BANK LENDING CHANNEL IN INDONESIA'S MONETARY POLICY TRANSMISSION MECHANISM: A VECM APPROACH

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Abstract- Various monetary policy transmission channels through which monetary policy actions impact real variables, such as interest rate channel, exchange rate channel, monetarist channel, and credit channel (Mishkin, 1995; Kutter and Mosser, 2002; Ireland, 2005). This paper tests the existence of the bank lending (credit) channel to explain the monetary policy transmission in Indonesia from 1986 through 2013. This paper used time-series Vector Error Correction Model (VECM) approach of stationarity test, cointegration test, and stability test. Impulse Response Function (IRF) has also been generated to explain the response to shock amongst the variables. Taking into account a long term relationship, Gross domestic product (real GDP), interest rates on bank loans (RC), reserve requirement (RR), and the consumer price index (CPI) negatively affect the Bank Loan (BL) in Indonesia. In the short term, real GDP, RR, and CPI positive influence on BL, while BL negatively affected by RC based on the results of the VECM analysis. Then, other variables also affect each other in the short term. The implication of this study is the banks need to reduce lending rates to boost investment, so that people can borrow easily to bank with low interest rates.

Keywords- Bank Lending Channel, Exclusion AndExogeneity Restriction, Monetary Policy Transmission, VECM Model

I. INTRODUCTION

The economic development which has lasted quite a long time in Indonesia requires various preconditions for achieving success. The involvement of the monetary and banking sector is one of important element in the development process. To conduct a monetary policy effectively, the monetary authorities must have an accuratecalculation of their economic policy effects, and an understanding the monetary transmission mechanism. Mishkin (1995), Kutter and Mosser (2002), and Ireland (2005) describe the various monetary policy transmission channels through which monetary policy actions impact real variables, such as interest rate channel, exchange rate channel, monetarist channel, and credit channel.

After the crisis of 1997, Indonesia experienced a decline in lending phenomenon as a suspects from Indonesia despite the slow economic recovery of other macroeconomic conditions such as inflation, exchange rates and interest rates after the crisis showed better conditions, but the loans extended by banks has not been able to restore economic growth in the situation before the crisis (Basith, 2007).

Along with the developments that occurred, the banking sector continued to show their existence in Indonesian real economic activity especially during the acceptance of Indonesian oil sector began to decline. The government no longer made the oil sector revenue as financing for development, but the government financed through financial institutions such as mobility of bank funds from the public and the deregulation of the banking sector

A study of Utari (2012), in principle the bank credit has very important role in financing the national economy which could be used as a the driving force of economic growth, due to the presence of credit could make the business sector to expand the business which cannot be performed with their own funds. This indicates that the condition cannot be separated from the role of the monetary authority (in this case the Bank of Indonesia) in conduct monetary policy, which is through the credit channel.

There are several studies have been tested and analyzed the monetary policy transmission through the bank lending (credit channel), such as Hsing (2014) conducted a study to prove the existence of the credit channel in the China's monetary policy transmission mechanism based on a reduced-form equation. He finds the balance of bank loans (credit) is negatively related to interest rate and bond yield and it has a positive relationship with the bank deposits, industrial production, the appreciation of the yuan, and inflation rate. Low interest rate of loans or more deposits in a bank will increase credit distribution, and vice versa.

A study from Basset (2014) by using VAR and assess the response level of banks to the Federal Reserve's Loan Officer Opinion Survey show that indicators shift in the supply of bank lending to businesses and households corresponding change in the standard credit, and also have a simultaneous effect on credit demand. Furthermore, the loss of credit supply shock associated with a substantial reduction in the capacity of businesses and households to borrow from the banking sector and a significant decline in real GDP.

Another study of Mishra (2014) show Monetary policy shocks tend to affect bank lending rates in several low-income countries by using the VAR approach. Low-income countries is much weaker in the transmission of monetary policy shocks on bank loan rate than developed and emerging economies countries. Cyrille (2012) examined the relationship the bank lending channel of monetary policy

transmission in the Central African Economic and Monetary Community (CEMAC) region using a structural VECM. The amount of policy impact can be explained by the characteristics of the existing banks in the region. Therefore, central banks in the CEMAC region should take advantage of the situation to implement policies based on the business cycle situation and reduce the excess in reserve at the central bank store, because it can hinder the implementation of monetary policy in that area.

The aim of this paper is to study the existence of the credit channel in the transmission of Indonesia's monetary policy. In this study, we use Johansen cointegration techniques and selected economic variables to provide clear understanding of credit channel in Indonesia, and the role of bank lending in Indonesia's monetary policy transmission. Due to data limitations, this study focuses on bank lending channel. The reminder of this paper is organized as follows: Section 2 describes the datas and theoretical model. Section 3 reports the empirical results. And, Section 4 concludes.

II. MATERIALS AND METHODS

All data of this research are annually frequencies and covered periods 1986 until 2013 to examine the existence of the credit channel in the transmission of Indonesia's monetary policy that obtained from various sources, namely Bank of Indonesia, International Monetary Fund (IMF), World Bank, and other sources of financial reports. Variables used in this study are the variables consumer price index (CPI), gross domestic product (GDP), required reserve ratio (RR), loan interest rate (RC), and bank loan (BL).

Theoretical Model:The identified model is five variable models which hypothesize that Bank Loan as a function of Loan Interest Rate, Consumer Price Index, Gross Domestic Product, and Required Reserve Ratio.

$$BL_t = F(RC_t, CPI_t, GDP_t, RR_t) \quad (1)$$

Where, BL represents yearly bank loan in Indonesia, RC represents yearly loan interest rate, CPI represents yearly consumer price index, GDP represents yearly gross domestic product, RR represents yearly required reserve ratio where t-sign represents time trend.

Stationarity Test: Time series data is used to study and analyze the relationship of stationary stochastic process which has constant mean, variance overtime and its covariance of two time periods; it must depend on the distance or lag only, not actual time (Gujarati, 2003). Stationarity of a series is an important phenomenon because it can influence its behaviour. If x and y series are non-stationary random processes (integrated), then modelling the x and y as a simple OLS relationship as in equation 2 will only generate a spurious regression.

$$Y_t = \alpha + \beta X_t + \varepsilon_t \quad (2)$$

Time series stationarity is the statistical characteristics of a series such as its mean and variance over time. If both are constant over time, then the series is said to be a stationary process (i.e. is not a random walk/has no unit root), otherwise, the series is described as being a non-stationary process (i.e. a random walk/has unit root). Differencing a series using differencing operations produces other sets of observations such as the first-differenced values, the second-differenced values and so on.

xlevel	x_t	
x 1st differenced value	$x_t - x_{t-1}$	
x 2nd differenced value	$x_t - x_{t-2}$	(3)

If the time series data is not stationary or does not have all those three properties, it is called "non-stationary" as same as the unit root test of Augmented Dickey-Fuller (ADF) (1998). Whenever the result shows that null hypothesis can be rejected, data is stationary (Enders, 2010).

Optimum Lag Test: Determination of the optimal number of lag used in the model is an important step that must be done in using the VAR model. The test for cointegrating relationships in a VAR system is sensitive to the lag length of the variables in the system. In choosing the lag length one must weigh two opposing considerations: the course of dimensionality and the correct specification of the model (Canova, 1995). Testing optimal lag length can utilize some information by using the Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan-Quinn Criterion (HQ).

Johansen and JuseliusCointegration Test: (Johansen and Juselius, 1990) In thisprocedures uses two tests to determine the number of cointegration vectors: the Maximum Eigenvalue test and the Trace test. The Maximum Eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of r+1 cointegrating relations for r = 0, 1, 2, ,…n-1. This test statistics are computed as:

$$LR_{max}(r/n+1) = -T * \log(1-\lambda) \quad (4)$$

Where is the Maximum Eigenvalue and T is the sample size. Trace statistics investigate the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, where n is the number of variables in the system for r = 0, 1, 2…n-1. Its equation is computed according to the following formula:

$$LR_{tr}(r/n) = -T * \sum_{i=r+1}^{n} \log(1-\lambda_i) \quad (5)$$

In some cases Trace and Maximum Eigenvalue statistics may yield different results and indicates that in this case the results of trace test should be preferred.

Vector Error Correction Model (VECM): If cointegration has been detected between series we know that there exists a long-term equilibrium relationship between them so we apply VECM in order to evaluate the short run properties of the cointegrated series. In case of no cointegration VECM is no longer required and we directly precede to Granger causality tests to establish causal links between variables. The regression equation form for VECM is as follows:

$$\Delta Y_t = \alpha_1 + p_1 e_1 + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{n} \delta_i \Delta X_{t-i} + \sum_{i=1}^{n} \gamma_i Z_{t-i}$$

$$\Delta X_t = \alpha_2 + p_2 e_{1-1} + \sum_{i=0}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{n} \delta_i \Delta X_{t-i} + \sum_{i=1}^{n} \gamma_i Z_{t-i} \quad (6)$$

In VECM the cointegration rank shows the number of cointegrating vectors. For instance a rank of two indicates that two linearly independent combinations of the non-stationary variables will be stationary. A negative and significant coefficient of the ECM (i.e.equations 6) indicates that any short-term fluctuations between the independent variables and the dependent variable will give rise to a stable long run relationship between the variables.

III. RESULTS AND DISCUSSION

Stationarity Test:We first check for the stationarity of the series. A variable is called integrated order of d, I(d), if it has to be differenced times to become stationary. We utilize the Augmented Dickey-Fuller (ADF) test with GLS detrending (DF-GLS) test (Elliott, Rothenberg and Stock, 1996) to test for stationarity. The ADF-GLS test avoids having to include a constant, or a constant and linear trend in the ADF test regression. Based on Table 1, all variables contain unit root (not stationary at level). It is observed from the value of ADF statistical variables which is greater than the critical value MacKinnon. Then, to prevent any false regression, we need to test the unit root at their first difference. It is clear from Table 1 that the null hypothesis of no unit roots for all the time series are rejected at their first differences since the ADF test statistic values are less than the critical values at 5% levels of significances. It conclude that the variables stationary on the first degree of integration test results or I (1).

Table 1: Results of Unit Root Test

Variabel	ADF-GLS *Statistic*	1%	5%	10%
Level				
GDP	-1,271917	-4,33933	-3,587527	-3,22923
BL	-1,628737	-4,33933	-3,587527	-3,22923
RR	-2,684884	-4,33933	-3,587527	-3,22923
RC	-3,44779	-4,356068	-3,595026	-3,23345
CPI	-1,911478	-4,33933	-3,587527	-3,2920
1st *Difference*				
GDP	-4,68570	-4,356068***	-3,595026**	-3,23345
BL	-5,106808	-4,356068***	-3,595026**	-3,23345
RR	-6,353855	-4,356068***	-3,595026**	-3,23345
RC	-5,328641	-4,374307***	-3,603202**	-3,22380
CPI	-4,139093	-4,356068	-3,595026**	-3,23345

Notes: **Significant at 1% level; *significant at 5% level. The results are obtained using Eviews 6. The sample period is 1986-2013

Determination of Lags : we determine the optimum lag, which is necessary since exogenous variable used is the lag of the endogenous variable and its exogenous variables. To set the optimum lag value, we used Akaike Information Criteria (AIC) and Hannan-Quinn Criterion (HQ) (Firdaus, 2012). Results of AIC and HQ calculation on Table 2 obtained optimum lag is the lag 2. So, we precede further tests with lags

Table 2: Results of Lag-order selection criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-153.5418	NA	0.221833	12.68334	12.92712*	12.75095
1	-123.0533	46.34251	0.149961	12.24426	13.70691	12.64994
2	-85.57681	41.97364*	0.072735*	11.24614*	13.92767	11.98989*

Cointegration Test: The existence of non-stationary variables increase the likelihood cointegration relationship between variables. It is necessary for the test cointegration to determine whether there is cointegration relationship and obtaining long-term relationship between variables the stock price, rate interest and inflation rates. All variables are stationary at the same rate, i.e. the degree of one (Table 1). Therefore, cointegration test can be done through the Johansen test Cointegration Test using the optimum lag length 2.

Table 3: Results of Johansen's cointegration test

Null Hypothesis	Eigenvalue	Trace Statistic	5% Critical Value	5% P Value**
r = 0*	0.974268	91.50093	37.16359	0.0000
r ≤ 1	0.695172	29.70020	30.81507	0.0681
r ≤ 2	0.495954	17.12720	24.25202	0.3277

Cointegration rank (rank of matrix)is estimated using Johansen methodology. Johansen'sapproach derives two likelihood estimators for the CIrank: a trace test and a maximum Eigen value test. The CI rank (R) can be formally tested with the trace and the maximum Eigen value statistics. The results are presented in Table 3. The trace statistic either rejects the null

hypothesis of no co-integration among the variables or does not reject the null hypothesis that there is two co-integration relation between the variables. Start by testing H0: r = 0. If it rejects, repeat for H0: r = 1. When a test is not rejected, stop testing there and that value of r is the commonly-used estimate of the number of cointegrating relations. In this test, H0: r = 1 is not rejected at the 5% level (29.70<30.82). In other words, this trace test result does not reject the null hypothesis that these five variables are not cointegrated. The final number of cointegrated vectors with two lags is equal to two, i.e. rank (π) =1. Since, the rank is equal to 1 which is more than zero and less than the number of variables; the series are cointegrating among the variables. Nevertheless, we will proceed to estimate the VECM model.

Vector Error Correction Model (VECM): From the Table 4 obtained regression coefficient estimates VECM short term and long term between Bank Loan (BL) with consumer price index (CPI), gross domestic product (GDP), required reserve ratio (RR), and loan interest rate (RC). So at this estimate is dependent variable BL whereas the independent variable is GDP, CPI, RR and RC.

Table 4: VECM Results in The Short Term

Short Term Variable	Coefficient				
	D(LN_BL)	D(LN_GDP)	D(RC)	D(RR)	D(CPI)
D(LN_BL(-1))	-0.1860	0.0144	0.6144	-0.1311	1.0834
D(LN_BL(-2))	-0.4035	-0.0136	0.0336	-0.0035	-0.5095
C	-23.550	0.0950	0.0205	-0.0150	5.9727

Table 5 VECM Results in The Long Term

Long Term Variable	Coefficient
	D(LN_BL)
LN_BL(-1)	1.0000
LN_GDP(-1)	-68.203
RC(-1)	-36.678
RR(-1)	-27.324
CPI(-1)	-0.498176
C	192.3304

In the short term, BL positively influenced by real GDP, RR, and the CPI, while BL (Bank Loan) negatively affected by the RC based on the results of the analysis VECM in Table 4. In the long run (Table 5), all dependent variable positively affects the BL. When there is an increase of real GDP by 1 percent would increase the Bank Loan (BL) at 6.82 percent. Thus, higher real GDP of Indonesia, it will cause a positive effect on the Bank loan. This will lead to positive influence on Indonesian banks.

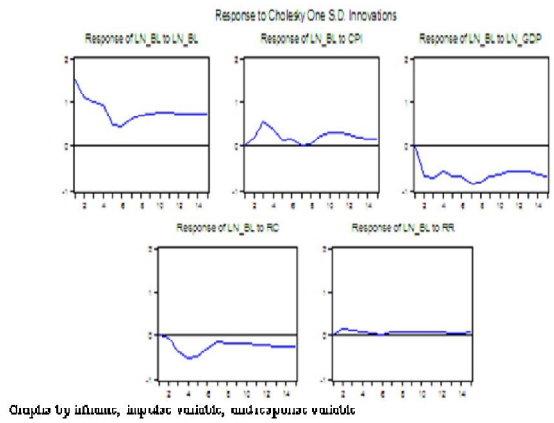
Loan interest rate (RC) effect on bank credit. When the bank lending rates is high, it will reduce the interest of the customer for a loan to the Bank. Based on the analysis of Table 4, the interest rates effect on credit (RC) against customer loans to the Bank (BL). This means that, when interest rates increased by 1 percent, then the loan / credit of society against Bank will decreased by 3.66 percent. Thus, when Bank imposed a low interest rate credit will attract customers to borrow, so it will increase investment in the community, especially in the small and medium business loans.

Based on Table 5 when Reserve Requirement (RR) and the Consumer Price Index (CPI) increased by 1 percent, will lead to a decrease the Bank Loan (BL). This means that RR and CPI negatively affect the Bank Loan in the long term. So, in order to credit bank loans increased significantly, the monetary policy should be conducted by the bank is the reduction of RR and the CPI.

Impulse Response Function (IRF) : The study usesimpulse response function as an additional check of the cointegration test's findings. Followed by Order and Fisher (1993), Cholesktype of contemporaneous identifying restrictions are employed to draw a meaningful interpretation. Impulse response functions are shownin Figure 1.

Since the first until the fourth year, shocks in bank loan responded negatively by itself. In the fifth until the ninth year, bank loan responded positively to the bank loan itself. The response to these shocks of bank loan reached a balance in long-term period, i.e. in the tenth year.

CPI shocks responded positively by bank loan in the first until the third year. In the fifth until the eighth year, bank loans respond negatively to the CPI. The response to these bank loan shocks reached a balance in long-term period in the ninth year. Shocks to GDP responded negatively by bank loans in the first until the third year. In the third year until long-term period, the response of bank loan due to fluctuating GDP shocks. RC shocks responded negatively by bank loan in the first until fourth year. In the fifth until the eighth year, bank loan respond negatively to the CPI. The response to these bank loan shocks began to reach a balance in long-term period in the ninth year.



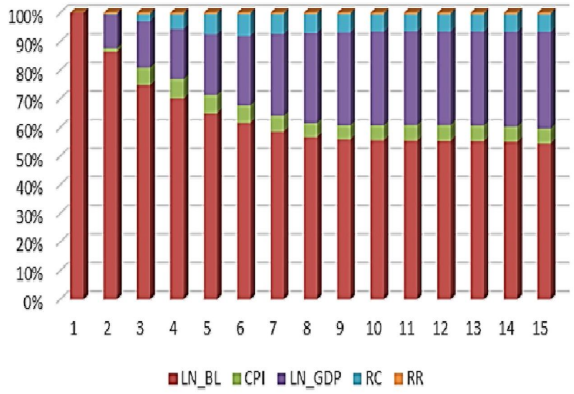
Graphs by impulse variable, and response variable

Fig. 1: Bank Loan Shock Respons to Macroeconomics and Banking Variables

Forecast Error Variance Decomposition (FEVD) Results :The study usesforecast error variance decomposition as an additional check of the contribution of each variable to the shock caused to the main endogenous variables. In this study, FEVD describes the percentage of each macroeconomic and banks variables shocks affect the bank loans. Time period used in projecting FEVD is 15 years.

Based on Forecast Error Variance Decompotion (FEVD) in Figure 2, Variations of bank loans (bank lending) in the first period Came from the variable itself, Which Reached 100% and then continued to fall until it Reaches 56.63% in the eighth period. in the next year fluctuations of bank loans has stabilized. Other macroeconomic variables began to play a role in the fluctuations of bank loans in the second year. CPI variable roles began to increase in the second year to the third year, i.e. from 1.24% to 6.15%. Then the rest of following year, fluctuations of CPI has begun to stabilize.

The role of the GDP variable began to increase in the second year until the seventh year, ie from 11.86% to 28.57%, fluctuations in GDP has begun to stabilize in subsequent years. RC variable roles began to increase in the second year until the fourth year, i.e. from 0.06% to 5.21%, fluctuation of RC has begun to stabilize in the subsequent years. RR variable roles began to increase in the second year to the third year, i.e. from 0.39% to 0.48%, in the following years fluctuations in RR has begun to stabilize.



In long-term period simulated in this analysis is a projection in the next fifteen years. It can be seen that the bank credit variable itself still the most dominant in the fluctuations of bank loans, with the proportion of 54.49%. Meanwhile, the CPI variable in the long term contributed 5.18%, GDP amounted to 33.72%, RC amounted to 6.18%, and RR of 0.41%. In the long-term the most dominant role in the fluctuations of bank loans are GDPvariable and bank loan itself. CPI and RC are also likely to play a role explain fluctuations in bank loans in a long-term period. Meanwhile, RR variables givessmall impact on the bank loans in a long-term period.

CONCLUSIONS

From the results of the analysis conducted the influence of the reserve requirement (RR), the loan interest rate (RC), the consumer price index (CPI), and real GDP towards Bank Loan in the short term have positive effect and negative effect. In the short term real GDP, RR, and CPI positive influence on BL, while BL negatively affected by RC based on the results of the VECM analysis. Other variables also affect each other in the short term.In the long term Gross domestic product (real GDP), interest rates on bank loans (RC), reserve requirement (RR), and the consumer price index (CPI) negatively affect the Bank Loan (BL) in Indonesia.

Banks need to reduce lending rates to boost investment, for example to lower bank credit SMEs in Indonesia so that people can borrow easily to bank with low interest rates. Reserve requirement (RR), the loan interest rate (RC), the consumer price index (CPI) should be made lower to improve the Bank Loan (BL).

There are some limitations in this study. First, this study uses aggregate credit data of the financial institutions, and we cannot identify the sensitivity of bank lending between different banks (small banks and big banks) with regard to the Bank of Indonesia (BI) policy changes. Research based on bank level data could complement the results of this study. Second, we use required reserve ratio and official one-year commercial bank lending interest rate to identity the bank lending channel. These two variables reflect the BI quantity and price instrument. Other variables that refers to the current monetary policy should be included in future studies to get stronger results.

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