Bank lending channel of monetary policy: dynamic panel data evidence from Malaysia

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Abstract

This paper aims to investigate the relevance of bank-lending channel (BLC) of monetary policy in a small-open economy, i.e. Malaysia by using disaggregated bank-level data set. A dynamic panel data method namely GMM framework proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) have been used in estimating the dynamic of banks' loan supply function. The empirical evidence has stated that monetary policy shocks is significantly and negatively influenced the banks' loan supply, and therefore has supported the existence of BLC in Malaysia. In addition, several bank-characteristics variables namely bank liquidity and bank capitalization (capital adequacy ratio) are also statistically significant in influencing the banks' loan supply. Therefore, the implementation of monetary policy is effective in influencing economic activity via bank balance sheet position, in particular bank loans.

Keywords : Bank-lending channel, monetary policy, dynamic panel data
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1. Introduction

The theory of transmission mechanism stated that monetary policy can influence real sector activity via several channels, namely interest rates channel, asset price channel, and credit channels.[1] However, the role of bank credit has been given a special attention by the prior researchers in examining how monetary policy transmitted to the economic activity via credit channel. Bernanke and Gertler (1995) describe two possible mechanisms of the credit channel theory, namely balance-sheet channel (BSC), and bank-lending channel (BLC). The balance-sheet channel (BSC) has emphasized on the impact of the changes in monetary policy on the borrower's balance sheet, whereas, the bank lending channel (BLC) has focused on the possible effect of monetary policy actions on the supply of loans by the banking system.

The bank lending channel is based on the view that bank plays an important role in the financial system as external sources of financing for the firms. Because of the bank's special role, certain borrower will highly dependent to the bank loan, and will not have access to the credit markets unless they borrow from bank. As argued by Bernanke and Gertler (1989), monetary policy can affect the bank portfolio behaviour through the bank asset in term of loan, securities as well bank reserves. Therefore, it is believed that the bank lending channel plays an important role in affecting the economic activity. This is because any changes in the monetary policy stance will affect the bank behaviour in both asset, and liabilities side. For instance, a tight monetary policy will drain the reserves from the banking system, which in turn the bank will restrict the supply of loans, leading to a decline in investment spending, and fall in economic activity (output)[2].

This paper aims to investigate the role of credit channel (in particular, BLC) in the monetary transmission in Malaysia by using the disaggregated bank-level data. By

[1] The detailed explanation about the channels of the monetary policy transmission mechanism can be found in Mishkin (1996).

[2] Schematically, the monetary policy effects on BLC can be summarised as follow;

$M \downarrow \Rightarrow bank\ deposit \downarrow \Rightarrow bank\ loans \downarrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$, which is contractionary monetary policy leads to a fall in bank reserves and bank deposit; subsequently will decline in the bank loans, in turn contract the investment spending, and fall in output.

examining the relevance of BLC in economic activity, it can provide some idea to the monetary authority in designing an appropriate monetary policy in order to achieve their ultimate targets (for example, price stability and sustainable of economic growth). The relevance of BLC will be examined by estimating the banks' loan supply function in dynamic panel data framework. Besides monetary policy variable, several macroeconomics variables (GDP, and inflation), and bank characteristics (bank size, liquidity, and capitalization) are also consider in estimating the banks' loan supply function.

This study contribute to the existing literature by extending the analysis of the relevance of BLC of monetary policy in a small-open economy by using disaggregated data of commercial bank in Malaysia. Specifically, this study tries to answer two main questions? First, how does the monetary policy instrument that is overnight inter bank rate affect the bank lending behaviour? Second, do banks' balance sheet variables namely bank capital, bank liquidity, and asset size matter in influencing the bank lending behaviour? In addition, this study uses the most recent panel data technique, that is the generalized method of moment (GMM) proposed by Arellano and Bond (1991), Arellano and Bover (1995), and recently extended by Blundell and Bond (1998). This technique has an advantage for addressing the Nickell (1981) bias associated with the fixed effects in short panels (for example, bias due to the presence of the lagged dependent variable and bias due to the endogeneity of other explanatory variables).

Consistent with the previous finding in developed countries, there is a relevance role of bank lending channel of monetary policy in Malaysian. Specifically, as postulated by BLC theory, monetary policy variable has influenced significantly and negatively to the banks' loan supply. In addition, several bank-characteristics variables namely bank liquidity and bank capitalization (capital adequacy ratio) are also play a significant role in influencing the banks' loan supply.

The remainder of this paper is organized as follow. Section 2 discusses the previous study relating to the transmission mechanism of monetary policy via bank-

lending channel. Section 3 deals with the theoretical aspect of the bank-lending behaviour. Section 4 explains the estimation procedures by using the dynamic panel data in GMM framework. Section 5 reports the empirical findings, and finally section 6 summarizes and concludes.

2. Literature Review

The important role of credit channel in monetary policy transmission can be traced back by Bernanke and Blinder (1988)[3]. They argued that there are three conditions for the existence of the BLC, namely (i)loans and open-market bonds must not be perfectly substitute, (ii)the central bank is able to affect the bank loan by changing the quantity of reserves, and (iii)imperfect price adjustment that prevents any monetary shocks from being neutral. By using the traditional IS-LM model, where IS curve is replaced by the credit-commodity curve (CC), they produced CC-LM model where state that monetary policy can affects economic activity via credit channel or bank loan channel. For example, a tight monetary policy through an increase in interest rates will drain the bank reserves and deposit, and subsequently, the bank will contract the loan to the business and consumer.

There is well documented in the literature that most of the studies relating to the credit channel are focused on bank aggregate data. For example, Bernanke and Blinder (1992) have used innovation in 3-month Treasury Bills rate to capture exogenous shifts in monetary policy, and found that the inverse relationship between bank loans and tight monetary policy, and therefore have supported the credit channel view in the US economy. However, the are several studies have use the disaggregated data bank in investigating the existence of the bank lending channel particularly in the developed countries, especially in the US economy [for instance, Kashyap et al. (1995a, 1995b)**;** Kashyap et al. (2000), Kishan and Opiela (2000), and Ashcraft (2006)**],** in the UK study [Huang (2003), and Gambacorta (2005)], and Euro area study [Altunvas et al. (2002) and Angeloni et al. (2003)][4]. The general conclusion in most of the studies is the

[3] The excellence literature review about the credit channel can be found in Mateu (2005), and Egert and MacDonald (2009).

[4] In Euro area, the role of banks in monetary transmission have been investigated by Ehrmann et al. (2003) in France, Germany, Italy, and Spain; Worms (2003) in Germany; Hernando and Martinez-Pages (2003) in Spain; Loupias et al. (2003) in France; Brissimis et al. (2003) in Greece; Gambacorta (2003) in

tight monetary policy leads to a decline in bank credit (loans), which in turn has a negative impact to the economy. For example, Kashyap et al. (1995a, 1995b) found that the growth in bank loans in the sub-segment of the small commercial banks was most responsive to monetary policy. A further study by Kashyap et al. (2000) have divided banks by two categorised namely asset and liquidity size, and found that the smallest most illiquid banks were most responsive to monetary policy shocks. This findings has supported by Kishan and Opiela (2000) by dividing banks according to the size and capital strength. However, Ashcraft (2006) has questioned the existence of the BLC in the US experienced. When using bank data, he identified a differential response of loan supply to changes in the Federal Fund Rate (FFR) across bank. However, when he aggregated the bank data up to the state level, the loan market share of affiliated banks tends to mitigate the negative response of loan supply to changes in monetary policy. In addition, the aggregate elasticity of output to bank lending is very small (insignificant).

Studies in the UK economy, and Euro area has also found a same conclusion, which is the relevance role of BLC in monetary transmission. For example, Altunvas et al. (2002) find that the important role of BLC in Italy and Spain, and Huang (2003) shows that a BLC works in the UK through reducing banks loans to small bank-dependent firms.

In the Malaysian context, study relating to the role of the bank lending channel in monetary transmission is still limited in the existing literature. So far, there are several studies have examined the existence of the bank lending channel by using aggregate data [for example, Ghazali and Abdul Rahman (2005), Karim et al. (2006) and Goh et al. (2007)]. Ghazali and Abdul Rahman (2005) have investigated the role of commercial banks' asset (loans) and liabilities (deposit) on selected Malaysian macroeconomic and financial variables. By employing the aggregate data bank and a simple Granger causality test, they found that the significant role of bank asset that is bank loan in influencing the economic variables. This finding supports the active role of bank lending channel in transmitting the macroeconomic variables. In contrast, Goh et

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Italy; Haan (2003) in Netherlands; Kaufmann (2003) in Austrian; Farinha and Marques (2003) in Portuguese, and Topi and Vilmunen (2003) in Finland. All studies have found that the existence of bank-lending channel in the Euro area.

al.(2007) have examined the existence of bank-lending channel by using ARDL approach. By using monthly aggregate data spanning from January 1990 until March 2004, they found that, deposit tend to fall in response to the contractionary of monetary policy shocks. However, the banks are able to protect the customer loans from the reduction in deposit through an adjustment in the liquid financial instrument. This finding state that the tight monetary policy did not depress growth in loans.

However, Said and Ismail (2008) have used bank-level data in investigating the role of bank-lending channel in Malaysia. By using a static panel data framework spanning from 1994 until 2004, they found that the relevance of bank-lending channel in Malaysia. However, their result is questionable because of the coefficient of interest rates on bank loan is quite huge[5]. Therefore, it is expected there is a misspecification error in their model. In fact, as argued by Baltagi (2008), most of economic relationship are dynamic in nature. Thus, by using dynamic panel data framework in estimating the bank loans supply function, it is believed that the monetary authority can obtain an appropriate result for the policy purposes.

3. Bank-lending channel : a theoretical model

The bank lending channel can be analyzed by using a simple model of a profit-maximizing bank as develop by Stein (1998), and Ehrmann et al. (2003). The model can be simplified as follows;

Assume that, the balance sheet identity bank i is defined as;

$$L_i + S_i = D_i + B_i + C_i \tag{1}$$

Where L is the volume of loans, S is the securities, D is the volume of the demand deposit from household, B is the level of non-secured funding, and C is the

[5] Specifically, the finding of the results indicate that a one percentage point increase in interest rates lead to a decline the bank loans by 458 321.8 percent. Therefore, it is believed that their estimation model has a misspecification error that relating to the econometric model, and bank-loan supply equation.

capital of the bank. It is also assume that the bank i acts in a loan market characterised by monopolistic competition. The demand for nominal bank loan L_i^d is given by;

$$L_i^d = -\alpha_0 r_{L,i} + \alpha_1 y + \alpha_2 p \tag{2}$$

In equation (2), the bank individual loan is determined by loans rate $(r_{L,i})$, aggregate real output (y), and the domestic price level (p); which assumption all coefficient α_0, α_1 and α_2 is positive. Under the Basle requirement, the bank capital is linked to the level of the loans and the bank's holding of securities to the level of the deposit (liquidity risk). Therefore, it can be simplified as;

$$C_i = kL_i \tag{3}$$

$$S_i = cD_i \tag{4}$$

The demand deposit (D) is secured, but not bear interest. The demand deposit is according to the money-demand function, and demanded because of their role as a means of payment. Therefore, the demand deposit is negatively related to the interest rates of an alternatives risk-free asset (r_s), which take to be the monetary policy rate as;

$$D = -\beta_0 r_s \quad \text{, where } \beta_0 > 0 \tag{5}$$

In equation (5), the bank cannot influence the amount the deposit. This deposit is exogenous to the bank, and it will drop after the monetary tightening (after an increase in r_s). However, the bank have access to an alternatives source of funds, which is unsecured, and the bank has to pay the interest (example, inter bank loan and debt securities). Because of the bank are perceived to be risky, the suppliers on unsecured finance ask for an external finance premium. The external finance premium depends on a signal of the bank's health (x_i), which can be observed by all market participant. The higher the x_i, the lower the external finance premium. Therefore, the interest rates of the unsecured financing $\left(r_i^B\right)$ is;

$$r_i^B = r_s(\mu - c_0 x_i), \text{ where } \mu - c_0 x_i \geq 1 \text{ for } \forall_i \tag{6}$$

In equation (6), bank i cannot raise unsecured funds if it offered less than r_i^B, whereas it can raise any amount of fund if it pays at least r_i^B. Given r_i^B is a cost factor, bank i will not be ready to pay more than r_i^B. By assuming $B_i > 0$, the profit of bank i (π_i) is given by;

$$\pi_i = L_i r_{L,i} + S_i r_s - B_i r_{B,i} - \psi_i \tag{7}$$

Where, ψ_i captures bank-specific administrative costs and remuneration costs for the required capital holdings. By inserting equation (1)-(5) into equation (7), and assuming equilibrium in the loan market, yields;

$$\pi_i = L_i\left(-\frac{1}{\alpha_0}L_i + \frac{\alpha_1}{\alpha_0}y + \frac{\alpha_2}{\alpha_0}p\right) + sD_i r_s - [(1-k)L_i - (1-s)D_i]r_i^B - \psi_i \tag{8}$$

By setting the first-order condition to zero, and inserting (6) in equation (8) yields;

$$L_i = \frac{\alpha_1}{2}y + \frac{\alpha_2}{2}p - \frac{\alpha_0\mu(1-k)}{2}r_s + \frac{\alpha_0 c_0(1-k)}{2}x_i r_s - \frac{\alpha_0}{2}\frac{\partial\psi_i}{\partial L_i} \tag{9}$$

Equation (9) is the standard loan equation in macro modelling. In equation (9), a monetary policy tightening through an increase in interest rates (r_s) leads to a reduction in deposit in equation (5). However, bank can keep the asset side of their balance sheet unchanged only if they increase others sources of funding (B_i) accordingly. But the interest rates a bank has to pay for these funds was increased by the monetary policy tightening according to the equation (6). Banks pass at least part of this higher cost to their loan rate $(r_{L,i})$, which in turn reduce the loan demand. Therefore, in equation (9) it is expected that the monetary policy variables r_S has a negative response to the bank loans.

However, is it reasonable to assume that individual banks loan is also influence by others factors such bank asset size, bank capital, and bank deposit. Therefore, this study will also consider the bank balance sheet variables in estimating the banks' loan supply function. Following the literature, there are three indicators widely used for measuring the bank characteristics such as bank size (S_{it}), liquidity (Liq_{it}), and capitalisation (Cap_{it}). Specifically, the definitions of the variables are as follows:

$$S_{it} = \log A_{it} - \frac{1}{N_t}\sum_i \log A_{it} \tag{10}$$

$$Liq_{it} = \frac{L_{it}}{A_{it}} - \frac{1}{T}\sum_t \left(\frac{1}{N_t}\sum_i \frac{L_{it}}{A_{it}} \right) \tag{11}$$

$$Cap_{it} = \frac{C_{it}}{A_{it}} - \frac{1}{T}\sum_t \left(\frac{1}{N_t}\sum_t \frac{C_{it}}{A_{it}} \right) \tag{12}$$

Size is measured by the log of total assets $(A_{i,t})$. Liquidity is measured as the ratio of liquid asset L_{it} (cash, bank deposit and securities) to total asset. Capitalisation is given by the ratio of capital and reserves as a percentage of total assets. All the three criteria are normalised with respect to their average across all the banks in the respective sample. All bank characteristics will be interacted with the monetary policy variables. For example, by interact bank-liquidity with monetary policy ($L_{it}xMP$), it can examine how the bank-loan supply response with the bank-liquidity after the monetary policy tightening. Therefore, the augmented loans equation in the dynamic panel data based on equation (9) can be specified as follows;

$$\begin{aligned} \log(L_{it}) = a_i + \sum_{j=1}^{l}\beta_j \log(L_{i,t-j}) + \sum_{j=0}^{l}\alpha_j IBOR_{t-j} + \sum_{j=0}^{l}\phi_j \log(GDP_{t-j}) + \sum_{j=0}^{l}\varphi_j \inf_{t-j} + \gamma X_{i,t-1} \\ + \sum_{j=0}^{l}\lambda_1 X_{i,t-1} IBOR_{t-j} + \eta_i + \mu_{i,t} \end{aligned} \tag{13}$$

Specifically, in equation (13), the bank loans supply (L_{it}) is determined by lagged dependent variable $(L_{i,t-j})$, monetary policy variable that is inter bank overnight rate $(IBOR)$, gross domestic product (GDP), inflation rate (Inf), bank characteristics (X_i),

and the interaction term of bank characteristics and monetary policy variables $(X_i.IBOR)$. In addition, η_i is bank-specific effect, where $\eta_i \sim IID\left(0, \sigma_\eta^2\right)$, and $\mu_{i,t}$ is the remainder error terms, which is $\varepsilon_{i,t} \sim IID\left(0, \sigma_\varepsilon^2\right)$. Therefore, the total error term is $\varepsilon_{i,t} = \eta_i + \mu_{i,t}$.

4. Research Methodology

4.1 Data

This study uses annual commercial bank balance sheet data spanning from 1993 up to 2008 (16 years). Few banks have been operated continuously since 1993, but some banks are operated continuously at some later point. Therefore, the data constitute an unbalanced panel. Specifically, there is 37 number of commercial banks in this study, which is equivalence to 311 bank-year observations. The bank balance sheet data set (loans, asset, liquidity, and bank capital) has been collected from Bank Scope database, meanwhile the data of macroeconomic variables (GDP, inflation, and IBOR) are collected from International Monetary Fund.

4.2 Dynamic Panel GMM

The inclusion of the lagged dependent variables in the baseline banks loan supply function in equation (13) implies that there is correlation between the regressors and the error term since the lag of banks loan supply $(\log(L_{i,t-j}))$depends on $\varepsilon_{i,t-1}$, which is a function of the bank specific effect (η_i). Therefore, due to this correlation, the dynamic panel data estimation in equation (13) suffers from Nickell (1981) bias, which disappears only if T is large or approaches infinity. Arellano and Bond (1991), Arellano and Bover (1995), and recently extended by Blundell and Bond (1998) have proposed generalized method of moments (GMM) estimators in order to deal the endogeneity problem (the correlation between the lagged dependent variable and the error term).

In order to remove the firm specific effect (η_i) in equation (13), Arellano and Bover (1995) proposed a forward orthogonal deviation transformation or forward Helmert's procedure. This transformation essentially subtracts the mean of future

observations available in the sample from the first $T-1$ observations. Its main advantage is to preserve sample size in panels with gaps. In contrast, a first-difference transformation has some weakness, which is, if some explanatory variable (x_{it}) is missing, then both $\Delta x_{i,t}$ and $\Delta x_{i,t+1}$ are missing in the transformed data (Roodman, (2009a)). However, under orthogonal deviations, the transformed $x_{i,t+1}$ need not go missing. This procedure can be expressed as follows:

$$x_{i,t+1} = c_{it}\left[x_{it} - \frac{1}{T_{it}} \sum_{s>t} x_{is} \right] \tag{14}$$

where T_{it} is the number of time-series observations on firm i, c_{it} is the scale factor that is $\sqrt{\frac{T_{it}}{T_{it}+1}}$ and $\sum_{s>t} x_{is} = x_{it} + x_{i,t+1} + ... + x_{iT}$. As noted by Hayakawa (2009), by using a Monte Carlo simulation study, the GMM estimator of the model transformed by the forward orthogonal deviation tends to work better than if transformed by the first difference. Therefore, based on this justification, this study has used forward orthogonal deviation transformation in order to eliminate the firm-specific variable.

However, by transformation using forward orthogonal deviation, a new bias is introduced, that is, the correlation between the transformed error terms, and the transformed lagged dependent variable. Similarly, the transformed explanatory variables, that is the inter bank overnight rate, the gross domestic product, the inflation rate, and firm characteristics are also potentially endogenous because they are related to the transformed error term. Therefore, three assumptions can be made regarding to the explanatory variables. First, an explanatory variable (X_{it}) can be a predetermined variable that is correlated with the past error or $E[X_{it}\varepsilon_{is}] \neq 0$ for $s < t$ but $E[X_{it}\varepsilon_{is}] = 0$ for all $s \geq t$. Second, an explanatory variable (X_{it}) can also be an endogenous variable, which is potentially correlated with the past and present error or $E[X_{it}\varepsilon_{is}] \neq 0$ for $s \leq t$ but $E[X_{it}\varepsilon_{is}] = 0$ for all $s > t$. Third, X_{it} is said to be strictly exogenous if $E[X_{it}\varepsilon_{is}] = 0$ for all t and s which is uncorrelated with either current, past or future error.

Arellano and Bond (1991) and Arellano and Bover (1995) recommend that the lagged levels or untransformed regressors are used as an instrument for the transformed variable. This refers to the difference GMM. However, Alonso-Borrego and Arellano (1999) and Blundell and Bond (1998) show that if the lagged dependent and the explanatory variables are persistent over time or nearly a random walk, then lagged levels of these variables are weak instruments for the regression equation in differences. This happens either as the autoregressive parameter (α) approaches unity, or as the variance of the individual effects (η_i) increases relative to the variance of the transient shocks (ε_{it}). Hence, to decrease the potential bias and imprecision associated with the difference estimator, Blundell and Bond (1998) have proposed a system GMM approach by combining both regression in differences and regression in levels. In addition to the regression in differences, the instruments for the regression in levels are the lagged differences of the corresponding instruments.

However, as noted by Roodman (2009), the system GMM can generate moment conditions prolifically. Too many instruments in the system GMM overfits endogenous variable even as it weakens the Hansen test of the instruments' joint validity. Therefore, in order to deal with the instruments proliferation, this study will use two main techniques in limiting the number of instruments – such as using only certain lags instead of all available lags for instruments and combining instruments through addition into smaller sets by collapsing the block of the instrument matrix. This technique has been used by previous researchers, for example Calderon et al. (2002), Beck and Levine (2004), Cardovic and Levine (2005) and Roodman (2009b).

This study has used one-step system GMM estimation. However, for robustness checking, a two-step estimation in the system GMM was also considered. The success of the GMM estimator in producing unbiased, consistent and efficient results is highly dependent on the adoption of the appropriate instruments. Therefore, there are three specifications tests as suggested by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). First, the Hansen test of over-identifying restrictions, which tests the overall validity of the instruments by analysing the sample analogue of the moments conditions used in the estimation process. If the moment

condition holds, then the instrument is valid and the model has been correctly specified. Second, it is important to test that there is no serial correlation among the transformed error term. Third, to test the validity of extra moment's conditions on the system GMM, the difference in Hansen test is used. This test measures the difference between the Hansen statistic generated from the system GMM and the difference GMM. Failure to reject the three null hypotheses gives support to the estimated model.

5. Estimation Results

Table 1 reports the estimation results of the determinants of the banks' loan supply by using system GMM estimation. The main results are the system GMM with one-step, and two-step estimation. As can be seen in Table 1, in one-step estimation, monetary policy variable (inter bank overnight rate) is negatively, and statistically significance in influencing the banks' loan supply. Specifically, a one percentage point increase in the inter bank overnight rate lead to a contemporaneously decrease in the banks loan supply by 0.389 percentage point. The lagged effect of monetary policy is also statistically significant in influencing the banks' loan supply, which is the banks loan has decreased by 0.104 percentage point in response to a one percentage point increase in inter bank overnight rate. This finding indicate that the relevance of bank lending channel (BLC) in monetary policy transmission mechanism in Malaysia. The results are also robust by using two-step system GMM estimation, which is both contemporaneous and lagged effect of monetary policy variables are negatively, and significantly influenced the banks loan supply. The significance of BLC in monetary transmission indicated that monetary policy enables to influence real sector economy through bank-balance sheet variables.

The interaction effect between monetary policy and bank characteristics are also statistically significant in influencing the banks' loan supply. For example, the positive coefficient of the interaction between bank liquidity and monetary policy (Char2 x MP) on banks' loan supply has indicated that a low value of bank liquidity interact with monetary tightening tend to reduce the banks' loan supply. The underlying reasoning is that banks with more liquid balance sheet can use their liquid asset to maintain their

loan portfolio, and therefore are affected less heavily by a monetary contraction (Ehrmann et al., 2003). The interaction term between bank capitalization and monetary policy (Char3 x MP) is also positive and significance, which is indicated that bank with high capitalization ratio (high capital adequacy ratio) are enable to offer more loans during monetary tightening. This findings signal that a sound bank characteristics in term of liquidity, and bank capitalization play an important role in influencing the banks' loan supply. However, the interaction term between bank asset and monetary policy (Char1 x MP) is not statistically significance. This indicates that bank asset or bank size is not relevance in influencing the banks' loan supply.

The results of the both specification tests, that is AR(2) for testing the serial correlation and the Hansen test for testing the validity of instrument adopted are also valid. As shown in Table 1, the p-values for the AR (2) and Hansen tests are higher than 0.10, that is, statistically insignificant at the ten percent significance level. This implies that the empirical model has been correctly specified because there is no serial correlation (autocorrelation) in the transformed residuals, and the instruments (moments conditions) used in the models are valid. The additional moment conditions such as difference in Hansen tests are also statistically insignificant in all models but not reported in order to save space.

Table 1: The Determinants of Banks' Loan Supply Function: System GMM estimation

	one-step estimation			two-step estimation		
	coef.	Robust standard error	p-value	coef.	corrected standard error	p-value
Lagged dependant variable	0.937	0.054	0.000***	0.945	0.051	0.000***
Inter bank overnight rate	-0.389	0.190	0.041**	-0.357	0.156	0.022**
Lagged of Inter bank overnight rate	-0.104	0.036	0.004***	-0.085	0.027	0.002***
Log of Gross domestic product	0.356	0.539	0.509	0.069	0.541	0.898
Lagged of Log of Gross domestic product	0.807	0.439	0.066*	0.447	0.500	0.372
Inflation rate	0.0925	0.047	0.051*	0.073	0.045	0.108
Lagged of Inflation rate	0.087	0.053	0.101	0.061	0.040	0.128
Char1 x MP	0.065	0.024	0.007***	0.065	0.023	0.004***
Char2 x MP	0.003	0.001	0.020**	0.003	0.001	0.035**
Char3 x MP	0.003	0.004	0.505	-0.0002	0.003	0.956
Number of instruments	25			25		
Number of observations	311			311		
Number of groups	35			35		
AR(2)-p value	0.387			0.368		
Hansen test –p value	0.152			0.155		

Note: The dependent variable is the log of banks loan. The independent variables are the inter bank overnight rate (IBOR), log of GDP, inflation rate, and bank characteristics (Blundell and Bond). Char1 is the bank size, Char2 is the bank liquidity, and Char3 is the bank capitalization. Char x MP is the interaction effect between monetary policy (IBOR) with the bank characteristics. *** significant at 1% level ; ** Significant at 5% percent level, and * Significant at 10% percent leve. Year dummies and constant are not included in order to save space. All *p-value* of the difference in Hansen tests of exogeneity of instruments subsets have also been rejected at least at 10 percent significant level, but not reported here. The full results are available upon request.

Instrument for orthogonal deviation equation:
Lags 2 to 3 for endogenous variables (lagged dependent variable), lags 1 to 2 for all predetermined variables (log of gross domestic product, inflation rate, and all bank characteristics), and all lags for strictly exogenous variable (inter bank overnight rate).

The estimation also collapses the instruments matrix as proposed by Calderon et al. (2002), and Roodman (2009b).

6. Summary and Conclusion

The role of BLC in monetary transmission has been studied extensively in advanced countries, however little attention has been given to investigating this issue in a small-open economy. Therefore, to fill this gap in the previous literature, this study focuses on the bank-lending channel (BLC) of monetary policy in Malaysia context by estimating the banks' loan supply function using a dynamic panel data framework.

This paper found that the relevance role of bank-lending channel (BLC) of monetary policy in Malaysian economy. This means that the tightening of monetary policy is significantly influenced the banks' loan supply, which is indicated that the role of commercial banks is very important in transmitted monetary policy to the real economic activity. The finding also indicated that significance role of bank characteristics variable namely bank liquidity, and bank capitalization in influencing the banks' loan supply. This indicated that, during tight monetary policy, the banks enable to maintain their loan to the customer by using the liquidity, and bank capital as alternatives of loan financing because they are affected less heavily during monetary contraction.

This paper has several implications for implementing of monetary policy. First, since BLC plays a pivotal role in monetary transmission, therefore the monetary authority has to monitor the stability in the interest rates in order to stabilize the banks' loan supply. This is because any changes in monetary policy variable, will affect the bank loan, and subsequently will affect the firm investment, and economic activity. Second, the monetary authority has also concerned the microeconomics aspect of bank behaviour in formulating their policy.

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