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The Bank Lending Channel in Peru: evidence and transmission mechanism

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The Bank Lending Channel in Peru: evidence and transmission mechanism

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Abstract:

In the past ten years the Peruvian economy has experienced important structural changes regarding monetary policy. This paper focuses on the bank lending channel as part of the transmission process to macroeconomic activity in the Peruvian economy based on Bernanke, Gertler, and Gilchrist (1996) flight-to-quality argument. The purpose of this paper is to identify the bank lending channel (using bank level data), and test its relevance for understanding the transmission to economic activity by comparing monetary policy effects under two scenarios with and without a bank lending channel operating (using structural autoregressive vectors.) As in Gambacorta (2005), I consider a sample period in which a policy variable can capture the monetary policy stance of the central bank. For the case of Peru, I conclude that the bank lending channel has operated but this channel is not important for identifying the transmission process from monetary policy to macroeconomic activity.

JEL Classification: C22, C23, E44, E51, E52, E58

Key words: Monetary policy transmission, Bank lending channel, flight-to-quality, panel of banks

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1. INTRODUCTION

In the past ten years, the Peruvian economy has experienced different monetary policy changes. One of those policy changes is the switch from an aggregate monetary target to an interest rate as the operative target. In 2002, the central bank of Peru adopted an explicit inflation targeting regime, and consistent with this regime, the interbank interest rate is set as the implicit operative target (in 2003, the interbank interest rate is explicitly announced as the operative target). One of the reasons for choosing the interbank interest rate is because it is a variable that clearly communicates the stance of the central bank monetary policy.[1] During this period, inflation became stable and converges to international standard levels. In this context, the interbank interest rate becomes the relevant variable to understand the mechanism of transmission of the monetary policy.

The view of the bank lending channel as a monetary policy transmission mechanism is focused on the role of the banks as either amplifying or slowing down the effects of the monetary policy shocks over macroeconomic activity through the lending process (supply of credit loans). Kashyap and Stein (2000) argue that empirical studies have not completely overcome the fundamental but very difficult problem of disentangling loan supply effects from loan demand effects. However, most of the empirical work that has been done takes into account that challenge and proposes better identification strategies.

In the presence of a contractionary monetary policy shock, some banks would be forced to reduce their supply of credit (bank lending channel). Nevertheless, other banks would have access to external sources of funding in order to protect their portfolio of credit loans. The net effect is subject to the financial system capacity to replace the

[1] See Rossini and Vega (2007) and Armas et al. (2006) for details.

reduction of financial resources. In other words, the heterogeneity within the banking system would help identify the bank lending channel. Controlling for demand variables and using bank level data in this paper I test whether the central bank affects the supply of banking credit loans.

Moreover, I test the bank lending channel for a developing country during a period of time which is consistent with important structural changes. Gunji and Yuan (2010) argue that asymmetric information is more important (more problematic) in developing countries in contrast to developed economies because banks have few alternatives for deposits as financing resources, and so, the bank lending channel of monetary policy should be more important.

For the Peruvian case, the historical evidence on the effectiveness of the bank lending channel is not clear. For example, Quispe (2001) argues that this channel is still weak due to two forces mainly opposed to the interior of this channel: on the one hand, the greater capital mobility and the development of an internal capital market have increased the availability of substitutes for the bank lending, on the other hand, after recovering the confidence in the banking system, the greater banking intermediation would improve the effectiveness of this channel.[2]

One of the arguments for identifying the effectiveness of the bank lending channel is the "flight to quality" situation. Bernanke et al. (1996) define flight to quality as the situation in which borrowers facing relatively high agency costs in credit markets will bear the brunt of economic downturns. The flight to quality situation is part of the financial accelerator view, and it is complemented with a situation in which reduced spending, production, and investment (given the high-agency-cost borrowers) will exacerbate the effects of recessionary shocks. In this context, banks have comparative

[2] Quispe argues that the financing process through the Lima Stock Exchange would have reduced the bank lending channel effectiveness. However, the banking system would replace informal mechanisms of financing for small firms which in turn would increase its portfolio of customers.

advantages in collecting and processing information as well as the capacity to establish long term relationships with their clients. It is also possible that banks are able to offer credits to riskier clients and if so, banks that serve clients who do not have any other alternative of funding may face greater default in credit loans in the presence of a contractionary monetary shock. If so, in a credit rationing scenario, firms who are dependent on bank lending would reduce their production levels even more.[3]

In this paper, the panel estimations follow Kashyap and Stein (1995) who conclude that for the bank lending channel to be operational, it is often sufficient that a central bank be able to affect the supply of loans made by commercial banks. My results are consistent with a bank lending channel operating in Peru for 2002 – 2010. The SVAR approach follows on the work of Gilchrist and Zakrajsek (1995) and a flight to quality scenario. I find evidence against any significant effect of this channel for explaining economic activity during this period.

The advantage of this paper over previous works made for Peru is based on data which begins in 2001. This allows the use of the interbank interest rate as the variable that determines the monetary policy stance. For previous years to 2001, it is more difficult to define which instrument is used by central bank for controlling inflation so I am not subject to strong assumptions regarding one instrument or many instruments. Another advantage is that this paper incorporates methodological changes in banking accounting given by the Superintendence of the Banking System (SBS) in Peru.

The remainder of this paper is organized as follows. In part II, I review the literature regarding the bank lending channel in both theory and empirics. Part III presents a representative bank model with a bank lending channel set up. I then in part IV describe

[3] The problem for this type of banks continues with potentials problems of asymmetric information, in such a way that it is difficult to evaluate their portfolios of loans, so later these banks would experience difficulties in replacing their sources of funding.

the data and indicators I use for the estimations made in part V. I conclude the analysis on part VI.

2. LITERATURE REVIEW

2.1 Modeling Issues and Theoretical Approach

One of the first theoretical formulations of the bank lending channel problem dates back to Bernanke and Blinder (1988) within an IS/LM-type setting. Bernanke and Blinder argue that the existence of a bank lending channel for monetary transmission is based on the premise that the supply of non-deposit sources of funding for banks is not infinitely elastic. In their model, banks are not able to replace non-remunerated deposits with alternative sources of funding, such as certificate of deposits, new equity, or a decrease their bond holdings in response to a monetary tightening.

Kashyap and Stein (2000) point out that the lending view of Bernanke and Blinder (1988) depends on the failure of the Modigliani-Miller proposition for banks in addition to borrowers who cannot find perfect substitutes for bank loans; and imperfect price adjustment.[4] Stein (1998) claims that his work can be interpreted as the microfundations of Bernanke and Blinder (1988) model and builds a model which considers the existence of a bank lending channel in a bank asset and liability framework based on adverse selection.[5]

Walsh (2003) extends the analysis of Bernanke and Blinder (1988) and analyzes the conditions under which the loan supply might be perfectly elastic. Walsh consider the portfolio decisions of a representative bank that maximizes profits and concludes that if

[4] The non-substitutability between loans and bonds violates the Modigliani–Miller proposition for banks.
[5] Stein develops this argument, observing that many classes of bank liabilities which escape reserve requirements are not covered by deposit insurance, and hence are potentially subject to adverse selection problems.

loans and demand deposits are complements in the bank's cost function, then a change in reserves that lowers deposits may directly increases the cost of loans, leading to a shift in the loan supply function. The shift in the loan supply function would represent a distinct bank lending channel leading to a drop in loans.

Ehrmann et al. (2003), develop a model of the loans market that draws also upon Bernanke and Blinder (1988). The solution of their model yields an equation for bank loans that relates the response of bank loans to monetary policy both directly (via the money channel) and to the bank characteristics (the lending channel). Ehrmann et al. accomplish this by adding an explicit demand function for nominal bank loans (which introduces aggregate variable like output and prices) and by considering that banks are perceived to be risky (which leads to the supplier of non-deposit banks demanding an external finance premium).[6]

Also it is important to mention that some theoretical modeling has been done in order to isolate the effect of cross-sectional differences on the response of banks to monetary policy. Peek and Rosengren (1995) model a representative bank which faces a loan demand and a large time deposit demand, both of which depend on capital and asset size. This model is extended in Kishan and Opiela (2000) who assume that the mean of the market interest rates for deposits, loans, and securities are directly related to the federal funds rate plus a fixed spread.

Most current empirical work is based on the Ehrmann et al. (2003) and Kishan and Opiela (2000) approaches.

2.2 Empirics on Bank Lending Channel and Identification Problem

[6] The interest rate that banks pay is the risk free rate (which the authors associate with the FED fund rates) plus a premium. The external finance premium depends on a signal of bank's health, which is different for each bank. The higher the health, the lower the external finance premium.

The first paper on the existence of a bank lending channel that focused on the estimation of reduced-form equations of credit supply using aggregate data is Bernanke and Blinder (1992). This paper attempts to provide empirical support to their theoretical model presented in Bernanke and Blinder (1988). In general, this strand of the literature is criticized because of identification issues of the credit supply responses, given that monetary shocks could simultaneously affect the demand and supply for loans. Failure to separate these effects leads to an overestimation of the impact of monetary policy on the supply of loans.[7]

More recently, different identification strategies have been proposed, including the use of bank-level data to account for heterogeneity in the response of banks to changes in monetary policy. This approach assumes that banks are price-takers but they react differently to monetary policy depending on the substitutability among alternative sources of non-deposit finance. Information on bank-level characteristics, such as capitalization, size, and liquidity, is used to account for heterogeneity. The main papers in this line of research are Kashyap and Stein (1995, 2000) and Kishan and Opiela (2000).

In their pioneering work, Kashyap and Stein (1995) use bank level data to test for a bank lending channel. They find that banks with fewer total assets tend to reduce loans relatively more under a tight monetary policy.[8] Moreover, Kashyap and Stein (2000) find that the effect of monetary policy is stronger for banks with less liquid assets. In other words, monetary policy has a limited effect on banks that can turn to liquid assets to cover the reduction in deposits. Kishan and Opiela (2000) complement previous work and emphasize the role of bank capital in the bank lending channel (banks with less

[7] See Romer and Romer (1990) for a discussion on endogeneity issues of the early empirical works.
[8] Kashyap and Stein (1995) argue that if deposits fall through tight monetary policy, banks have to reduce their loans unless they turn to other methods of financing. It is relatively easier for large-scale banks to borrow in interbank markets or issue certificates of deposit. For this reason, even if a tight monetary policy is implemented, large-scale banks do not have to reduce loans.

capital tend to reduce loans following tight monetary policy.) Together, the previous three studies have stimulated much research on the bank lending channel in other economies.[9] However, as emphasized by Kashyap and Stein (2000), even under appropriate identification conditions, aggregation makes it difficult to quantify the overall impact of monetary policy on credit using evidence based on bank-level data.

To avoid aggregation problems, a strand of literature has favored the use of aggregate data and relied on the estimation of vector error correction models. Within this framework the supply and demand for loans can be identified by testing for the presence of multiple cointegrating relationships and exclusion, exogeneity, and homogeneity restrictions. Loan supply and demand can therefore be modeled jointly, rather than in a one-equation reduced-form setting.

Identification of the credit demand and supply equations in this framework relies predominantly on the sign of banks' borrowing and lending rates, as well as that of bank capital, coupled with exclusion and homogeneity restrictions imposed on the long-run coefficients. The works of Kakes (2000), Calza et al. (2006) and Mello and Pisu (2010) use this approach.[10]

Kakes (2000) finds two cointegrating relationships for the case of the Netherlands and imposes a homogeneity restriction on the borrowing and lending rates in the supply equation. Nevertheless, there does not appear to be strong evidence of a bank lending channel. Calza et al. (2006) find only one cointegrating vector for the Euro-area, which they normalize as a loan demand equation on the basis of the signs of the long-term

[9] For estimations of the bank lending channel following this view, see Altunbas et al. (2002) for European countries and Gunji and Yuan (2010) for the case of China. Gunji and Yuan contribute to this literature suggesting the use of profits as another bank characteristic and find that profitable banks tend to be less sensitive to monetary policy. They also point out that previous studies are doubtful of the reliability of the data and their study is an attempt to uncover the effects of monetary policy qualitatively rather than quantitatively.

[10] Mello and Pisu (2010) points out that if the presence of two cointegrating relationships cannot be rejected by the data, identification of the supply and demand functions depends on the estimated sign of the lending rate, which should be negative in the demand equation and positive in the supply equation, and the sign of the borrowing rate, which should be negative in the supply equation.

coefficients. In the same vein, Melo and Pisu (2010) find evidence of two cointegrating vectors, which identifies a loan demand and a supply functions for the case of Brazil.

Coming back to the panel data approach, this strategy requires a large number of banks. An alternative approach is to use a panel model that allows the reaction of bank loans to monetary policy to become dependent on the bank characteristics. This approach, suggested by Ehrmann et al. (2003), avoids the problem associated with the number of banks and is also used in Hernando and Martinez-Pages (2001), Alfaro et al. (2004), Gambacorta (2005), Mautosek and Sarantis (2009), Altunbas et al. (2009), and Tabak et al. (2010).

Hernando and Martinez-Pages (2001) find evidence against the existence of a bank-lending channel in Spain while Ehrmann et al. (2003) find that the bank lending channel is operating in Germany, France, Italy, and Spain. Ehrmann et al. find that less liquid banks react more strongly to shifts in monetary policy than more liquid banks do, but bank size and capitalization are generally not important. Mautosek and Sarantis (2009) systematically test for the bank lending channel in Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia (Central and Eastern European countries, CEE countries) and find evidence of a bank lending channel in all countries, however the strength of it varies across countries. Gambacorta (2005) employs Italian data which covers mainly one monetary policy regime and shows: (i) bank scale is unrelated to the impact of monetary policy, and (ii) the impact of monetary policy on banks with more liquid assets is weaker.[11] Alfaro et al. (2004) and Tabak et al.

[11] Gambacorta (2005) points out that a previous study has different results, and argues that those estudies are based on BankScope database which does not control for mergers and acquisitions. Gambacorta used Supervisory reports data for Italy and correct for previous data problems.

(2010) find that bank loans supply reacts differently when interest rate changes in Chile and Brazil, respectively.[12]

Another approach to the identification of the bank lending channel is to identify liquidity supply shocks which are exogenous to the loan demand side. Peek and Rosengren (1997, 2000) and Schnabl (2010) look for natural experiments that generate exogenous liquidity supply shocks. Mian and Khwaja (2010) use firm-level and bank-level data for the identification of the bank lending channel and pin down a shock that affected the supply of credit loans.

Peek and Rosengren (1997) use Japanese bank lending operations in the U.S. to test the extent to which the strong decline in Japanese stock prices is transmitted to the U.S. via U.S. branches of Japanese parent banks.[13] Peek and Rosengren (2000) consider that the Japanese banking crisis at the end of the 90s provides a natural experiment to test whether a loan supply shock can affect real economic activity.[14] Schnabl (2010) use the 1998 Russian default as a negative liquidity shock to the bank system in Peru and find an operating bank lending channel.[15] Mian and Khwaja (2010) use data that follows all loans made by lenders to borrowing firms in Pakistan, and exploit cross-bank variation in liquidity shocks induced by the unanticipated nuclear weapons tests in 1998 made by the governments of India and Pakistan.[16]

In general, studies for the U.S. banks provide evidence for the bank lending channel. This has been questioned by Ashcraft (2006). Similar to previous studies, Ashcraft

[12] Altunbas et al. (2009) adds securitized lending as another bank characteristic that make the lending channel stronger, but it is difficult to compare their results with precious work.
[13] This strategy permits the identification of a supply shock to the U.S. bank lending that is independent of the U.S. loan demand.
[14] Because the shock was external to the U.S. credit markets, yet connected through the Japanese bank penetration of the U.S. markets, this event allows an identification of an exogenous loan supply shock.
[15] Schnabl (2010) uses a point in time and evaluate the effects a year before and after in order to identify this channel.
[16] Mian and Khwaja (2010) isolate the causal impact of the bank lending channel by showing that for the same firm borrowing from two different banks, the size of loans from the bank experiencing a larger decline in liquidity drops by some additional percentage points.

identifies a differential response of loan supply to changes in the federal funds rate across banks. However, when the bank data is aggregated to the state level, the loan market share of affiliated banks tends to mitigate the negative response of state loan growth to changes in monetary policy, while the aggregate response of output to bank lending is insignificant and negative.[17] Matousek and Sarantis (2009) follow Ashcraft's strategy for CEE countries, and find the opposite results. The authors argue that it is plausible that the deep and liquid financial markets in the U.S. enable firms to replace bank loans, while the undeveloped financial markets in the CEE countries prevent firms in those countries to do likewise.[18]

The empirical literature on Peru includes the work of Quispe (2001), Loo-Kung and Shiva (2003), Carrera and Espino (2006), and Schnabl (2010). Quispe uses SVAR techniques and suggests that the bank lending channel is neutralized due to the possibility of financial resources substitution for part of the banks. The work of Loo-Kung and Shiva (2003) uses a panel of banks to explain that the monetary policy does not have the capacity to affect the total supply of bank loans and report evidence of a channel in domestic currency only so that, banks of greater relative size are affected to a lesser extent by the changes in the monetary policy stance. Carrera and Espino find a relationship between bank's size and the spread of interest rates, using bank level data. While Quispe's work is focused on the credit channel and his conclusions do not include any explicit measure of the bank lending channel, Loo-Kung and Shiva did not provide any test of the effectiveness of this channel and Carrera and Espino leave the transmission process from central bank to the banking system to future research. On the

[17] On the other hand Dricoll (2004) find evidence of a lending channel by aggregating bank data to the state level. The difference between these papers is the use of the interest rate in Ashcraft while Driscoll use the money demand for the identification of the monetary policy shock.

[18] Matousek and Sarantis aggregate the bank data up to the country level. To investigate the effectiveness of the channel, Matousek and Sarantis estimate an equation that regresses the country output growth on country bank loan growth.

other hand, the work of Schnabl lacks explanation about the 1997 Asian crisis and the 1998 Niño Phenomenon that may hit the Peruvian economy during that period of time affecting both, the demand and the supply credit loans. This essay provides updated data, uses a different indicator of the monetary policy stance, and tests for the effectiveness of the bank lending channel.

3. A REPRESENTATIVE BANK MODEL

The model in Ehrmann et al. (2003) allows the identification of the bank lending channel. In this model, a profit-maximizing bank decides the optimal amount of credit loans. The balance sheet identity of bank *i* is defined as:

$$L_i + S_i = D_i + B_i + C_i \quad (1)$$

where L_i is the volume of loans, S_i is securities, D_i is the volume of deposits, B_i is the level of non-secured funding, and C_i is the capital of bank *i*. Bank *i* is on a loan market characterized by monopolistic competition. The demand for bank loans is given by:

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

where $r_{L,i}$ is the bank individual loan rate, *y* denotes aggregate real output, and p is the aggregate price level. All coefficients are assumed to be positive: $\alpha_0, \alpha_1, \alpha_2 > 0$.

In this model, bank capital is linked to the level of loans as:

$$C_i = kL_i \quad (3)$$

Deposits are secured, but do not pay any interest. They are demanded because of their role as a means of payment. In order to avoid any liquidity risk, a proportion of the deposits are secured so securities are represented as:

$$S_i = sD_i \quad (4)$$

Aggregate deposit demand, on the other hand, can be represented as negatively related to the interest rate of a risk free asset, r_S and follows:

$$D = -\theta r_S \quad (5)$$

where $\theta > 0$ and r_S also represents the monetary policy rate.

Since a bank does not remunerate these deposits, all the banks cannot influence the amount of deposits that each bank holds (D_i). Aggregate deposits are exogenous to the bank and fall after a monetary tightening (an increase in r_s).

On the other hand, any bank has access to an alternative source of funds, which is unsecured and for which has to pay an additional interest rate. Because a bank is perceived as a risky agent, the suppliers of unsecured funding request an external finance premium. The interest rate that this bank pays is $r_{B,i}$ which is the risk free rate r_s plus a premium. This premium depends on a bank's health signal (x_i) which can be observed by all market participants. The higher the x_i, the lower the external finance premium. The interest rate that a bank has to pay for these funds is:

$$r_{B,i} = r_S(\mu - \gamma x_i) \quad (6)$$

where $\mu - \gamma x_i \geq 1$ for all individual banks.[19]

Then it follows that the profit of bank *i* is given by:

$$\pi_i = L_i r_{L,i} + S_i r_S - B_i r_{B,i} - \Psi_i \quad (7)$$

where Ψ_i captures bank-specific administrative costs and the remuneration costs for the required capital holdings.

Inserting equations (1) to (5) in (7), and assuming equilibrium in the loan market, the profit of bank *i* can be re-written as:

$$\pi_i = L_i\left(-\frac{1}{\alpha_0}L_i + \frac{\alpha_1}{\alpha_0}y + \frac{\alpha_2}{\alpha_0}p\right) + (sD_i)r_S + [(1-k)L_i - (1-s)D_i]r_{B,i} - \Psi_i \quad (8)$$

[19] See Ashcraft (2005) for evidence of bank health from the U.S. at the state level and its relationship with economic growth.

Each bank maximizes with respect to L_i, so setting the first order condition to zero, and inserting condition (6) yields:

$$L_i = \frac{\alpha_1}{2} y + \frac{\alpha_2}{2} p - \frac{\alpha_0 \mu (1-k)}{2} r_S + \frac{\alpha_0 \gamma (1-k)}{2} x_i r_S - \frac{\alpha_0}{2} \frac{\partial \Psi_i}{\partial L_i} \qquad (9)$$

In the "money view," no informational asymmetries imply no external finance premium, hence, $r_{B,i}$ is equal to r_S and there are no differences in the response to monetary policy across banks.

In this model, a monetary policy tightening (increase in r_S) leads to a reduction in deposits. If a bank increases other sources of funding, it would keep the asset side of their balance sheet unchanged. However, the interest rate a bank has to pay for these funds was increased. A bank passes at least part of this higher cost to its loan rate ($r_{L,i}$) which in turn reduces loan demand. This implies a negative coefficient for r_S in (9).

In order for a bank lending channel to operate, the costs for raising non-secured funds depend on the degree to which it suffers from informational frictions in financial markets. In this model, this implies that different banks face different costs for raising non-secured deposits ($\gamma > 0$). This differentiation would force some banks to reduce their lending by more because they have a low health value. If loan demand is homogeneous across banks a differential loan reaction to monetary policy identifies a loan supply movement. The differential reaction can be seen on the parameter associated to the interaction term $x_i r_S$. If this coefficient is significantly positive, monetary policy affects loan supply.

Considering that bank loans are the main source of financing for firms (specially in developing countries) and that readily available substitutes in times of monetary tightening are limited, this representative bank model is as a reasonable benchmark for testing the bank lending channel.

4. DATA DESCRIPTION

The data base comes from the banks' financial statements, available in the official web page of the SBS and covers from 2001 to 2010. I also use macroeconomic series, which are taken from the official web page of the Central Reserve Bank of Peru (BCRP).

In January 2001 the SBS made it effective a new Manual of Banking Accounting, and introduced different modifications in the definition and treatment of diverse accounts. These changes make some numbers published until December 2000 non-comparable with the ones published from 2001, for example assets and liabilities of the banking system.

The database inhere covers from 2001 to 2010, monthly frequency for the panel of banks estimation, and quarterly frequency for the VAR estimations. When using the financial statements of the banks, I consider all banks operating for the whole sample period and also excluded any foreign filial (which diminishes the problem associated with heterogeneous demand shocks).

The total credit loans are then discriminated into consumption credit loans and commercial loans. This distinction of loans would allow a better identification of the changes in the supply of credit loans. I argue that both series would tend to have different reactions during different moments of the business cycle, as can be shown on Figure 2.

Previous work on bank lending channel tests the presence of the lending channel by controlling for three bank characteristics: size, liquidity, and capitalization. Kashyap and Stein (1995) and Kishan and Opiela (2000) consider the size of banks as one of these characteristics because small banks are more prone to the problem of information

asymmetry than large banks (large banks that can issue market instruments.) Evidence provided by Kashyap and Stein (2000) shows that liquid banks can insulate their loan portfolios by reducing their liquid assets, while less liquid banks are unable to do so. Peek and Rosengren (1995) and Kishan and Opiela (2000) argue that poorly capitalized banks reduce their loan supply more than well capitalized banks after a monetary contraction (limited ability to tap into uninsured sources of funds.) I also collect proxies variables of those bank characteristics. Size is defined as the total of assets of each bank in relation to the total of assets in the banking system, liquidity is defined as the ratio of liquid assets over total assets, and capitalization is defined as the ratio of capital and reserves over total assets in each bank. The summary statistics of size, liquidity, and capitalization are reported on Table 1.[20]

I estimate also an indicator of quality of the loans. This indicator is motivated for the idea that adverse shocks to the economy may be amplified by worsening credit market conditions. Bernanke et al. (1996) interpret the financial accelerator as resulting from endogenous changes over the business cycle in the agency costs of lending. At the onset of a recession, borrowers facing high agency costs should receive a relatively lower share of credit extended (the flight to quality) and hence should account for a proportionally greater part of the decline in economic activity (amplification effect).

Taking into account that commercial credit loans mainly include corporative credits, I estimate a credit quality ratio as: (Consumption credit loans + Small company loans) / (Commercial credit loans).[21]

[20] Liquid assets are defined by the SBS as assets of short-term maturity. This includes cash; funds available at the central bank, at other financial institutions, and at foreign first-rate banks; interbank available funds; bonds and certificates of deposit issued by the central government and the central bank; and certificates of deposit issued by other financial institutions.

[21] Alfaro et al. (2004) take the banking debts of the medium and large firms in Chile and construct a low/high quality ratio of banking loans as the consumption credits over the large-firm credits to capture the availability of banking credit for households and small companies in relation to the credit granted to big companies. Mian and Khwaja (2006) find that large firms in Pakistan completely compensate the

Consumption and small firm credit loans allow the incorporation of the flight-to-quality effect following the concept of Bernanke et al. (1996). When I compare the series consumption loans and small firm loans, both series follow a similar pattern (the correlation is around 98 percents).[22] In Figures 3, I present the evolution of these time series.

The operative financial mechanism of the flight to quality effect would be: indebted consumers and specially the small firms would be replaced by big companies ("crowded out"). In this situation, consumers and small companies would be restricted to take banking credit loans.

In order to identify the effect of the monetary policy actions over supply of banking credit loans, I need an indicator that is nearly related to the monetary policy stance. For the Peruvian case I have the advantage over previous research given by the period sample. This fact allows the use of the interbank interest rate as such indicator. Then, a positive movement of the interbank interest rate would reflect a contractive monetary policy regime.

Finally, I use different macroeconomic variables both in the panel of banks and in the VAR systems:

- For the panel of banks, I use the annual growth of the real GDP (effects of changes in income), and the annual devaluation of the real exchange rate (changes in relative prices). Both variables would control for demand conditions.
- For the VAR systems, I use three additional endogenous variables (in addition to the credit quality ratio and the interbank interest rate): a variable proxy for macroeconomic activity, the consumer prices index, and the real exchange rate. I

effect of a liquidity shock by borrowing from more liquids banks while small unconnected firms are entirely unable to hedge and face large falls in overall borrowing.

[22] A possible explanation of the high correlation is that many credit loans granted to small and even medium companies have been registered as consumption credit loans. Alfaro et al. (2004) find similar situation for the Chilean case.

use real GDP, output gap, industrial production, private investment, private consumption, and unemployment rate as proxies for macroeconomic activity. Each VAR model includes terms of trade, inflation target, external production, and a trend tendency variable as exogenous variables.[23]

The described variables are sustained in the fact that Peru is a small open economy with announcements of an inflation range from 1994 and an explicit inflation target regime since 2002. In particular, I include terms of trade and external output in order to control for external shocks. In this way, if I find that the credit quality ratio influences the economic activity after a monetary policy shock, I would possible interpret that such flight-to-quality effect is domestically generated.

5. EMPIRICAL ANALYSIS

5.1 Monetary Policy Changes in Peru

In the past ten years, the Peruvian economy has experienced different structural changes regarding monetary policy. One of those changes was the switch from an aggregate monetary target to an interest target as the operative target. Rossini and Vega (2007) point out that the switch is the result of achieving levels of inflation similar to international standards and of the low correlation between inflation and the growth rate of the primary emission of money.

The transition of such switch can be described as follows: In 2002, the central bank adopts an explicit inflation targeting regime, also in 2002 central back switches from operative quantitative target in the commercial banks account on central bank to a reference band for the interbank interest rate, and in 2003 the interbank interest rate was

[23] Inflation target is the center value of the inflation band that the Peruvian Central Bank announces every year and external GDP is the growth rate of the U.S. GDP.

set as the new operative target. Figure 4 reports the scheme of the transition of the operative target, and Figure 5 displays the interbank interest rate.

Under this scheme, the central bank announces a reference interest rate (and a band), and leads the interbank interest rate to the center of the band in open market operations.[24]

5.2 Identification of the Bank Lending Channel: Panel Data of Banks

The empirical strategy initially follows on the tradition of Kashyap and Stein (2000). Bank level data is used to estimate the sensitivity of credit to changes in the monetary stance through a reduced-form equation for loan supply, while using bank heterogeneity (arising essentially from size, liquidity, and capitalization indicators) for identification purposes.

The central bank must be able to affect the supply of loans so banks must not be able to offset the decrease in deposits (caused by open market sales) or increased reserve requirements (by raising funds from any other source), otherwise total supply of loans may not change.[25]

I classify loans in three categories: total, consumption, and commercial loans. Such classification allows the identification of a flight to quality effect. Following on Ehrmann et al. (2003) I estimate a panel of 22 banks and use a set of macroeconomics

[24] Armas et al. (2006) argues that the main advantages of such switch to the interbank interest rate are: (i) it is an instrument that clearly communicates the stance of the monetary policy, (ii) it is a reference for other interest rates basically for transactions in domestic currency, (iii) its volatility has been reduced and the pass trough to other interest rates has been strength, and (iv) it is a flexible instrument which allows central bank to quickly react in difficult situations.

[25] Golodniuk (2006) reviews similar specification of previous empirical work for identification of the bank lending channel and use it for Ukraine, while Gambacorta and Mistrulli (2004) made a review of different strategies for bank lending channel for the case of European countries, and take the panel of banks approach for the case of Italy. Both of them find evidence in favor of a bank lending channel.

and bank characteristics variables to control for demand and supply sources of variation. The empirical approximation is as follows:[26]

$$y_{it} = \sum_{j=0}^{K} y_{it-j} + \sum_{j=0}^{K} x_{it-j}^{'} \beta + z_{it-1}^{'} \gamma + \sum_{j=0}^{K} x_{3t-j} z_{t-1}^{'} \varphi + u_{it} \qquad (11)$$

where: y_{it} is the annual growth of total loans (commercial loans or consumption loans), x_{it} is a vector of macroeconomics variables (x_{3it} is the interbank interest rate), z_{it} is a vector of bank specific characteristics variables (liquidity, size, and capitalization), and u_{it} is an error term vector.

I include macroeconomics variables in the panel in order to control for demand shocks, whereas the specific bank characteristics would be more associated with the different possibilities of asymmetric information in the bank lending market.

To disentangle loan-supply from loan-demand effects I test for the cross-sectional differences in the response of bank loans to a monetary policy shock. If these differences are related to indicators of the degree of asymmetric information (size, liquidity, or capitalization), they would support the existence of the bank lending channel.

If the bank lending channel is operating, there must be a negative and significant effect between the coefficients associated to the interbank interest rate and a positive effect on the combined effect of the interbank interest rate and bank's characteristics. In the same line, Walsh and Wilcox (1995) show that innovations in the supply of banking credit loans are associated to changes in liquidity ratios, in the required reserves, and in the imposition of credit controls.[27]

Due to the inclusion of lags of the dependent variable, I use the GMM estimator suggested by Arellano and Bond (1991). The differencing procedure ensures efficiency

[26] Similar specification can be found in, for example, Altunbas et al. (2009), Matusek and Sarantis (2009), Gmabacorta (2005), Alfaro et al. (2004), and Ehrmann et al. (2003).

[27] For Peru, an announcement of increase of the reference interest rate would be reflected in an increase in the interbank interest rates, which produces both a reduction of the banking loans due to the smaller demand for credit loans and greater supply of credits from more solvent, liquid, and/or bigger banks.

and consistency of the estimates, provided that instruments are adequately chosen to take into account the serial correlation properties of the model.[28]

In these estimates, I find evidence that, on average, monetary policy has the capacity to affect the total supply of bank credit loans. Table 2 shows that an increase in the interbank interest rate reduces the supply of bank credit loans and increases the supply of bank credit loans from bigger banks. Also I find that the signs are as expected for demand shocks.

By type of credit, an increase of the interbank interest rate would reduce the amount of commercial bank credits. This effect would be partial for banks that have bigger market participation. This type of credits would increase during expansive stages of the economic activity. Also I identify a credit channel in consumer credit loans; those credit loans would tend to decrease when there is an increase of the interbank interest rate, effect that would be compensated by bigger and more liquid banks. [29]

In summary, with respect to the coefficients of the explanatory variables: (i) the real growth of the GDP coefficient is positive when it is statistically significant; (ii) the devaluation of the real exchange rate coefficient is negative when it is statistically significant; (iii) the interbank interest rate coefficient is negative in all the cases; and, (iv) regarding the interaction of the bank characteristics with monetary policy, liquidity coefficient is positive for the consumer credit loans, size coefficient is positive and significant in all cases, and capitalization coefficient is not significant in all the cases. In Table 3, I show the differentiated effect over banks that have different characteristics in the presence of a monetary policy shock.

These results suggest that the bank lending channel has operated in Peru during 2002-2010. In addition, the consumption credits seem to capture better the role of the

[28] The validity of the instruments is tested with the Sargan test.
[29] Loo-Kung and Shiva (2003) use a similar technique but discriminate by type of currency as his main strategy and find a similar result than mine with respect to credit loans in domestic currency.

asymmetric information of the banking credit loans when monetary policy shocks are observed.

5.3 Bank Lending Channel: VAR Estimations

In this section, I test the proposition that the borrowing ratio of "low quality" firms relative to those of "high-quality" firms have predictive power for explaining aggregate real variables. On this second stage I consider the indicator of bank lending credit quality. Such a variable would incorporate the fact that the numerator would include loans of lower quality compared to the denominator which would include credits of higher quality. This rate captures the flight-to-quality effect in the credit positioning for different types of banks in the presence of a contractive monetary policy shock (validation of the credit channel).

The VAR base model incorporates five variables: macroeconomic activity, consumer prices, interbank interest rate in domestic currency, credit quality ratio, and real exchange rate. The exogenous variables including in this specification are terms of trade, objective inflation, external GDP, and a variable of trend tendency. In matrix form, the VAR system is defined as:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + e_t \qquad (12)$$

where y_t is a vector of endogenous and exogenous variables, c is a vector of constants, A_i is a matrix of coefficients (for i = 1,2, ...p) and e_t is an independent and identical distributed vector of errors.

More evidence in favor of the bank lending channel is the rejection of the null hypothesis that the credit variable is not helping to predict macroeconomic activity. This hypothesis can be tested and be complemented with two simultaneous conditions: rejection of the null hypothesis that the interbank interest rate is irrelevant to predict the

credit variable, and rejection of the null hypothesis that the variable proxy of economic activity is useful to predict the credit variable.

I estimate six VAR models and each one has a different measure of macroeconomic activity: GDP, output gap, industrial production, private investment, private consumption, and unemployment rate. A negative monetary policy shock would decrease the credit quality ratio (flight-to-quality effect) which would strongly affect households and small businesses that have banks as the only source of external financing.

The results are presented in Table 4 for six VAR models. Using Granger causality tests, these results show that the credit quality ratio helps to predict macroeconomic activity variables in four out of six estimations. These results also indicate that the interbank interest rate is not significant in also four out of six estimations for predicting macroeconomic activity when the bank lending channel is considered.[30]

On the other hand, macroeconomic activity variables would not help to predict credit quality ratio in all cases, whereas the interbank interest rate would help to predict the credit quality ratio in one out of six cases (four out of six cases, if the ten percent of statistical significance is considered.)

These results suggest that causality goes from monetary policy stance to the banking credit loans, and from banking credit loans to macroeconomic activity. This additional piece of information confirms the presence of the bank lending channel in the Peruvian economy.

[30] The choice of the optimal number of lags for each VAR is done taking into account the information criteria tests (Akaike and Schwarz, mainly), lag exclusion tests (test of Wald) and tests of error autocorrelation (test of autocorrelation of Portmanteau, Q statistic).

5.4 Relevance of the Bank Lending Channel: SVAR Estimations

In order to determine any significant effect of the bank lending channel, which in this case is identified by the credit quality ratio, I estimate a set of autoregressive structural vectors (SVAR) and report the impulse-response functions to a monetary policy shock.

The set of variables are divided in three recursive groups: non policy variables that are contemporaneously affected by the monetary policy variable, monetary policy variable, and non policy variables that are not contemporaneously affected by the monetary policy variable. This specification allows a complete identification of the VAR system.

In other words, the central bank policy reaction function is identified by dividing the variables into non monetary policy variables that cause a policy reaction and non monetary policy variables that are affected by the policy decisions.[31]

The sequence of events would be: the central bank determines the objective inflation and then it sets the monetary policy stance. Then the non policy variables ordering would be: inflation, macroeconomic activity, and credit quality rate of banking loans. Assuming that price level is stickier than output and that the credit variable reacts faster and contemporaneously to policy decisions than previous variables, I would have the representation suggested for this SVAR. In this context, one would expect that a structural monetary policy shock would lead to a decrease in the credit quality ratio, as represented in Figure 9.

Using different variables for macroeconomic activity, I test if the bank lending channel operated during the sample period following this identification strategy: first incorporate the credit quality ratio as an endogenous variable in the VAR system (dark

[31] This assumption would be associated with the fact that capital markets react faster than goods and services markets when a monetary policy shock occurs, and that help the identification of the VAR systems.

lines in impulse-response functions in Figure 10), then define the credit quality ratio as an exogenous variable in the system (light lines in Figure 10), finally shock both systems with the monetary policy variable (to the interbank interest rate) and test the difference between them.

In order to identify the relevance of the bank lending channel I compare one scenario in which this channel is totally annulled versus a scenario where this channel holds. The difference between impulse-responses to a monetary policy shock would give a measure of the relevance of the bank lending channel for describing macroeconomic activity.

In order to determine if such difference is statistically significant, I also estimate the intervals of confidence at 95 percent for each impulse-response when the bank lending channel is annulled. If the impulse-response functions estimated under the assumption that the credit quality variable is endogenous fall outside the confidence interval, it is possible to interpret it as evidence of the relevance of the bank lending channel to explain macroeconomic activity variables.

In five out of six estimations, the results are statistically significant (no significant only for unemployment.) In all five cases, the use of the credit quality ratio has amplifying effects (as suggested in a financial accelerator mechanism.) However in all five cases the difference between the two scenarios is not statistically significant enough (close to be significant in the cases of output gap, private consumption, and GDP.) These results suggest that the use of the credit quality ratio for identifying the evolution of macroeconomic activity is not important and the bank lending channel identified in

the previous sections is not necessary for identifying the transmission mechanism of the monetary policy.[32]

These results are in line with works of Walsh and Wilcox (1995) who find that a shock of interest rate tends to diminish the amount of bank lending and output, however this channel would not have an important role in the economic cycles for the U.S.; of Driscoll (2004) who conclude that there is lending channel operating in the U.S. but this channel has a small/insignificant effect on output; of Kakes et al. (2002) who conclude that the bank lending channel is not an important transmission mechanism for Germany;[33] and of Quispe (2001) who suggests that the bank lending channel for the Peruvian case is neutralized due to the possibility of substitution of financial resources on the part of the banks.[34]

6. CONCLUSIONS

As Peek and Rosengren (1995) point out, one should not expect the impact on the economy of monetary policy to remain constant over time because the financial condition of firms and banks will vary over a business cycle and from business cycle to business cycle. I find evidence of a bank lending channel in the Peruvian economy during the period 2002-2010 i.e. inverse relationship between credit loans and monetary policy stance and direct relationship between credit loans and mix effect of bank characteristics and monetary policy stance in a panel data approach. I also find that

[32] An alternative strategy would be to estimate from the model that includes the credit quality ratio, and simulate it with coefficients on the credit quality ration set to zero, as in Bernanke et al. (1997). Nevertheless the results are similar following both strategies.
[33] Kakes et al. (2002) argues that the lending channel is strong is banking groups that have a very small market share with little consequences for the economy.
[34] On the other hand, the work of Alfaro et al. (2004) and Peek et al. (2003) find significant effects of the bank lending channel on macroeconomic activity. Peek et al. (2003) strategy is different and focus on explaining inventory movements because this is the component of investment (and therefore of GDP) most dependent on bank lending.

causality is running from monetary policy stance to credit loans variables and from credit loans variables to macroeconomic activity variables. However the identified channel is not an important determinant of the monetary policy transmission to macroeconomic activity variables.

With respect to the identification of the bank lending channel, I consider bank level data in order to capture the heterogeneity in the reaction of different type of banks. This specification allows the identification of a negative effect of an increase of the interbank interest rate on the credit loans, result that is consistent with movements in the demand and supply of loans so this channel has been operating in the Peruvian economy. I also find similar result for the commercial and consumption loans.

The identification of the bank lending channel is strengthened by a series of VAR exercises and Granger causality tests in which it is possible to identify that the directionality of the causality goes from the interbank interest rate to the credit variable, and from the credit variable to macroeconomic activity variables.

When dealing with estimating the relevance of the bank lending channel, I find that this channel would not have been important and/or it would have been annulled by other effects that may not be fully considered in this work (like market imperfections, firms' balance sheet, strength of the banking system, among others). The strategy of a credit quality variable inclusion in a set of SVAR estimations allows the amplification of the effects of the monetary shock which is consistent with a financial accelerator mechanism. However, the difference in the impulse-responses is not statistically significant for explaining the behavior of activity variables in the presence of such a shock.

As part of my agenda, I plan on robust these results with co-integrations techniques however that exercise is subject to a bigger sample data, to include long-term effects.

Expanding the sample period and comparing two scenarios: when money emission and when the interest rate are considered as operative target would shade light on the relevance of the lending channel for the transmission of monetary policy shocks to the economy. In line with the work of Mian and Khwaja (2006), the estimation of a firm borrowing channel (the inability of firms to smooth out bank lending channel effects by borrowing from alternative source of financing) with micro level data linking bank to firms would be important in determining how the bank lending channel is an important mechanism of transmission.

APPENDIX - MONETARY POLICY AND EXTERNAL CREDIT CONDITIONS

The work of Kashyap et al. (1993) proposes an alternative identification strategy that are centered in the money as a transmission mechanism (which associates the amount of money to output); and theories that are centered in the bank loans as a transmission mechanism (relationship between bank loans and output). The task is how to avoid endogeneity problems between money, bank lending, and output.

In case that the monetary channel is operating, a monetary contraction would induce a fall in the output which would cause a decrease in the demand for banking credits. In case that the bank lending channel is operating, the contraction of the monetary policy would cause a reduction of the bank loans supply.

Kashyap et al. (1993) make exercises in which in the presence of a contractionary monetary policy:

- If the monetary channel is operating, then a decrease in the output is observed which would lead to a decrease in the demand of both banking and non-banking sources of debt (for example bonds or commercial papers).

- If the bank lending channel is operating, a decrease for banking credit loans is observed (contraction of the loans supply). This would be associated with an increase in the demand for non-banking sources of debt (like a substitute of the banking loans).

The results that they find are: changes in the monetary policy would alter the ratio of bank loans and debt by means of commercial papers,[35] and the changes induced in this ratio would affect the investments of the companies.[36]

The data that I use in order to replicate Kashyap et al. (1993) estimations are: bank credit loans, private sector bonds, private investment (in logarithms), and the interbank interest rate. I also define the variable banking financing ratio: (banking credit loans) / (banking credit loans + private bonds). Figure 11 displays this ratio.

In the case that the bank lending channel is operating, a contractive monetary policy shock would decrease in the supply of bank credit loans and would decrease the composition of private company external financing. This would be associated with a greater demand for non banking debt (bonds).[37]

I estimate the following VAR system: interbank interest rate, ratio of banking financing and investment. Figure 12 presents the negative effect of a contractionary policy shock over the financing ratio. Even though this result is statistically significant, the magnitude of the change is small. In the first quarter the ratio tends to increase, but after that, it consistently takes negative or close to zero values. This suggest that in the presence of a monetary policy shock, firms that have access to the stock exchange will

[35] Kashyap et al. (1993) defines the ratio as banking credit loans to the sum of banking credit loans plus short term commercial papers.
[36] The exercises that Kashyap et al. (1993) do are of Granger causality for the affirmation of effects of the monetary policy towards the ratio of bank loans, whereas they make impulse-response exercises between a shock to bank loans and different measures of investment, in which it is generally observed an increase of the investment variables.
[37] Huang (2003) proposes a similar exercise and conclude that a higher interest rate induces more bank lending to listed U.K. companies, but this effect diminishes if monetary policy becomes tight enough to impose severe constraints on bank loan lending. Similar strategy and result can be found in Scharler (2008) for U.S. firms.

increase the demand for external sources of funding (increase in the ratio) in order to compensate for the decrease on the bank credit loans but later, the net effect is negative.

REFERENCES

Alfaro, R., Franken H., García C., Jara A., 2004. The Bank Lending Channel in Chile. In Banking Market Structure and Monetary Policy, Central Bank of Chile.

Altunbas, Y., Fazylov, O., Molyneux, P., 2002. Evidence on the bank lending channel in Europe. Journal of Banking & Finance 26, 2093–2110

Altunbas, Y., Gambacorta, L., Marquez-Ibanez, D., 2009. Securitisation and the bank lending channel. European Economic Review 53, 996–1009.

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Montecarlo evidence and an application to employment equations. Review of Economic Studies, Vol. 58, pp. 277–297.

Armas, A., Ize, A., Levy E., 2006. Dolarización Financiera: La Agenda de Política. International Monetary Fund and Central Reserve Bank of Peru (BCRP).

Ashcraft, A., 2006. New Evidence on the Lending Channel. Journal of Money, Credit, and Banking, Vol. 38, No. 3, 751-775.

Ashcraft, A., 2005. Are Banks Really Special? New Evidence from the FDIC-Induced Failure of Healthy Banks. The American Economic Review, Volume 95, Number 5.

Bernanke, B., Blinder, A. S., 1988. Credit, money and aggregate demand. The American Economic Review, 78, 435–439.

Bernanke, B., Blinder, A. S., 1992. The federal funds rate and the channels of monetary transmission. The American Economic Review, 82, 901–921.

Bernanke, B., Gertler, M., Gilchrist, S., 1996. The Financial Accelerator and the Flight to Quality. The Review of Economics and Statistics, Vol. 78, No. 1, pp. 1-15.

Bernanke, B., Gertler, M., Watson, M., 1997. Systematic Monetary Policy and the Effects of Oil Price Shocks. Economic Research Reports, C.V. Starr Center for Applied Economics, New York University.

Calza, A., Manrique, M., Souza, J., 2006. Credit in the euro area: An empirical investigation using aggregate data. The Quarterly Review of Economics and Finance 46, 211–226

Carrera, C., Espino, F., 2006. Concentración bancaria y margen de las tasas de interés en el Peru. Revista de Estudios Económicos, Banco Central de Reserva del Perú (BCRP).

Driscoll, J., 2004. Does bank lending affect output? Evidence from the U.S. Journal of Monetary Economics 51, 451–471.

Ehrmann, M., Gambacorta, L., Martínez-Pagés, J., Sevestre, P., Worms, A., 2003. Financial systems and the role of banks in monetary policy transmission in the Euro Area. In: Angeloni, Ignazio, Kashyap, Anil, Mojon, Benoit K. (Eds.), Monetary Policy in the Euro Area. Cambridge University Press, pp. 235–269.

Gambacorta, L., 2005. Inside the bank lending channel. European Economic Review 49, 1737 –1759.

Gambacorta, L., Mistrulli, E., 2004. Does bank capital affect lending behavior? Journal of Financial Intermediation 13, 436–457.

Gilchrist, S., Zakrajsek, E., 1995. The Importance of Credit for Macroeconomic Activity: Identification through Heterogeneity. Conference Series 39: 129–58. Federal Reserve Bank of Boston.

Golodniuk, I., 2005. Evidence on the bank-lending channel in Ukraine. Research in International Business and Finance, 20, 180-199.

Gunji, H., Yuan, Y., 2010. Bank profitability and the bank lending channel: Evidence from China. Journal of Asian Economics 21, 129–141.

Hernando, I., Martinez-Pages J., 2001. Is there a bank lending channel of Monetary Policy in Spain? Working Paper 99. European Central Bank.

Huang, Z., 2003. Evidence of a bank lending channel in the UK. Journal of Banking & Finance 27, 491–510.

Kakes, J., 2000. Identifying the mechanism: is there a bank lending channel of monetary transmission in the Netherlands? Applied Economics Letters 7, 63-67.

Kakes, J., Sturm J., 2002. Monetary policy and bank lending: Evidence from German banking groups. Journal of Banking & Finance 26, 2077–2092.

Kashyap, A., Stein J., 2000. What Do a Million Observations on Banks Say about the Transmission of Monetary Policy? American Economic Review 90 (3): 407–28.

Kashyap, A., Stein J., 1995. The Impact of Monetary Policy on Bank Balance Sheets. Carnegie-Rochester Conference Series on Public Policy 42: 151–95.

Kashyap, A., Stein, J., Wilcox, J., 1993, Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance. American Economic Review, 83 (1): 78-98.

Kishan, R., Opiela, T., 2000. Bank Size, Bank Capital, and the Bank Lending Channel. Journal of Money, Credit and Banking 32(1): 121–41.

Loo-Kung R., Shiva M., 2003. El efecto de la política monetaria en la dinámica de los préstamos bancarios: un enfoque a nivel de bancos. Concurso de Investigación para Jóvenes Economistas 2002-2003. Banco Central de Reserva del Perú (BCRP).

Matousek, R., Sarantis, N., 2009. The bank lending channel and monetary transmission in Central and Eastern European countries. Journal of Comparative Economics 37, 321–334.

Mello, L., Pisu, M., 2010. The bank lending channel of monetary transmission in Brazil: A VECM approach. The Quarterly Review of Economics and Finance 50, 50–60.

Mian, A., Khwaja, A., 2006. Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market. NBER Working Paper No. 12612.

Peek, J., Rosengren, E., 2000. Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States. The American Economic Review 90(1): 30-45.

Peek, J., Rosengren, E., 1997. The International Transmission of Financial Shock: The Case of Japan. The American Economic Review 87(4): 495-505.

Peek, J., Rosengren, E., 1995. Is Bank Lending Important for the Transmission of Monetary Policy? Conference Series No. 39, June, Federal Reserve Bank of Boston.

Peek, J., Rosengren, E., Tootell, G., 2003. Identifying the macroeconomic effect of loan supply shocks. Journal of Money Credit and Banking, 35, 931–946.

Quispe, Z., 2001. Transmission mechanisms of monetary policy in an economy with partial dollarization: the case of Peru. BIS Papers 8, en Bank of International Settlement.

Romer, C., Romer, D., 1990. New evidence on the monetary transmission mechanism. Brookings Paper on Economic Activity, 1, 149–198.

Rossini, R., Vega, M., 2007. El mecanismo de transmisión de la política monetaria en un entorno de dolarización financiera: El caso del Perú entre 1996 y 2006. Revista de Estudios Económicos. Banco Central de Reserva del Perú (BCRP).

Scharler, J., 2008. Bank lending and the stock market's response to monetary policy shocks. International Review of Economics and Finance 17, 425–435.

Schnabl, P., 2010. Financial Globalization and the Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market. Journal of Finance, forthcoming.

Stein, J., 1998. An adverse-selection model of bank asset and liability management with implications for the transmission of monetary policy. RAND Journal of Economics Vol. 29, No. 3, pp. 466-486.

Tabak, B., Laiz, M., Cajueiro, D., 2010. Financial Stability and Monetary Policy – The case of Brazil. Central Bank of Brazil, Working Paper Series 217.

Walsh C., Wilcox J., 1995. Bank Credit and Economic Activity. In J. Peek and E. Rosengren (eds.), Is Bank Lending Important for the Transmission of Monetary Policy?, Federal Reserve Bank of Boston Conference Series N. 39, June 1995, 85-112.

Walsh C., 2003. Monetary Theory and Policy. Second Edition. MIT Press.

Table 1
Bank Summary Characteristics
(percent)

Characteristic	Mean	Standard Error	Minimum	Maximum	Percentile		
					25	50	75
Size	7.36	9.96	0.04	38.41	0.92	2.67	9.50
Liquidity	29.27	15.74	0.10	97.91	18.89	25.35	36.19
Capitalization	13.76	16.64	3.24	93.61	7.04	9.06	13.05

Sample: 22 banks.

Table 2
Effects of Monetary Policy over Loans Supply

Dependent variable	Coefficient	Standard error
1 Growth of total loans		
Real GDP growth	3.23 *	2.02
Real exchange rate devaluation	-4.36 ***	1.53
Interbank interest rate	-10.35 **	5.15
Bank characteristic and Interbank interest rate		
Liquidity	-12.92	25.90
Size	13.24 **	7.15
Capitalization	17.44	56.06
2 Growth of commercial loans		
Real GDP growth	18.43 ***	4.83
Real exchange rate devaluation	-3.34	2.59
Interbank interest rate	-14.96 *	8.17
Bank characteristic and Interbank interest rate		
Liquidity	-49.48	47.27
Size	26.37 **	12.98
Capitalization	-171.16	125.65
3 Growth of consumer loans		
Real GDP growth	0.54	1.48
Real exchange rate devaluation	-0.15	0.82
Interbank interest rate	-19.05 ***	3.33
Bank characteristic and Interbank interest rate		
Liquidity	50.34 *	45.96
Size	37.20 ***	12.41
Capitalization	-814.19	681.57

One, two, and three stars indicate, respectively, statistical significance at the 10, 5, and 1 percent level.

Table 3
Overall Effect of a Monetary Policy Shock on the Growth Rate of Loans
(by percentile)

Type of loan	Liquidity			Size			Capitalization		
	25	50	75	25	50	75	25	50	75
Total	-10.4	-10.4	-10.4	-10.2	-10.0	-9.1	-10.4	-10.4	-10.4
Consumer	-9.5	-6.3	-0.8	-18.7	-18.1	-15.5	-19.0	-19.0	-19.0
Commercial	-15.0	-15.0	-15.0	-14.7	-14.3	-12.5	-15.0	-15.0	-15.0

Table 4
Credit Quality and Macroeconomic Activity
VAR Pairwise Grager Causality/Block Exogeneity (Wald tests)
P values from exclusion test

Models classified according to proxies for macroeconomic activity	Variable excluded from: 1/			
	Macroeconomic activity equation	P value (percent)	Credit quality ratio equation 2/	P value (percent)
GDP	Interbank interest rate	41.8	GDP	46.3
	Credit quality ratio	0.3	Interbank interest rate	5.0
Output gap	Interbank interest rate	64.7	Output gap	28.2
	Credit quality ratio	95.1	Interbank interest rate	7.1
Industrial production	Interbank interest rate	0.6	Industrial production	93.0
	Credit quality ratio	3.7	Interbank interest rate	8.4
Private investment	Interbank interest rate	92.1	Private investment	26.0
	Credit quality ratio	2.5	Interbank interest rate	27.8
Private consumption	Interbank interest rate	75.0	Private consumption	95.7
	Credit quality ratio	21.1	Interbank interest rate	8.1
Unemployment rate	Interbank interest rate	1.3	Unemployment rate	82.5
	Credit quality ratio	0.9	Interbank interest rate	28.1

1/ The numbers in the table are the P values for the null hypothesis that some variables contain no information for the dependent variable. For each model, we choose the equation that represent both the proxy for macroeconomic activity and credit variable (credit quality ratio). I then test, respectively, wheather macroeconomic activity and monetary policy do not Granger cause the credit variable. In other words, if the P value is lower than 5 percent, we can reject the null hypothesis.
2/ Ratio of credit bank loans for consumer and small firms to credit bank loans for commercial firms.

FIGURE 1.- ANNUAL GROWTH OF LOANS

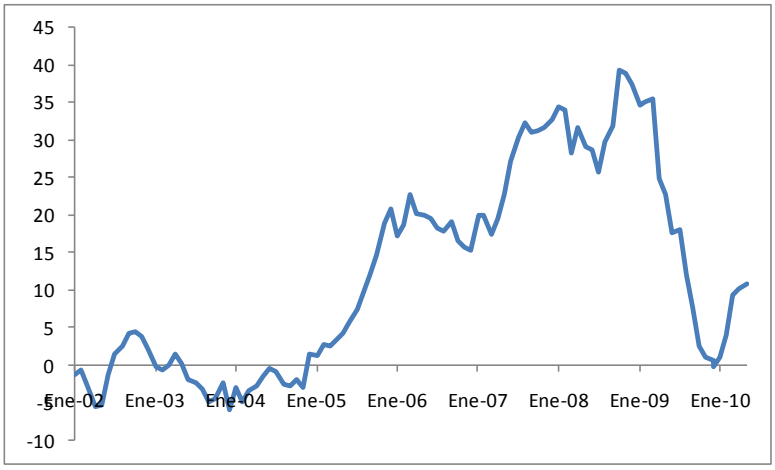


FIGURE 2.- ANNUAL GROWTH OF COMMERCIAL AND CONSUMPTION LOANS

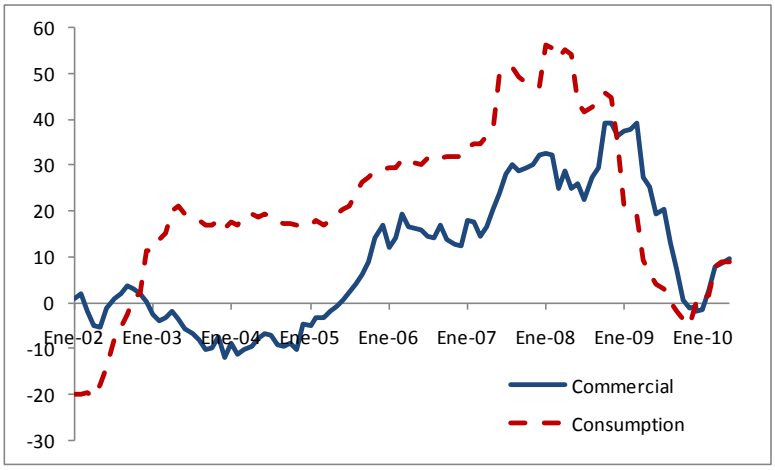


FIGURE 3.- ANNUAL GROWTH CONSUMPTION AND SMALL FIRMS LOANS

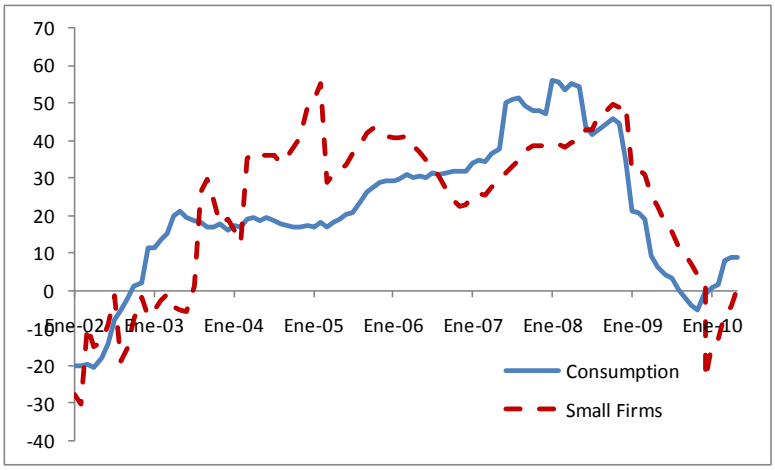
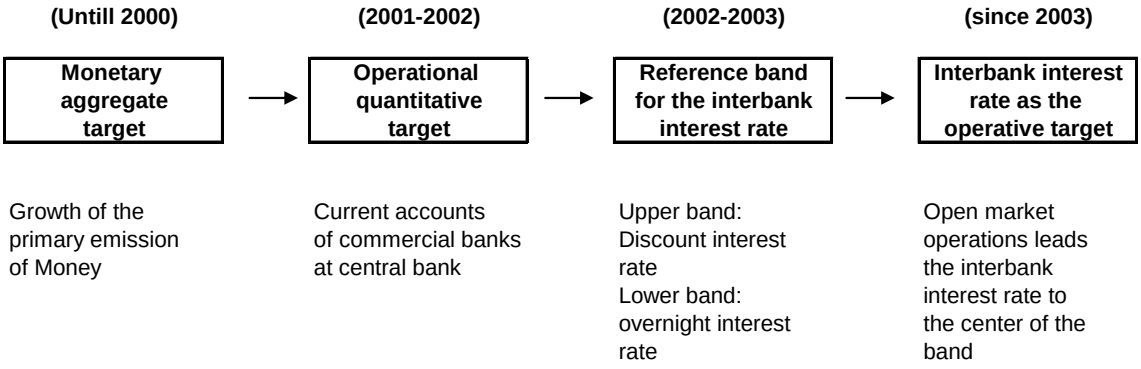


FIGURE 4.- EVOLUTION OF THE OPERATIVE TARGET



Source: Rossini and Vega (2006).

FIGURE 5.- INTERBANK INTEREST RATE

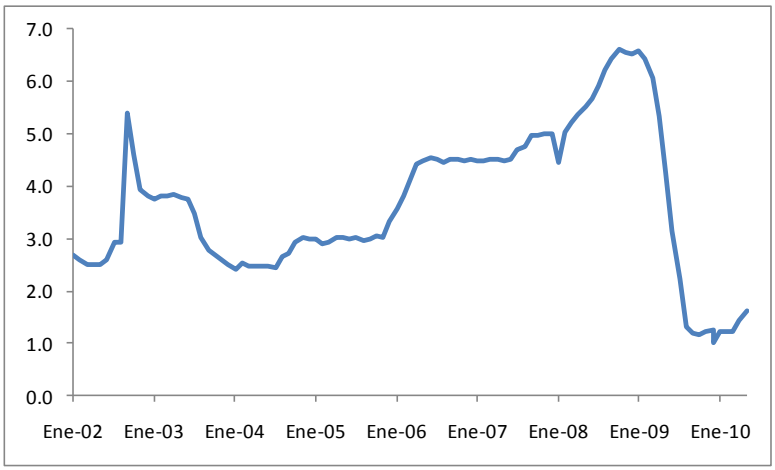


FIGURE 6.- ANNUAL GROWTH RATE OF THE CREDIT QUALITY RATIO

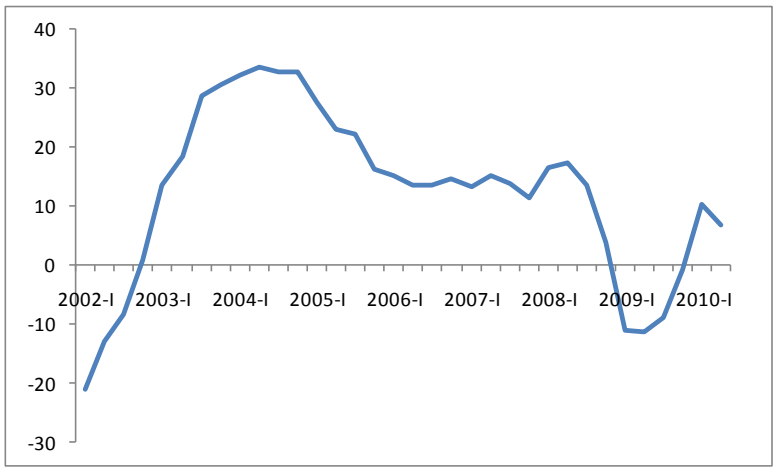


FIGURE 7.- ANNUAL GROWTH RATE OF THE GDP

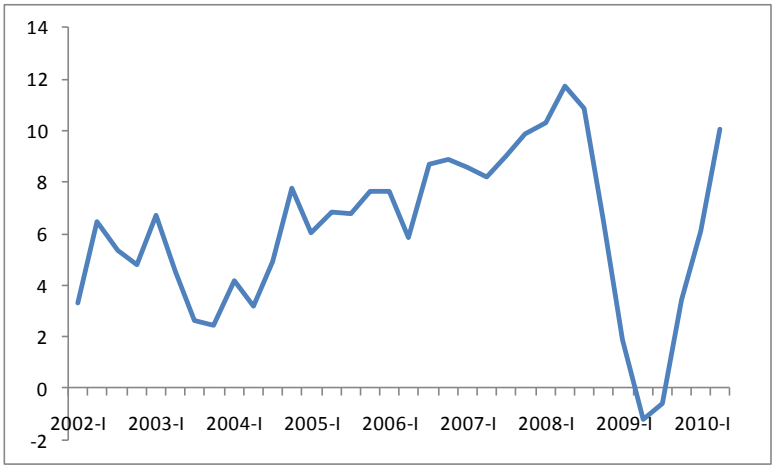


FIGURE 8.- INTERBANK INTEREST RATE

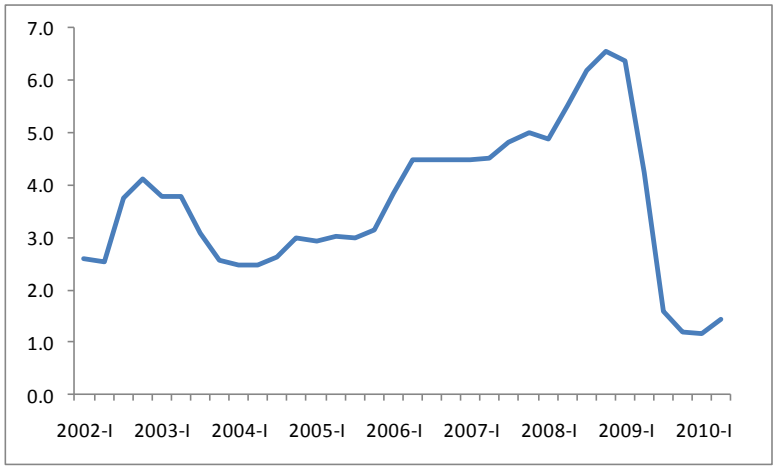
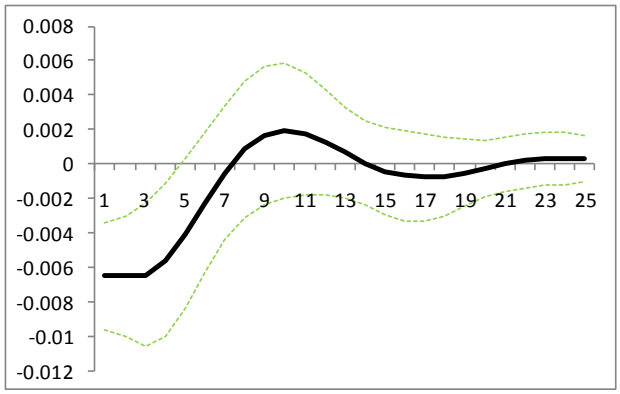
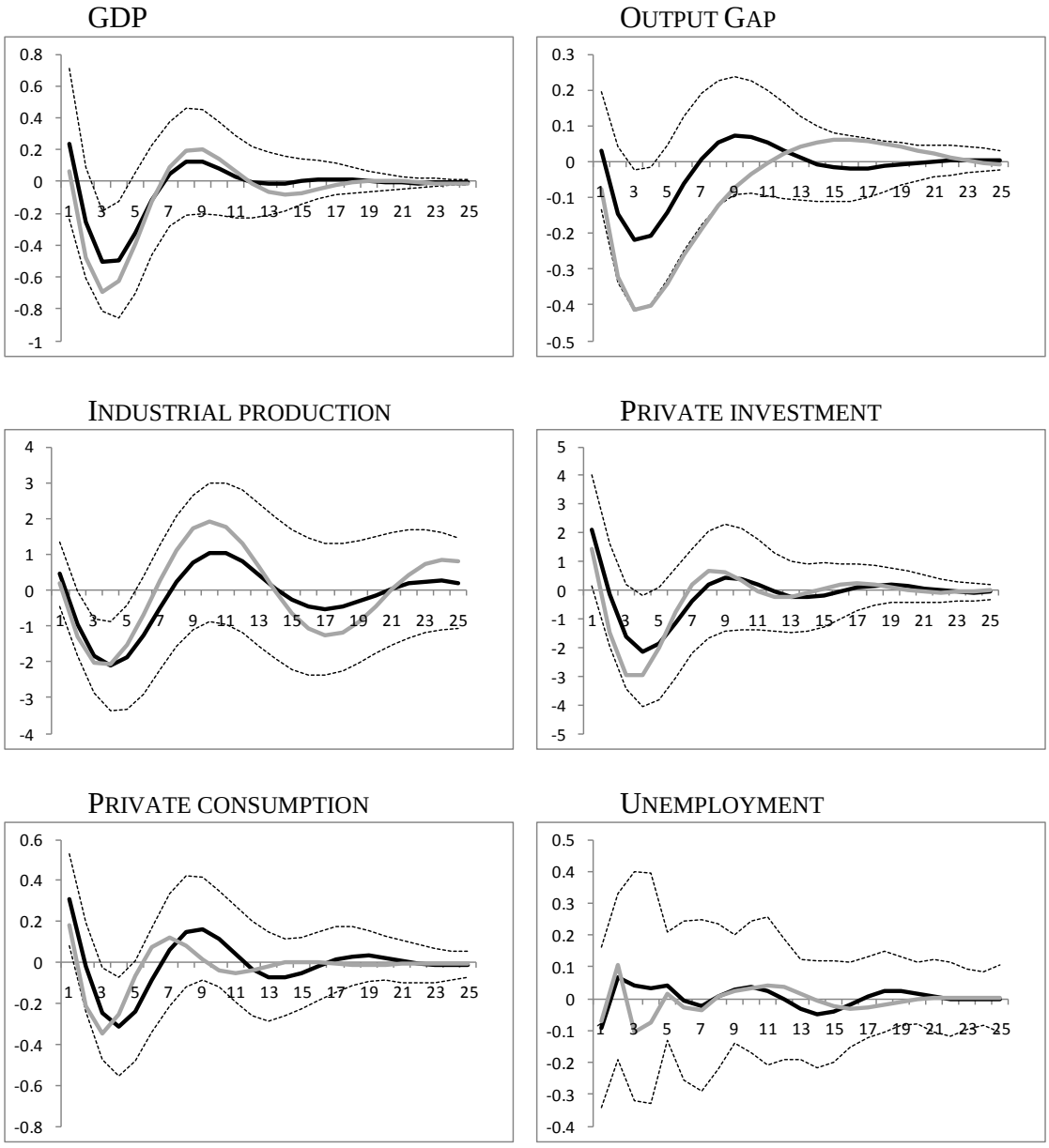


FIGURE 9.- MONETARY POLICY TRANSMISSION AND THE CREDIT QUALITY RATIO



NOTE: RESPONSE OF CREDIT QUALITY RATIO TO STRUCTURAL ONE S.D. INNOVATIONS ON THE INTERBANK INTEREST RATE.

FIGURE 10.- MONETARY POLICY TRANSMISSION TO ECONOMIC ACTIVITY



NOTE: RESPONSE OF SIX MACROECONOMIC ACTIVITY VARIABLE TO STRUCTURAL ONE S.D. INNOVATIONS ON THE INTERBANK INTEREST RATE.

FIGURE 11.- BANKING FINANCING RATIO

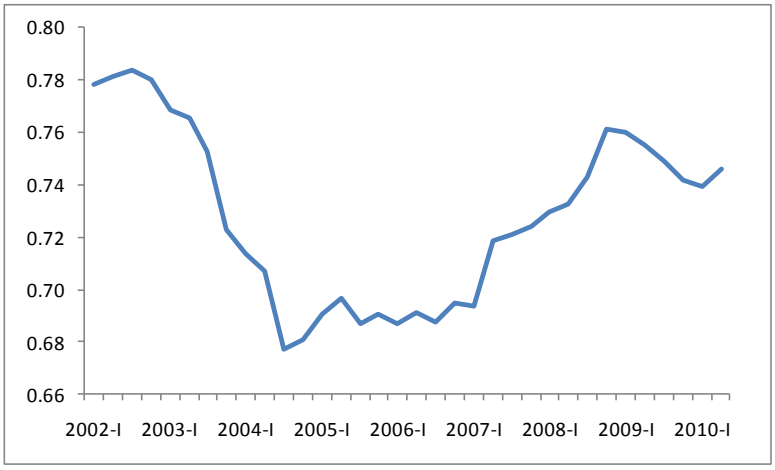
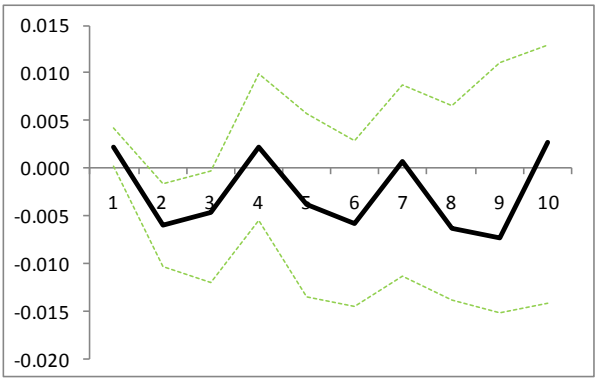


FIGURE 12.- MONETARY POLICY TRANSMISSION TO BANKING FINANCING RATIO



NOTE: RESPONSE OF BANKING FINANCING RATIO TO STRUCTURAL ONE S.D. INNOVATIONS ON THE INTERBANK INTEREST RATE.