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Is bank lending channel of monetary policy evident in the Philippines? A dynamic panel data approach

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Abstract

Understanding monetary policy transmission through the bank lending channel is imperative as impact of monetary policy adjustments to Philippine banking system can be amplified in the real economy. Using dynamic panel Generalized Method of Moments (GMM) model for quarterly micro-level bank data, this research finds that the bank lending channel of monetary policy in the Philippines is non-existent as highly liquid banks tend to react more to monetary tightening than less liquid banks. More liquid banks would rather hold their stock of liquid assets as buffers against crises or contingencies than sustain their lending activity amid monetary tightening. Moreover, banks are risk-sensitive in their lending behavior as increase in the cost of borrowing following tighter monetary policy could increase the likelihood of loan default. The study also concludes that liquidity is the only bank-specific feature that has significant influence on bank lending.

JEL Codes: C23, E52, G21

Keywords: Bank lending channel, monetary policy transmission, dynamic panel data

Corresponding author: Jean Christine A. Armas (armasja@bsp.gov.ph)

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Jean Christine Armas [1]

1. Introduction

The credit channel of monetary policy transmission emerged as one of the well-sought contemporary macroeconomic policy researches following the 2007-2009 Global Financial Crisis (GFC). The intrinsic information asymmetry problems present in the financial markets and banks' singular role in responding to these issues made the credit channel of special research interest (Mishkin, 1996). The two primary mechanisms of the credit channel, as identified by Bernanke & Gertler (1995), are the balance sheet channel (BSC) and the bank lending channel (BLC). Where the former highlights the importance of monetary policy changes to borrowers' financial statements, the latter underscores the impact of monetary policy decisions to loan provision by deposit-taking institutions (ibid).[2] When central bank tightens monetary policy, bank deposits fall and when banks are not able to fully compensate for the shortage of deposits with alternative sources of funds, banks are prompted to reduce available loanable funds (Farinha & Marques, 2001). This mechanism is referred to as the BLC of monetary policy.

The BLC of monetary policy allows central banks to affect the supply of credit from banks and, consequently, influence activities in the real economy (Brissimis et al., 2003). Such rationale sparked renewed interest among researchers to put forth empirical analysis on the BLC of monetary transmission. However, the intricacy in verifying the existence of BLC lies on differentiating the shifts in loan supply from shifts in loan demand. A breakthrough yet data-intensive resolution to uncover whether the lending channel of monetary policy exists or not is to test the heterogeneity in banks' lending responses to monetary policy changes based on the three (3) bank-specific characteristics, namely, size, liquidity and capitalization (Kashyap & Stein, 2000).

The BLC is one of the important channels of monetary policy transmission in the Philippines as the financial system is largely dominated by banks, covering 82 percent of the financial system's total resources.[3] The Philippine banking system remains to be the domestic economy's primary source of credit to the formal institutional sectors in the country, accounting for 59 percent of the GDP as of December 2019.[4] However, the financial market liberalization in the Philippines during the early-1990s and the aftermath of the 1997 Asian Financial Crisis (AFC) that prompted banks to exercise cautious lending were believed to have

[1] Ms. Armas is from the Department of Economic Research (DER) of Monetary Policy Sub-Sector (MPSS). The usual institutional disclaimer applies.

[2] Loan and credit are interchangeably used in this paper. Deposit-taking institutions, in this paper, is likewise referred to as the banking system (e.g., universal, commercial and thrift banks).

[3] Data is as of June 2020. Source: Department of Economic Statistics, Bangko Sentral ng Pilipinas (BSP).

[4] Bank credit to GDP is computed as the ratio of gross total loan portfolio of the banking system to annualized GDP. Data source: Bangko Sentral ng Pilipinas (BSP) and Philippine Statistics Authority (PSA).

somewhat weakened the ability of bank lending to reflect the central bank's monetary policy stance (Guinigundo, 2006).

Understanding, therefore, the impact of monetary policy changes to banks' lending responses via the BLC is vital in guiding monetary policy decisions and in assessing the effectivity of monetary policy transmission in the Philippines. However, the BLC research has rarely been explored and discussed in the Philippine context. In the Philippines, there are only four (4) empirical researches on BLC that made use of bank-level data.[5] These research studies are, however, varied in terms of the author/s' research objectives, data coverage and methodology used. The main contribution of this paper, therefore, is to extend the BLC empirical research in the Philippine context in terms of research objectives, econometric methodology, period coverage, and sample size.

1.1 Research Objectives

The specific research objectives of this study, which spinoff from the paper's general objective, which is to investigate the existence of BLC in the Philippine banking system[6], are as follows:

a. To test whether the effect of monetary tightening to banks' lending responses varies with bank-specific features (i.e., size, liquidity and capitalization), and
b. To examine if the different types of Philippine banks (i.e., universal, commercial, and thrift) have significant influence on banks' credit supply when there is contractionary monetary policy.

The remainder of this paper is structured as follows. The theoretical and empirical literatures are reviewed in Section 2. The structure of the banking system and the conduct of monetary policy in the Philippines are discussed in Section 3. Meanwhile, the data, model and methodology used in the study are presented in Section 4. The empirical results of the paper are analyzed in Section 5. Finally, the conclusions and policy implications of the research are summarized in Section 6.

2. Literature Review

The debate on the existence and effectiveness of the monetary policy transmission through the bank lending channel is best understood through the lens of theory and empirics. While theoretical underpinnings provide logical assumptions, the empirical studies can either validate or reject these conjectures.

2.1 Theoretical Framework

The standard view on monetary policy transmission focuses on the interest rate channel, which hinges upon the traditional IS-LM Keynesian point of view. Adjustments in policy rates are transmitted in various market interest rates, which affects investment and,

[5] These empirical research studies will be explored in Section 2.2 of the paper.
[6] The Philippine banking system, in this paper, includes the universal, commercial and thrift banks.

ultimately, output. This theory is predicated on the basis of perfect financial markets without frictions and information asymmetry (Mishkin, 1996). However, financial markets are imperfect in reality. The inherent frictions and asymmetric information present in the financial markets and banks' unique role in responding to these issues made the BLC of monetary policy transmission of special research interest.

The BLC of monetary policy highlights the special role of the banking system because this channel asserts that monetary policy adjustments will affect banks' loan supply. This, in turn, will have spillover impact to the real economy as the spending and investment behavior of bank borrowers are contemporaneously affected (Ananchotikul & Seneviratne 2015).

The BLC implies that when central bank siphons off liquidity from the financial system, banks are prompted to shift from insured to uninsured sources of funds. And, it is often presumed that banks with weak balance sheet positions find it cumbersome to raise uninsured funds. Against this premise, the existence of BLC can be tested whether there is heterogeneity in bank lending responses to changes in monetary policy based on the banks' balance sheet strength or specific characteristics. In general, the hypothesis is that BLC is amplified when banks with weak balance sheets are more sensitive and react strongly to contractionary monetary policy shock vis-à-vis banks with strong balance sheets.

A large body of literature in testing the presence of BLC uses the following three major bank-specific features. First is bank size where small banks are assumed to be more vulnerable to sudden tight monetary shock than large banks because of the conjecture that the former has limited access to unconventional sources of funds such as in the capital markets and thus, encounters more difficulty in raising external funds than large banks (Kashyap & Stein, 1995). Second is bank liquidity where less liquid banks react more than highly liquid banks during periods of monetary contraction because the former has lower level of liquid assets to draw from and therefore, they cut on their bank lending (Ashcraft, 2001; Ehrmann et al., 2001). Third is bank capitalization where poorly capitalized banks are presumed to reduce their loan portfolio more than the well-capitalized banks when there is contractionary monetary policy because the financing cost tends to go up as a result of limited access to unconventional or non-deposit sources of funding (Heryán & Tzeremes, 2017; Zulkhibri, 2013).

2.2 Empirical Studies

Investigating the presence of BLC empirically requires microdata on a large number of banks to gather information on bank's total assets, liquid assets as well as capital and reserves. The findings of the empirical studies available in the literature is often partitioned into two – one is strong support and the other is weak evidence on the existence of BLC. These studies are carried out both in the context of advanced and emerging economies.

One of the most influential papers on the existence of BLC is that of Kashyap & Stein, 1995. Using disaggregated data on US banks, they found out that bank size is a relevant bank characteristic in identifying the differential lending responses of banks to monetary policy shocks. Their study is further extended in 2000 to investigate for bank liquidity and they showed that highly-liquid banks are not sensitive to monetary tightening because even during this period, these banks can still maintain or expand their credit provision as they have

amassed large amount of liquid assets (Kashyap & Stein, 2000a). Moreover, bank capitalization is found out to be an important determinant of bank lending channel in the US (Kishan & Opiela, 2006).

In European countries, the findings are varied. Banks' heterogeneity in lending responses, which is magnified in banks' size and liquidity, is evident in Central and Eastern European (CEE) countries (Matousek & Sarantis, 2009). In some European countries, however, the results are inconclusive where the existence of BLC is rather weak. These countries include Germany, France, Italy, Portugal, Belgium, Netherlands, and Austria (Altunbas, Gambacorta & Marques-Ibanez, 2009; Brissimis et al., 2003; Ehrmann et al., 2001; Matousek & Sarantis, 2009). Meanwhile, no robust evidence about the presence of BLC was found in United Kingdom and Spain (Hernando & Martínez-Pagés, 2003; Matousek & Sarantis, 2009).

In the emerging economies, few empirical studies on BLC have been put forth. In Malaysia, there is a strong support for banks' heterogeneity in lending responses to monetary tightening that is magnified in banks' liquidity and capitalization (Zulkhibri, 2013). In Korea, the existence of BLC of monetary policy is strong as smaller banks tend to reduce the volume of their bank lending following a monetary policy tightening (Hsing, 2014). However, in the study conducted by Ananchotikul & Seneviratne (2015) in nine Asian economies, there is no solid evidence on the existence of BLC at the aggregate level.[7] Their study implies that the transmission of monetary policy via the BLC is weakened by the increasing global financial integration and rising foreign bank penetration in these select Asian economies.

In the Philippines, there are only four (4) empirical researches on BLC that made use of micro-level bank data. These research studies are, however, varied in terms of the author/s' research objectives, data coverage and methodology used. Aban (2012) and Glindro, et al. (2016) uses quarterly data for universal and commercial banks (UKBs) only. On the one hand, Aban (2012) employs panel ordinary least squares using 35 sample UKBs from 2008 to 2011 and finds out that the size of banks (particularly, the small banks) react to monetary policy adjustments. On the other hand, Glindro, et al. (2016) extended the period of study to 2013 from 2008 but covers 25 UKBs only. Using panel fixed-effects model, they find out that among the three (3) bank-specific features (i.e., size, liquidity and capitalization), only the capitalization variable has significant effect when interacted with monetary policy rate. Meanwhile, Bayangos (2010) uses the consolidated balance sheets of the banking system from 1999 to 2010. Applying macro-econometric model, the author finds out that bank capital is significant in explaining banks' lending behavior. Using a larger sample size (529 banks) and covering a longer period (Q1 2008 to Q4 2015), Austria and Bondoc (2018) find very weak to no evidence of BLC of monetary policy in the Philippines.

The empirical studies in emerging Asia is not as extensive as the researches in advanced economies. This scarcity on BLC literature in the context of emerging economies arises mainly because of data constraints and to some extent, the arduous task that comes along with data compilation of micro-level bank data. It is for this reason that this research paper was conducted.

[7] These nine Asian economies include Hong Kong SAR, India, Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan.

3. The banking system and monetary policy in the Philippines

The structure and performance of the Philippine banking system as well as an overview of the conduct of monetary policy in the Philippines will be discussed in this section to gain better understanding of banks' lending behavior amid monetary policy adjustments.

3.1 The Philippine banking system

The Philippine financial system is largely dominated by the banking system, accounting for 82 percent of the financial system's total resources.[8] It remains to be the domestic economy's primary source of credit to the formal institutional sectors in the country, especially for the non-financial corporations sector.[9] In this paper, the Philippine banking system is comprised of the universal, commercial and thrift banks, which are distinguished according to the size of capitalization and kind of activities they engage into (Table 1).

Table 1: Philippine Banking System's Key Features and Select Indicators

Particulars	Universal Banks (UBs)	Commercial Banks (KBs)	Thrift Banks (TBs)
Key Features			
Capitalization	Php 4.9 billion	Php 2.4 billion	Php 0.33 billion
Capital adequacy ratio (BASEL III standards)	8 percent	8 percent	8 percent
Capital adequacy ratio (BSP standards)	10 percent	10 percent	10 percent
Activities	Accepts drafts and issue letters of credit as well as other evidences of indebtedness; engages also in investment activities such as investing in equity of business-related companies, among others.		Accumulates depositors' savings and, in turn, invest these deposits into retail loans and other financing-related activities.
Select Indicators			
Liquid asset-to-total asset ratio (%)	28.67	29.31	26.84
Capital-to-total asset ratio[10] (%)	12.08	11.67	30.58
Loan portfolio-to-total asset ratio (%)	47.14	48.92	51.17
Total asset (in logs)	11.80	10.25	7.27
Sample size	21	15	48
Capital adequacy ratio (CAR) [11]	15.91		16.01

[8] Data is as of June 2020. Source: Department of Economic Statistics, Bangko Sentral ng Pilipinas (BSP).

[9] Based on the Q42019 Balance Sheet Approach (BSA) Report, the lending of the other depository corporations (ODCs) to the NFCs accounted for 55.5 percent of the total loan portfolio as of Q4 2019.

[10] Capital-to-total asset is measured as the ratio of capital and reserves (or retained earnings) to total assets. This computation is based on the paper of Hernando and Martínez-Pagés (2003).

[11] CAR is computed as the ratio of total qualifying capital over total risk-weighted assets (RWA).

Source: Espenilla (2007), Department of Supervisory Analytics (DSA)-BSP, author's calculations based on quarterly data from Q12006-Q42017

The level of liquid assets relative to total assets of the PBS registered an average of 28.27 percent, ranging from 26.84 percent to 29.31 percent from Q1 2006-Q4 2017. Meanwhile, the capital-to-total asset ratio of the PBS stood at a mean of 18.11 percent. Based on the select key indicators from the table above, it can be inferred that the PBS adopts a relatively cautious and prudent lending stance as signalled by the statistics on loan portfolio-to-total asset ratio. The loan portfolio or the level of available loanable funds in relation to the total assets of the PBS is estimated to be at an average of a little less than 50 percent. The adequate capital buffers of the PBS as shown in Table 1 provides baseline evidence of the financial system's ability to withstand unavoidable financial crashes or adverse macro-financial shocks. The PBS remains well-capitalized, with capital adequacy ratios (CAR) exceeding that of the Bank for International Settlements' (BIS) BASEL III prescribed threshold of 8 percent and BSP's capital ratio requirement of 10 percent.[12]

The structural changes associated with the liberalization of the Philippine financial system in the early 1990s posed some important implications on the transmission of monetary policy via the BLC. The availability of sophisticated financial products and non-bank sources of funds has, to some extent, attenuated the link between the bank lending and the real economy. Another key event that could possibly explain the cautious lending stance of the PBS is the Philippine experience during the 1997 Asian Financial Crisis (AFC). Following the aftermath of the 1997 AFC, the BSP has instituted policy changes and financial reform packages that are primarily aimed at ensuring the stability of the Philippine financial system. Some of the supervisory strategies adopted by the BSP to strengthen its prudential regulatory framework include the: (i) adoption of a consolidated risk-based approach to supervision and examination of banks; (ii) implementation of a ladder approach in the imposition of corrective and punitive measures on erring banks; and (iii) adoption of the timely exit of problematic banks (Guinigundo, 2006).

3.2 Monetary Policy in the Philippines

The overriding goal of the Bangko Sentral ng Pilipinas (BSP), the Philippines' independent central monetary authority, is to maintain low and stable prices (Republic Act 7653).[13] In the Philippine history of central banking, it is noteworthy to highlight that there was a significant change of monetary policy framework – from monetary targeting strategy during the 1980s and 1990s to inflation targeting (IT) regime in 2002 (Lim 2006). The shift to IT regime in 2002 was largely due to the damaging pro-cyclicality effects of monetary targeting during the wake of Philippine economic crises in the 1980s and 1990s (ibid). Monetary aggregate targets were then replaced by policy interest rates as key monetary policy instrument in 2002.

The inflation targeting approach involves the announcement of an inflation target that the BSP aims to achieve over a given time period. The BSP created an Advisory Committee (AC), which meets every six (6) weeks to discuss and recommend to the Monetary Board (MB)

[12] Basel III is a comprehensive set of reform measures, developed by the Basel Committee on Banking Supervision, to strengthen the regulation, supervision and risk management of the banking sector.

[13] The three (3) pillars of central banking in the Philippines are price stability, financial stability, and efficient payments and settlements system. Among these pillars, price stability is the BSP's primary goal.

the appropriate monetary policy stance to achieve the inflation target. In implementing the BSP's monetary policy stance, it employs a set of monetary policy instruments. The reverse repurchase (RRP) rate, which is a transaction between the central bank and the banks, is the BSP's primary policy instrument. The RRP is the rate at which the BSP borrows money from the banks. Raising or lowering the RRP rate is done through the open market operations (OMO) by holding (buying) or issuing (selling) government securities. Moreover, the BSP can contract or expand liquidity in the financial system by increasing or decreasing the reserve requirements (RR). The RR refers to the portion of deposits that banks are required to keep or maintain in reserve in BSP's vaults. Acceptance of term deposits and offering of standing liquidity windows are also used by the BSP to influence money supply and, in turn, exert some influence on prices.[14]

The implementation of the interest rate corridor (IRC) framework was adopted by the BSP in June 2016 to improve the BSP's ability to guide market interest rates and, in the process, strengthen the transmission of monetary policy adjustments to the economy. The IRC framework consists of a rate at which the BSP lends to and takes deposits from the banks. The lending rate and deposit rate will serve as the upper bound (ceiling) and lower bound (floor), respectively, for short-term market interest rates. Reforms made in the BSP's monetary operations with the adoption of IRC includes the: (i) modification in the BSP's RRP facility, which transformed the previous RRP facility to a purely overnight facility; (ii) introduction of term deposit facility (TDF), which offered 7-day, 14-day[15] and 28-day term deposits; and (iii) modification in BSP's standing liquidity facilities, which converted the special deposit account (SDA) and repurchase (RP) facility to overnight standing liquidity facilities that are available on demand during BSP business hours.[16]

The BSP always stands ready to deploy appropriate monetary policy measures in responding to challenges and evolving developments. Restrictive monetary policy conditions in the Philippines were observed from 2006Q1 to 2007Q2 – during periods where higher global oil prices strikingly hit the ASEAN countries in which the Philippines is a part of (Downes, 2007). Monetary policy tends to be contractionary in anticipation of an inflationary pressure, which usually arises from oil price shocks. Meanwhile, the GFC represents the loose monetary policy stance in the Philippines. The biggest impact of the GFC to the Philippine stock market is noted from July 2007 (Q3 2007) to August 2009 (Q3 2009). Policy rate reductions during the GFC periods aggregated to 200 basis points (Guinigundo, 2010).

4. Data and Methodology

This section details the list and structure of the variables used as well as the estimation methodology employed in this paper. In addition, the model specifications and equations estimated in this study will be elaborated.

[14] Source: BSP's Primer on Inflation Targeting.
[15] The BSP started to offer 14-day term deposit facility of 14 February 2018.
[16] Source: https://www.bsp.gov.ph/Media_and_Research/Primers%20Faqs/IRC.pdf

4.1 Variables and Data Characteristics

The paper uses quarterly unbalanced panel dataset on Philippine banking system's published balance sheets from Q1:2006-Q4:2017 to perform the empirical analysis of this research.[17] The Philippine banking system is comprised of universal, commercial, thrift, and rural/cooperative banks. However, the rural/cooperative banks are excluded in data sampling due to limitations with respect to period coverage. Table 2 summarizes the structure of the data sample employed in this research. The basic descriptive statistics of the variables used are shown in Appendix 1.

Table 2: Data sampling structure[18]

Number of time series observations	***Bank group***	***Number of banks***	***Frequency of time series observations***
48	Universal banks	20	960
44		1	44
48	Commercial banks	14	672
32		1	32
48	Thrift banks	41	1968
42		2	84
24		2	48
32		2	64
44		1	44
TOTAL		**84**	**3916**

The variables that will be used in this study is categorized into response, monetary policy, bank-specific and control. The selection of most of the variables used in this paper were based from largely-referenced and peer-reviewed studies, especially for the choice of response variable and bank-level characteristics (Kashyap & Stein, 1995; Zulkhibri, 2013; and Ehrmann et al., 2001). Table 3 describes in detail the definition of these variables.

[17] The unbalanced panel data structure is primarily due to mergers of some banks, upgrading of some rural banks into thrift banks during certain period of time, and establishment of banks at a later date (e.g., a bank is instituted in 2007, one year after 2006 which is the starting period of this study).

[18] The total number of observations in this study is 3916 which satisfies the consistency criteria of estimators because it is considered as large sample.

Table 3: Description of variables[19]

Variables		***Description***	***Reference***
response variable	Total loan portfolio	Total loan portfolio (tlp) refers to the sum of (i) loans to BSP, (ii) loans to other banks, (iii) loans and receivables-others, and, (iv) loans and receivables arising from repurchase agreements/certificate of assignment/participation with recourse/securities lending and borrowing transactions, net of amortization.	Bangko Sentral ng Pilipinas (BSP)
monetary policy indicator	Overnight reverse repurchase rate	The overnight reverse repurchase rate or borrowing rate is the Bangko Sentral ng Pilipinas' primary monetary policy instrument. RRPs are transaction between the central bank and the banks. It is the central bank's main monetary policy tool in absorbing excess liquidity from the banking system temporarily.	BSP
Bank-specific variables	Size	Bank size is measured as log of total assets of bank *i* at time *t* minus the mean of the log of total assets of all banks at time *t*.	Hernando, I. & Martínez-Pagés, J. (2003). *'Is there a bank-lending channel of monetary policy in Spain?'*
	Liquidity	Liquidity is calculated as liquid assets divided by total assets of bank *i* at time *t* minus the mean of the ratio of liquid assets to total assets in the whole sample.	
	Capitalization	Capitalization is measured by the ratio of capital and reserves (or retained earnings) to total assets of bank *i* at time *t* minus the average of the ratio capital and reserves to total assets in the whole sample.	
control variables	Real GDP	The estimates for the constant price of GDP are obtained by expressing the values in terms of a base period (i.e., 2000).	Philippine Statistics Authority (PSA)
	Consumer Price Index (CPI)	CPI is measured using 2006 prices as the base year.	BSP

[19] All variables were transformed into their natural logarithmic form, except for the bank-specific variables.

4.2 Model Specification

The specifications used in this study to estimate the model and test its robustness will be discussed in this section.

4.2.1 Baseline Model

The approach that this paper will adopt for the empirical analysis of the research questions follows that of the influential works of Gambacorta (2005) and Kashyap & Stein (2000). This study, which is applied in the Philippine context, will likewise draw empirical insights from methods applied in the context of emerging Asia (Zulkhibri 2013 and Ananchotikul & Seneviratne 2015). The following model specification that serves as the baseline model of this paper will be estimated as:

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \sum_{k=1}^{3} \omega_k X_{it-1} + \sum_{k=1}^{3} \tau_k X_{it-1} * \Delta MP_{t-1} + \theta \Delta Y_t + \delta \Delta P_t + \Delta \vartheta_i + \Delta \mu_{it} \quad (1)$$

Where Δ represents the first-difference operator, $i = 1,2, \dots N$, $t = 1,2, \dots T$, N is the total number of banks while T is the number of time series observations, L_{it} is the logarithm of total loan portfolio of bank i in period t. MP is the monetary policy indicator used in this paper to test for both the contemporaneous ($j = 0$) and delayed ($j = 1$) effects of policy rate adjustments to bank loans. This is measured by the RRP – the monetary policy rate of BSP.[20] Among the BSP's monetary policy instruments, the use of RRP in conducting open market operations (OMOs) has the most instantaneous impact in the market. This is because any monetary policy decisions regarding changes in policy rate is implemented real-time (Kashiwabara 2013). Hence, the choice of RRP as this paper's monetary policy variable.

The vector X_{it} represents the bank-specific characteristics (k): (i) size, (ii) liquidity, and (iii) capitalization. In this paper, these bank-specific criteria are normalized with respect to their mean across all banks in the sample to obtain indicators that shall sum up to zero for all observations, transforming the series as stationary (Ehrmann et al. 2001; Kashyap & Stein 1995, 2000b).[21] These measures are calculated as below:[22]

$$Size_{it} = lnTA_{it} - \frac{1}{N} \sum_{i=1}^{N} lnTA_{it} \quad (2)$$

$$Liquidity_{it} = \frac{LA_{it}}{TA_{it}} - \frac{1}{NT} \sum_{t=1}^{T} \left(\sum_{i=1}^{N} \frac{LA_{it}}{TA_{it}} \right) \quad (3)$$

[20] The BSP is the central bank of the Philippines.

[21] The paper uses one-period lag for the indicators of bank characteristics to minimize the potential endogeneity between loans and bank-specific characteristics.

[22] For the definition of these formulae, refer to Table 2 of Section 3.1 of this paper.

$$Capitalization_{it} = \frac{CAP_{it}}{TA_{it}} - \frac{1}{NT}\sum_{t=1}^{T}\left(\sum_{i=1}^{N}\frac{CAP_{it}}{TA_{it}}\right) \quad (4)$$

The interaction term between the monetary policy indicator and bank-specific factors ($MP * X$) captures the implicit impact of monetary policy changes on the growth of bank's loan provision that varies with bank-specific features (i.e., bank lending channel). These three (3) bank-specific factors are widely used in the empirical literature of bank lending channel to capture the potential existence of banks' heterogeneous lending responses to monetary policy cycles or shocks (Hernando & Martínez-Pagés 2003). The inclusion of this interaction effect is essential to isolate the indirect effect of monetary policy transmission in bank lending channel – a mechanism which is contrary to the usual interest rate channel that is known to have direct impact to banks' loan growth (Ananchotikul & Seneviratne 2015).

The model also includes real GDP (Y) and consumer price index (P) to control for the demand-side impacts on loans as well as to capture the cyclical movements in the economy (Hernando & Martínez-Pagés 2003). These control variables for the demand aspect of loans is independent of bank-specific features and is dependent upon macroeconomic factors only.

The total error term, e_{it}, is categorized into: (i) ϑ_i captures the unobserved bank-specific fixed effects; and (ii) μ_{it} which is the observation specific errors (time varying unobservables).[23] Both ϑ_i and μ_{it} follows an independent, identical distribution (IID) with zero mean and constant variance $\sim IID\ (0, \sigma^2)$.

4.2.2 Bank-specific Characteristics

To isolate the impact of each bank-specific characteristic to banks' loan supply, the following models will be run independently:

$$\Delta L_{it} = \alpha\Delta L_{it-1} + \sum_{j=0}^{1}\beta_j\Delta MP_{t-j} + \varphi Size_{it-1} + \emptyset\Delta MP_{t-1} * Size_{it-1} + \theta\Delta Y_t + \delta\Delta P_t + \Delta\vartheta_i + \Delta\mu_{it} \quad (5)$$

$$\Delta L_{it} = \alpha\Delta L_{it-1} + \sum_{j=0}^{1}\beta_j\Delta MP_{t-j} + \eta Liquidity_{it-1} + \psi\Delta MP_{t-1} * Lqd_{it-1} + \theta\Delta Y_t + \delta\Delta P_t + \Delta\vartheta_i + \Delta\mu_{it} \quad (6)$$

$$\Delta L_{it} = \alpha\Delta L_{it-1} + \sum_{j=0}^{1}\beta_j\Delta MP_{t-j} + \lambda Capital_{it-1} + \rho\Delta MP_{t-1} * Cap_{it-1} + \theta\Delta Y_t + \delta\Delta P_t + \Delta\vartheta_i + \Delta\mu_{it} \quad (7)$$

Equations (5) to (7) are estimated to test for the alternative hypothesis that bigger, more liquid and well-capitalized banks are less vulnerable to changes in policy interest rate

[23] Unobserved and exogenous factors (e.g., prudential regulations, circulars, among others) that might affect banks' lending behaviour are captured in the total error term.

vis-à-vis smaller, less liquid and poorly capitalized banks. If the parameters, $\emptyset, \psi$, and ρ, are positive then it means that the BLC of monetary policy is evident in the country.

4.2.3 Types of banks

In the Philippines, the banking system is categorized into universal and commercial banks, thrift banks, and, rural and cooperative banks. To empirically test for the third research objective of this paper, three dummy variables are generated, namely, UB, KB and TB. The UB, KB, and TB dummy takes the value of one if the bank is a universal bank, commercial bank and thrift bank, respectively, and zero otherwise. The equations below will be estimated separately:

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \sum_{k=1}^{3} \omega_k X_{it-1} + \sum_{k=1}^{3} \tau_k X_{it-1} * \Delta MP_{t-1} + \theta \Delta Y_t + \delta \Delta P_t + \boldsymbol{\varpi} \Delta \boldsymbol{MP_t} * \boldsymbol{UB} + \Delta \vartheta_i + \Delta \mu_{it} \quad (8.1)$$

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \sum_{k=1}^{3} \omega_k X_{it-1} + \sum_{k=1}^{3} \tau_k X_{it-1} * \Delta MP_{t-1} + \theta \Delta Y_t + \delta \Delta P_t + \boldsymbol{\partial} \Delta \boldsymbol{MP_t} * \boldsymbol{KB} + \Delta \vartheta_i + \Delta \mu_{it} \quad (8.2)$$

$$\Delta L_{it} = \alpha \Delta L_{it-1} + \sum_{j=0}^{1} \beta_j \Delta MP_{t-j} + \sum_{k=1}^{3} \omega_k X_{it-1} + \sum_{k=1}^{3} \tau_k X_{it-1} * \Delta MP_{t-1} + \theta \Delta Y_t + \delta \Delta P_t + \boldsymbol{\sigma} \Delta \boldsymbol{MP_t} * \boldsymbol{TB} + \Delta \vartheta_i + \Delta \mu_{it} \quad (8.3)$$

4.3 Estimation Methodology

The paper will employ the linear dynamic panel Generalized Method of Moments (GMM) model to carry out the research objectives of this study. The panel GMM estimator is referred to as dynamic because the left-hand side of model (1) or the dependent variable is dependent on its own past value. This is the reason why GMM is an increasingly popular econometric approach in investigating bank lending channel using bank-level data because of the assumption that loan growth tends to be persistent. Hence, the inclusion of lagged dependent variable (i.e., loan) as one of the regressors. The GMM technique, which was initially proposed by Arellano & Bond (1991), Arellano & Bover (1995), and later extended by Blundell & Bond (1998), was chosen due to some econometric and specification problems that can potentially arise from the untransformed version of model specified in (1). The untransformed model is without the inclusion of the first difference operator, Δ, as below:

$$L_{it} = \alpha L_{it-1} + \sum_{j=0}^{1} \beta_j MP_{t-j} + \sum_{k=1}^{3} \omega_k X_{it-1} + \sum_{k=1}^{3} \tau_k X_{it-1} * MP_{t-1} + \theta Y_t + \delta P_t + \vartheta_i + \mu_{it} \quad (9)$$

First, estimating equation (9) will result to endogeneity because of the presence of simultaneity or reverse causality in the equation wherein changes in bank-specific variables may cause variations in loan supply (dependent variable) and vice-versa. Since bank

characteristics (regressors) are not strictly exogenous, it could be correlated with variables omitted in the model (unobserved or error term). Such scenario would generate estimates that are bias and inconsistent; thereby, violating the first Gauss-Markov (GM) assumption (Wooldridge 2012). Second, the inclusion of lagged dependent variable (L_{it-1}) as one of the explanatory variables gives rise to Nickell bias (Nickell 1981). This bias arises in equation (9) since the lag of banks' loan portfolio is correlated with e_{it-1}, which is a function of the unobserved bank-specific fixed effects, ϑ_i.

The use of the two-step GMM estimator (as will be used by this paper) is designed to: (i) make endogenous variables as pre-determined by incorporating appropriate instruments in the regression; (ii) handle time-invariant, unobserved bank-specific characteristics (e.g., bank ownership) that might be correlated with the explanatory variable by using the difference GMM as in model (1); and (iii) fix heteroscedasticity and autocorrelation within banks (Roodman 2006).

The estimation for the GMM procedures use "internal" instruments (i.e., lagged differences of endogenous variables in the model) to address the endogeneity problem associated with the endogenous regressors. These instruments need to satisfy two necessary conditions – instruments must be strongly correlated with the endogenous variables and must be exogenous. The second condition is a critical one and the exogeneity of these instruments should be tested and validated. The Sargan or Hansen tests are the standard metric for examining the "over-identifying restrictions" in the model. Between these two tests, the Hansen test is more reliable for a two-step difference GMM since it generates consistent estimates for the coefficients and better or robust standard errors (Roodman 2006). The Hansen test also ensures that there is no "over-instrumentation", which implies that the number of internal instruments should be limited by reducing the number of lags (i.e., preferably by using one to four lags) and 'collapsing' instruments (ibid).[24]

Meanwhile, since the lagged differences of the endogenous variables are used as the instruments of the model, autocorrelation is a potential problem. Hence, the second order autocorrelation test must be conducted to detect whether serial correlation exists or not. A further diagnostic for testing and validating the strength of the instruments used in the model is the "weakiv" or the weak instrument robust tests. To conclude that the internal instruments used are strong, the p-values of these statistics should be greater than 0.01, 0.05, and 0.10 (Stock, Wright & Yogo 2002).[25]

4.4 Robustness of the model

Dynamic panel data (DPD) models include four types, namely, (i) standard difference-GMM; (ii) standard system-GMM; (iii) difference-GMM with orthogonal deviations; and (iv) system-GMM with orthogonal deviations (Roodman 2009).[26] To test the robustness of the model used in this study (i.e., standard difference-GMM), the other types of DPD models will

[24] Collapsing the instruments refers to restricting the lag ranges used in the creation of instruments.

[25] In these tests, the null hypothesis that the instruments are strong should NOT be rejected.

[26] The orthogonal deviations GMM, which was proposed by Arellano & Bover (1995), is a type of GMM procedure that preserves the sample size especially with strong unbalanced panel data because it subtracts the past observation from the average of all available observations (Roodman 2006).

be conducted. The standard difference-GMM and system-GMM both employ first difference in the estimation; but, only the latter includes level or constant in the estimation. The system-GMM tends to use more instruments than difference-GMM because of the inclusion of level in the estimation (Roodman 2006).

Moreover, to ensure the robustness of testing the existence of bank lending channel in the Philippines, the interaction terms between the monetary policy indicator and bank-specific characteristics are classified according to size, liquidity ratio, and capital ratio (capital and reserves to total assets). The classification was conducted to draw further insights on the heterogeneous lending responses of banks to monetary policy shocks (Zulkhibri 2013). Banks are categorized as $small_{it}$ or $large_{it}$ if bank $i's$ total assets at time t falls at the bottom or upper 25 percentiles of the distribution, respectively. Less and high liquid banks are classified as $lliquid_{it}$ or $hliquid_{it}$ if bank $i's$ ratio of liquid assets to total assets is at the bottom or upper 25 percentiles of the distribution, respectively. And, banks are either poorly-capitalized ($lcapital_{it}$) or well-capitalized ($hliquid_{it}$) if bank $i's$ ratio of capital and reserves to total assets falls at the bottom or upper 25 percentiles of the distribution, respectively.

5. Empirical Results

A detailed interpretation and analysis will be provided in this section on the following topics: (5.1) impact of monetary policy to bank lending; (5.2) impact of bank-specific characteristics; (5.3) differential effects of monetary policy to bank lending; (5.4) impact of type of banks; and (5.5) dynamic panel data model selection.

Table 4 provides the parameter estimates for equations 1 and 5-7, which are specified in Sections 4.2.1 and 4.2.2 of this paper, respectively. The preceding discussion of the results will pertain to the column of equation (1) or the full model, unless otherwise stated.

5.1 Impact of Monetary Policy to Bank Lending

The result shows that the impact of monetary policy rate to bank lending is contemporaneous and is consistent with the standard effect of contractionary monetary policy (Table 4). The coefficient for the policy rate is significant across models, -0.36 in the full model and in a range of -0.36 to -0.69 in equations (5) to (7). This implies that a one percent increase in the policy rate will lead to a decrease in banks' loan supply growth by 0.36 percent (Table 4, equation 1). As the cost of borrowing money increases following a tight monetary policy, lending activity in the economy is estimated to decrease on the average.

The coefficient for the lagged value of banks' total loan portfolio is statistically significant in all estimations (Table 4: equations 1, 5, 6 and 7), which means that the past loan provision of the banks affects their current lending. It indicates that if loan supply is higher (lower) in the previous period, then current loan provision is expected to increase (decrease). A one percent increase in the previous lending of banks is estimated to increase current period's loan provision by 0.50 percent (Table 4, equation 1).

With regard to the control variables, while GDP has the expected coefficient, it is statistically not different from zero. The estimated coefficient for CPI is positively significant across equations, which is expected since a one percent increase in price level tends to increase growth of loan supply (in nominal terms) by 1.54 percent.[27]

Table 4: Models for Bank-Specific Features

Independent Variables	**FULL (eq. 1)**	**SIZE (eq. 5)**	**LIQUIDITY (eq. 6)**	**CAPITAL (eq. 7)**
ΔL_{it-1}	0.50***	0.49***	-0.16***	-0.17***
	(0.09)	(0.15)	(0.04)	(0.05)
ΔMP_t	-0.36*	-0.36**	-0.69***	-0.54***
	(0.20)	(0.18)	(0.13)	(0.15)
ΔMP_{t-1}	0.03	0.15	0.31***	0.28***
	(0.27)	(0.33)	(0.08)	(0.08)
Impact of bank-specific characteristics to bank lending				
$Size_{it-1}$	-0.62	-0.37		
	(0.48)	(0.91)		
$Liquidity_{it-1}$	0.67***		0.60**	
	(0.26)		(0.29)	
$Capital_{it-1}$	-0.56)			-0.34
	(0.39)			(0.37)
Differential effects of monetary policy to bank lending				
$\Delta MP_{t-1} * Size_{it-1}$	-0.06	-0.05*		
	(0.06)	(0.03)		
$\Delta MP_{t-1} * Lqd_{it-1}$	-0.34**		-0.37**	
	(0.15)		(0.17)	
$\Delta MP_{t-1} * Cap_{it-1}$	0.19			0.23
	(0.20)			(0.19)
Control variables				
ΔY_t	0.08	0.05	0.08	0.06
	(0.10)	(0.09)	(0.07)	(0.07)
ΔP_t	1.54***	1.75***	3.54***	3.82***
	(0.41)	(0.59)	(0.37)	(0.39)
# of IV	20	10	18	18
Hansen p-value	0.31	0.40	0.16	0.18
AR(2) p-value	0.23	0.33	0.16	0.18
# of banks	84	84	84	84
# of obs	3,748	3,748	3,748	3,748

*Note: Robust standard errors in parentheses; ***, **,* denotes p-value less than the 1%, 5% and 10%, respectively; the instruments used in the GMM estimation includes lags one (1) to four (4) only to avoid "over-instrumentation". The Hansen and AB autocorrelation tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

[27] This is because variables that are expressed in nominal terms is measured as real plus price level.

5.2 Impact of Bank-specific Characteristics

In terms of the impact of bank-specific characteristics to banks' loan supply, liquidity turned out to be the most important bank-specific feature. In interpreting these coefficients, it is important to refer to equations (2) to (4) of this paper for appropriate analysis. Since all the bank-specific characteristics are measured in terms of deviations with respect to the bank averages in the whole sample, these variables are time-invariant which means that interpretation is not based on the changes or development (e.g., increase or decrease in assets) of each bank specific indicator.[28]

Liquidity has the expected positive coefficient which implies that more liquid banks significantly influence bank lending than less liquid banks as the former have more stock of liquid assets which they can draw from to support their bank-lending activity. This result is consistent with a number of empirical literature on bank lending (Heryán & Tzeremes 2017; Matousek & Sarantis 2009; Zulkhibri 2013). The estimated coefficient for liquidity implies that highly-liquid banks are estimated to impact the growth rate of banks' loan supply by 0.67 percent more than less liquid banks.

5.3 Differential Effects of Monetary Policy to Bank Lending

To test the existence of banks' heterogeneity in their lending responses when there is monetary policy adjustments (i.e., bank lending channel), this paper used the interaction term between bank-specific characteristics and monetary policy rate. The results are reported in Table 4. If bank-lending channel of monetary policy is evident, the coefficient for the interaction terms should be positively significant. To answer the first research objective of this paper, three bank-lending channel hypotheses are tested.

First, $\frac{\partial^2 \Delta L_{it}}{\partial \Delta MP_t * \partial Size_{it-1}} > 0$, means that lending of large banks is less sensitive to contractionary monetary policy than the lending of small banks because the former can easily have access to external financing or other sources of financing than the latter (Matousek & Sarantis 2009). Second, $\frac{\partial^2 \Delta L_{it}}{\partial \Delta MP_t * \partial Liquidity_{it-1}} > 0$, implies that more liquid banks are still able to sustain and insulate their lending activity even in times of monetary tightening vis-à-vis less liquid banks. This is because of the premise that the more liquid banks can draw from their stock of liquid assets to support their lending activity during monetary contraction. Third, $\frac{\partial^2 \Delta L_{it}}{\partial \Delta MP_t * \partial Capital_{it-1}} > 0$, indicates that well-capitalized banks react less to changes in monetary policy position than less-capitalized banks based on the grounds that the former holds more capital buffers than the latter (ibid).

Based on the foregoing postulates and results from Table 4, this paper finds weak evidence for the existence of bank-lending channel of monetary policy in the Philippines. Contrary to the result when bank liquidity (non-interacted variable) positively impacts bank loan supply growth without any monetary policy adjustments, highly-liquid banks react

[28] Caveat: the negative coefficient of the size should **not** be interpreted in this way – "As bank i's total assets increase, loan supply growth tends to decrease."

differently and strongly in times of contractionary monetary policy. The negative coefficient result from this study, albeit disagreeing with the standard bank-lending channel theory, is similar with the findings of Hernando & Martínez-Pagés (2003), Farinha & Marques (2001), Heryán & Tzeremes (2017) for new EU countries before GFC periods, and Matousek & Sarantis (2009) for Hungary and Poland.[29]

The negative sign for bank liquidity interacted with monetary policy rate implies that highly-liquid banks are more sensitive to monetary tightening than less liquid banks. More liquid banks are less likely to draw down their stock of liquid assets to sustain or insulate their lending during periods of contractionary monetary policy. These banks would rather hold their liquid assets as buffers against contingencies or financial crises. The risk-averse stance of the Philippine banking system could be traced from the Philippine experience during the Asian Financial Crisis (AFC). Following the AFC, the BSP took some pre-emptive regulatory measures that required banks to maintain 30 percent liquid asset cover against foreign currency deposits (Singson 1998). Moreover, liquid assets are used as emergency loans "on a fully secured basis in accordance with law" for banks (usually less liquid ones) that faced liquidity problems during periods of crisis (ibid). Banks have been risk-averse, which prompted them to reduce their credit provision for investment purposes (Guinigundo, 2005).

To ensure the robustness of testing the existence of bank lending channel in the Philippines, the interaction terms between the monetary policy indicator and bank-specific characteristics are classified according to banks' size, liquidity ratio, and capital ratio. These bank-specific characteristics, by category are presented in Table 5.

Table 5: Bank-specific characteristic by category (*in logs*)[30]

Percentiles	Size		Liquidity		Capitalization	
	small	*large*	*less liquid*	*highly-liquid*	*poorly capitalized*	*well-capitalized*
1%	4.203		1.318		0.711	
5%	4.781		1.825		1.266	
10%	5.236		2.181		1.703	
25%	6.709		2.675		2.278	
50%	9.189		3.250		2.674	
75%		11.093		3.645		3.436
90%		12.491		3.881		3.934
95%		13.164		4.036		4.124
99%		14.112		4.307		4.536

Author's estimates

[29] Hernando & Martínez-Pagés (2003) finds some evidence that banks with low level of liquidity react more strongly than more liquid banks, but this is not purely explained by loan-supply response.

[30] Interpretation: The 25 percentile of banks have an asset size equivalent to 6.71 in logs.

Table 6: Models for bank-specific features by category

Independent Variables	**SIZE (eq. 5)**	**LIQUIDITY (eq. 6)**	**CAPITAL (eq. 7)**	**FULL (eq. 1)**
ΔL_{it-1}	0.49***	-0.19***	-0.17***	0.53***
	(0.82)	(0.04)	(0.04)	(0.11)
ΔMP_t	-0.02	-0.59***	-0.62***	-0.32**
	(0.43)	(0.14)	(0.14)	(0.14)
ΔMP_{t-1}	-0.77	0.37***	0.42***	0.21
	(0.98)	(0.09)	(0.16)	(0.18)
Impact of bank-specific characteristics to bank lending				
$Size_{it-1}$	-0.61			-0.28
	(0.43)			(0.30)
$Liquidity_{it-1}$		0.09		0.18***
		(0.07)		(0.04)
$Capital_{it-1}$			0.05	-0.06
			(0.14)	(0.15)
Differential effects of monetary policy to bank lending, by category of bank-specific features				
$\Delta MP_t * Small$	0.46			0.36
	(0.28)			(0.24)
$\Delta MP_t * Large$	0.15			0.11
	(0.10)			(0.12)
$\Delta MP_t * Lliquid$		-0.04		0.06
		(0.20)		(0.06)
$\Delta MP_t * Hliquid$		-0.24**		-0.08**
		(0.10)		(0.03)
$\Delta MP_t * Lcapital$			-0.09	-0.002
			(0.08)	(0.06)
$\Delta MP_t * Hcapital$			-0.08	-0.07
			(0.16)	(0.11)
Control variables				
ΔY_t	-0.18	0.06	0.07	0.05
	(0.21)	(0.07)	(0.05)	(0.10)
ΔP_t	1.28	3.89***	3.71***	1.86***
	(0.78)	(0.42)	(0.36)	(0.41)
# of IV	9	14	15	30
Hansen p-value	0.64	0.82	0.56	0.14
AR(2) p-value	0.40	0.15	0.23	0.17
# of banks	84	84	84	84
# of obs	3,748	3,748	3,748	3,748

*Note: Robust standard errors in parentheses; ***, **,* denotes p-value less than the 1%, 5% and 10%, respectively; the instruments used in the GMM estimation includes lags one (1) to four (4) only to avoid "over-instrumentation". The Hansen and AB autocorrelation tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

Table 6 highlights the results of the impact of bank-specific characteristics on bank lending by category to test the robustness of the results from Table 4. The signs of the estimated coefficients for $Liquidity_{it-1}$ and $\Delta MP_t * Hliquid$ (Table 6), which are statistically significant, are consistent with the results in the baseline or full-model specification in Table 4. The negative sign for the interaction term between monetary policy rate and highly-liquid

banks supports the aforementioned argument of this paper that banks with high level of liquidity tend to be more sensitive when there is monetary tightening.

5.4 Impact of Type of Banks

Table 7: Models for Different Types of Banks

Independent Variables	**UNIVERSAL (eq.8.1)**	**COMMERCIAL (eq.8.2)**	**THRIFT (eq.8.3)**
ΔL_{it-1}	0.51***	0.51***	0.50***
	(0.10)	(0.09)	(0.08)
ΔMP_t	-0.70**	-0.51*	-0.29
	(0.30)	(0.28)	(0.19)
ΔMP_{t-1}	0.75	0.41	0.37
	(0.52)	(0.57)	(0.30)
Impact of bank-specific characteristics to bank lending			
$Size_{it-1}$	-0.05	-0.47	-0.27
	(0.48)	(0.54)	(0.28)
$Liquidity_{it-1}$	0.81**	0.72**	0.78**
	(0.40)	(0.32)	(0.34)
$Capital_{it-1}$	-0.32	-0.45	-0.44
	(0.34)	(0.35)	(0.30)
Differential effects of monetary policy to bank lending			
$\Delta MP_{t-1} * Size_{it-1}$	-0.09	-0.06	-0.091
	(0.07)	(0.06)	(0.08)
$\Delta MP_{t-1} * Lqd_{it-1}$	-0.43**	-0.37**	-0.402**
	(0.20)	(0.17)	(0.18)
$\Delta MP_{t-1} * Cap_{it-1}$	0.13	0.16	0.174
	(0.18)	(0.18)	(0.17)
Impact of type of banks to bank lending			
$\Delta MP_t * UB$	0.42		
	(0.31)		
$\Delta MP_t * KB$		0.08	
		(0.36)	
$\Delta MP_t * TB$			-0.31
			(0.36)
Control variables			
ΔY_t	0.15	0.11	0.09
	(0.15)	(0.14)	(0.11)
ΔP_t	2.31***	1.98***	2.03***
	(0.65)	(0.60)	(0.55)
# of IV	20	20	20
Hansen p-value	0.27	0.31	0.37
AR p-value	0.13	0.19	0.15
# of banks	84	84	84
# of obs	3,748	3,748	3,748

*Note: Robust standard errors in parentheses; ***, **,* denotes p-value less than the 1%, 5% and 10%, respectively; the instruments used in the GMM estimation includes lags one (1) to four (4) only to avoid "over-instrumentation". The Hansen and AB autocorrelation tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

To test for the second research objective of this paper, equation 8 (refer to Section 4.2.3) was estimated and the results are reported in Table 7. Contrary to the findings of Zulkhibri (2013), this paper finds no evidence of significance of type of banks to changes in bank loan supply and that loan provision is not determined by the class or type of a bank as presented in Table 7. This result, to some extent, provides support to the widely-held view in a number of literature that bank lending is often affected by the three major bank-specific characteristics (i.e., size, liquidity and capitalization).

5.5 Dynamic Panel Data (DPD) Model Selection

The baseline model of this paper, which was specified in Section 4.2.1, was tested for robustness by estimating equation (1) using the four types of DPD models. Table 8 shows the estimates for equation (1) under the four different types of DPD models, namely, diff-GMM, sys-GMM, diff-GMM (orthogonal), and sys-GMM (orthogonal).

Based on the results in Table 8 below, the standard difference-GMM model is selected as the best DPD technique on a number of econometric specifications. First, the Hansen p-value shows that we cannot reject the null hypothesis and conclude that the instruments used in the GMM estimation are valid and exogenous. Second, the Arellano-Bond (AB) autocorrelation test of order two (AR 2) indicates that there is no second-order autocorrelation in the idiosyncratic residuals under the difference-GMM model. Third, the number of lags included in the estimation are fewer under this type of DPD technique compared to other models, which circumvents the potential problem of over-instrumentation.

The choice for the diff-GMM model is further strengthened by conducting the weak instrument robust tests. Table 9 confirms that the diff-GMM is the best technique among the DPD models since all the instruments used in the GMM estimation are exogenous and robust. In all the "weakiv" tests (CLR, K, J, K-J, and AR), the null hypothesis that the instruments used are robust and exogenous was never rejected under the standard diff-GMM (i.e., p-value is greater than 0.01, 0.05 and 0.10).

Table 8: Dynamic Panel Data Model Selection

Independent Variables	**diff-GMM: standard**	**sys-GMM: standard**	**diff-GMM: orthogonal**	**sys-GMM: orthogonal**
ΔL_{it-1}	0.50***	0.71***	0.79***	0.80***
	(0.09)	(0.06)	(0.07)	(0.04)
ΔMP_t	-0.36*	-0.26***	-0.12	-0.17*
	(0.20)	(0.08)	(0.23)	(0.10)
ΔMP_{t-1}	0.03	0.30***	0.17	0.21**
	(0.27)	(0.12)	(0.20)	(0.10)
Impact of bank-specific characteristics to bank lending				
$Size_{it-1}$	-0.62	0.32***	0.30	0.20***
	(0.48)	(0.08)	-0.44	(0.05)
$Liquidity_{it-1}$	0.67***	-0.20**	-0.05	-0.12*
	(0.26)	(0.09)	(0.19)	(0.06)
$Capital_{it-1}$	-0.56	-0.13	-0.17	-0.11
	(0.39)	(0.10)	(0.38)	(0.10)
Differential effects of monetary policy to bank lending				
$\Delta MP_{t-1} * Size_{it-1}$	-0.06	-0.01	0.00	0.01
	-0.06	(0.01)	(0.03)	(0.01)
$\Delta MP_{t-1} * Lqd_{it-1}$	-0.34**	0.10*	0.02	0.03
	(0.14)	(0.06)	(0.10)	(0.05)
$\Delta MP_{t-1} * Cap_{it-1}$	0.19	0.08	0.09	0.05
	(0.20)	(0.07)	(0.11)	(0.05)
Control variables				
ΔY_t	0.08	-0.02	0.02	0.07
	(0.10)	(0.09)	(0.15)	(0.08)
ΔP_t	1.54***	0.92***	0.59*	0.52***
	(0.41)	(0.25)	(0.35)	(0.17)
_cons		-1.81		-1.88***
		(1.22)		(0.63)
# of IV	20	31	20	31
Hansen p-value	0.31	0.22	0.01	0.03
AR (2) p-value	0.23	0.03	0.03	0.04
# of banks	84	84	84	84
# of obs	3,748	3,832	3,748	3,832

*Note: Robust standard errors in parentheses; ***, **,* denotes p-value less than the 1%, 5% and 10%, respectively; the instruments used in the GMM estimation includes lags one (1) to four (4) only to avoid "over-instrumentation". The Hansen and AB autocorrelation tests show that the instruments are valid and there is no autocorrelation, respectively (p-value is greater than 0.10, 0.05, and 0.01).*

Table 9: Weak Instrument Robust Tests

DYNAMIC PANEL DATA MODELS								
Tests	Diff-GMM		Sys-GMM		Diff-GMM with orthogonal		Sys-GMM with orthogonal	
	Statistic	pvalue	Statistic	pvalue	Statistic	pvalue	Statistic	pvalue
CLR	0.82	1.00	4.68	1.00	28.72	0.03	18.83	0.37
K	0.67	1.00	1.97	1.00	10.83	0.46	8.63	0.66
J	9.47	0.40	26.53	0.12	22.66	0.01	28.37	0.08
K-J	<n.a.>	1.00	<n.a.>	0.53	<n.a.>	0.03	<n.a.>	0.36
AR	10.14	0.97	28.5	0.54	33.48	0.03	37.00	0.18

Note: For details of the different tests, see Finlay, Magnusson & Schaffer (2016)

6. Conclusion

The Philippine banking system still remains to be the major source of credit to the formal institutional sectors in the economy and, in part, the force behind the economy's strong macroeconomic fundamentals and relatively upbeat economic performance on the average. As the credit provision of banks is channelled to consumption and investment spending, aggregate demand also increases. However, banks' loan supply is fundamentally affected by changes in monetary policy rate. Hence, understanding banks' lending responses to monetary policy shocks is imperative. This paper investigated the existence of bank lending channel of monetary policy transmission by using the three major bank-specific characteristics (size, liquidity and capitalization) as indicators for testing heterogeneity in bank lending responses to monetary tightening.

The following are the highlights of this paper's findings: First, among the three bank-specific features, liquidity is the significant predictor for bank lending in the Philippines. The result that highly liquid banks positively affect banks' loan supply more than less liquid banks is broadly consistent with the theoretical and empirical literature. Second, the transmission of monetary policy under contractionary monetary policy stance matter in influencing bank lending wherein tight monetary condition restricts banks' lending activity. Third, the different types of banks (i.e., universal, commercial and thrift) do not significantly affect bank lending, an indication that it is not the classification of banks that matter but the specific balance sheet features of the banks.

The last and main finding of this research is that the BLC of monetary policy transmission in the Philippines is non-existent. In particular, highly liquid banks react more strongly than less liquid banks when central bank tightens monetary policy, reflecting the risk-averse and conservative lending stance of the Philippine banking system. More liquid banks would rather hold their level of liquid assets as buffers against contingencies or impending financial crises than withdraw from these assets to insulate or sustain their lending activity in times of monetary tightening. Liquid assets are used as emergency loans "on a fully secured basis" for banks that encounter liquidity problems during periods of financial crises. Moreover, as policy rate has risen, then cost of borrowing would likewise rise and it would increase the likelihood of loan default as borrowers would find it hard to pay off their debt obligations. Hence, it is sensible to presume that it would be more prudent for banks to restrict

their lending during contractionary monetary policy to put off potential credit risk exposure. These developments could have weakened the transmission of monetary policy via the BLC.

Meanwhile, the empirical findings of this research about the non-existence of BLC in the Philippines have important implications on the role of the central bank of the Philippines or the BSP. While the BSP's primary mandate is to maintain price stability, it has also a special role in maintaining the financial stability of the country. In the central bank's conduct of monetary policy to achieve its primary goal, it can inevitably affect the system's financial stability. If the monetary policy is tight, it can adversely affect the borrowers' capacity to pay, which, in turn, makes the banks susceptible to risk exposure and loan defaults (Guinigundo, 2017). From this financial stability standpoint, it can be inferred that the findings of this paper about highly-liquid banks being more sensitive to monetary contraction supports the stance of the BSP to implement prudent regulatory standards that would keep the financial system resilient even in the midst of financial crisis. Among these risk management measures enacted by the BSP include the following: (i) the threshold for the BSP's capital adequacy ratio requirement of 10 percent exceeds that of the 8 percent requisite of BASEL III; and (ii) introduction of the Net Stable Funding Ratio (NSFR) last June 2018 to complement the Liquidity Coverage Ratio (LCR) to fortify banks' resiliency against liquidity stress (Bangko Sentral ng Pilipinas 2018).

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Appendix 1: Descriptive Statistics[31]

VARIABLES	(1) Number of observations	(2) Mean	(3) Std. Dev.	(4) Min	(5) Max
Real GDP (log)	4032	14.26	0.20	13.91	14.67
Consumer price index (log)	4032	4.83	0.13	4.59	5.01
Overnight_RRP (log)	4032	1.46	0.27	1.10	2.01
Total loan portfolio (log)	3916	8.17	2.84	0.30	14.37
Total assets (log)	3916	8.97	2.70	3.84	14.75
Liquid assets (log)	3916	7.49	2.76	1.74	13.33
Size (log)	3916	0.00	2.68	-5.21	5.25
Liquidity (log)	3916	0.00	0.69	-3.52	1.45
Capitalization (log)	3916	0.00	0.85	-3.50	2.52

[31] Variables with missing data or observations were dropped in running the model as the technique that this research will use is first-difference GMM.

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