COMPETITION AND LEADER-FOLLOWER INTERACTIONS: PANEL ESTIMATES ON INDONESIAN BANKING

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Abstract

This paper discusses banking competition and leader-follower relationship. Banking competition is investigated using some specification from Monti-Klein model that allows leader-follower (i.e. Stackleberg) relationship, the possibility of Cournot competition and other form of competition. We use monthly observations across 119 banks listed in Indonesia using the standard panel fixed effect methodology to absorb time-invariant unobserved heterogeneity and dynamic panel data to minimize the risks of endogeneity. The estimation suggests the leader-follower relationship among banks exist both on loan and deposit markets. The results are mostly consistent across different groups and on full sample estimates, although are quite different in magnitudes. While leader-follower relationship is dominantly occur in credit market, there are some evidence of simultaneous appearance of both leader-follower and Cournot interactions on the deposit market.

Keywords: Banking, monetary policy
JEL Classifications: C70, E50, G21

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I. INTRODUCTION

Our preliminary investigation indicates that the response of deposit interest rate and lending rate towards monetary policy in Indonesia has been asymmetric. The response of deposit rate has been relatively proportional and timely, whereas the response of lending rate has been lagging and relatively rigid. This could be an indication of uncompetitive market (Cottarelli dan Kourelis, 1994; Borio and Fritz, 1995). Moreover, responses towards monetary policy among group of banks with different assets are heterogenous. Therefore, it indicates that some behavior related to individual market power and interaction among banks affect the industry response.

Those problems, which related to competition behavior in banking industry, are likely to affect the monetary policy transmission, particularly through interest rate channel and lending channel. Further, competition is also a relevant factor to increase efficiency (Hafidz dan Astuti, 2013) and to determine interest rates (Muljawan et. al. 2014).

Previous literatures conduct empirical estimates on this issue by applying widely-used competition indicators such as Lerner Index (Amidu and Wolfe, 2013), Hirchman-Herfindahl Index (Adams and Amel, 2011), Panzar and Rosse H-Statistic (Gunji et. al, 2007; Oliviero et. al., 2011) and Boone Indicator (van Leuvensteijn, 2013). This method, particularly by using Lerner, Boone Indicator or H-Statistic can indicate “conduct and performance” effect, whereas HHI only capture market structure effect. However, those approaches are generally explains competition on the whole industry, and does not capture asymmetrical interactions among individual banks.

Ariefianto (2009) suggest estimating specification that derived from Monti-Klein model that allows possible indication of leader-follower or Cournot interactions. This model is originally based on Cournot interactions (see Klein, 1971; Frexias and Rochet, 2008). In addition, Toolsema-Veldman and Schoonbeek (1999) had derived a Stackleberg version of this model. However, Ariefianto (2009) estimates are based on arbitrary choice of samples.

This research will examine competition in banking industry using industrial organization approach, also by improving methods to determine sample selection. Further, this research will model interest rate setting on a bank towards monetary policy using game theory and analyze the implications on monetary policy transmissions. Particularly, this research tries to answer three questions; first, how is the competition behavior on Indonesian banking industry? Second, if the leader(s) exist, how the followers will respond to leader’s decisions? Third, how does the bank competition indirectly affect monetary policy transmissions?

This research is aim to contribute a more interactive indication about competition behavior on banking industry. In addition, this research potentially indicates a recommendation to increase the effectiveness of monetary policy transmission. We limit the analysis on the case of Indonesia.
II. THEORY

Bank competition is essential to be discussed. Competition between banks tends to raise efficiency (Hafidz and Astuti, 2013). Empirically, the degree of competition is one of determining factors of interest rate (Muljawan et. al. 2014). Moreover, a more concentrated banking industry has more rigid interest rate movement (Hannan and Berger, 1991; Neumark and Sharpe, 1992). However, Adams and Amel, (2011) said that the relationship between banking competition and monetary policy response are ambiguous.

Previous empirical studies conduct estimates on this issue by applying a widely-used competition indicators such as Lerner Index (Amidu and Wolfe, 2013), Hirchman-Herfindahl Index (Adams and Amel, 2011) and Panzar and Rosse H-Statistic (Gunji et. al, 2007; Oliviero et. al., 2011). This method, particularly by using Lerner or H-Statistic can indicate “conduct and performance” effect, whereas HHI only capture market structure effect. However, those approaches generally provide insights on the industry as a whole, and cannot capture asymmetrical interactions among individual banks.

Ariefianto (2009) suggest estimating specification that derived from Monti-Klein model that allows possible indication of leader-follower relationship or Cournot interactions. This model is originally based on Cournot interactions (see Klein, 1971; Frexias and Rochet, 2008). In addition, Toolsema-Veldman and Schoonbeek (1999) had derived a Stackleberg version of this model.

We recall a form of Monti-Klein model, by noting the following assumptions:

1. Two bank products, deposit and credit, are homogenous. Bank 1 and bank 2 have linear function of deposit and credit demand:

   \[ r_L = \alpha - \beta L; L = L_1 + L_2 \]  

   \[ r_D = a + bD; D = D_1 + D_2 \]  

2. Banks using deposit and credit quantities as strategic instrument

3. Linear cost function:

   \[ C_1 (L_1, D_1) = \gamma_{L_1} L_1 + \gamma_{D_1} D_1 \]  

   \[ C_2 (L_2, D_2) = \gamma_{L_2} L_2 + \gamma_{D_2} D_2 \]  

4. Interbank money market rate \( r \) is exogenous variable as it affected by monetary policy of Bank Indonesia.
5. Profit function of bank:

\[ \pi_i = r_iL_i - r_iD_i - r(L_i - D_i) - C(L_i, D_i) \]  

Combining equations (1) to (5) above, obtained maximization utility function of bank:

\[ \max_{L_i, D_i} \pi_i = (\alpha - \beta (L_1 + L_2 + L^P) )L_i - \]  
\[ \left( \alpha + b(D_1 + D_2 + D^P) \right)D_i - r(L_i - D_i) - \gamma_{L,i}L_i - \gamma_{D,i}D_i \]  

First partial differentiation of (6) to lending and credit variable derives equation (7) and (8) as follows:

\[ L_i = \frac{a - r - \gamma_{L,i}}{2\beta} - \frac{1}{2}L^p - \frac{1}{2}L_i \]  
\[ D_i = \frac{r - a + \gamma_{D,i}}{2b} - \frac{1}{2}D^p - \frac{1}{2}D_i \]  

Equation (7) and (8) show that the quantity of credit (deposit) of a bank is affected inversely by that the quantity of credit (deposit) of the leader and those of other competitor.

III. METHODOLOGY

3.1. Empirical Specification

For the first analysis, we use a general specification that allows leader-follower (i.e. Stackleberg) relationship, the possibility of Cournot competition and other form of Competition, as in Ariefianto (2009).

From (7) and (8), we have basic understanding that one bank’s lending (deposit) depends on its leader and other bank’s lending (deposit). Combining (7) and (8) with macroeconomics and banking variables, where \( X \in (L, D) \), the general specification can be represent as follows:

\[ X_{it} = \alpha + \beta_1 X_{it}^{p} + \beta_2 X_{it} - \gamma_k Y_{it} + \sum_{m} \mu_m Z_{it}^m + u_{it} \]  

\( X_{it} \) is the amount of loan (deposit) of a particular bank \( i \) at \( t \), \( X_{it}^{p} \) is the amount of loan (deposit) supplied by the leader, \( X_{it} \) is the amount of loan (deposit) supplied by the rest of followers, \( Y_{it}^k \) is the \( k^{th} \) panel-invariant factor, \( Z_{it}^m \) is the \( m^{th} \) panel-variant factor, and \( u_{it} \) is the stochastic error. \( \alpha \) is a constant.
The possible key hypotheses on Equation (9) are as follows: 1. If $\beta_1 < 0$ and $\beta_2 < 0$, it indicates that the leader and other competitor are significant to affect bank’s quantity of credit/deposit; 2. If $\beta_1 < 0$ and $\beta_2 = 0$, then the market is indicated to be consistent to leaderfollower relationship (i.e. Stackleberg competition). 3. If $\beta_2 < 0$, $\beta_1 = 0$, then the market is indicated to be consistent with Cournot model, or it can be inferred that there is no leader exist. 4. If $\beta_1 > 0$ and/or $\beta_2 > 0$, it may indicate other form of competition that is not usually predicted.

Control variables, the “panel variant” or “panel invariant” factors consists of macroeconomic variables (GDP, inflation, exchange rates, and benchmark interest rates), specific internal bank variables (non-performing loans, capital adequacy ratio, etc), and industry variables (HHI). This list of control variables are partly based on Claessens and Laeven (2004) and Angellini dan Certorelli (2003). Further details of these variables are reported on the appendix.

We use two approaches to estimate Equation (9), namely: 1. the standard panel fixed effect methodology to absorb time-invariant unobserved heterogeneity (by replacing a with $a_i$); 2. dynamic panel data as in Arellano-Bond (1991) to minimize the risks of endogeneity (by replacing $a$ with $X_{it-1}$).

### 3.2. Grouping of Observations

Observations consist of monthly data of 119 banks listed in Indonesia. The main data source are Bank Indonesia and CEIC. Observations are grouped based on an identification of whether banks compete on a relevant market, where the products across banks have a high degree of interchangeability. This step is crucial as competition is the central issue in this paper. To facilitate this matter, on estimations on credit market we use degree of similarity on credit across economic sectors between each bank and the leader candidate, using the following formula:

\[
X_i = \sum_k^K \left| \frac{x_{ik}}{\sum_k x_{ik}} - \frac{x_{lk}}{\sum_k x_{lk}} \right|
\]

(10)

$x_{ik}$ is bank i’s lending on sector k, and $x_{lk}$ is bank leader’s lending on the corresponding sector. This formula was modified and inversed from trade complementary index (Michaely, 1996), which is used generally in international trade analysis. The leader candidates are Bank A, Bank B, Bank C, Bank D, and Bank E.

Similarly, for estimations on deposits, we use degree of similarity on deposit spatially (i.e. individual bank’s deposit distribution across provinces) between each bank and its leader candidate, using following representation:
\[ X_i = \sum_{m}^{M} \frac{x_{im}}{\sum_{k} x_{im}} - \frac{x_{im}}{\sum_{k} x_{im}} \]  

(11)

\( x_{im} \) is bank \( i \)'s deposits on province \( m \), and \( x_{im} \) is the leader’s quantity of deposits on the corresponding province.

Each group estimate applies to a group of observations that consists of 30 banks with the lowest value of \( Xi \). As we have 5 suspected leaders (Bank A, B, C, D, E), then we have 5 groups (Group A, B, C, D, E, respectively) to estimate. In addition, we conduct estimation using all observations as a robustness test for omitted variable bias regarding omitted competitors across groups. To note, for full-sample estimations, we define the quantity of leaders’ deposit/credit is the sum of those of all leader candidates.

### IV. RESULTS AND ANALYSIS

#### 4.1. Credit Market

The results of fixed effect panel regression (Table IV.1-1) shows that four groups of banks, each with Bank A, Bank B, Bank D, and Bank E as the leader respectively, follow Stackleberg competition, without any indication of Cournot competition. The highest follower response to the leader’s choice of credit quantity is indicated on the group of banks with Bank B as the leader (i.e. Group B). Moreover, GDP have positive impact to dependent variables with elasticity close to unity. Non-performing loan (NPL) has negative impact to bank lending.

| VARIABLES | Group A | Group B | Group C | Group D | Group E |
|-----------|---------|---------|---------|---------|---------|
| Leader Credit | -0.0189** | -0.0557** | -0.0107 | -0.0175* | -0.0292* |
| | (0.00799) | (0.0232) | (0.0307) | (0.00923) | (0.0148) |
| Follower Credit | 0.0961 | 0.0209 | -0.110 | 0.215 | 0.375 |
| | (0.204) | (0.168) | (0.253) | (0.285) | (0.345) |

| CONTROL VARIABLES |
|-------------------|
| 1. Macroeconomics  | GDP, inflation rate, interbank rate, exchange rate |
| 2. Structural      | HHI, credit diversification, credit to PDB ratio |
| 3. Internal bank   | NP L, CAR, BOPO |

| Constant | -4.483*** | -3.426* | -4.104*** | -3.940*** | -3.360 |
|          | (1.107)   | (1.601) | (1.236)   | (1.196)   | (3.170) |
| Observations | 420 | 525 | 525 | 525 | 525 |
| R-squared | 0.902 | 0.862 | 0.914 | 0.900 | 0.720 |
| Number of bank | 12 | 15 | 15 | 15 | 15 |
| Hausman Prob | 0.008 | 0.099 | 0.093 | 0.000 |

Dependent variable: Log (Credit) \((\ldots)\) = Robust standard errors
Significance level: *** \(p<0.01\), ** \(p<0.05\), * \(p<0.1\)
Dynamic panel data for credit indicates a leader-follower relationship for all groups estimated, and also consistent for full-sample estimates, that contain all banks in the industry.

Bank C and Bank B groups follow Stackleberg and Cournot competition models simultaneously. The highest response to the leader’s decision is indicated on the group of banks with Bank D as the leader. GDP have positive impact with short term elasticity 0.14 – 0.30. Interbank money market rate and NPL variables are negative, tends to be inelastic. The lag dependent parameters are estimated below unity, thus indicate dynamic stability.

### 4.2. Deposit Market

The fixed effect panel data regression shows that a leader-follower relationship occurs in all groups of observations, except for the groups of observations with Bank C and Bank A as the leader, respectively. Cournot competition model applies for all groups, except for the group of banks with Bank A as the leader. The highest follower response to the leader’s decision occurs on the group of banks with Bank D as the leader. GDP have positive impact to quantity of deposit with elasticity that close to unity, especially in groups of banks with Bank C, Bank A, and Bank D the leader, respectively. Non-performing loan (NPL) has a negative impact to bank’s deposit amount.
In general, dynamic panel regression indicates that Stackleberg and Cournot competition models apply simultaneously for all group estimates and full-sample estimates.

The highest response occurs on the group of banks with Bank D as the leader (i.e. Group D), where 10% increase on Bank D’s deposit will be responded by, on average, 3.6% decrease...
on follower’s deposit. GDP have positive impact to deposit variables. Herfindahl–Hirschman Index (HHI) has negative impact with small effect. Lag dependent coefficients below 1 indicates dynamic stability of the model.

V. CONCLUSIONS

The estimation results suggest a leader and follower relationship among banks on most of the grouped observations, although with some variations in magnitude. Generally, competition between followers is insignificant on credit market, but is significant on deposit market. Leader and follower competition result can be viewed on Table 3 below. Control variables, such as: GDP, inflation rate, interbank rate, exchange rate, HHI, credit diversification, credit to PDB ratio, and operational bank ratios are generally show consistent parameters as expected. All-sample estimates also suggesting similar results, and hence confirming the robustness of selected-sample regressions. For estimates using dynamic panel regressions, all estimations fulfill dynamic stability and well represent the data variations. Moreover, the estimations met the exogeneity assumptions for instrumental variables.

| Panel Data          | Lending                          | Deposit                          |
|---------------------|----------------------------------|----------------------------------|
| Fixed Effect        | Competition                      | Stackleberg,                     |
|                     |                                  | Except Group C                   |
| Arellano-Bond       | Highest Response                 | Group B                          |
|                     | Competition                      | Stackleberg with Cournot         |
|                     |                                  | for Group C and Group B          |
|                     | Highest Response                 | Stackleberg and Cournot          |
|                     | Group D                          | Group D                          |
| Arellano-Bond       | Competition                      | Stackleberg                      |
|                     | Highest Response                 | Group D and Group B              |
|                     | Group D                          | Stackleberg and Cournot          |
|                     | Simultaneously                   |                                  |

Although our results indicate that leader-follower relationship is generally hold on both credit and deposit market, either in separate groups or full sample, this paper still put restrictive assumptions on the leaders’ behavior. The interactive responses between leaders have yet to be analyzed without any prior restrictions. The suggestion for further research is to improve the empirical specification. For instance, to use credit/deposit similarities as a weight matrix that attached to the leader-follower coefficients to allow multiple leaders at once as well as to allow heterogeneous response towards each leader’s decisions.
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# APPENDIX

## Table 1.
**List and Notes of Dataset**

| Variables                      | Source                                | Notes                                                                 |
|-------------------------------|---------------------------------------|----------------------------------------------------------------------|
| **Main Variables**            |                                       |                                                                      |
| Credit                        | Bank Indonesia                        | Total credit of individual bank data                                |
| Deposit                       | Bank Indonesia                        | Total deposit of individual bank data                               |
| Credit/deposit of the leader  | Bank Indonesia                        | 5 banks as candidate (Bank A, B, C, D, E)                           |
| Credit/deposit of the followers | Bank Indonesia, authors’ calculation. | Industry data – data on a particular bank observed                  |
| **Macroeconomics**            |                                       |                                                                      |
| GDP                           | CEIC                                  | Nominal, interpolated to monthly using quadratic match sum          |
| Inflasi                       | CEIC                                  | Year-on-year terms                                                  |
| Interest rate                 | CEIC, Bank Indonesia                  | Interbank call money                                                |
| Exchange rates                | CEIC                                  |                                                                      |
| **Industry**                 |                                       |                                                                      |
| HHI                           | Bank Indonesia, authors’ calculation.  | Using credit/deposit approach                                       |
| Credit to GDP ratio           | Authors’ calculation                  | As a proxy to indicate the industry                                 |
| **Internal Bank**            |                                       |                                                                      |
| NPL                           | Bank Indonesia                        |                                                                      |
| CAR                           | Bank Indonesia                        | Share of credit with quality 3 to 5                                 |
| BOPO                          | Bank Indonesia                        |                                                                      |
| Credit to asset ratio         | Bank Indonesia, authors’ calculation.  | Operational cost / revenues                                          |
|                               |                                       | As a proxy to indicate business diversification                     |
### Table 2.
**Fixed Effect Estimates on Credit Market**

| VARIABLES                      | Group A                  | Group B                 | Group C                  | Group D                  | Group E                  |
|--------------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|
| **Kredit leader**              | -0.0189**                | -0.0557***              | -0.0107                  | -0.0175*                 | -0.0292*                 |
|                                | (0.00799)                | (0.0232)                | (0.0307)                 | (0.00923)                | (0.0148)                 |
| **Kredit follower**            | 0.0961                   | 0.0209                  | -0.110                   | 0.215                    | 0.375                    |
|                                | (0.204)                  | (0.168)                 | (0.253)                  | (0.285)                  | (0.345)                  |
| **Variabel kontrol**           |                          |                         |                          |                          |                          |
| 1. Makroekonomi                |                          |                         |                          |                          |                          |
| PDB                            | 1.041***                 | 1.124***                | 1.185***                 | 0.908***                 | 0.933***                 |
|                                | (0.236)                  | (0.208)                 | (0.230)                  | (0.280)                  | (0.199)                  |
| Inflasi                        | -0.000251                | -0.00365                | -0.000910                | 0.000500                 | 0.000488                 |
|                                | (0.00135)                | (0.00298)               | (0.00200)                | (0.00164)                | (0.00417)                |
| Suku bunga PUAB                | -0.00530                 | -0.00556                | -0.0127*                 | -0.0116                  | -0.00582                 |
|                                | (0.00556)                | (0.0113)                | (0.00652)                | (0.00935)                | (0.0231)                 |
| Real Exchange Rate             | -0.182*                  | -0.355***               | -0.214***                | -0.211                   | -0.250**                 |
|                                | (0.0836)                 | (0.0730)                | (0.0575)                 | (0.131)                  | (0.105)                  |
| 2. Struktural                  |                          |                         |                          |                          |                          |
| HHI                            | -0.000474                | 0.000980                | 0.00102**                | -8.79e-05                | -0.00108                 |
|                                | (0.000411)               | (0.000663)              | (0.000437)               | (0.000573)               | (0.000646)               |
| Diversifikasi                  | -0.199***                | -0.238***               | -0.125***                | -0.148***                | -0.0771                  |
|                                | (0.0458)                 | (0.0688)                | (0.0324)                 | (0.0454)                 | (0.0813)                 |
| Rasio kredit/PDB               | 0.0694***                | 0.0685***               | 0.107***                 | 0.0661***                | 0.144*                   |
|                                | (0.0180)                 | (0.0209)                | (0.0190)                 | (0.0150)                 | (0.0659)                 |
| 3. Internal bank               |                          |                         |                          |                          |                          |
| NPL                            | -0.0197**                | -0.0288***              | -0.00764                 | -0.0280***               | -0.0248**                |
|                                | (0.00648)                | (0.00416)               | (0.00826)                | (0.00151)                | (0.00956)                |
| CAR                            | -9.92e-05***             | 0.000721                | -0.00197                 | -0.00249                 | -0.00345                 |
|                                | (1.31e-05)               | (0.00162)               | (0.00362)                | (0.00376)                | (0.00669)                |
| BOPO                           | 1.91e-05                 | 0.000229                | 0.000250**               | 0.000244                 | -0.000663                |
|                                | (0.00271)                | (0.000165)              | (9.83e-05)               | (0.000200)               | (0.000514)               |
| Constant                       | -4.483***                | -3.435*                 | -4.104***                | -3.940***                | -5.745                   |
|                                | (1.107)                  | (1.795)                 | (1.236)                  | (1.196)                  | (4.673)                  |
| Observations                   | 420                      | 525                     | 525                      | 525                      | 525                      |
| R-squared                      | 0.902                    | 0.862                   | 0.914                    | 0.900                    | 0.720                    |
| Number of bank                 | 12                       | 15                      | 15                       | 15                       | 15                       |

Group A, Group B, Group C, Group D, Group E refer to different groups or categories within the study.
| Variabel                  | Group A       | Group B       | Group C       | Group D       | Group E       | Full Sample   |
|--------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| **Kredit leader**        | -0.0638**     | -0.0585**     | -0.0447**     | -0.134**      | -0.0247**     | -0.609*       |
|                          | (0.0263)      | (0.0184)      | (0.0197)      | (0.0680)      | (0.0108)      | (0.314)       |
| **Kredit follower**      | 0.00843       | -0.122**      | -0.167**      | -0.0834       | -0.0422       | 0.642*        |
|                          | (0.0414)      | (0.0521)      | (0.0419)      | (0.0942)      | (0.0541)      | (0.365)       |
| **Variabel kontrol**     |               |               |               |               |               |               |
| **1. Makroekonomi**      |               |               |               |               |               |               |
| PDB                      | 0.131**       | 0.205**       | 0.305**       | 0.189**       | 0.144**       | 0.0970        |
|                          | (0.0545)      | (0.0632)      | (0.0545)      | (0.0487)      | (0.0731)      | (0.0847)      |
| Inflasi                  | 0.00279*      | 0.000804      | 0.00250**     | -0.000652     | 0.00178       | -0.000783     |
|                          | (0.00148)     | (0.000889)    | (0.000825)    | (0.000915)    | (0.00163)     | (0.00165)     |
| Suku bunga PUAB          | -0.0157***    | -0.0155***    | -0.0236***    | -0.0176***    | -0.0178**     | -0.0109*      |
|                          | (0.00643)     | (0.00449)     | (0.00513)     | (0.00474)     | (0.00759)     | (0.00640)     |
| Exchange Rate            | -0.111        | -0.142**      | -0.251***     | -0.0198       | -0.115        | 0.0374        |
|                          | (0.0698)      | (0.0492)      | (0.0541)      | (0.0486)      | (0.0812)      | (0.0473)      |
| **2. Struktural**        |               |               |               |               |               |               |
| HHI                      | -0.000484**   | 0.00055***    | -5.84e-06     | 0.00075***    | -0.000501     | 0.00104**     |
|                          | (0.000280)    | (0.000202)    | (0.000188)    | (0.000211)    | (0.000321)    | (0.000522)    |
| Rasio kredit/PDB         | 0.00409*      | 0.000956      | 0.00460       | 0.00719***    | 0.00609       | 0.00516**     |
|                          | (0.00241)     | (0.00156)     | (0.00402)     | (0.00222)     | (0.00457)     | (0.00248)     |
| Diversifikasi            | -0.0131       | 0.00464       | -8.21e-05     | 0.0120***     | 0.0174***     | -0.00155      |
|                          | (0.0111)      | (0.00459)     | (0.00584)     | (0.00380)     | (0.00496)     | (0.00350)     |
| **3. Internal bank**     |               |               |               |               |               |               |
| BOPO                     | -0.000100     | 5.70e-05      | -0.000195     | -0.000186     | 5.03e-05      | -2.89e-05     |
|                          | (0.000197)    | (0.000125)    | (0.000152)    | (0.000155)    | (0.000154)    | (0.000102)    |
| NPL                      | -0.00170      | -0.00558***   | -0.0064***    | -0.0070***    | -0.00219      | 0.00305       |
|                          | (0.00128)     | (0.00157)     | (0.00208)     | (0.00139)     | (0.00379)     | (0.00643)     |
| CAR                      | -0.00077***   | 0.00113***    | 0.000980      | -6.58e-05     | -0.000149     | -0.00086***   |
|                          | (0.00243)     | (0.000526)    | (0.000717)    | (8.72e-05)    | (0.000722)    | (0.000310)    |
| Lag dependen             | 0.983***      | 0.997***      | 0.992***      | 0.983***      | 0.970***      | 0.986***      |
|                          | (0.00495)     | (0.00595)     | (0.0102)      | (0.00611)     | (0.0105)      | (0.00939)     |
| Observations             | 913           | 945           | 945           | 832           | 840           | 3.319         |
| Number of bank           | 27            | 27            | 27            | 26            | 24            | 105          |
### Table 4.
**Fixed Effect Estimates on Deposit Market**

| VARIABLES                  | Group A       | Group B       | Group C       | Group D       | Group E       |
|----------------------------|---------------|---------------|---------------|---------------|---------------|
| DPK leader                 | -0.106        | -0.122**      | -0.0968       | -0.359**      | -0.166**      |
|                            | (0.138)       | (0.0421)      | (0.103)       | (0.127)       | (0.0639)      |
| DPK follower               | -0.607        | -0.887**      | -0.831*       | -1.893***     | -0.974*       |
|                            | (0.426)       | (0.316)       | (0.390)       | (0.562)       | (0.461)       |
| Variabel kontrol           |               |               |               |               |               |
| 1. Makroekonomi            |               |               |               |               |               |
| PDB                        | 0.222         | 1.078***      | 1.575***      | 1.580**       | 2.199***      |
|                            | (0.336)       | (0.301)       | (0.429)       | (0.628)       | (0.523)       |
| Inflasi                    | -0.0365***    | -0.00629**    | -0.0103       | -0.0170***    | -0.0121*      |
|                            | (0.0107)      | (0.00277)     | (0.00690)     | (0.00314)     | (0.00569)     |
| Suku bunga PUAB            | 0.179**       | 0.0574***     | 0.0312        | 0.128***      | -0.00557      |
|                            | (0.0788)      | (0.0140)      | (0.0207)      | (0.0154)      | (0.0331)      |
| Exchange Rate              | 0.0575        | -0.489**      | -0.749***     | -0.491**      | -0.855*       |
|                            | (0.235)       | (0.158)       | (0.228)       | (0.204)       | (0.443)       |
| 2. Struktural              |               |               |               |               |               |
| HHI                        | -0.00513**    | -0.00624***   | -0.00669***   | -0.00620***   | -0.0150***    |
|                            | (0.00166)     | (0.00118)     | (0.00170)     | (0.00127)     | (0.00437)     |
| Diversifikasi              | 0.124***      | 0.215***      | 0.0191        | 0.0762***     | 0.0228***     |
|                            | (0.0307)      | (0.0443)      | (0.0610)      | (0.0216)      | (0.00370)     |
| Rasio kredit/PDB           | 0.164***      | 0.121***      | 0.105***      | 0.165***      | 0.418         |
|                            | (0.0395)      | (0.0273)      | (0.0331)      | (0.0367)      | (0.270)       |
| 3. Internal bank           |               |               |               |               |               |
| NPL                        | -0.000784     | 0.00186       | -0.0185       | 0.0156        | 0.00430       |
|                            | (0.0246)      | (0.0141)      | (0.0172)      | (0.0154)      | (0.0314)      |
| CAR                        | 0.00509***    | -0.0159***    | -0.0187***    | -0.000991     | -0.0111**     |
|                            | (0.000583)    | (0.00454)     | (0.00414)     | (0.000869)    | (0.00386)     |
| BOPO                       | 0.000440      | 4.76e-05      | 0.000648      | 0.000629      | -4.96e-05     |
|                            | (0.000889)    | (0.000387)    | (0.000605)    | (0.000538)    | (0.000194)    |
| Constant                   | 17.76**       | 14.50***      | 8.653***      | 23.26***      | 4.441         |
|                            | (6.755)       | (3.571)       | (2.630)       | (3.152)       | (7.023)       |
| Observations               | 391           | 408           | 408           | 380           | 403           |
| R-squared                  | 0.430         | 0.558         | 0.493         | 0.526         | 0.271         |
| Number of bank             | 12            | 12            | 12            | 12            | 14            |
| VARIABLES          | Group A       | Group B       | Group C       | Group D       | Group E       | Full Sample  |
|--------------------|---------------|---------------|---------------|---------------|---------------|--------------|
| DPK leader         | -0.466***     | -0.269***     | -0.185***     | -0.298***     | -0.209***     | -0.471***    |
|                    | (0.0541)      | (0.0419)      | (0.0455)      | (0.0711)      | (0.0402)      | (0.128)      |
| DPK follower       | -0.231***     | -0.165*       | -0.370***     | -0.256***     | -0.777***     | -0.339***    |
|                    | (0.0860)      | (0.0851)      | (0.116)       | (0.0900)      | (0.170)       | (0.0582)     |
| Variabel kontrol   |               |               |               |               |               |              |
| 1. Makroekonomi    |               |               |               |               |               |              |
| PDB                | 0.857***      | 0.394***      | 0.643***      | 0.652***      | 0.903***      | 0.776***     |
|                    | (0.0963)      | (0.114)       | (0.153)       | (0.156)       | (0.188)       | (0.218)      |
| Inflasi            | 0.00259       | 0.00409*      | 0.00252       | 0.00539**     | -0.00336      | -0.00392     |
|                    | (0.00269)     | (0.00240)     | (0.00231)     | (0.00262)     | (0.00609)     | (0.00315)    |
| Suku bunga PUAB    | 0.0161**      | 0.0328***     | 0.0149*       | -0.0178       | 0.0602**      | 0.0380**     |
|                    | (0.00799)     | (0.0110)      | (0.00837)     | (0.0109)      | (0.0236)      | (0.0190)     |
| Exchange Rate      | -0.0597       | 0.419***      | -0.0256       | -0.205*       | 0.351*        | 0.240        |
|                    | (0.0856)      | (0.123)       | (0.0966)      | (0.119)       | (0.196)       | (0.169)      |
| 2. Struktural      |               |               |               |               |               |              |
| HHI                | -0.00352***   | -0.00266***   | -0.00206***   | -0.000923     | -0.00369***   | -0.000771    |
|                    | (0.000461)    | (0.000462)    | (0.000495)    | (0.000591)    | (0.00118)     | (0.00114)    |
| Rasio kredit/PDB   | 0.00301       | 0.00318       | 0.00245       | 0.00505       | 0.0763**      | 0.00844      |
|                    | (0.00209)     | (0.00253)     | (0.00234)     | (0.00532)     | (0.0344)      | (0.00541)    |
| Diversifikasi      | -0.0137***    | -0.00451      | 0.00949*      | 0.0133        | -0.00125      | -0.00322**   |
|                    | (0.00519)     | (0.00768)     | (0.00516)     | (0.0124)      | (0.00194)     | (0.00154)    |
| 3. Internal bank   |               |               |               |               |               |              |
| BOPO               | 0.0000596     | 0.000765**    | 0.000229      | 0.000398      | 0.000542*     | 0.00101*     |
|                    | (0.000379)    | (0.000366)    | (0.000344)    | (0.000506)    | (0.000327)    | (0.000590)   |
| NPL                | -0.00265      | -0.00428***   | -0.00225      | -0.00583      | -0.0161       | 0.0109       |
|                    | (0.00261)     | (0.00158)     | (0.00150)     | (0.00532)     | (0.0129)      | (0.00853)    |
| CAR                | 0.0000204     | 0.000230      | -0.000343     | -0.000152     | -0.000823     | 0.00778***   |
|                    | (0.000298)    | (0.000292)    | (0.000355)    | (0.000396)    | (0.00117)     | (0.000680)   |
| Lag dependen       | 0.989***      | 0.991***      | 0.992***      | 0.999***      | 0.937***      | 0.988***     |
|                    | (0.00834)     | (0.00797)     | (0.00968)     | (0.0122)      | (0.0250)      | (0.0171)     |
| Observations       | 798           | 822           | 774           | 846           | 754           | 3.212        |
| Number of bank     | 25            | 25            | 25            | 25            | 26            | 106          |
Graph 1. Credit Market: Dynamic Panel Actual Vs. Fitted Values

Graph 2. Deposit Market: Dynamic Panel Actual Vs. Fitted Values
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