Does the bank credit channel of monetary policy matter in the Philippines?

Veronica B. Bayangos [1]
Bangko Sentral ng Pilipinas

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Abstract

This paper addresses the bank credit channel of monetary policy in the Philippines by adding and re-specifying a dynamic, structural, economy-wide macro econometric model. The main question is whether the credit channel matters in transmitting impulses to the real economy in the Philippines. The evidence on the bank credit channel is obtained by estimating changes in bank credit that take into account not only the monetary policy indicators, but specific banking indicators to monetary policy actions, such as bank capital. Simulation results suggest that bank credit channel matters in Philippine monetary transmission mechanism. The total demand impact of changes in bank credit is the sum of various effects in the money supply, Treasury bill and lending rates, personal consumption and investment, all of which have significant impact on aggregate demand. However, the impact of a monetary policy tightening on output appears to be relatively moderate and quite long. Meanwhile, the impact on the price level appears to be stronger and shorter compared to the impact on output. In addition, bank capital is found to have significant effects on bank credit, implying that it could potentially be a key determinant of monetary policy transmission. The preliminary results also indicate a feedback loop from real output to bank credit through the financial accelerator and wealth effects.

Corresponding author: Veronica B. Bayangos (vbayangos@bsp.gov.ph)
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[1] Veronica Batallones Bayangos is a Senior Economist from the Center for Monetary and Financial Policy (CMFP) of the Bangko Sentral ng Pilipinas (BSP). This paper is part of the Third Annual Asian Research Network Workshop co-organized by the Bank for International Settlements (BIS) and the Bank of Japan (BoJ) held in Chiba, Japan on 25-26 March 2010. I would like to thank Dr. Josef Yap, President of the Philippine Institute for Development (PIDS) in Manila, Philippines, Mr. Adrian Ng from the Monetary Authority of Singapore (MAS) and the participants from the workshop for their comments and insights. I am solely responsible for any remaining errors. The views expressed in this paper are mine and no responsibility should be attributed to the BSP.

1. Introduction

The way in which changes in monetary policy are transmitted into the real economic activity has always been a topic of great interest to economists and monetary authorities. Banks have the expertise in extending credit to borrowers, especially those who do not have access to other types of credit. If banks adjust their loan supply following a change in the stance of monetary policy, it is expected that such an adjustment influences the real sector activity to the extent that some borrowers have to reschedule their spending decisions.[2]

In the recent decade the so-called credit channel has received much attention in the monetary policy transmission debate (Boughrara and Ghazouani 2009; Huelsewig et al. 2005; Altunbas et al. 2004; Angeloni et al. 2003; and de Bondt 2000). The credit channel focuses on the special role banks play in the financial system, arising from the fact that banks ameliorate asymmetric information problems between borrowers and lenders, and also by the fact that large fluctuations in the aggregate economy are often brought by small shocks under the financial accelerator hypothesis. However, the empirical relationship between bank credit and growth is complicated by problems of endogeneity, associated difficulties in finding adequate instruments to explain the behavior of bank credit and identification issues.

It is to be expected that when credits extended by banks are steadily increasing such as in the Philippines, they are likely to have significant macroeconomic effects. The focus of this paper is on estimating the quantitative importance of bank credit at a macroeconomic level.

This paper modifies the Bayoumi and Melander (2008) framework for policy analysis of macro-financial linkages. While the Bayoumi and Melander (2008) used the reduced-form methods, this paper uses the approach that builds on adding and re-specifying a dynamic, structural, economy-wide macro econometric model of the Philippines from 1999 to 2009 to examine the bank credit channel of monetary transmission. The contribution of this paper is that bank credit has been explicitly introduced into the model as an endogenous variable with a number of impacts on the macro economy. The evidence on bank credit channel is obtained by estimating a bank credit behavior that takes into account not only the monetary variables but also specific banking indicators to monetary policy actions such as bank capital and non-

[2] See page 2 of Huelsewig et al. (2005). Huelsewig et al. (2005) assumes that some borrowers particularly small and medium-sized firms are having difficulty on issuing corporate bonds at reconcilable terms because of informational problems or high costs associated with launching debt securities. Banks as financial intermediaries specialize in gathering and distilling information lead them to make loans to those borrowers at more favorable terms.

performing loans. The main question is whether the bank credit channel matters in transmitting impulses to the real economy in the Philippines.

Simulation results suggest that bank credit channel matters in Philippine monetary transmission mechanism. The total demand impact of changes in credit is the sum of various effects in the money supply, Treasury bill and lending rates, personal consumption and investment, all of which have significant impact on aggregate demand. However, the impact of a monetary policy tightening on real output appears to be relatively moderate and quite long. Meanwhile, the impact on the price level appears to be stronger and shorter compared to the impact on the real output. In addition, bank capital is found to have significant effects on bank credit, implying that it could potentially be a key determinant of monetary policy transmission. The preliminary results also indicate a feedback loop from the aggregate demand to bank credit through the financial accelerator and wealth effects. This latter finding underscores the overall sentiment of this paper to look further into the behavior of credit channel in the Philippines to include banking conditions.

The rest of the paper is organized as follows: The next section presents the links of the study to recent literature, highlighting the conceptual structure of bank credit channel and the existing empirical evidence from selected studies, including the Philippines. Section 3 describes the macro model and methodology used in this paper. Section 4 presents the main findings, before a discussion of some caveats in the macro model in Section 5. Section 6 concludes.

2. Links to the literature

Much of the previous empirical literature on the effects of credit aims to distinguish between different transmission mechanisms, such as the balance sheet channel, the bank lending channel and the bank capital channel.[3] Since these different channels have similar predictions for aggregate quantities, many empirical studies use micro-level data from banks and/or firms rather than the aggregate data (Bayoumi and Melander 2008). One consequence of these empirical studies is that the general conditions of the banking sector and the specific characteristics of individual banks can have predictable impacts on the monetary policy transmission. A critical element of the monetary policy process is knowledge of the quantitative effects of these policy actions.

[3] See Oliner and Rudebusch (1996) (balance sheet channel vs bank lending channel) and van den Heuvel (2002; 2007) (bank capital channel vs bank lending channel).

However, the precise role played by banks in the monetary policy process remains controversial. The focus of this debate is whether credits extended by banks play a significant role in the monetary policy transmission. If a special lending or credit channel exists, changes in the willingness and ability of banks to extend credit may have implications for aggregate economic activity. Moreover, changes in the role of banks in financial markets may affect the credit channel, hence, may alter the monetary transmission mechanism. This paper provides a preliminary quantitative assessment of bank credit channel of monetary policy in the Philippines.

The workhorse of general equilibrium models typically does not feature explicitly the financial accelerator or the credit channel of monetary policy. It may be argued that it is not difficult to play down the role of financial conditions in short-term economic dynamics. In fact, the 1997 Asian financial and currency crises and the 2008 global financial crisis offered strong evidence that the financial system can severely impact the real sector. In addition, the theoretical work also showed that credit becomes non-trivial for consumption and investment, once frictions are taken into account (Gertler 1988). Some study the role of specific intermediaries (Gerali et al. 2009) while some have broken down credit into its detailed components (Bernanke and Gertler 1995; Van den Heuvel 2002).

Efforts to analyze the interaction between credit and monetary policy include studies by Bernanke et al. (1999), Carlstrom and Fuerst (2001), Van den Heuvel (2002), Iacoviello (2005). These empirical studies on the importance of bank lending or credit channel of monetary policy fall into two broad strategies. The first strategy relies on aggregate data. It usually involves examining the reaction of bank loans, deposits and bonds to monetary policy shocks, using impulse response functions from a vector-autoregression (VAR) model and reduced-form methods. These methods, however, do not allow the quantitative identification of supply and demand effects on credit growth. Therefore, the evidences obtained using such methods are typically treated as indicative only.

A number of studies based on VAR have examined whether the credit channel is operating alongside the interest rate channel by using aggregate data. Many studies have shown that bank loans decline after a monetary policy shock, but these findings are weighed down by the identification problems, as it remains unclear whether the drop is driven by the loan supply or loan demand effects. While the credit channel emphasizes a shift in loan supply, the interest rate channel stresses a shift in loan demand, which stems from a policy-induced decline in real activity. Huelsewig et al. (2005) claimed that distinguishing between these predictions is a

difficult task as it is not possible using reduced-form estimates based on aggregate data alone, to identify whether bank balance sheet contractions are caused by shifts in loan supply or loan demand.

The second strategy uses bank-level data. Such a strategy attempts to identify shifts in loan supply from shifts in loan demand. The presumption is that certain bank characteristics determine the degree to which banks respond to monetary policy shocks. Most studies specify loan growth for each bank as a function of its lagged values, aggregate variables (GDP growth, short-term interest rate change, and inflation) and bank-specific characteristics (size, liquidity and capitalization). However, in most studies, this strategy does not address the issue that the change in monetary policy may not be exogenous, which makes it hard to identify the true effect of higher interest rates on loan supply.

This paper's strategy is to estimate the quantitative importance of credit channel at a macroeconomic level that includes the relevant institutions, markets and agents and the various interactions between them. Such an approach gives a better insight into the relative quantitative impact of changes in bank credit on the Philippine macro economy.

The Bayoumi and Melander (2008) model provides an empirical approach in tracing the impact of changes from the capital to asset ratio of banks to bank lending standards to credit supply and finally to aggregate spending. In addition, the framework highlights the financial accelerator and wealth feedback loops.

The first link is from the capital to asset ratio to bank lending standards. Capital requirements on banks are imposed by regulators and/or market discipline, so a negative shock on capital to asset ratio constrains the capacity for lending. Thus, banks are induced to tighten their lending standards in order to reduce the quantity of credit and restore the capital to asset ratio. Lending standards are non-price loan terms, which reflect credit availability. A tightening of lending standards causes a decrease in the quantity of credit. When credit availability falls, there is a direct effect on spending due to credit constraints, notably through consumption and investment.

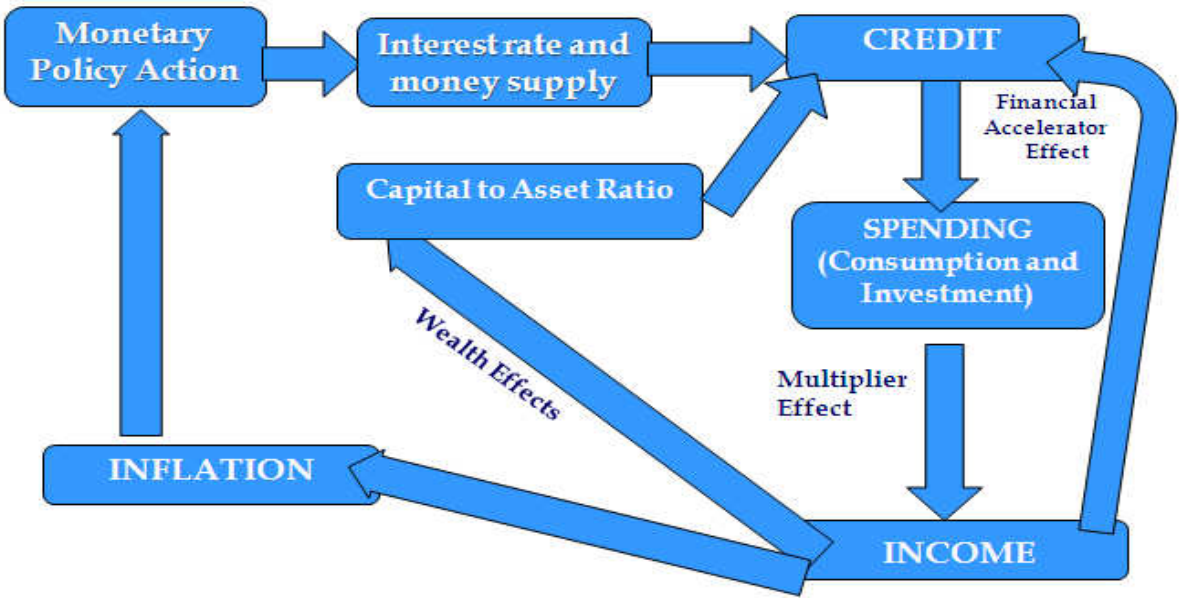
The final link is the feedback loop from income through the balance sheets of banks.[4] The feedback takes place through two different channels. The first channel works through the effect of an economic slowdown on bank balance sheets. As spending and income fall, loan losses

[4] In Bayoumi and Malender (2008), the balance sheets of firms and households from the flow of funds analysis for the United States were used. In the absence of a longer series of the flow of funds analysis for the Philippines, the estimation considered the consolidated balance sheet of banks (universal/commercial, thrift and rural banks).

gradually increase and the capital to asset ratio deteriorates further. The second feedback channel is due to deterioration of incomes and balance sheets for households and firms, which has a further adverse financial-accelerator effect on credit availability.

Taking these feedback mechanisms into account, the final effect of a capital to asset ratio shock on aggregate economic activity is larger than the direct effect. Eventually, as bank credit declines while the capital to asset ratio starts to improve. Bank deleveraging causes a decrease in the denominator of the capital to asset ratio, which increases the overall ratio.

Figure 1: Modified Bayoumi and Melander (2008) Framework



Source of basic framework: Bayoumi and Melander (2008).

In the Philippines, the empirical evidence on the bank credit channel is scarce. Using a single-equation estimation method using the generalized method of moments (GMM) to trace the impact of macro-financial linkages in the Philippines from 1999 to 2009, preliminary results in Bayangos (2010) indicate that while the transmission of monetary policy through the interest rate and exchange rate channels have become more pronounced during the inflation targeting (IT) period (1999-2002), bank credit channel matters in transmitting impulses to the real economy. To our knowledge, the existing studies so far only applied a single-equation methodology to determine the impact of bank credits to the economy but that may offer only limited insight in complex adjustment processes.

This paper traces the quantitative impact of bank credit channel by modifying and estimating the relevant behavioral equations in the Bayoumi and Melander (2008) framework. The estimated equations are then added and simulated using the Bayangos and Jansen (2009) macro econometric model. In particular, bank credit to the private sector and the capital asset ratio are estimated. The impact of these two behavioral equations is traced through the interest rates, money supply and spending on consumption and investment. Such a strategy arguably gives a better insight into the linkages of bank credit in the Philippines economy.

3. Credit developments in the Philippines

About 89% of domestic credit in the Philippines, including the purchase and sale of government securities, is channelled through the banking system. The largest lenders are the universal/commercial banks. Smaller lenders include the regular commercial banks, thrift banks, and rural banks.

In terms of its relative share to nominal gross domestic product (GDP), private sector credits by Philippine banks soared from 21.4% in 1991 to a high of 56.0% in 1997, before dropping to 66.7% in 1998 when the economy reeled from the effects of the currency crisis. Since then, the ratio of net domestic credit to GDP has tracked a downward trend before it recovered to 31% percent in 2009.

In terms of growth, outstanding bank credit to the private sector rose from 28.1% in December 1990 to 51% growth in December 1996 (Figure 2). However, growth in bank credit has been sluggish after the currency crisis as the general economic downturn reduced the demand for loans, low profitability, and a steady increase in the level of non-performing loans. Outstanding credits to the private sector contracted by 1.2% in December 1999 and by 0.3% in December 2005, before it crept up to 16.8% in December 2008.

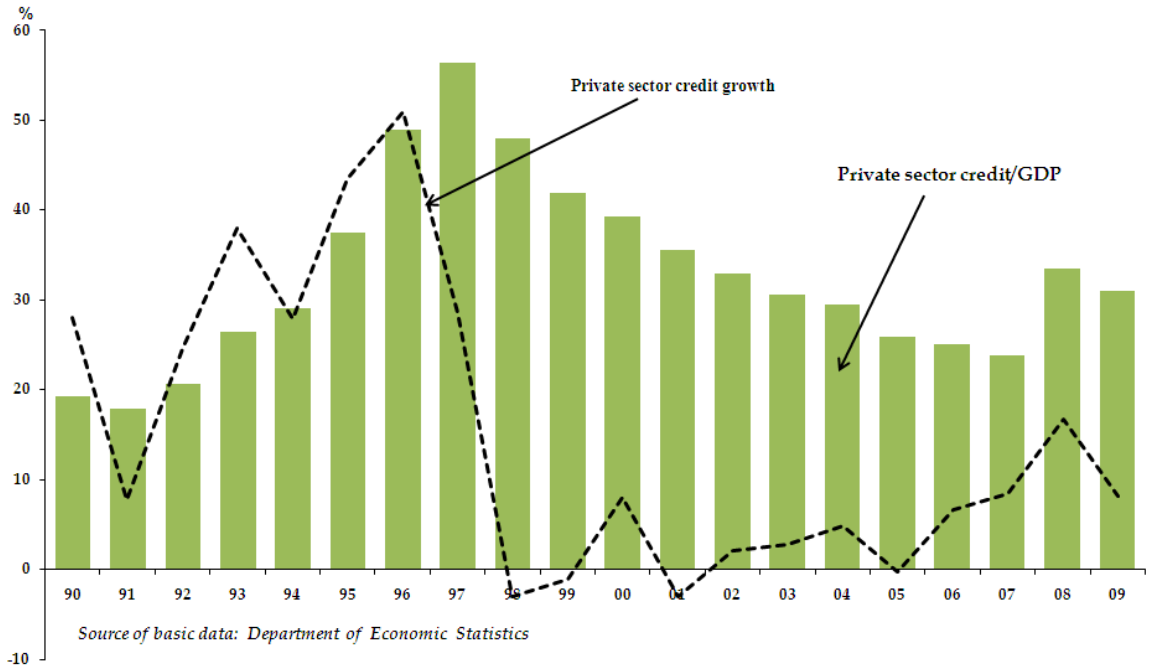
Meanwhile, growth of bank credit to the private sector has continued despite the relatively stricter bank lending standards in 2009**.** Based on the Senior Bank Loan Officers' Survey conducted by the BSP in 2009, lending standards among banks, in general, had indeed tightened. In particular, the majority of respondents indicated moderately tighter lending standards in 2009 in terms of collateralization requirements and credit screening. Respondents also cited the uncertainty in the economic outlook as the main reason for their cautious lending stance. Meanwhile, the latest Senior Bank Loan Officers' Survey indicated a decline in the banks' lending

standards for the first quarter of 2010, with the decline more pronounced for loans extended to large middle market enterprises.

In addition, banks' credit standards on loans to households have eased considerably compared to the previous quarters in 2009, with the easing more pronounced for credit card loans, housing loans and personal or salary loans. The improving economic outlook for 2010 was the main driver of banks' easing of credit standards as indicated by the overall significant narrowing of loan margins to households. These findings may indicate a pick-up of bank credits over the ensuing months.

Meanwhile, the ratio of loan-loss provisions to total loan portfolio increased after the 1997 currency crisis as banks increased their loan-loss provisions as non-performing loans continued to build up. Provisioning has loosened up as banks' asset quality improved in recent years although total provisions as a percentage of loans remain higher than pre-1997 levels.[5] Nevertheless, growth in private sector credit continued throughout 2009, albeit lower than the growth recorded in 2008. As of December 2009, bank credit growth was posted at 8.1%, as the impact of the global financial turmoil took a toll on bank lending.

Figure 2: Private Sector Credit (Year-on-Year Growth and Share to GDP, %)



[5] Gonzales (2009) showed that bank credit and provisioning are pro-cyclical with the Philippine business cycle in the 1990s. In other words, during times of economic boom (early 1990s), domestic credit grew, while at times of economic downturn (late 1990s), domestic credit contracted.

The growth in bank credit was driven largely by the rise in outstanding loans to productive sectors. Over the past years, growth in loans outstanding of universal and commercial banks has consistently been led by loans extended to the productive sectors, specifically transportation, storage and communication, wholesale and retail trade, and electricity, gas and water. In turn, total loans outstanding of universal and commercial banks showed a steady year-on-year increase to end-December 2008. In particular, loans outstanding of commercial banks grew steadily from 4.5% in December 2006 to 8.3% in 2007 and further up to 20.5% in December 2008. Year-on-year growth dropped to 10% in December 2009 following the impact of the global financial crisis.

These observations so far reveal that bank credit occupies a significant portion of the aggregate income, hence, it implies that changes in bank credits may entail significant changes in real output and inflation. To get a first insight into the relationships between bank credits and selected monetary, financial and real sector indicators, Granger causality tests at 5% and 10% levels of significance were used. Using a lag of three quarters, results of the Granger causality tests from the first quarter of 1998 to the second quarter of 2009 showed that bank credit to the private sector is part of a set of economic interactions.[6] In particular, there is a bi-directional causality between the private sector credit (seasonally-adjusted) and real GDP (seasonally-adjusted), between private sector credit (seasonally-adjusted) and consumer price index with 2000 as base year (seasonally-adjusted), between money supply (seasonally-adjusted) and private sector credit (seasonally-adjusted), between real GDP (seasonally-adjusted) and consumer price index with 2000 as base year (seasonally-adjusted), between reserve money (seasonally-adjusted) and money supply (seasonally-adjusted), and between loan-loss provision ratio and non-performing loan ratio.

At 10% level of significance, the (Granger) causation appears to run from the overnight reverse repurchase (RRP) rate to reserve money (seasonally-adjusted), from the overnight reverse repurchase (RRP) to money multiplier (defined as the ratio of domestic liquidity with base money), from the overnight RRP rate to private sector credit (seasonally-adjusted), from reserve money (seasonally-adjusted) to private sector credit (seasonally-adjusted), from the money supply (seasonally-adjusted) to private sector credit (seasonally-adjusted), from the capital to asset ratio to private sector credit (seasonally-adjusted).

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[6] Latest BSP data on capital to asset ratio, loan loss provision and non-performing loans are available up to the second quarter of 2009 only.

These results indicate that bank credits to the private sector are part of a set of economic interactions with selected monetary and banking indicators. Another interesting result from the test shows that the overnight RRP rate appears to (Granger) cause the money multiplier and reserve money at 10% level of significance, suggesting that a direct link of monetary policy to private sector bank credit (seasonally adjusted) may exist through the bank reserves. This implies that the money multiplier may contain significant information between monetary policy and bank credit.[7]

To determine the relative importance of bank credits to real output growth, this paper estimates the significance of bank credit (*PCREDIT*) along with real interest rates, indicated by the difference between the 91-day Treasury bill rate (*TBR91*) and inflation (*INFL*), real peso-dollar rate (*RFXR*), stock market value (*STOCK*) and bond trading volume (*BOND*), including the government and corporate bonds, from March 1998 to June 2009.

Table 1 [8]

Dependent Variable: **POTGAP**
Method: Generalized Method of Moments
Sample: 1999Q1 2009Q2
Included observations: 45
Kernel: Bartlett, Bandwidth: Fixed (3), No prewhitening
Simultaneous weighting matrix & coefficient iteration
Convergence not achieved after: 499 weight matrices, 500 total coef iterations
Instrument list: TBR91 INFL FXR PCREDIT POTGAP(-1)
Lagged dependent variable & regressors added to instrument list

	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.196	0.222	-0.882	0.383
TBR91(-1)-INFL(-1)	-0.080	0.001	5.902	0.000
RFXR	0.150	0.000	3.780	0.001
LOG(PCREDIT(-1))	0.180	0.152	2.780	0.000
LOG(STOCK(-1))	0.112	0.013	0.013	0.112
LOG(BOND(-1))	0.003	0.031	1.258	0.189
AR(1)	0.001	0.002	0.627	0.534
R-squared	0.718	Mean dependent var		0.003
Adjusted R-squared	0.826	S.D. dependent var		0.021
S.E. of regression	0.014	Sum squared resid		0.007
Durbin-Watson stat	1.935	J-statistic (Adjusted)		0.055
Inverted AR Roots	0.00			

Table 1 specifies the Philippine output gap dynamics. Rather than modeling the output gap by a purely stochastic process, the variables are chosen that can provide extra information on the

[7] See studies of Borio and Disyatat (2009) and Disyatat (2008) which argue that a decoupling of interest rates from reserves may exist at least for a few countries such as Japan, United Kingdom, New Zealand.
[8] In the empirical estimation, the results are significant up to three quarters of lags.

evolution of the output gap. In addition, the variables employed in the equation characterize a set of financial variables that may largely affect the actual output, not necessarily the potential output. Although these factors are vital in explaining the output performance in the short-run, they are viewed to be more effective on the demand side, and thus, neutral for the behavior of potential output in the short run. Therefore, these variables appear in the output gap equation to account for the deviation of actual output from its potential level.

Using a GMM and at 5% level of significance, the regression results in Table 1 show that changes in *TBR91-INFL*, *RFXR* and *PCREDIT* drive the behavior of the output gap. By contrast, changes in *STOCK* and *BOND* yielded insignificant coefficients. These findings so far confirm the findings from other literature. However, the impact of changes in *TBR91-INFL, RFXR* and *PCREDIT* on output gap is part of a complex set of interactions in the economy. A more complete macroeconomic model that includes the relevant institutions, markets and agents and the various interactions between them may give a better insight into the relative impact of changes in bank credits on the Philippine macro economy.

4. Tracing the bank credit channel of monetary policy in the Philippines

4.1 Macro model structure, diagnostics and model solution

This paper traces the bank credit channel of monetary policy by adding and re-specifying the Bayangos and Jansen (2009) model from March 1999 to June 2009.[9] [10] In this paper, bank credit has been explicitly introduced as an endogenous variable with a number of impacts on the macro economy.

To a broad extent, the structural, dynamic, quarterly, macro econometric model presented here is New Keynesian a la Ball (1999). It can be noted that the Ball (1999) model assumes that inflation and output are backward-looking. It thus deliberately abstains from any optimizing foundation. In addition, a purely backward-looking specification is appealing in that it resembles the empirical macro econometric models used by many central banks (Ball 1999; Rudebusch and

[9] In particular, Bayangos and Jansen (2009) did not give much attention to bank credits as a monetary policy transmission channel. Bank credits were an exogenous inflow on the money supply. Shocks to bank credits would lead to changes in money supply and this would have a small effect on the 91-day Treasury bill which would subsequently affect consumption and investments.

[10] Latest BSP data on capital to asset ratio, loan loss provision and non-performing loans are available up to the second quarter of 2009 only, hence, the estimation runs from first quarter 1999 to the second quarter of 2009.

Svensson 1999). Central to this model are important nominal rigidities in describing the macro economy, typical of the New Keynesian approach.

Moreover, this model describes an economy in which there is an excess supply; hence, aggregate output is demand-determined in the short to medium run.[11] The agents in this macro model include the (a) households, (b) domestic firms, (c) the government, (d) the rest of the world provides capital, goods and services demanded by the domestic economy and a market for domestic production and (e) the central bank. In this model, the central bank has the task of anchoring the nominal side of the economy. The central bank adopts an inflation targeting framework (IT) and is a flexible inflation targeter and sets a short-term interest rate to achieve an inflation target, and, consequently provides nominal stability. There are lags and delays between a change in interest rate and inflation. Given these lags and price and wage rigidities, the use of a simple interest rate rule is required to anchor inflation in the long run.

Meanwhile, asset markets are imperfect. The nominal exchange rate is allowed to transitorily deviate from purchasing power parity (PPP) so that movements occur in the real exchange rate. In addition, the nominal short-term interest rates play the leading role as the instrument of monetary policy.

The contribution of this study is that there is an explicit role of monetary policy in bank credit behavior. This is a modification to the Bayoumi and Melander (2008) framework.

The transmission mechanism starts with the BSP's domestic interest rate policy. The overnight reverse repurchase rate (RRP) is prescribed as the nominal interest rate which follows a behavioral equation required to anchor inflation in the long run (Clarida, Gali and Gertler 2000).

The overnight RRP adjusts to inflationary pressure measured by the difference between the inflation forecast and the inflation target announced by the Government and the output gap. This is seen as,

$$r_t^p = \alpha + \beta(\pi_t^f - \pi_t^*) + \rho(q_t - q_t^*) + \varepsilon, \qquad (1)$$

where r^p is the RRP, α connotes the neutral monetary policy stance [12], π^f is the one-quarter ahead inflation forecast, π^* is the medium-term inflation target announced by the Government, q is real output, q^* is potential real output , and an error term, ε.

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[11] Typically represents a Keynesian approach in describing an economy.

[12] In some studies, the constant represents the desired *RRP* rate that is expected to prevail when inflation and output are at their target growth.

The *RRP* rate is transmitted to the benchmark interest rate r^d through the natural arbitrage condition. In this model, the benchmark interest rate is the 91-day Treasury bill rate. As seen in equation 2, r^d is also affected by other variables, such as the overnight RRP r^p, inflation expectations π^e, foreign interest rate r^u, real money supply m and an error term ε.

$$r_t^d = \alpha + \beta r_t^p + \rho \pi_t^e + \gamma r_t^u - \vartheta m_t + \varepsilon. \qquad (2)$$

Equation 2 states that the 91-day Treasury bill rate is higher, the higher the overnight RRP rate, the higher the inflation expectations, the higher the foreign interest rate, and the lower the level of money supply. In this equation, there is a direct channel from the BSP's policy rate to the 91-day Treasury bill rate. Equation 2 feeds directly to real personal consumption expenditure in equation 6.

Changes in the 91-day Treasury bill rate r^d are then carried over to the changes in the other market interest rates, such as lending rates in equation 3 through the natural arbitrage condition.

$$r_t^l = \alpha + \beta r_t^d + \varepsilon. \qquad (3)$$

It is also assumed that the short-run domestic inflation is relatively sticky, indicating that inflation expectations for the short term are similarly sticky. This further implies that by controlling the nominal overnight RRP rate, the BSP can also affect the short-term real RRP rate or the difference between the short-term RRP rate and short-term inflation expectations. Through market expectations of future real rates, longer real rates (that is, longer than overnight rates) also are affected. Thus, the lowering of the overnight RRP is expected to lower short and longer real interest rates, and consequently affect economic activity.

Changes in the overnight RRP rate also affect bank credits as seen in equation 4.

$$c_t^p = \alpha + \beta q_t - \delta(r_t^l - \pi_t^e) + \varpi m_t + \gamma k_t - \vartheta n + \varepsilon, \qquad (4)$$

where C^p is private credit, q is real output, r^l is bank lending rate, π^e is inflation expectations, m is money supply, k is the bank regulatory capital to risk-weighted assets (in excess of the required BSP capital to asset ratio), n is banks' non-performing loan ratio and an error term, ε. Meanwhile, k is expected to have a positive coefficient as higher capital buffer (relative to the regulatory capital) to absorb losses helps banks to expand credit. In Bayoumi and Melander

(2008), the balance sheets of firms and households are included. In the absence of a longer and consistent series for the Philippines, the model in this study is limited to the consolidated balance sheets of commercial/universal banks, thrift and rural banks. In the case of n, a negative coefficient is expected, as higher shares of non-performing loans to total loans are riskier, hence, banks are expected to be prudent in extending new loans. Meanwhile, the presence of q in equation 4 reflects the feedback look from income to bank credit via the financial accelerator effect.

Bank credit together with net other items [13] determine the level of money supply from the asset side. It should be noted that in the model, money supply is an indicator of the quantity of money that the economy requires, without the BSP setting any target for it. From the liability side, the impact of changes in the real market interest rates $(r_t^d - \pi_t^e)$ affects currency in circulation in the monetary system as in equation 5:

$$c_t^c = \alpha + \beta q_t - \gamma(r_t^d - \pi_t^e) + \varepsilon. \qquad (5)$$

Equation 5 is then added to deposit liabilities to arrive at the total money supply level ***(m)*** from the liabilities side and feeds back into equation 4.

To determine the impact of bank credit on spending, real personal consumption C and real investment spending I are re-specified.

Real consumption C in equation 6 follows the permanent income and life-cycle hypothesis. In the long run, it is assumed to depend on real disposable income di and real wealth m. The presence of di implies that a proportion of households are "liquidity constrained" while c^p implies that households are "credit constrained" in the short-run (Bayoumi and Melander, 2008; Greenlaw et al., 2008). The remaining households' consumption, however, is determined by their wealth positions. In this model, real wealth m includes real financial aspects (including the market value of domestic equity).

$$C_t = \alpha + \mu di_t + \lambda m_t + \varpi c_t^p - \gamma(r_t^d - \pi_t^e) + \varepsilon. \qquad (6)$$

[13] Net other items account is taken as residual. Technically, it includes other net domestic assets and neo other items from the depository corporations' survey.

Meanwhile, the inclusion of the long-term real interest rate $r_t^d - \pi_t^e$ in equation 6 captures the direct substitution effect between consumption and savings. In addition, the presence of ε accounts for the time lag before consumption responds to changes in the real interest rate.

The desired investment spending by domestic firms I_t in equation 7 uses the accelerator principle linking the desired fixed capital with output q_t, real lending rate $r_t^l - \pi_t^e$ and the exchange rate e_t^r (Montiel 2003):

$$I_t = \alpha + \beta q_t + \upsilon c_t^p - \theta(r_t^l - \pi_t^e) - \rho e_t^r + \varepsilon. \qquad (7)$$

The impact of bank credit is seen as directly affecting investment in equation 7. In this model, technology is fixed. Moreover, firms hold inventories which represent insurance against demand surprises. However, this is taken as exogenous in the model, implying that firms make their decisions regarding capital, labor and prices first, and then make decisions about the desired level of inventories.

The choice of investment demand model stems from the ease of identifying the policy instruments (in this model interest rate and exchange rates) available to monetary authorities to influence the aggregate supply resulting from investment behavior. However, in the empirical estimation, an attempt is made to produce a complete and detailed estimation of investment in terms of capital stock and employment. This is essential in determining the link between investment and production capacity and consequently the output gap

In sum, changes in interest rates and bank credits lead to changes in the real sector through consumption and investment. All the changes in spending behavior, when added up across the whole economy, generate changes in aggregate spending.[14] Total domestic expenditure plus the balance of trade in goods and services reflects the aggregate demand in the economy, and is equal to gross domestic product *(GDP).*

GDP (demand) feeds into the *GDP* (production) side which consists of two sectors: the primary sector (agriculture) and the advanced sector (industry and services). The output of the agriculture sector is exogenous in the model. This leaves us with the industry and services sectors which are assumed to have excess capacity. Hence, supply responds to the level of aggregate demand.

[14] In the empirical estimation, changes in interest rates also create changes on fiscal balances.

GDP feeds into banks' capital to asset ratio k in equation 8 below.

$$k_t = \alpha + \beta q_t + \varepsilon. \qquad (8)$$

In Bayoumi and Melander (2008), bank lending standards determine changes in banks' capital to asset ratio. A limitation of equation 8 is the absence of bank lending standards. In Bayoumi and Melander (2008), bank lending standards are based on answers from the quarterly Federal Reserve Bank's survey of bank loan officers. The BSP started to conduct senior bank loan officers' survey only in March 2009, hence, the information is too short. This represents an area for further study.

In the initial specification, there was an attempt to include the overnight RRP rate (equation 1) in equation 8 to examine the impact of monetary policy actions on changes in bank capital.[15] However, in the empirical estimation, the overnight RRP rate was dropped as it yielded insignificant coefficient. This represents another area for further study.

Moving forward, there are two distinct and mutually reinforcing feedback channels in Bayoumi and Melander (2008) framework. The first channel is that as spending and income fall, loan losses increase and thus there are further negative effects on bank capital. The second feedback channel is that a deterioration of incomes (and balance sheets for households and firms) has a further negative financial-accelerator effect on credit and spending. This model allows for these two feedback channels through equations 4 and 8.

$$Y_t^g = q_t - q_t^* \qquad (9)$$

Potential output and the resulting gap as measure of future inflationary pressures have regained importance under the IT framework. As indicated in equation 9, output gap in this model is estimated based on Dakila (2001) in which it is expressed as the difference between the log of a one quarter moving average of supply side (industry and services) GDP (deseasonalized series) q and potential output q^*.[16]

$$P_t^W = \alpha + \delta Y_t^g + \beta p_t^M + \theta m_t + \rho W_t + \varepsilon. \qquad (10)$$

The output gap Y^g then feeds into the wholesale price index P^W in equation 10. The whole price index in this model is affected by the average prices of merchandise imports in pesos p^M, the excess liquidity as indicated by real money supply m relative to gross domestic product

[15] See Disyatat (2010) for a comprehensive discussion on the link between monetary policy actions and changes in bank capital.

[16] Also cited in Angeles and Tan (2004).

and the average compensation (or wages) for industry and services sectors W . This specification makes the pricing decision based on a flexible mark up.

In this specification, the main link between monetary policy and wholesale price index, and consequently on inflation is the output gap. Hence, there is an impact of monetary policy on expenditure. In addition, the real money supply strengthens the link to price level and consequently between monetary policy and the production sector.

Meanwhile, changes in the wholesale price drives prices of the industry and services sectors, and finally the final demand prices. Final demand prices are dependent on the relative weights of industry and services sector prices and are contained in the implicit GDP deflator. This then is the basis of headline inflation.

Because of the forward-looking nature of inflation targeting, the role of inflation expectations in this transmission mechanism becomes crucial. Indicators of inflation expectations include the two-year ahead inflation forecast.

$$\pi_t^e = \alpha + \beta\pi_t^* + \rho\pi_t + \nu\pi_{t-1}. \qquad \textbf{(11)}$$

The estimation of long-run inflation expectations π_t^e in equation 11 follows a hybrid structure that contains both forward-looking and backward-looking expectations. The structure includes rational component of inflation, indicated by the medium-term (three to five years) inflation target announced by the Government π_t^* and contemporaneous and inertial components indicated by current π_t and past inflation rate π_{t-1}. The rational component is based on Demertzis' and Viegi's (2005) work on inflation targets as focal points for long run inflation expectations. The idea is that in the absence of concrete information of inflation expectations, the only information that agents have is the quantitative inflation target announced by the Government.

In the empirical estimation, the macro model uses a more detailed approximation of gross *GDP*. This provides the impact of *RRP* rate, 91-day Treasury bill rate, lending rate, peso-dollar rate, and bank credit into the different components of expenditure and sectoral output separately, allowing us to identify monetary policy transmission variables more accurately. Inflation expectations provide the bridge between the relatively short term RRP to rather long-term rates such as the 91-day Treasury bill, savings and lending rates.

4.2 Diagnostics and model solution

The updated macro model has 70 equations which are grouped into seven major blocks: monetary sector, public sector, prices and expenditures, including balance of payments, production and employment. As discussed in Section 4.1, bank credit is seen to affect money supply, interest rates and total expenditure. Of these 70 equations, 32 are simultaneous equations estimated using generalized method of moments (GMM, 6 equations), two-stage least squares (14 equations) and ordinary least squares (12 equations). The choice of instruments for the GMM and two-stage least squares are assumed to be all the lagged endogenous variables and all current and lagged exogenous variables in the whole system. These equations are largely overidentified, while the rest are identified.

Unit root and co-integration group tests are conducted to two groups of equations which are added and re-estimated. Group 1 includes financial indicators such as capital to asset ratio, bank credit to the private sector, currency in circulation, the 91-day Treasury bill rate and bank lending rate. On the other hand, Group 2 includes real sector variables such as personal consumption expenditure and spending on gross domestic capital formation.

Results show that all the series in levels and first differences are stationary at the 5% and 10% levels of significance. The results further suggest that the time series under investigation are integrated of order one, I(1). In terms of the number of co-integrated relationship(s) in the two groups, the results show that Group 1 shows more co-integrated relationships than Group 2 at the 5% and 10% levels of significance.

Each of the 32 simultaneous equations is assessed for basic and higher-order diagnostic tests. The signs and magnitudes of individual coefficients in each equation, such as *t* statistics, the adjusted R^2, Durbin Watson and *F* statistics are all examined. All calculated *F* values are higher than the critical values, at the 5% to 10% levels of significance, thereby indicating a significant degree of reliability of coefficients of determination. Results of higher order test statistics of residuals are similarly examined. Results of the Jarque-Bera test show that all of the series are normally distributed. With a lag order of up two and at a 5% to 10% level of significance, Breusch-Godfrey results show that not all equations exhibit serial correlation. J-test is also checked for six equations estimated using GMM at 5% to 10% level of significance. Results show that the six equations are over-identified and are valid equations.

The model is solved in a system simultaneously using Fair-Taylor method.[17] Meanwhile, terminal conditions are assumed to hold in a specified time period. Forward solution is similarly used for equations that contain future (forward) values of the endogenous variables.

4.3 Bank credit transmission mechanism

The estimated macro model captured changes in monetary policy to bank credit to the private sector to inflation through the aggregate demand (output gap), production-cost and the money supply variables. The analysis in this section uses short-run, and in some instances long-run multipliers.[18] Table 2 provides the estimated equations and results of diagnostic tests.

Equation 12 states the BSP's reaction function since 2000 that is consistent with the IT requirements. It shows that nominal RRP rate reacts to inflationary pressure seen in the difference between inflation forecast and inflation target, output gap or the difference between actual GDP and potential GDP.[19] In addition, equation 12 implies that the BSP raises *RRP* rate by 0.30 percentage point whenever the difference between inflation forecast and target is expected to rise by one percentage point. The coefficient of the output gap implies that the BSP increases *RRP* rate by 0.13 percentage point when it is positive or an excess in aggregate demand is anticipated.

The long-run impact though seems to be moderate. The BSP has to raise the *RRP* rate by 0.38 percentage points when inflationary gap increases by one percentage point and 0.16 percentage points when there is excess aggregate demand.

Meanwhile, the lagged *RRP* rate received the bigger importance in terms of the magnitude of coefficient (0.21 in equation 12, Table 2) compared to the output gap. This is not unusual though, as most quarterly macro models exhibit this behavior. This estimation takes the more conventional wisdom that this gradual adjustment reflects policy inertia (or an action of not adjusting once-for-all to changing conditions) or interest rate smoothing behavior by BSP.

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[17] This is an iterative algorithm, where each equation in the model is solved for the value of its associated endogenous variable, treating all other endogenous variables as fixed.

[18] The long-run multiplier is derived based on the following: in the model with lagged dependent variable, $y_t = c + ax_t + by_{t-1} + e_t$, the long run multiplier (*m*) of a change in *x* is $m = \frac{a}{(1-b)}$.

[19] Currently, the BSP uses three estimation methods to measure the output gap for the Philippines: Hodrick-Prescott filter, the constant elasticity of substitution (CES) production function approach, and the structural vector autoregression (SVAR) approach. For purposes of analysis, the study uses the average of the output gap estimates from the three methods.

Table 2
Estimated Equations

VARIABLES	Lag (quarter)	Monetary and Banking Sector						Real Sector	
		RRP (EQ 12)	TBR91 (EQ 13)	LR (EQ 14)	ECAR (EQ 15)	PCREDIT (EQ 16)	CC (EQ 17)	PCE (EQ 18)	GDCF (EQ 19)
Constant		5.68	0.67	1.20	4.65	-2.28	7.99	-0.16	1.73
Log(GDP)	1					0.20 */			0.79*/
Log(GDP)	2						0.16 */		
Log(GDP)	3				0.66 */				
Potgap	1	0.13 */							
Log(DISY)								0.86 */	
Log(INV)	1								
Log(PCE)	1							0.78 */	
RRP	1		0.25 */						
RRP	2	0.21 */							
TBR91	1			0.15 */			*/	*/	
TBR91-XINFL	1					**/	-0.18	-0.25	*/
LR-XINFL						-0.12			-0.22
Libor90			0.11 */						
FXR	1		0.20 */						0.15 */
Log(Currency in circulation)	1						0.45 */		
Log(Money Supply)	1		-0.21	**/					
LLOSS									
LR	1			0.45 */					
ECAR	1				0.15 */	0.08 **/			
NPL	1					-0.67	*/		
Log(PCREDIT)	1					0.22 */		0.13 */	0.22 */
XINFL			0.69 */						
FINFL-INFTAR		0.3 */	*/			*/			*/
AR(1)		0.87 */	-0.18	0.08 */	0.17 **/	-0.78	0.25 **/	0.09 **/	-0.58
AR(2)			-0.55	**/					
Diagnostic Tests:									
Adjusted R^2		0.84	0.97	0.91	0.41	0.90	0.84	0.92	0.62
Durbin Watson		2.01	2.05	1.98	2.01	1.96	1.73	2.05	2.01
Prob (Jarque-Bera)		0.21	0.22	0.18	0.51	0.12	0.11	0.41	0.12
White Heteroscedasticity					0.16				0.75
Breusch-Godfrey					0.98				0.03
Prob (Ramsey RESET Test)					0.30				0.12
J-statistic (Adjusted)		0.08	0.05	0.03		0.01	0.04	0.07	

/ Significant at 5% level of significance* */ Significant at 10% level of significance*

The results in Table 2 show that the impact of the BSP policy rate changes on the 91-day Treasury bill rate is moderate (0.25 in equation 13, Table 2).[20] The *TBR91* is further driven by the 90-day Libor, changes in nominal peso-dollar rate, changes in money supply and inflation expectations.

There is an indirect channel of the level of overnight RRP to bank lending rate through the 91-day Treasury bill rate in equation 14. The idea is that increases in *LR* are warranted when *TBR91* rises by one percentage point. For instance, *LR* increases by 0.15 percentage point when *TBR91* increases by one percentage point. However, in the long-run, the impact of a one

[20] In Bayangos (2007), the impact of the changes in the overnight RRP rate on the 91-day Treasury bill rate is estimated at 0.18 percentage point from first quarter 1988 to first quarter 2002.

percentage rise in *TBR91* translates to 0.27 percentage point increase in *LR*. These results are broadly in line with a preliminary estimate of the market interest rate pass through from March 2000 to September 2009 shows that overnight RRP rate affects the 91-day T-bill rate, savings deposit rate and bank lending rate after a quarter.

Bank lending rate has a direct impact on credit to the private sector in equation 16. Credit to the private sector is also driven by real output (lagged by one quarter), real lending rate *(LR-XINFL)*, non-performing loan (*NPL*) ratio (lagged by one quarter), credit to the private sector (lagged by one quarter), and banks' capital to asset ratio, in excess of the 10% BSP requirement (*ECAR*, lagged by one quarter*).*[21] In particular, equation 16 shows that a financial accelerator is operating as the higher level of GDP leads to higher bank credit to the private sector *(PCREDIT).* By contrast, higher real lending rate *(LR-XINFL*) and higher non-performing loan ratio lead to lower credit to the private sector.

It should be noted that the specification of bank capital follows that of Gambacorta and Mistrulli (2004). Any excess of bank capital from the 10% BSP requirement (*ECAR)* creates a positive impact (or higher) bank credit.[22] An interesting implication of this result is that bank capital constitutes a potentially key determinant of the transmission mechanism through the banking system. An interesting area for further study is how the size and capitalization of banks may affect bank credit channel.

Three endogenous equations in the model were re-specified to capture the impact of bank credit to the private sector on the real currency in circulation *(CC),* the real personal consumption spending *(PCE*) and the real investment spending (*GDCF*). Equation 17 shows that real currency in circulation *(CC)* is driven by the real 91-Treasury bill rate, lagged by one quarter and real GDP, lagged by two quarters and real currency in circulation lagged by one quarter. An increase in the real 91-Treasury bill rate leads to lower currency in circulation. Changes in real currency in circulation are then added to real bank deposits[23] which determine the level of money supply. And changes in money supply have, as equation 2 shows, an impact on the 91-day Treasury bill rate *(TBR91*).

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[21] In the empirical estimation, capital to asset ratio (CAR) was also considered. The estimated coefficient was significant but the mean absolute percent error (MAPE) was higher than the 10% benchmark. Hence, CAR was dropped from the equation.

[22] It should be noted that in the case of the BIS, the requirement is 8%.

[23] Real bank deposits are modeled as dependent on the real GDP, inflation expectations and real bank deposits, lagged by one quarter.

Changes in bank credits[24] are positively related with real consumption expenditure *(PCE)* in equation 18 (Table 2) and with spending on gross domestic capital formation (*GDCF*) [25] in equation 19 (Table 2). This relationship indicates that bank credits increase when demand for consumption and demand for investment accelerate, and vice versa.

It can be seen in equation 18 (Table 2) that real bank credit (*PCREDIT)* drives real personal consumption spending.[26] This finding is in line with those of Bayoumi and Melander (2008) and Greenlaw et al (2008). It is interesting to note that the impact of *DISY* on personal consumption expenditure appears to be larger than that of *PCREDIT*, suggesting that consumers depend more on income rather than credit for personal consumption. In this model, the behavior of *DISY* is driven significantly by remittances, suggesting that the in impact of remittances on personal consumption and consequently on real GDP may be robust.[27] Meanwhile, the lagged *PCE* accounts for a household's behavior to protect itself against income fluctuations.

It can be seen in equation 19 that investment spending (*GDCF*) is driven directly by bank credits to the private sector and that these changes in bank credit are operating alongside the changes in the policy rate (overnight RRP rate) through the real lending rate *(LR-XINFL).* It can also be seen that changes in *GDCF* are determined by changes in real output (*GDP*), lagged by one quarter. The relevance of real output in the behavior of *GDCF* connotes that real GDP growth must be sustained to maintain investment.

Meanwhile, the relevance of the movements in the nominal peso-dollar exchange rate (*FXR*) reveal that a depreciation of *FXR* is expected to dampen investment spending.[28] It can be noted that the nominal peso-dollar is another variable through which bank credits can indirectly affect *GDCF.* In the model, the nominal exchange rate is driven by the current account balance relative to GDP, interest rate differential as indicated by the difference between 90-day Libor and 91-day T-bill rate, nominal exchange rate, lagged by one quarter and a dummy variable for crisis. The impact of changes in bank credits to changes in *GDCF* cuts into the 91-day Treasury bill rate, consequently affecting the nominal peso dollar rate. Meanwhile, the lagged *GDCF* captures the adjustment costs in investment decisions of individuals, potentially due to expectations. In Bayoumi and Melander (2008), the impact of bank credit on the sub-components of consumption,

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[24] Converted into real bank credit by dividing *PCREDIT* with *PGDP* (GDP deflator).
[25] In the model, investment is the gross domestic capital formation (GDCF).
[26] It should be noted that in the estimation, disposable income and bank credit were also included as instrument variables (Greenlaw et al 2008).
[27] See Bayangos (2009) and Bayangos (2010).
[28] In the empirical estimation, a positive impact connotes depreciation of the peso-dollar rate.

such as durable goods, non-durable goods and services is estimated. This paper leaves this as an area for further study.

An interesting finding in equation 15 in Table 2 is the significant feedback loop of changes in real GDP (lagged by three quarters) on *ECAR*. It should be noted that compared with other studies, the feedback loop of real GDP on *ECAR* is a simplification in the sense that real GDP does not have a direct causal effect on *ECAR*. In most studies, there is only an indirect effect through loan losses. Nevertheless, the preliminary estimates in this paper connote a significant feedback loop from the real GDP to *ECAR*.

4.4 Simulation results

To gauge the simulation and forecasting performance of the model, the mean absolute percent error (*MAPE*) of selected endogenous variables is computed. *MAPE* (which is unit free) is computed as follows:

$$MAPE = \left(\frac{1}{n}\right)\sum\left[\frac{P-A}{A}\right]*100, \qquad \textbf{(20)}$$

where $\boldsymbol{A}$ refers to the actual value, $\boldsymbol{P}$ is predicted or simulated by the model and n is the number of periods covered by the simulation. As a general rule, the smaller the *MAPE* the better the fit of the model to the actual data is.

The model's dynamic forecasting performance over parts of the sample period and the simulated response to some exogenous changes in policy variables are assessed (Appendix A). The simulation period extends from the first quarter of 2001 to the second quarter of 2009. Using GMM, two-stage least squares and ordinary least squares, about 90% of the *MAPEs* fall below 10%. These include key variables in the monetary, external and real sectors, like bank credit to the private sector (*PCREDIT),* lending rate *(LR)*, real personal consumption (*PCE*), gross domestic capital formation *(GDCF)*, the consumer price index (*CPI2000*), the wholesale price index (*WPI2000*), the labor force (*LF*) and long-run inflation expectations *(XINFL).* For instance, *CPI2000*, *WPI2000, PCREDIT, LR,* and *XINFL* have a MAPE of, respectively, 0.91%, 2.28%, 2.65%, 9.81%, and 9.87%.

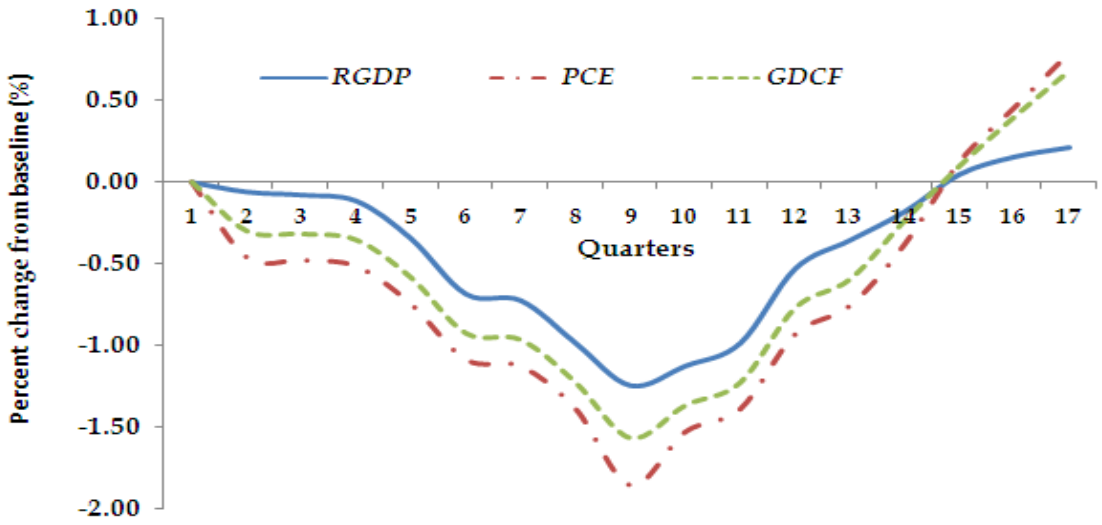
A simulation exercise is employed to assess the impact of a one percentage point increase in the overnight RRP rate and on selected variables. The choice of the simulation exercise in this

paper is consistent with the other studies that examine the importance of bank lending channel by looking at the impact of a monetary policy tightening on bank credit transmission mechanism.[29]

Results in Figures 3 and 4 show that a one percentage point increase in the overnight RRP rate increases the cost of the deposits that banks rely on as a source of funding banks' lending activity. This in turn leads to lower money supply but higher 91-day Treasury bill rate. Consequently, bank credit to the private sector declines. This in turn causes a fall in consumption spending by households and investment spending by firms. The negative effect on real GDP increases gradually over time, peaking at 1.3% (from baseline scenario) nine quarters after the maximum impact on higher lending rate. On average, the impact of a monetary policy tightening leads to a 0.4% decline from the baseline scenario over the simulation period.

Meanwhile, the impact of a monetary policy contraction is more pronounced on personal and investment spending as seen in Figure 3. These findings are in line with those from Bayoumi and Melander (2008), although the magnitude of the negative impact on real GDP for the United States appears to be deeper and longer.[30] All in all, a tightening of monetary policy stance brings real sector impacts.

Figure 3: Impact of a Monetary Policy Tightening on Real GDP and Its Major Components (% Change from Baseline Scenario)



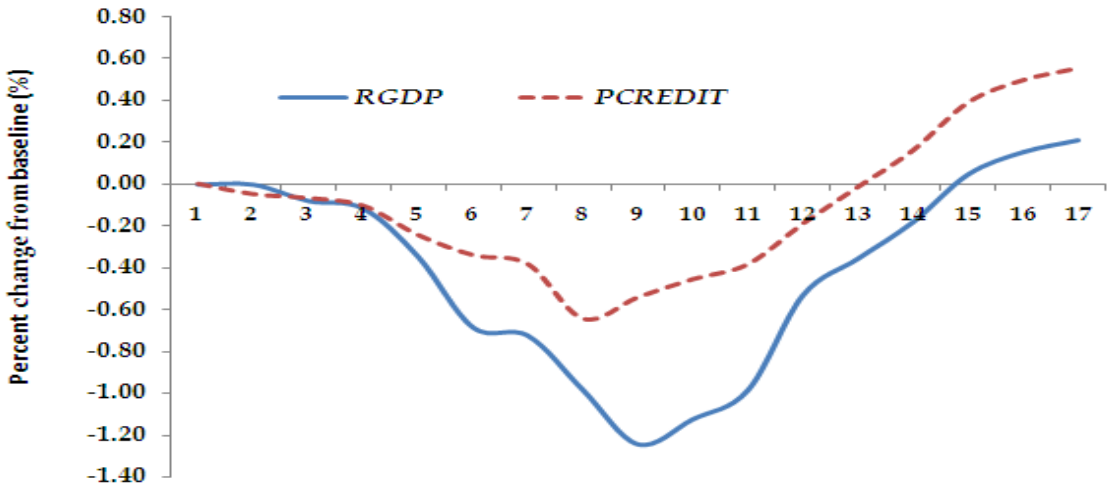
[29] See Disyatat (2010), Morris and Sellon (2004).

[30] In Bayoumi and Melander (2008), the impact of a negative shock on capital-to-asset ratio on GDP peaked at 1.4% of GDP three years (or 12 quarters) after the initial shock on CAR.

A closer look at the simulation results in Figure 4 show that the impact of a monetary policy tightening on bank credit appears to be modest compared with those from Bayoumi and Melander (2008). The negative effect on bank credit increases gradually over time, peaking at 0.6% (from baseline scenario) eight quarters after the maximum impact on higher lending rate. On average, the impact of a monetary policy tightening leads to a 0.1% decline from the baseline scenario. This may suggest that banks in the model appear to be well-capitalized and that a monetary policy tightening does not result in a significant reaction from these banks.

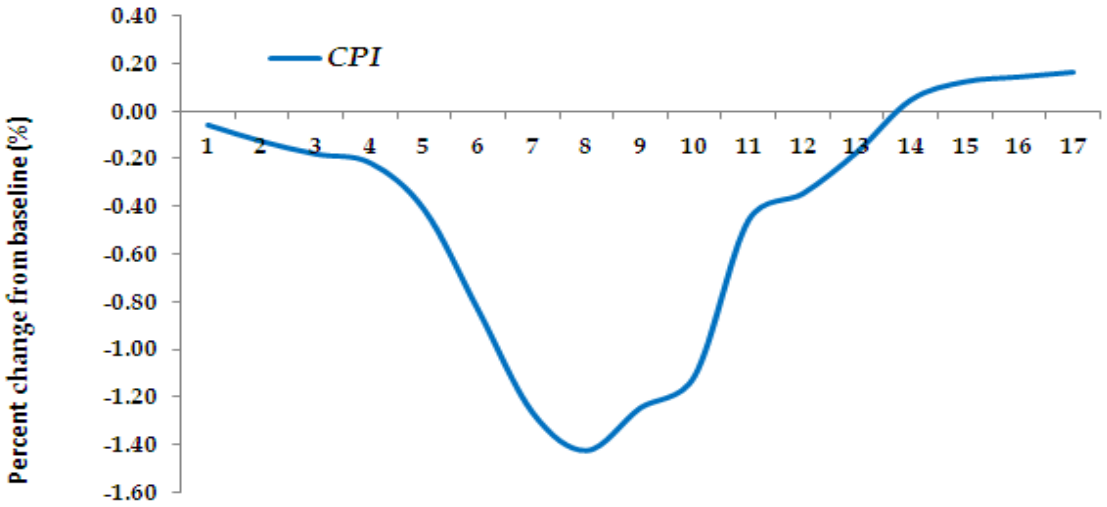
The above finding obviously requires a detailed analysis in terms of the size and capitalization of banks. In recent empirical studies, for example, Disyatat (2010), Kishan and Opiela (2000, 2006) in the United States and Gambacorta (2005) in the Italian context support the notion that banks with low-capital ratios are more responsive to monetary policy actions, while those banks with high-capital ratios are less responsive to monetary actions. There is therefore a need to study the impact of bank size and bank capitalization on bank credit at a micro-level.

Figure 4: Impact of a Monetary Policy Tightening on Real GDP and Bank Credit to the Private Sector (% Change from Baseline Scenario)



When the impact of a monetary policy tightening on CPI is examined, the impact appears to be larger but shorter than that of the impact on real GDP (Figure 5). The negative effect on CPI increases gradually over time, peaking at 1.4% (from baseline scenario) eight quarters after the maximum impact on higher lending rate. On average, the impact of a monetary policy tightening leads to a 0.5% decline from the baseline scenario.

Figure 5: Impact of a Monetary Policy Tightening on Consumer Price Index (% Change from Baseline Scenario)



This finding may reveal the relatively moderate relationship between the BSP policy rate and the market interest rates, such as the 91-day Treasury bill and bank lending rates. There is no model in the Philippines to which this magnitude could be compared with. The closest are the 2004 NEDA Quarterly Macro Model (QMM) that uses an *IS-LM* framework to estimate *TBR91* and the Bayangos (2007) model. The impact from the QMM was much weaker at only 0.05 percentage point while that from Bayangos (2007) was close at 0.2 percentage point.

The relatively moderate impact of the interest rate pass through may contribute to the rather longer impact of a monetary tightening on inflation. This could be attributed to the apparent overregulation in Philippine financial system with a variety of credit variations and mandatory allocation of funds. Although there was an agreement between the Bankers Association of the Philippines (BAP) and the BSP to keep the lending spread at 2.5 percentage points, this spread remains high.[31] This makes the transmission mechanism channel from the traditional interest rate to market-determined lending rates much weaker than desirable.

A related point is that in practice, however, interest rates are determined by the market only up to a certain point. The Bureau of Treasury (BTr) auctions Treasury bills (in tenors of 91, 182 and 364 days) twice a month, and rates are determined by the bids BTr accepts. The BTr may

[31] Since May 1998 the private Bankers Association of the Philippines (BAP) has had a standing agreement to keep interest spreads over the base rate at no more than 1.5 percentage points for prime customers and at no more than five percentage points for non-prime borrowers. In practice, some banks charge non-prime lending spreads of up to eight percentage points above the 91-day T-bill rate.

reduce or increase its regular offering of T-bills to influence rates, either to save the government from paying high rates on its debt or to control liquidity. It may also reject all tenders in order to force participating financial institutions to return the following week with lower bids.

The policy implications are quite clear. The moderate impact of policy rate leaves the impression that a slight deviation from the expected path requires a significant change in the RRP to bring the economy back to the central path. Put simply, this is a strong indication that the interest rate elasticity to macroeconomic equilibrium is moderate. There is then a need to correct these distortions in the financial system and improve the efficiency of transmission mechanism.

5. Some caveats to the macro model

The findings in this paper are subject to several important caveats which could be bases for further research. First, the overall liquidity levels and capitalization in the Philippine banking system may appear to be highly important. As such, the estimated effect of liquidity and bank capitalization on bank credit may not be constant over time. Given the recent downward trend in liquidity and capitalization at the aggregate level, however, the impact of these variables is most likely to be higher in the future than currently estimated.

Second, the identifying assumption that all banks face the same loan demand shock (say a higher lending rate from monetary policy tightening) could potentially lead to biased results. It is unlikely, however, that banks with lower liquidity have customers whose loan demand is more responsive to interest rate shocks. Third, the sharp movements in the peso-dollar rate during the latter part of 2008 (October-December 2008) could be an additional factor that may affect bank credit to the private sector.

6. Conclusion: policy implications for inflation targeting

This paper traces and quantifies the impact of changes on bank credit on the real sector economy by modifying the empirical framework of Bayoumi and Melander (2008). This paper builds on adding and re-specifying a dynamic, structural, economy-wide macro econometric model of the Philippines from 1999 to 2009 to examine the bank credit channel of monetary policy in the Philippines. The contribution of this paper is that the bank credit has been explicitly introduced into the model as an endogenous variable with a number of impacts on the macro economy. The evidence on bank lending channel is obtained by estimating a credit behavior that takes into account not only the monetary variables, but also specific banking indicators such as

the capital to asset ratio and the non-performing loan ratio. The main question is whether bank credit matters in transmitting impulses to the real economy in the Philippines.

Each separate link in the bank credit transmission mechanism could be studied in more detail, using a large number of explanatory variables and more sophisticated econometric techniques. Yet, the main results are similar to what other studies have found using alternative methods (Disyatat 2010). Simulation results from the macro model suggest that bank credit channel matters in monetary policy transmission mechanism, albeit moderate. In particular, the impact of a monetary policy tightening on bank credit appears to be modest. The negative effect on bank credit increases gradually over time, peaking at 0.6% (from baseline scenario) eight quarters after the maximum impact on higher lending rate. On average, the impact of a monetary policy tightening leads to a 0.1% decline from the baseline scenario.

Moreover, a sustained monetary policy tightening creates a negative effect on real GDP and on inflation. The negative impact of tight monetary policy on real GDP increases gradually over time, peaking at 1.3% (from baseline scenario) nine quarters after the maximum impact on higher lending rate. On average, the impact of a monetary policy tightening leads to a 0.4% decline from the baseline scenario over the simulation period.

Meanwhile, the negative effect on CPI appears to be larger and shorter compared to the effect on real GDP. The negative impact on inflation increases gradually over time, peaking at 1.5% (from baseline scenario) eight quarters after the maximum impact on higher lending rate.

In addition, changes on bank capital is found to have significant effects on changes in bank credit, implying that it could potentially be a key determinant of monetary policy transmission. The preliminary results also indicate a feedback loop from real output to bank credit through the financial accelerator and wealth effects. This latter finding further underscores the overall sentiment of this paper to look further into the behavior of credit channel in the Philippines to include banking conditions.

The topic of bank credit channel clearly needs to be explored further. For instance, the overall impact of a tightening in monetary policy on the real economy may even be smaller if banks are classified according to size and capitalization and that that a bank lending channel may probably be affected by an active asset and liability management by banks.

Given our preliminary finding that bank capital matters in understanding the behavior of bank credit, there are several avenues for future research. An immediate topic of interest is to analyze the quantitative impact of the Basel capital requirements on the relation between bank

credit and monetary policy transmission. Another issue for further research is a better understanding of how the (institutional) differences between banks and other financial intermediaries can affect the relation between bank capital and the transmission of monetary policy.

These findings have important implications for monetary policy as it revisits the connection between monetary policy and stability in the banking sector. In particular, a crucial issue among IT central banks is whether an IT Plus framework could be a reasonable option. Although banking stability is not a primary objective for central banks, central banks may benefit from the awareness of risks posed to banking stability. Consequently, there is a need for monitoring banking stability in general and the degree of bank capitalization in particular from a monetary policy perspective in order to assess the transmission of monetary impulses.

The experience stemming from the global financial turmoil has sparked renewed attention on whether central banks can afford to care only about inflation, even though the primary goal of monetary policy is still price stability. A key question going forward is how to maintain a primary focus on inflation in a context where concerns about financial stability are equally important.

Indeed, the concern about bank credit relates to the broader issue of the nexus between monetary and financial stability. Going forward, one suggested policy response is to combine monetary and regulatory policies into a macro financial stability framework along the lines of Bill White's (2009) proposal. In this proposal, there are three salient elements. One would be a primary focus on systemic developments. A second characteristic would be even closer cooperation between monetary authorities and financial regulators in assessing the build-up of systemic risks and in deciding what to do to mitigate them. The third element would be a much more counter-cyclical way for conducting both monetary and regulatory policies, one that would use both instruments to lean in a systematic way against credit excesses in the upswing of the cycle (White 2009). More specifically, monetary policy would lean against "booms" in the growth of credit (and asset prices), particularly if accompanied by unusual spending patterns that would open up a real risk of subsequent reversal.

Such efforts to mesh together monetary and supervision policy would need to be done on a broad, all-encompassing scale, since attempts to reduce risk in one segment of the financial system (for example, the banking system) may only shift risk-taking activity away to other segments or markets.

Perhaps the relevant question over the near term is whether inflation targeters will begin to broaden their objective function, to allow for important considerations such as financial stability, for example. Judging from the relative flexibility in the implementation of inflation targeting that the studies have argued thus far, particularly in emerging economies, the consensus in empirical literature is that this may be a reasonable option in the future.[32]

[32] See Tetangco (2009), "Some thoughts on the future of inflation targeting," Notes for panel discussion on "Issues of monetary policy and exchange rates in Asia and the Pacific" at the conference on "The International Financial Crisis and Policy Challenges in Asia and the Pacific," sponsored by the People's Bank of China (PBC) and the Bank for International Settlements (BIS) on 6-8 August 2009 in Shanghai, China.

REFERENCES

Altunbas, Yener, Gabe de Bondt and David Marques-Ibanez (2004), "Bank capital, bank lending, and monetary policy in the euro area," Centre for Banking and Financial Studies, School of Accounting , Banking and Economics, University of Wales.

Angeloni, I., A. Kashyap and B. Mojon (ed.) (2003), *Monetary Policy Transmission in the Euro Area*, Cambridge University Press.

Blanchard, Olivier J. and N. Kiyotaki (1987) 'Monopolistic competition and the effects of aggregate demand,' *American Economic Review* 77, p. 647-666.

Ball, Laurence N. (1999) 'Policy Rules for Open Economies,' in: J.B. Taylor, (ed.) *Monetary Policy Rules*, Chicago, The University of Chicago Press, pp. 127-156.

Bayangos, Veronica (forthcoming in 2010), "Tracing the Macro-Financial Linkages in the Philippines," SEACEN paper on Macro-Financial Links and Monetary Management, Kuala Lumpur, Malaysia.

Bayangos, Veronica and Karel Jansen (2009), "The Macroeconomics of Remittances in the Philippines," Institute of Social Studies Working Paper No. 470, March.

Bayangos, Veronica B. (2007), *Inflation Targeting and Exchange Rate Uncertainty,* Shaker Publishing, Maastricht, The Netherlands, ISBN. No. 978-90-423-0329-4.

Bayangos, Veronica B. (2006), "Exchange rate uncertainty and monetary transmission in the Philipines," Institute of Social Studies Working Paper No. 434, September.

Bayoumi, Tamim and Ola Melander (2008), "Credit matters: Empirical Evidence on U.S. Macro-Financial Linkages," IMF Working Paper No. WP/08/169, July.

Bernanke, B.S., and Blinder, A.S. (1988), "Credit, money, and aggregate demand", *American Economic Review* 78, pp.435-439.

Bernanke, B., M. Gertler, and S. Gilchrist (1999) "The Financial Accelerator in a Quantitative Business Cycle Framework." Handbook of Macroeconomics, North Holland.

Bernanke, B.S., Gertler, M., and Gilchrist, S. (1996) "The financial accelerator and the flight to quality", *Review of Economics and Statistics* 78, pp.1-15.

Bernanke, B.S. and Gertler, M. (1995), "Inside the black box: The credit channel of monetary policy transmission", Journal of Economic Perspectives Vol. 9(4), pp. 27-48.

Blanchard, Olivier J. and N. Kiyotaki (1987) 'Monopolistic competition and the effects of aggregate demand,' *American Economic Review* 77:647-666.

Bondt, G.J. de (2000), Financial Structure and Monetary Transmission in Europe: A Cross-Country Study, Edward Elgar.

Borio, C. and P. Disyatat (2009), "Unconventional Monetary Policies: An Appraisal," BIS Working Papers, No. 292.

Boughrara, Adel and Samir Ghazouani (2009). "Is there a bank lending channel of monetary policy in selected MENA countries? A comparative analysis," paper for the Equity and Economic Development 15th Annual Conference, 23-25 November 2008, Cairo, Egypt.

Brooks, Petya Koeva (2007), "Does the Bank Lending Channel of Monetary Transmission Work in Turkey?" European Department, IMF Working Paper No. WP/07/272, December.

Calvo, Guillermo (1983) 'Staggered prices in a utility maximizing framework,' *Journal of Monetary Economics*, 12 (3): 383-398.

Charles T. Carlstrom & Timothy S. Fuerst (2001), "Monetary policy in a world without perfect capital markets," Working Paper 0115, Federal Reserve Bank of Cleveland**.**

Clarida, R., J. Galí, and M. Gertler (2000) 'Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory' *Quarterly Journal of Economics* 115: 147-180.

Dakila, Francisco Jr (2001) 'Älternative Monetary Policy Rules for the Philippines,' *Philippine Review of Economics,* Vol. XXXVIII, No. 2 , December.

Demertzis, Maria and Nicola Viegi (2005) 'Inflation Targets as Focal Points' De Nederlandsche Bank (DNB) Working Paper, No. 17 (version October 2005), DNB, Amsterdam.

Disyatat, Piti (2010), "The bank lending channel revisited," BIS Working Paper No. 297, BIS.

Disyatat, P (2008), "Monetary Policy Implementation: Misconceptions and Their Consequences," BIS Working Paper No. 269.

Gambacorta, Leonardo (2005), "Inside the Bank Lending Channel," European Economic Review 49, 1737-1759.

Gambacorta, Leonardo and Paolo Emilio Mistrulli (2003), "Bank capital and lending behaviour: empirical evidence in Italy," Banco de Italia, Temi di Discussione, No. 486, September.

Gerali, A., Neri, S., Sessa, L. and Signoreti, F.M. (2009), "Credit and Banking in a DSGE model of the euro area", paper presented at the Conference on Financial Markets and Monetary Policy organized by the Federal Reserve Board of Governors, June 4-5 2009, Washington D.C.

Gertler, Mark (1988), "Financial Structure and Aggregate Economic Activity: An Overview," *Journal of Money, Credit and Banking,* Blackwell Publishing, vol. 20(3), pages 559-88, August.

Gonzales, Jose Ernesto (2009), "The Fundamentals of Procyclicality of the Financial System," BSP Economic Newsletter, No. 09-03, July.

Greenlaw, D., Hatzius, J., Kashyap, A, and H. Shin (2008), "Leveraged Losses: Lessons from the Mortgage Market Meltdown," US Monetary Policy Forum.

Huelsewig, Oliver; Eric Mayer and Timo Wollmershaeuser (2005), "Bank loan supply and monetary policy transmission in Germany: an assessment based on matching impulse responses," CESIFO Working Paper No. 1380, January.

Iacoviello, Matteo (2005), "House Prices, Borrowing Constraints, and Monetary Policy in the Business Cycle," *American Economic Review*, American Economic Association, vol. 95(3), pages 739-764, June

Kashyap, A.K., Stein, J.C., and Wilcox, D.W., 1993. "Monetary policy and credit conditions: Evidence from the composition of external finance", *American Economic Review* 83, pp.78-98.

Kashyap, A.K., and Stein, J.C., 1994. "Monetary policy and bank lending", in Mankiw, N.G., (eds.), *Monetary policy*, pp.221-256, University of Chicago Press, Chicago.

Kishan, R. and T. Opiela (2006), "Bank Capital and Loan Asymmetry in the Transmission of Monetary Policy," Journal of Banking and Finance 30, 259-285.

Kishan, R. and T. Opiela (2000), "Bank Size, Bank Capital, and the Bank Lending Channel," Journal of Money Credit, and Banking 32 (1), 121-141.

Mishkin, Frederic S. and Adam S. Posen (1997) 'Inflation Targeting: Lessons from Four Countries,' in *Federal Reserve Bank of New York Economic Policy Review*, August 1997: 9-110.

Oliner, S. And G. Rudebusch (1996), "Monetary Policy and Credit Conditions; Evidence from the Market for Autombile Credit, " Journal of Money and Credit and Banking, 30, pp. 366-383.

Rudebusch, G.D. and L.E.O. Svensson (1999) 'Policy Rules for Inflation Targeting' in: J.B. Taylor, ed., *Monetary Policy Rules* (The University of Chicago Press, Chicago) 203-246.

Tetangco, Jr., Amando (2009), "Some thoughts on the future of inflation targeting," Notes for panel discussion on "Issues of monetary policy and exchange rates in Asia and the Pacific," conference on "The International Financial Crisis and Policy Challenges in Asia and the Pacific," sponsored by the People's Bank of China (PBC) and the Bank for International Settlements (BIS) on 6-8 August 2009 in Shanghai, China.

Van den Heuvel, S.J. (2002): Does bank capital matter for monetary transmission?, FRBNY Economic Policy Review, May, 259-265.

White, W. (2009): "Whither monetary policy? Monetary policy challenges in the decade ahead." *BIS Papers No. 45,* Seventh BIS Annual Conference, Bank for International Settlements 26–27 June 2008.

Appendix A

	Variables	Sector	MAPE Dynamic
1	CPI2000	Real	0.91
2	*ECAR*	*Monetary*	*1.01*
3	PVSR	Real	1.36
4	*PCE*	*Real*	*1.65*
5	LF	Real	1.77
6	INDIV	Fiscal	2.15
7	ISEMP	Real	2.22
8	VSR	Real	2.25
9	WPI2000	Real	2.28
10	*LENDING*	*Monetary*	*2.30*
11	*PCREDIT*	*Monetary*	*2.65*
12	PVIR	Real	3.05
13	VIR	Real	3.13
14	QSE1P	Real	4.58
15	DOMIP	Fiscal	5.39
16	NONOILM	Real	6.93
17	DISY	Real	7.32
18	*DUREQ*	*Real*	*7.41*
19	SDR	Monetary	7.68
20	*DEPLIAB*	*Monetary*	*8.04*
21	REMIT	External	8.43
22	*TBR91*	*Monetary*	*8.64*
23	RRP	Monetary	9.06
24	XMFG	Real	9.14
25	PMGDS$	Real	9.45
26	LR	Monetary	9.81
27	FXR	Monetary	9.84
28	XINFL	Real	9.87
29	*CONS*	*Real*	*9.94*
30	XNMFG	Real	10.41
31	CC	Monetary	10.49
32	MFUEL	Real	10.75