2003 and a panel data set of about 2,600 banks in 134 non industrialized countries for 1993-2004. Both samples indicate a more concentrated banking market is more prone to banking crises (bank's failure) and bank competition enhances bank's willingness to lend. Shaeck et al. (2009) provide empirical evidence using data of 38 countries over 1980-2003 and employ Panzar and Rosse H-Statistic as a measure for competition. They conclude that a more competitive banking system is less prone to systemic crises. Moreover, Poghosyan (2012) finds that within low income countries, a more concentrated banking industry which is lack of competitiveness will result in high financial intermediation cost where bank's margin tend to increase along with higher riskiness of credit portfolio, lower bank capitalization and smaller bank size.

In contrast, other researches find there is a trade-off between competition and banking stability. Beck, at al. (2003) show that bank concentration ratio is negatively correlated to probability of banking crises. In other words, competition leads to higher probability of banking crises as in a highly competitive environment bank tends to engage in more risky activities to get higher margin. An increase in deposit market competition raises the deposit rates, reduces banks' expected profits and encourages banks to take on more risk on asset (loan) market. This inference has been also studied by Allen and Gale (2000), Hellmann, Murdock and Stiglitz (2000), Cordella and Levi-Yeyati (2002), and Repullo (2004), among many others. This general conclusion may become one reason why some policy makers prefer for bank merger, even though merger, particularly between large banks may produce little or nothing in term of scales economies (De Nicollo, 2000).

As many researches have been dedicated to evaluate the links between banking stability and competition as well as link between banking stability and effectiveness monetary transmission, this research will try to examine the link between banking competition and effectiveness monetary policy transmission. By examining the link between banking competition and effectiveness monetary transmission via interest rate channel, both theoretical and empirical findings of this research is expected to enhance explanation on micro factors contribute to the sensitivity of retail banking rates.

2. Research Question and Methodology

Based on the objective above, this study is aimed to answer whether or not competition in the banking industry affect the transmission of changes in the monetary policy rate to loan and deposit interest rates and if the transmission mechanism altered by the imposition of capital adequacy ratio?

To answer the question, we employ industrial organization approach to derive theoretical results. We assume bank as an entity that maximizing its profit while managing the risk by setting aside an adequate amount of capital as risk buffer. Therefore, the original Monti Klein model of a monopolistic banking industry (Freixas & Rochet, 2008) will be extended by incorporating capital adequacy ratio as a measure of bank behavior toward risk. We will set the model under two market scenarios. For simplicity, we assume there are two banks in the market that have the same cost function. The first scenario "no coordination" assumes each bank maximizes its profit independently while trying to predict other bank's optimum choice of outputs. The second one "with coordination or collusive" assumes the two banks trying to maximize joint profit by coordinating or merging. The first scenario then represents a more competitive market than that of the second one.

3. The Model

3.1 Bank balance sheet

For simplicity, we model a bank as an entity that only engages in activities of collecting deposits (D) and investing it in long terms asset in terms of loan (L) for firms and households (real sectors) as well as in short term asset in money market (M). In addition, regulator requires a bank to set certain portion of collected deposits as cash reserve in central bank (R) as part of liquidity management (we assume here the cash reserve will bear no interest) as well as a minimum capital adequacy ratio (β). Hence, a typical bank balance sheet is as follows:

<table>
<tr><th>Assets</th><th>Liabilities</th></tr>
<tr><td>Loans (to real sectors) (L)

Net interbank money market (M)

Reserve in Central bank (R)</td><td>Deposits (D)

Equity (K)</td></tr>
</table>

A bank's balance sheet equation can be stated as:

$$L + M + R = D + K \quad (1)$$

3.2 Capital Adequacy Ratio (CAR)

Capital Adequacy Ratio (CAR) is defined as a ratio of bank's capital to risk weighted assets (= capital/RWA). Regulator imposes minimum CAR for banks to hold as a buffer to cover loss that may arise due to riskiness of bank's credit, market and operational activities. As per BASEL II recommendation, a bank is required to hold a minimum CAR of 8% and banking regulator in each country may have national discretion in determining the appropriate minimum level of CAR according to its banking industry condition. However, setting a certain level of CAR is costly. A bank can achieve the level either by raising new capital through debt issuance or lowering its risky asset which implies on losing opportunity to invest a certain amount of fund to generate more profit. In other words setting CAR comes with cost of capital ($\mathbf{r_K}$). We assume here the cost of raising capital ($\mathbf{r_K}$) will be higher than the interest rate a bank can get by investing its fund in short term money market ($\mathbf{r_M}$). This is

because short term money market usually offers low interest rate for short term investment (policy interest rate is assumed to be a benchmark in determining money market rate). A bank may have higher CAR than that of minimum mandatory requirement. Higher CAR may indicate bank's behavior that tends to be risk averse. Therefore, amount of capital (K) set by a bank in relation to its risky assets and to meet the minimum regulatory requirement is:

$$K = \beta(\omega_L L + \omega_M M) \quad (2)$$

β = CAR (capital adequacy ratio) which is ≥ minimum regulatory ratio set by the central bank

ω_L= risk weight for loan

ω_M= risk weight for bank's net investment in interbank money market

$\omega_L > \omega_M$, because channeling fund in terms of long term loan is tend to be risky than that in short term money market.

3.3 Cost Function

Following the original Monti Klein model, each bank is assumed to have same cost structure and bank cost function ***C(D,L)*** is interpreted as the cost of managing a volume ***D*** of deposits and a volume ***L*** of loans and will be assumed to be linear:

$$C(D, L) = c_D D + c_L L \quad (3)$$

3.4 Costumer's Demand for Loans and Supply for Deposits

The Monti-Klein model used in this analysis considers a bank confronted with a downward sloping demand function for loans as a function of loan interest rates $\boldsymbol{L(r_L)}$ as:

$$L(r_L) = l_0 - l_1 r_L \text{ or } r_L(L) = \frac{l_0}{l_1} - \frac{L}{l_1} \quad (4)$$

and an upward sloping of deposit supply as a function of deposits interest rates $\boldsymbol{D(r_D)}$ from its customers as:

$$D(r_D) = d_0 + d_1 r_D \text{ or } r_D(D) = -\frac{d_0}{d_1} + \frac{D}{d_1} \quad (5)$$

3.5 The Role of Central Bank

Central bank's policy rate will affect short term interbank money market rate of which a reference for commercials banks to determine their deposit and lending rates. When the central bank decides to decrease (increase) its policy rate ($\mathbf{r_B}$), similar adjustments in short-term money market rates will take place ($\mathbf{r_B}$). To maintain current term structure, a decrease (increase) of short term interest rates will be followed by a decrease (increase) of long term interest rates, which results in lower (higher) cost of borrowing over all maturity horizons. This condition will affect both banking willingness to collect deposits and lend the fund and firms/households willingness to save and borrow money to finance new

investment or consumption. This willingness is reflected in terms of lower (higher) loan interest rates ($\mathbf{r_L}$) and deposits rate ($\mathbf{r_D}$) charging by banks which will lead to higher (lower) demand of credit and lower (higher) supply of deposits from firms and household sectors.

Furthermore, in part of liquidity management, regulator may require commercial banks to place a certain mandatory portion ($\boldsymbol{\alpha}$) of collected deposits (**D**) at the central bank as a cash reserve (***R***):

$$\mathbf{R = \alpha D} \tag{6}$$

The central bank will absorb excessive liquidity in market by increasing $\boldsymbol{\alpha}$ and reducing it in a tight liquidity market condition. This reserve requirement could be a counter cyclical measures that provides buffer for commercial bank during a tight liquidity condition, as the central bank may allow commercial banks to draw its reserves which was accumulated during the excessive period to be used in a shortage liquidity period.

3.6 Bank's objective

Following the Monti-Klein model for oligopolistic competition (Freixas & Rochet, 2008), a bank is postulated to maximize its profit by deciding the optimum amount of loans $\boldsymbol{L(r_L)}$ and deposits $\boldsymbol{D(r_D)}$ and takes fixed money market rate ($\mathbf{r_B}$). We expand this postulation by assuming a bank as an entity to maximize its profit while trying to shield its risks by setting a certain amount of capital following the requirement from the regulator.

Therefore a bank's objective function can be derived as:

$$\begin{aligned} \boldsymbol{Max\ \pi} &= \boldsymbol{Total\ revenue - total\ cost} \\ &= \boldsymbol{L \cdot r_L + M \cdot r_B - D \cdot r_D - K.r_K - C(D,L)} \end{aligned} \tag{7}$$

From (1) and (6), amount of ***M*** invested into the money market is as much as:

$$M = (1-\alpha)D - L + K \tag{8}$$

Substituting (8) to (2) yields amount of capital **K**:

$$K=\frac{\beta}{1-\beta\omega_M}[\omega_L L + \omega_M((1-\alpha)D - L)] \tag{9}$$

And substituting (9) back to (8) yields:

$$M=(1-\alpha)D + \frac{\beta}{1-\beta\omega_M}\left[\omega_L L + \omega_M\left((1-\alpha)D - L\right)\right] - L \tag{10}$$

Therefore, the bank profit function above can be stated as:

$$\pi = \left[r_L - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)\right]L + \left[(1-\alpha)r_M - r_D - c_D - \beta\frac{r_K - r_M}{1-\beta\omega_M}(1-\alpha)\omega_M\right]D \quad (11)$$

Now, we will differentiate the market into two scenarios. For the simplicity, we assume the market consists of two banks with same cost function.

Scenario 1: No coordination market

Under this scenario a bank is assumed to operate independently and maximize its profit by setting its optimum amount of loan (L_i) and deposits (D_i) given its belief about other bank's possibility optimum allocation. The market loan and deposit interest rates are then determined by amount of total loan ($L_1 + L_2$) and total deposit ($D_1 + D_2$) in the market. From equation (3) and (4) we can write $\boldsymbol{r_L}$ as the inverse function of $\boldsymbol{L}$:

$$r_L(L_1, L_2) = a - b(L_1 + L_2) \quad (12)$$

Where $a = \frac{l_0}{l_1}$, $b = \frac{1}{l_1}$, a, b > 0

and $\boldsymbol{r_D}$ as the inverse function of $\boldsymbol{D}$:

$$r_D(D_1, D_2) = -x + y(D_1 + D_2) \quad (13)$$

Where $x = \frac{d_0}{d_1}$,$y = \frac{1}{d_1}$, x, y > 0.

Therefore, profit function for bank 1 can be expressed as:

$$\pi_1 = \left[a - b(L_1 + L_2) - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)\right]L_1 + \left[(1-\alpha)r_M - \left(-x + y(D_1 + D_2)\right) - c_D - \beta\frac{r_K - r_M}{1-\beta\omega_M}(1-\alpha)\omega_M\right]D_1 \quad (14)$$

and profit function for bank 2:

$$\pi_2 = \left[a - b(L_1 + L_2) - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)\right]L_2 + \left[(1-\alpha)r_M - \left(-x + y(D_1 + D_2)\right) - c_D - \beta\frac{r_K - r_M}{1-\beta\omega_M}(1-\alpha)\omega_M\right]D_2 \quad (15)$$

Scenario 2: Coordination (collusive) market

Under this scenario Bank 1 and Bank 2 coordinate to maximize their joint profit π_j:

$$\pi_j = \pi_1 + \pi_2 = \left[a - bL - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)\right]L + \left[(1-\alpha)r_M - x + yD\right) - c_D - \beta\frac{r_K - r_M}{1-\beta\omega_M}(1-\alpha)\omega_M]D \quad (16)$$

Now π_j is equal to profit function of a monopoly bank or a condition where bank 1 and bank 2 merges.

4. *Theoretical Results*

4.1 Bank Loan

4.1.1 No coordination market

First order condition on the profit function for bank 1 and bank 2 yields:

- Bank 1 amount of loan as response function on Bank 2 loan:

$$R(L_2) = L_1 = \frac{a - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)}{2b} - \frac{L_2}{2} \quad (17)$$

- Bank 2 amount of loan as response function on Bank 1 loan:

$$R(L_1) = L_2 = \frac{a - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)}{2b} - \frac{L_1}{2} \quad (18)$$

Substituting (18) into (17) yields optimum amount of loan for each bank as:

$$L_1^* = L_2^* = \frac{a - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)}{3b} \quad (19)$$

Thus, market lending rates under a non coordination market will be:

$$r_L(L^*) = r_L\left(L_1^*, L_2^*\right) = a - b(L_1^* + L_2^*) = \frac{1}{3}a - \frac{2}{3}\left(-r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)\right) \quad (20)$$

And Sensitivity of bank volume and lending rates to policy rates:

$$\frac{\partial(L_1^* + L_2^*)}{\partial r_M} = -\frac{2}{3b}\left(1 - \frac{\beta(\omega_L - \omega_M)}{1-\beta\omega_M}\right) \quad (21)$$

$$\frac{\partial r_L}{\partial r_M} = \frac{2}{3}\left(\frac{1-\beta\omega_L}{1-\beta\omega_M}\right) \quad (22)$$

4.1.2 Coordination (collusive) market

First order condition on the joint profit function if bank 1 and bank 2 do coordination yields optimum amount of loan as:

$$L^* = \frac{a - r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)}{2b} \quad (23)$$

Therefore, market lending rates under a coordination market will be:

$$r_L(L^*) = a - b(L^*) = \frac{1}{2}a - \frac{1}{2}\left(-r_M - c_L - \beta\frac{r_K - r_M}{1-\beta\omega_M}(\omega_L - \omega_M)\right) \quad (24)$$

And Sensitivity of bank volume and lending rates to policy rates:

$$\frac{\partial L^*}{\partial r_M} = -\frac{1}{2b}\left(1 - \frac{\beta(\omega_L - \omega_M)}{1-\beta\omega_M}\right) \quad (25)$$

$$\frac{\partial r_L}{\partial r_M} = \frac{1}{2}\left(\frac{1-\beta\omega_L}{1-\beta\omega_M}\right) \quad (26)$$

Comparing the sensitivities of volume (eq.21 and eq.25) and price (eq.22 and eq.26) of loan between the two markets, we could infer that a more competitive market is more responsive to the changes of monetary interest rate than the collusive one. However, the presence of capital prudential regulation will reduce the sensitivity of both lending interest rates and optimal volume to monetary policy rate, because to achieve the required level of CAR, bank will try to reduce its loan volume by increasing its price, hence leaving smaller room for banks to increase more of loan rates should one day central bank decide to increase its monetary rates.

This sensitivity reduction is more pronounced in a competitive credit market given the presence of CAR causes a competitive market decreases its loan volume and increases loan price more than does by a collusive market.

4.2 Bank Deposits

4.2.1 No coordination market

First order condition on the profit function for bank 1 and bank 2 yields:

- Bank 1 amount of deposit as response function on Bank 2 deposit:

$$R(D_2) = D_1 = \frac{x+(1-\alpha)r_M-c_D-\beta\frac{r_K-r_M}{1-\beta\omega_M}(1-\alpha)\omega_M}{2y} - \frac{D_2}{2} \quad (27)$$

- Bank 2 amount of deposit as response function on Bank 1 deposits:

$$R(D_1) = D_2 = \frac{x+(1-\alpha)r_M-c_D-\beta\frac{r_K-r_M}{1-\beta\omega_M}(1-\alpha)\omega_M}{2y} - \frac{D_1}{2} \quad (28)$$

Substituting (32) into (33) yields optimum amount of deposit for each bank as:

$$D_1^* = D_2^* = \frac{x+(1-\alpha)r_M-c_D-\beta\frac{r_K-r_M}{1-\beta\omega_M}(1-\alpha)\omega_M}{3y} \quad (29)$$

Thus, market deposit rates will be:

$$r_D(D^*) = r_D\left(D_1^*, D_2^*\right) = -x + y(D_1^* + D_2^*) = -\frac{1}{3}x + \frac{2}{3}\left((1-\alpha)r_M - c_D - \beta\frac{r_K-r_M}{1-\beta\omega_M}(1-\alpha)\omega_M\right) \quad (30)$$

And Sensitivity of bank deposit volume and rates to policy rate

$$\frac{\partial(D_1^*+D_2^*)}{\partial r_M} = \frac{2}{3y}\left((1-\alpha) + \frac{\beta(1-\alpha)\omega_M}{1-\beta\omega_M}\right) \quad (31)$$

$$\frac{\partial r_D}{\partial r_M} = \frac{2}{3}\left(\frac{1-\alpha}{1-\beta\omega_M}\right) \quad (32)$$

4.2.2 Coordination (collusive) market

First order condition on the joint profit function if bank 1 and bank 2 do coordination yields:

$$D^* = \frac{x+(1-\alpha)r_M - c_D - \beta\frac{r_K - r_M}{1-\beta\omega_M}(1-\alpha)\omega_M}{2y} \quad (33)$$

and market deposit rates will be:

$$r_D(D^*) = -x + y(D^*) = -\frac{1}{2}x + \frac{1}{2}\left((1-\alpha)r_M - c_D - \beta\frac{r_K - r_M}{1-\beta\omega_M}(1-\alpha)\omega_M\right) \quad (34)$$

And Sensitivity of bank deposit volume and rates to policy rate

$$\frac{\partial D^*}{\partial r_M} = \frac{1}{2y}\left((1-\alpha) + \frac{\beta(1-\alpha)\omega_M}{1-\beta\omega_M}\right) \quad (35)$$

$$\frac{\partial r_D}{\partial r_M} = \frac{1}{2}\left(\frac{1-\alpha}{1-\beta\omega_M}\right) \quad (36)$$

Comparing the sensitivities of volume (eq.31 and eq.35) and price (eq.32 and eq.36) of deposits in the two markets, we could infer that a more competitive market is more responsive to the changes of monetary rate than the collusive one. In contrast to loan market, the presence of capital prudential regulation will increase the sensitivity of deposits price and volume to monetary policy rate. As explained before, (higher) CAR will cause banks to also decrease optimum volume of issued deposits by offering lower interest rates to customers. Should one day central bank decides to increase its monetary rates, banks still have more room to increase its deposits interest rates which may lead to greater responses to monetary policy changes. Given more deposit volume and price reduction in a competitive without coordination market than that in a collusive market due to the presence of (higher) CAR, this sensitivity increment is then more evident in a more competitive market indicating a competitive deposit market is still more responsive to monetary policy rate changes in spites of the presence of CAR.

Moreover, as the central bank requirement on certain or higher level of CAR causes banks to reduce their optimal volume of extended loan, the balance sheet equilibrium will require banks to adjust the volume of issued deposits. Banks in both markets will reduce its total volume of issued deposit in order to bring down its cost of fund to keep the profit maximum. The reduction effect of CAR on deposits volume is larger in a market without coordination than that in a collusive one, indicating a competitive deposits market is more sensitive to this prudential regulation than a collusive one.

5. Empirical Studies: Indonesian Case

5.1 Data and Model

This section will try to provide empirical evidence on the previous theoretical findings that increasing competition leads to a more responsive banks' retail rates to policy rates changes. We first construct the **Lerner index** as a measure of competition, ranging from 0 to 1, where 0 indicates a perfectly competitive bank with no market power while higher number implying lower competition or greater market power.

$$\text{Log}(C_{it}) = \alpha_0 + \alpha_1*\log(Q_{it}) + \alpha_2*(\log(Q_{it}))^2 + \alpha_3*\log(W_{1,it}) + \alpha_4*\log(W_{2,it}) + \alpha_5*\log(W_{3,it}) + \alpha_6*\log(Q_{it})*\log(W_{1,it}) + \alpha_7*\log(Q_{it})*\log(W_{2,it}) + \alpha_8*\log(Q_{it})*\log(W_{3,it}) + \alpha_9*(\log(W_{1,it}))^2 + \alpha_{10}*(\log(W_{2,it}))^2 + \alpha_{11}*(\log(W_{3,it}))^2 + \alpha_{12}*\log(W_{1,it})*\log(W_{2,it}) + \alpha13*\log(W_{1,it})*\log(W_{3,it}) + \alpha14*\log(W_{2,it})*\log(W_{3,it}) + \varepsilon_{it} \quad (37)$$

$$MC_{it} = \delta C_{it}/\delta Q_{it} \quad (38)$$

$$\text{Lerner}_{it} = (P_{it} - MC_{it})/P_{it} \quad (39)$$

Then, bank's retail rates response to the changes of policy rate could be modeled as:

$$\Delta R_{it} = \beta_0 + \beta_1*\Delta\text{policy}_{t-k} + \beta2*\text{Lerner}_{it}*\Delta\text{policy}_{t-k} + \beta3*\Delta CAR_{it}*\Delta\text{policy}_{t-k} + \varepsilon_{it} \quad (40)$$

Where:

ΔR_{it} = bank i loans (deposits) rate at year(t) – bank i loans (deposits) rate at year (t-1)

$\Delta\text{policy}_{t-k}$ = interest rate (SBI rate) set by regulator at year (t) - interest rate set by regulator at year (t-1)

Lerner_{it} = Lerner index of bank i at year t

ΔCAR_{it} = capital adequacy ratio of bank i at year(t) - capital adequacy ratio of bank i at year(t-1)

P_{it} = price of assets = ratio of total revenue to total assets bank i at year t

C_{it}= total costs of bank i at year t

Q_{it}= total assets of bank i at year t

$W_{1,it}$= ratio of interest expenses to total deposits of bank i at year t

$W_{2,it}$= ratio of personnel expenses to total assets of bank i at year t

$W_{3,it}$= ratio of other operating expesens to total assets of bank i at year t

The previous theoretical results imply that the sign of β_1 will be positive as bank will increase (decrease) its loans (deposits) rates following a hike (a decline) in policy rate. The sign of β_2 could be either positive or negative. Positive β_2 indicates that a low competition bank will be more responsive to changes in policy rate, while negative β_2 means that low competition leads to a less responsive bank. With regards to impact of macroprudential policy CAR, positive β_3 implying higher CAR to promote a more risilient banking system leads to a more responsive bank while negative β_3 indicating higher CAR will reduce sensitivity of bank's retail rates to changes in monetary policy rates.

We estimate the model by applying Least Square method on panel data of 95 Indonesia banks over the annual period of 2001-2012. Hausmann test indicates that the random effect is more efficient than the fixed effect. The heteroscedasticity problem is corrected by applying White cross-section standard errors and covariance.

5.2 Empirical Result

The results are summerized in the following table.

	Δ Deposits rate	**Δ Loans rate**
β_0	-0.12 [-0.37]	-0.34*** [-3.43]
Δpolicy (β_1)	0.52*** [5.63]	0.30*** [5.53]
Lerner*Δpolicy (β_2)	-0.07 [-1.33]	-0.20* [-1.78]
CAR*Δpolicy (β_3)	0.00 [0.28]	0.00 [0.43]
Adj $-R^2$	0.61	0.20

Data source: Bank Indonesia
Figures in parantheses are t-stats and *, **, ***, refer to 10%, 5% and 1% significance level, respectively

The results above support the theoretical findings in loan market, where a competitive bank is significantly more responsive in adjusting its loan rates to changes in monetary policy rate. Eventhough stronger pass through of monetary policy rates takes place in deposit market than in loan market, our findings show that competition is not a significant factor affecting responsiveness of bank's deposits rate toward monetary policy changes. This may indicate that the competitive pressure in deposits market is weaker than in the loan market given that Indonesian bank has quite high liquidity (average ratio of liquid instruments to total deposits during the observed period is around 48%, while liquid instruments to non core deposits is around 244%). Moreover, imposition of macroprudential measure of CAR doesn't alter the transmission mechanism significantly in both deposits and loan markets, implying there is no trade off between promoting a more resilience banking system and effectiveness of monetary policy transmission to Indonesia banking industry.

6. Conclusion and Policy Implication

This study extends the Monti Klein model by incorporating capital adequacy requirement (CAR) as a measure to bank's behavior towards risk and compares how banks response to monetary rate movement under two different market structures, ie. one without coordination (or a competitive market) and the other is a market with coordination or collusive leading to a non competitive market.

The theoretical model suggests that a competitive market offers competitive advantages over a collusive market (less competitive) in terms of larger volume of loan and deposit with price of both deposits and loan are more responsive to monetary policy rate changes.

However, our empirical assessment on Indonesia case indicates that only in a loan market a competitive bank is significantly more responsive in adjusting its loan rates to changes in monetary policy rate. Despite stronger pass through of monetary policy rates in deposits market than in loan market, competition is not a significant factor affecting responsiveness of bank's deposits rate toward monetary policy changes. A quite high liquidity level in banking may contribute to weaker competitive pressure in deposits market.

With regards to CAR, we find no competing impact of central bank policies between promoting a more resilient banking industry and enhancing effectiveness of monetary policy transmission as imposition of CAR does not alter the transmission mechanism significantly in both deposits and loan markets.

All in all, these findings underline that promoting bank competition may have impact on enhancing effectiveness of monetary policy transmission in Indonesia loan market.

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