BIS CCA-008-2011

May 2011

The bank lending channel in Peru: evidence and transmission mechanism

Paper prepared for the 2nd BIS CCA Conference on

"Monetary policy, financial stability and the business cycle"

Ottawa, 12–13 May 2011

Authors*: César Carrera

Affiliation: Central Bank Reserve Bank of Peru

Email: cesar.carrera@bcrp.gob.pe

* This paper reflects the views of the author and not necessarily those of the BIS or of central banks participating in the meeting.

The Bank Lending Channel in Peru: evidence and transmission mechanism

CÉSAR CARRERA YALÁN [†]
Banco Central de Reserva del Perú

December 2010

Abstract:

In the past ten years the Peruvian economy has experienced important structural changes regarding monetary policy. This document 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 work 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 (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

[†] I would like to thank to Carl Walsh, Federico Ravenna, Kenneth Kletzer, Aspen Gorry, Guillaume Rocheteau, Thomas Wu, Marco Vega, and Paul Castillo for valuable comments. The points of view expressed throughout this document are the author's own and are not necessarily shared by the institutions he is currently affiliated.
Email: cesar.carrera@bcrp.gob.pe Banco Central de Reserva del Perú, Gerencia de Estudios Económicos, Jr. Miroquesada 441, Lima, Peru, Lima 1.

1. INTRODUCTION

In the past ten years, the Peruvian economy has experienced several monetary policy changes. One of those policy changes is the switch from a monetary aggregate target to an interest rate as the operating 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 operating target (in 2003, the interbank interest rate is explicitly announced as the operating 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 converged to international levels. In this context, it is relevant to understand the monetary policy transmission mechanism during this period of time.

The view of the bank lending channel as a monetary policy transmission mechanism focuses on the role of 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. In their view, the empirical case in support of a lending channel has not been viewed as airtight. However, most of the empirical work that has been done in recent years takes into account that challenge and proposes better econometric and identification techniques.

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

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

credit loans. The net effect is subject to the financial system capacity to replace the 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 document I test whether the central bank affects the supply of bank loans.

In developing countries there are two arguments that strengthen the bank lending channel. First, as pointed out by Gunji and Yuan (2010) asymmetric information can be more pervasive in such countries.[2] Second, banks typically solely rely on deposits as a source of funds which induces more credit supply sensitivity to monetary policy changes. Given the likely importance of the bank lending channel in developing countries like Peru, the aim of this paper is to test whether this channel is indeed important for monetary policy transmission in Peru.

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 opposing forces at 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 to 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.[3]

One of the arguments in this document for identifying the effectiveness of the bank lending channel is the existence of "flight to quality." Bernanke et al. (1996) define

[2] The broad credit channel is related to the supply of credit by all financial intermediaries, emphasizing the role of asymmetric information in the existence of an external financing premium (difference in the costs of external and internal financing.) The external financing premium depends negatively on the net worth of a borrower and positively on the stance of monetary policy. The financing premium is a financial accelerator mechanism that amplifies the effects of monetary policy on investment and consumption decisions. The bank lending channel is more important if some banks are able to lift funds (after a tight monetary policy) and provide credit to firms that are not able to get external funding.

[3] 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.

"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 whereby reduced spending, production, and investment (given the high-agency-cost borrowers) will exacerbate the effects of recessionary shocks.[4] In this context, banks have comparative 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 probability of default in credit loans in the presence of a contractionary monetary policy shock. If so, in a credit rationing scenario, firms who are dependent on bank lending would reduce their production levels even more.[5]

In this document, the panel estimations follow Kashyap and Stein (1995) who conclude that for the bank lending channel to exist, it is often sufficient that a central bank be able to affect the supply of loans 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 work 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

[4] Bernanke and Gertler find strong evidence for the case of firms that downturns differentially affect both the access to credit and the real economic activity of high agency- cost borrowers.
[5] 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.

that determines the monetary policy stance.[6] For previous years to 2001, it is more difficult to define which instrument is used by central bank for controlling inflation so the main results of this work are not subject to strong assumptions regarding one instrument or many instruments.[7] Another advantage of this work is that it incorporates methodological changes in banking accounting given by the Superintendence of the Banking System (SBS) in Peru.

The remainder of the document is organized as follows. Part II presents a review of both theory and empirics in bank lending channel and a representative bank model with a bank lending channel is set in part III. I then in part IV describe the data and indicators I use for the estimations made in part V. The conclusions of de the analysis are presented 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, which contract in response to a monetary tightening, with alternative sources of funding,

[6] Golodniuk (2006) cited Bernanke and Blinder (1992) and argued in favor of the money market interest rate as an indicator of monetary policy stance, since the short-term interest rate controlled by the central bank is a good indicator of monetary policy and is less contaminated by endogenous responses to contemporaneous economic conditions than is the money growth rate. For the Peruvian case, Armas et al. (2006) pointed out that "the evolution of the operating target [...] It was made a transition from a monetary target to an interest rate target when the scheme of explicit inflation target was formally adopted in 2002." PP. 139.

[7] In this review of the next section, there are different assumptions about taking the interest rate from 2001, and then generate an estimator for the behavior for previous years, while others assume that a monetary aggregate reflex better the stance of the monetary policy.

such as certificate of deposits or new equity, or to decrease their bond holdings. Thereafter, more research is focused on this first setup.

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 some borrowers who cannot find perfect substitutes for bank loans; and imperfect price adjustment. The non-substitutability between loans and bonds violates the Modigliani–Miller proposition for banks, a proposition that is discussed in several papers.[8]

Stein (1998) claims that his work can be interpreted as the microfundations of Bernanke and Blinder (1988) model. Stein builds a model which considers the existence of a bank lending channel in a bank asset and liability framework based on adverse selection. 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 and the attendant credit rationing.[9]

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 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

[8] The mechanism described by Kashyap and Stein is as follows: when the FED drains reserves from the system, it compromises banks' ability to raise reservable forms of finance, such as insured transaction deposits. But it cannot constrain banks' use of non reservable liabilities, such as large-denomination certificate of deposits (CD). In a Modigliani – Miller world, banks are indifferent at the margin between issuing transactions deposits and large CD, so shocks to the former do not affect their lending decisions. All that monetary policy can do in this framework is alter the amounts of deposits (aka "money") and CD (aka "bonds") outstanding. So if there is to be an active lending channel, it must be that banks cannot frictionlessly tap uninsured sources of funds to make up for a FED induced short fall in insured deposits.

[9] For example, if there is adverse selection in the market for large uninsured CD, a bank that loses a dollar of insured deposits will not raise a full dollar of new CD financing to offset this loss. As a result, its lending is likely to decline. Thus if there is a link between the reservability and insurability of bank liabilities, the Modigliani - Miller theorem can break down, and open-market operations can matter for bank lending.

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).[10]

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 (1996) 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). They 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.[11]

[10] The interest rate that banks pay is the risk free rate (which the authors later will 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 is. With this condition and the explicit demand functions for loans, Ehrmann et al. solve for an optimizing bank.

[11] Disyatat (2010) focuses on credit extension to firms and present a model that has 3 types of agents: firms, banks, and households. To produce, firms need to obtain bank credit to pay wages. Households may keep their wages as deposits at the bank or investment on a risk free government bond. Banks finance loans through deposits. Taking into account heterogeneity among banks, the author concludes that bank balance sheet strength, and their response to changes in market interest rate, constitute a determinant of the transmission mechanism through the banking system.

2.2 Empirics on Bank Lending Channel and Identification Problem

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 for loans. Failure to separate these effects leads to an overestimation of the impact of monetary policy on the supply of loans.[12]

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 (i.e., the demand for loans is infinitely elastic). But banks are hypothesized to 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) for the U.S. economy.

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. They 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

[12] See Romer and Romer (1990) for a discussion. The authors also discuss endogeneity issues of the early empirical works.

is implemented, large-scale banks do not have to reduce loans.[13] 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.[14] Kishan and Opiela (2000) complement previous work and emphasize the role of bank capital in the bank lending channel. They argue that banks with fewer liabilities have much more capital and can cover the reduction in deposits. Kishan and Opiela conclude that banks with less capital tend to reduce loans following tight monetary policy.[15] All these papers focus on providing support for the bank lending channel in the U.S.

Together, the previous three studies have stimulated much research on the bank lending channel in other economies. Recently, Gunji and Yuan (2010) contribute to this

[13] Kashyap and Stein use U.S. quarterly data from 1976 to 1992. They regress the growth rate of loans against four lags of the change in the FED funds rate (primary indicator of changes in the stance of monetary policy), as well as four lags of the growth rate of the CPI. They also include four lags of the dependent variable, four quarterly dummies and a dummy for 1984. They repeat this specification for five different size classes. They test if the sum of the coefficients on the funds rate is negative and significant. In a second specification, they add four lags of the growth in nominal GDP as an additional control variable. The addition of the GDP control tends to reduce the statistical significance of the FED funds coefficients. They repeat the exercise for commercial and industrial loans.

[14] In this paper, Kashyap and Stein use U.S. quarterly bank data for the period 1976–1993 (almost one million observations) and opt for a two-step procedure. In the first step, they run a cross sectional regression separately for each size class and each time period t. The log change in lending volume (for both total and commercial and industrial loans) against four lags of itself, a liquidity variable (the ratio of securities plus federal funds sold to total assets), and a Federal Reserve-district dummy variable (geographic control). The coefficient on liquidity is used as a measure of the intensity of liquidity constraints in a given size class at time t. In the second step, Kashyap and Stein take for each size class the coefficient on liquidity as the dependent variable in two time-series specifications. First, they consider a "univariate" specification in which the right-hand-side variables include the contemporaneous value and four lags of the change in the monetary measure (Boschen and Mills (1995) index, the federal fund rates, and the Bernanke and Mihov (1992) index) and a linear trend. In the second specification, a "bivariate" framework is considered in which the contemporaneous value and four lags of real GDP growth is added to the right-hand side. They find that, for the smallest class of banks, an expansionary impulse to the monetary measure lead to a reduction in the measure of liquidity intensity.

[15] Kishan and Opiela use U.S. quarterly bank level data from 1980 to 1995. The growth rate of loans is regressed on four lagged values of itself, four lagged values of the change in the federal funds rate, current period growth in large time deposits, and current period growth in securities. Growth rate of loans is divided in four categories: total, commercial and industrial, real estate, and consumer loans. Also included on their regressions are three seasonal dummy variables and a dummy variable corresponding to the 1984. Time deposits and securities are included to control for "funding" effects on loans within each size and leverage ratio group. GDP is dropped from this specification because of insignificant effect on all categories of loans. They first estimate on loan growth for various types of loans and for two measures of monetary policy (change in federal funds rates and the change in the Bernanke-Mihov (1995) indicator) taking into account different Capital levels and Capital/Asset ratios. Then they estimate the response by banks to changes in borrower quality and on time deposit growth.

literature suggesting the use of profits as another bank characteristic. Gunji and Yuan use Chinese data, identify a bank lending channel, and find that profitable banks tend to be less sensitive to monetary policy, because when tight monetary policy leads to a fall in deposits, less profitable banks face a higher cost of capital.[16]

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 recent 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 on the cointegrating relationships. 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.[17] The works of Kakes (2000), Calza et al. (2006) and Mello and Pisu (2010) use this approach.

---

[16] Gunji and Yuan use Chinese yearly data that covers the period 1985–2007. The authors 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.

[17] 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. Identification also requires r restrictions for each vector, where r is the number of cointegrating vectors. As a result, this approach requires to test for two exclusion restrictions: bank capital should not enter the demand equation (while being positively signed in the supply equation), and economic activity should not enter the supply equation (while being positively signed in the demand equation). While exclusion of bank capital from the demand equation is intuitive, it can be argued that loan supply may be affected by economic conditions. For example, the supply of loans may be pro-cyclical to the extent that firms' balance sheets improve as economic conditions strengthen, making banks more willing to lend to creditworthy borrowers.

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. In doing so, the sensitivity of loan supply to the interest-rate spread can be quantified. Nevertheless, there does not appear to be strong evidence of a bank lending channel and Kakes concludes that a bank lending channel is not an important transmission mechanism.[18] 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 coefficients.[19] 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. Loan supply is found to be negatively related to the interbank deposit certificate rate, suggesting the existence of a lending channel for monetary transmission.[20]

Coming back to the panel data approach, this strategy requires a large number of banks, which is not a problem for the U.S. or most developed countries. But the number of banks in developing countries is relatively small, so such approach is not feasible. 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 this is also used in Hernando and Martinez-Pages (2001), Alfaro et al. (2004), Gambacorta (2005), Mautosek and Sarantis (2009), and Tabak et al. (2010).

[18] Kakes (2000) use Netherlands quarterly data from 1979 to 1993.
[19] Calza et al. (2006) use Euro-area quarterly data from 1981 to 2001. Euro area is defined according to the principle of concurrent composition (the 11 original countries up to the fourth quarter of 2000; these plus Greece, thereafter). Using reconstructed historical series for the euro area potentially may bias the results given the aggregation method for the national data referring to the period prior to the adoption of the single currency on 1 January 1999 (1 January 2001 in the case of Greece). Calza et al. (2006) discuss this issue in greater detail.
[20] Melo and Pisu (2010) use Brazilian monthly data from 1995 to 2008.

Hernando and Martinez-Pages (2001) find evidence against the existence of a bank-lending channel in Spain[21] 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.[22] Gambacorta (2005) employs Italian data which covers mainly one monetary regime and shows that bank scale is unrelated to the impact of monetary policy, and that the impact of monetary policy on banks with more liquid assets is weaker. This result is consistent with Ehrman et al. (2003).[23]

The work of Alfaro et al. (2004) conclude that the bank lending channel operated as a monetary policy transmission mechanism in Chile, with a significant effect in terms of macroeconomic activity.[24] Mautosek and Sarantis (2009) systematically test for the bank lending channel in Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia and find evidence of a bank lending channel in all countries, however the strength of it varies across countries.[25] Tabak et al. (2010) find that bank loans supply reacts differently when interest rate changes depending on size, capitalization, and liquidity in Brazil.[26]

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

[21] Hernando and Martinez-Pages (2001) uses Spain quarterly bank level data for the period 1991 – 1998. Hernando and Martinez-Pages argue that their result appears to be related to the important role of many small banks as collectors of savings which may have a large volume of resources available for lending. In addition to a loan function, they also estimate a deposit function.
[22] The data for France goes from 1993 to 2000; for Germany, from 1993 to 1998; for Italy, from 1986 to 1998; for Spain, from 1991 to 1998. In all cases, the frequency of the data is quarterly.
[23] Gambacorta (2005) employs Italy quarterly data from 1986 to 2001. He also points out that a previous study of Ehrman has different results, and argues that BankScope database does not control for mergers and acquisitions while Supervisory reports data for Italy do.
[24] Alfaro et al. (2004) use data for the period 1990–2002. They use VAR techniques for analyzing the effect of the bank lending channel on economic activity.
[25] Mautosek and Sarantis (2009) estimate their panel data for a large number of banks over the period 1994–2003. The eight Central and Eastern Europe countries joined the E.U.
[26] Tabak et al. (2010) use Brazilian quarterly data for the period 2003 to 2009.

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. as a way 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, as well as to identify a supply shock to the U.S. bank lending that is independent of the U.S. loan demand.[27] 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. 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.[28] Schnabl (2010) use the 1998 Russian default as a negative liquidity shock to the bank system in Peru and find a bank lending channel. Schnabl uses a point in time and evaluate the effects a year before and after in order identify this channel. 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. The authors isolate the causal impact of the bank lending channel by showing that for the same firm borrowing from two different banks,

[27] The authors find that binding risk-based capital requirements associated with the Japanese stock market decline resulted in a decrease in lending by Japanese banks in the U.S. that was both economically and statistically significant.

[28] The authors exploit the variation across geographically distinct commercial real estate markets to establish conclusively that loan supply shocks emanating from Japan has real effects on economic activity in the U.S.

the size of loans from the bank experiencing a larger decline in liquidity drops by some additional percentage points.[29]

In general, studies for the U.S. banks provide evidence for the bank lending channel. This has recently been questioned by Ashcraft (2006). Similar to previous studies, Ashcraft identifies a differential response of loan supply to changes in the federal funds rate across banks.[30] 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.[31] Matousek and Sarantis (2009) follow Ashcraft's strategy for Central and Eastern European (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.[32]

The recent 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

[29] The authors claim that thanks to the data quality the use of a panel data technique with firm-fixed effect methodology is enough to identifying the bank lending channel.
[30] Ashcraft use bank level data from 1987 to 1999. He uses panel OLS and IV estimations.
[31] Ashcraft points out that interstate branching restrictions have historically meant that commercial banks largely operate in the state where chartered, so for much of the last 25 years it seems plausible to treat the U.S. as a collection of state economies. Ashcraft also mention that this becomes a "poor" assumption in recent data with the advent of interstate branching. Despite this potentially cleaner measure of state-level financial constraints, the results are almost identical to his previous exercises.
[32] Matousek and Sarantis aggregate the bank data up to the country level. They calculated the loan market share of the largest, more liquid and more capitalized banks in each country. To investigate the effectiveness of the channel, Matousek and Sarantis follow Ashcraft's strategy estimating an equation that regresses the country output growth on country bank loan growth. They suggest that an increase in the loan market share of large, highly liquid, and capitalized banks does not offset the negative response of aggregate (country) bank loan growth to shifts in monetary policy. This result contrast to Ashcraft work in which the negative response of state loan growth to changes in the federal funds rate is mitigated by the loan market share of affiliated banks. Matousek and Sarantis also find that firms in the CEE countries do not seem able to replace bank loans with other sources of finance, which implies that the differential bank response to shifts in monetary policy does affect real economic activity. This finding also contradicts Ashcraft's (2006) negative and insignificant elasticity of state output growth to state loan growth.

possibility of financial resources substitution for part of the banks.[33] The work of Loo-Kung and Shiva (2003) uses a panel of banks to explain the supply of credits behavior in relation to the instrument of monetary policy. In their work, they conclude that the monetary policy does not have the capacity to affect the total supply of bank loans. Nevertheless, they find evidence of a channel in domestic currency so that, banks of greater relative size are affected to a lesser extent by the changes in the monetary policy stance.[34] Carrera and Espino find a relationship between bank's size and the spread of interest rates, using bank level data.[35] 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 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. In this paper, I use updated data, a different indicator of the monetary policy stance, and test for the effectiveness of the bank lending channel.

3. A REPRESENTATIVE BANK MODEL

This model is based on Ehrmann et al. (2003), which is an extension of Bernanke and Blinder (1988). In this model, a profit-maximizing bank decides the optimal amount of credit loans. The balance sheet identity of bank *i* is defined as:

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

[33] Quispe uses Peruvian monthly data from 1979 to 2000.
[34] Loo-Kung and Shiva use Peruvian monthly data from 1995 to 2002.
[35] Carrera and Espino use Peruvian quarterly data from 1995 to 2004.

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

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

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. Ehrmann et al. argues that this assumption is consistent with the Basle requirements. Bank capital can be represented as:

$$C_i = k L_i \qquad (3)$$

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. Securities in this model can be represented as:

$$S_i = s D_i \qquad (4)$$

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:

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

where $\theta > 0$. In this model, r_S is 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 is x_i, the lower is the external finance premium. The interest rate that a bank pays can be represented as follows:

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

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

Bank *i* cannot raise unsecured funds if it offers less than $r_{B,i}$, whereas it can raise any amount of funds if it pays at least $r_{B,i}$. Then it follows that the profit of bank *i* is given by:

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

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

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

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

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

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

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, according to (5). If a bank increases other sources of funding (non-secured funds, B_i), 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 by the monetary policy tightening, according to (6). A banks passed at least part of this higher cost to its loan rate ($r_{L,i}$) which in turn reduces loan demand. In this model, 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 (those that has higher costs of raising non-secured deposits) because they have a low health value (bank characteristics, x_i). If loan demand is homogeneous across banks, regardless of their value of x_i, a differential loan reaction to monetary policy identifies a loan supply movement. Whether such a differential reaction is present, can be seen by looking at the coefficient:

$$\frac{\alpha_0 \gamma (1-k)}{2} \qquad (10)$$

In this framework, if this coefficient is significantly positive, monetary policy affects loan supply.

The assumption of a homogeneous reaction of loan demand across banks is important for the identification of loan supply effects of monetary policy. Ehrmann et

al. (2003) argues that this assumption excludes cases where large or small banks' customers are more interest rate sensitive.

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

4. DATA DESCRIPTION

The database comes from the banks' financial statements, available in the official web page of the Superintendence of the Banking System of Peru (SBS) and covers the period 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 published a new Manual of Banking Accounting, and introduced different modifications in the definition and treatment of diverse accounts. These changes made some figures published until December 2000 non-comparable with those published from 2001, for example assets and liabilities of the banking system.[36]

The database 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).

[36] Source: Superintendence of the Banking System of Peru (SBS).

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. The difference in the evolution between these two types of loans would control for different types of shocks from the demand side in the loan credit market. I argue that both series would tend to have different reactions during different moments of the business cycle, as can be shown on Figures 1 and 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. That should be reflected in the higher sensitiveness of small banks to monetary policy shocks unlike 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, due to their limited ability to tap into uninsured sources of funds. It is also collected proxy variables of those bank characteristics in the banking system. 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.[37]

[37] 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; bondsand certificates of deposit issued by the central Government and the Central bank; and certificates of deposit issued by other financial institutions.

In this work 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.[38]

For the Chilean case, Alfaro et al. (2004) take the total of banking debts of the medium and large firms that are listed in the Registry of Values and Insurances. Then they construct the low/high quality ratio of banking credit 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.[39] For the Pakistani case, Mian and Khwaja (2006) find that large firms completely compensate the 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.

Taking into account that commercial credit loans mainly include corporate credits, it is estimated a credit quality ratio as the ratio (Consumption credit loans + Small company loans) / (Commercial credit loans). Consumption credit loans and small firm credit loans allow the incorporation of the flight-to-quality effect following the concept of Bernanke et al. (1996).[40] When the series of consumption loans and small firm loans

[38] Bernanke et al. find evidence drawn from a panel of large and small U.S. manufacturing firms.
[39] Alfaro et al. (2004) use the low/high quality ratio name to emphasize the fact that the credits for consumption would have a lower quality compared with the corporative credits, idea that tries to emphasize throughout their work.
[40] One source of motivation is to answer if this effect arises in situations of credit rationing as well as in situations of expansion. In the later sections I present VAR exercises that test whether a change in the monetary policy stance can be sufficient enough to affect the credit quality ratio.

are compared, both series follow a similar pattern (the correlation is around 98 percents).[41] In Figures 2 and 3, I present the evolution of these time series.

The operating 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 estimations, I used the annual growth of the real GDP to capture the effects of changes in the income, and the annual devaluation of the real exchange rate to capture changes in relative prices. Both variables would control for demand conditions.

For the VAR systems, I used three additional endogenous variables (in addition to the credit quality ratio and the interbank interest rate): a proxy variable for macroeconomic activity, the consumer prices index, and the real exchange rate. Also I use six different variables as proxies for macroeconomic activity: real GDP, output gap, industrial production, private investment, private consumption, and unemployment rate. In addition to the endogenous variables, each VAR model includes the following

[41] 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.

exogenous variables: terms of trade, inflation target, external production, and a trend tendency variable.[42]

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, it is possible to 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 operating 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 bank switch 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

[42] Inflation target is the center value of the inflation band that the Peruvian Central Bank announces every year as the target for inflation 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 operating target, and in Figure 5 displays the interbank interest rate.[43]

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

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.

I identify how the supply of loans changes due to a change in the monetary policy stance, taking into account the heterogeneity across banks. 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 of the central bank or increased reserve requirements by raising funds from any other source, otherwise banks can do so, and total supply of loans to the economy may not change.[44]

[43] In 2002, the inflation target was 2.5 percent with a band of 1 percent above and below. Since 2007, the target has been 2.0 percent with similar band of 1 percent above and below.

[44] Golodniuk (2006) reviews similar specification of previous empirical work for identification of the bank lending channel and use it for Ukraine, while Gambacorta (2004) made a review of different

As described in section 3, I classify loans in three categories: total, consumer, and commercial loans. Such classification allows the identification of a flight-to-quality effect in the Peruvian economy. Following on Ehrmann et al. (2003) I estimate a panel of 21 banks and use a set of macroeconomics and bank characteristics variables to control for demand and supply sources of variation. The empirical approximation suggested in the literature is as follows:[45]

$$y_{it} = \sum_{j=0}^{K} y_{it-1} + \sum_{j=0}^{K} x'_{it-j}\,\beta + z'_{it-1}\,\gamma + \sum_{j=0}^{K} x_{3it-j}\; z'_{it-1}\,\varphi + u_{it} \qquad (11)$$

where:

y_{it} = annual growth of total loans, commercial loans, and consumer loans.

x_{it} = vector of macroeconomics variables, x_{3it} is the interbank interest rate.

z_{it} = vector of bank specific characteristics variables (liquidity, size, and capitalization)

u_{it} = error term vector.

i = 1, ... 21 represents the number of banks includes in our data base.

t = 1, ... T is the time, and goes from 2002:1 to 2010:06.

I include macroeconomic 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.

As suggested in the literature, 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

---

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.

[45] Similar specification can be found also in Matusek and Saranis (2009), Alfaro et al. (2004), Ehrmann et al. (2003), and Hernando and Martinez-Pages (2001).

information (size, liquidity, or capitalization), they would support the existence of the bank lending channel. More specifically, if the bank lending channel holds, I should expect a positive and significant cross-coefficient between the interbank interest rate and bank characteristics, as pointed out in Section 3.

If the bank lending channel is operating in the Peruvian economy, there must be a positive and significant effect between the coefficients associated to the interbank interest rate and 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 banking ratios of liquidity, to changes in the required reserves, and the imposition of credit controls.[46]

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 and consistency of the estimates, provided that instruments are adequately chosen to take into account the serial correlation properties of the model.[47]

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 increases the supply of bank loans from bigger banks. Also I find that the signs are as expected for demand shocks.[48]

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 expansionary stages.

[46] 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.
[47] For testing for unit root, I use Im, Pesaran, and Chin, and Levin, Lin, and Chu. For the validity of the instruments, I use the Sargan test. The results of these tests will be provided under request.
[48] In this estimation the central bank is able to affect the supply of bank credit loans. In the presence of an announcement of the reference interest rate increase, the active interest rates (interest rates for loans) would tend to increase, which produces a reduction of the bank credits which is consistent with a smaller demand for credits, nevertheless, this effect would be compensated by bigger banks that has greater available amount of financial resources.

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. [49]

All in all, with respect to the coefficients of the explanatory variables: (i) the real growth of the GDP coefficient is positive and statistically significant; (ii) the devaluation of the real exchange rate coefficient is negative and 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 when it is statistically significant, 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 consumer bank credits seem to capture better the role of the 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 rates 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

[49] Loo-Kung et al. (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.

different types of banks in the presence of a contractive monetary policy shock (validation of the credit channel).

The VAR 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:

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

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.[50]

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 during the period 2002-2010.

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 of the bank lending, 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.

[50] 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). For unit root, I use the Augmented Dickey Fuller. The results of the test will be provided under request.

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 that are affected by the policy decisions.[51]

The sequence of events would be: the central bank determines the target 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 the 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 representation the credit quality ratio is the proxy for the bank lending channel.

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.[52]

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 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 to explain variables of macroeconomic activity I compare one scenario in which this channel is totally annulled versus a scenario where this channel holds. The difference between impulse-responses

[51] 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 will help the identification of the VAR systems.

[52] Kakes et al. (1999) find the opposed response function of consumption loans to a monetary policy shock and take it as evidence of no flight-to-quality effect.

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 95 percent confidence intervals 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 the relevance of the bank lending channel to explain macroeconomic activity variables.

In five out of six estimations, the results are statistically significant (not significant only for the rate of unemployment.) However in all five cases the difference between the two scenarios is not significant enough. 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.[53]

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.;[54] of Kakes et al. (1999) who conclude that the bank lending channel is not an important transmission mechanism for Germany;[55] and of Quispe (2001) who suggests that the

[53] The empirical evidence in the previous section suggests that a decrease in the supply of banking loans would affect first to indebted consumers and to small companies (which are mostly intensive in labor). It has a strong impact in terms of unemployed workers (usually unskilled who are difficult to absorb in other sectors of the economy). As unemployment increases, the consumer confidence would fall so does the aggregate demand.

[54] Berrospide et al. (2002) find evidence of credit rationing or "credit crunch" for the period November 1999- September 2000 in Peru. They find that a fall of the credit loans to the private sector is associated to a context of capacity recovery of bank given loans, decrease of Peruvian country risk and recovery of the economic activity i.e. it would not be a positive relationship between level of credit loans and economic activity. That decrease of the credit loans would be tied fundamentally to a greater caution of the banks by the continuous decrease of customer portfolio quality.

[55] On the other hand Kakes et al. highlight that their results do not suggest a “flight to quality” following a monetary contraction, at least if households are supposed to be the low quality borrowers.

bank lending channel for the Peruvian case is neutralized due to the possibility of substitution of financial resources on the part of the banks.[56]

6. CONCLUSIONS

As Peek and Rosengren (1995) point out that 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 the business cycle and from business cycle to business cycle. In this document, I find evidence of a bank lending channel in the Peruvian economy during the period 2002-2010. Namely, there is an inverse relationship between credit loans and the monetary policy stance and there is a direct relationship between credit loans and the combined effect of bank characteristics and the monetary policy stance. I also find that 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, controlling for variables affecting demand and supply for credit as well as bank's own characteristics. This specification allows the identification of a negative effect of an increase of the interbank interest rate on credit loans, and in the panel estimations I find, in average, that this channel has been operating in the Peruvian economy during the

[56] Quispe (2001) mentions that the effectiveness of the central bank to reduce the credit supply of the commercial banks through the reduction of the interbank funding in domestic currency would be limited by the existence of external alternative sources of financing, neutralizing the possible effects of the monetary policy on the credits to the private sector.

period of study. I also find similar results for the commercial credit loans and consumer 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 this channel to understand the possible effects of monetary policy over the level of macroeconomic activity, 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 (market imperfections, firms' balance sheet, strength of the banking system, among others). My strategy is the inclusion of a credit quality variable in a set of SVAR estimations for different macroeconomic variables and check whether this variable is important for explaining the behavior of these variables when a monetary policy shock occurs.

As part of my agenda, it is possible to robustify these results with co-integrations techniques. However that exercises is subject to a bigger sample, to include long-term effects. I will expand the sample period and compare two scenarios: when the growth of the primary emission of money and when the interest rate are considered as intermediate target of the central bank, and compare 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 key in determining whether and 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 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 credit loans supply). This would be associated with an increase in the demand for non-banking sources of debt (like a substitute of the banking credit 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,[57] and the changes induced in this ratio would affect the investments of the companies.[58]

[57] Kashyap et al. (1993) defines the ratio as banking credit loans to the sum of banking credit loans plus short term commercial papers.

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 as the rate between the banking credit loans over the sum of banking credit loans and private bonds. Figure 11 displays this ratio.

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

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 evidence suggest that in the presence of a monetary policy shock, firms that have access to the stock exchange will 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.

[58] The exercises that Kashyap et al. (1993) do are of Granger causality for the affirmation of effects of the monetary policy towards 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.

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

Angeloni, I., Kashyap, A., Mojon, B., Terlizzese, D., 2003. Monetary Transmission in the Euro Area: Does the Interest Rate Channel Explain All? NBER Working Paper No. 9984.

Arellano, M., Bover, O., 1995. Another Look at the Instrumental Variables Estimation of Error Components Models. Journal of Econometrics, Vol. 68, pp. 29–51.

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 Polítca. 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.

Atta-Mensah, J., Dib, A., 2008. Bank lending, credit shocks, and the transmission of Canadian monetary policy. International Review of Economics and Finance 17, 159–176.

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., Mihov I., 1998. Measuring Monetary Policy. Quarterly Journal of Economics 113(3): 869–902.

Brissimis, S., Delis, M., 2009. Identification of a loan supply function: A cross-country test for the existence of a bank lending channel. International Financial Markets, Institutions and Money 19, 321–335.

Brissimis, S., Magginas, N., 2005. Changes in financial structure and asset price substitutability: A test of the bank lending channel. Economic Modelling 22, 879– 904.

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).

Cetorelli, N., Goldberg, L., 2008. Banking Globalization, Monetary Transmission, and the Lending Channel. NBER Working Paper No. 14101.

Disyatat, P., 2010. The bank lending channel revisited. BIS Working Papers No 297

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.

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

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.

Goldberg, L., Cole, R. , White L., 2002. Cookie-cutter versus Character: The Micro Structure of Small Business Lending by Large and Small Banks. Banking and Financial Institutions Working Paper 9(32). Rochester, NY: Social Science Research Network.

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.

Hancock, D., Wilcox J., 1998. The 'Credit Crunch' and the Availability of Credit to Small Businesses. Journal of Banking and Finance 22(6–8): 983–1014.

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.

Kakes, J., Sturm J., Maier, P., 1999. Monetary transmission and bank lending in Germany. University of Groningen, CCSO Centre for Economic Research in its series CCSO Working Papers, number 199906.

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., 1993. Monetary policy and bank lending. In G. Mankiw (Ed.), Monetary policy. Chicago, IL: Chicago University Press.

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.

Kierzenkowski, R., 2005. The multi-regime bank lending channel and the effectiveness of the Polish monetary policy transmission during transition. Journal of Comparative Economics 33, 1–24.

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

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).

Shiva M., Loo-Kung R., 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).

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.

Walsh C., 2010. Monetary Theory and Policy. Third 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

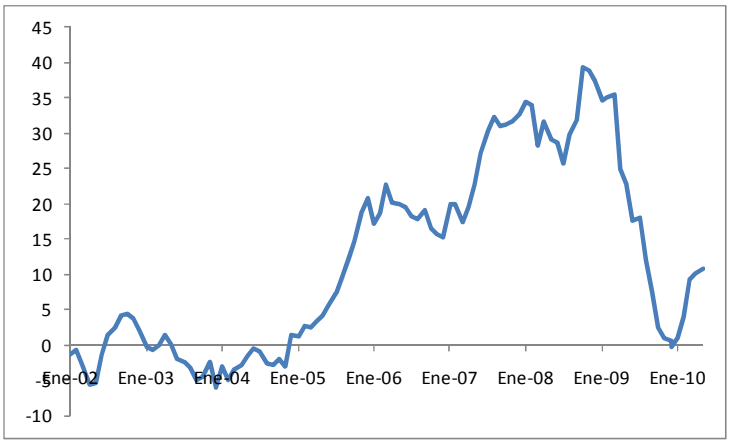


FIGURE 2.- ANNUAL GROWTH OF COMMERCIAL AND CONSUMPTION LOANS

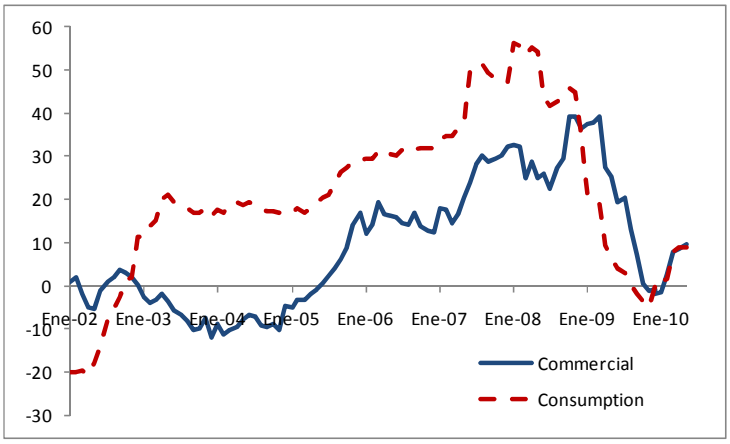


FIGURE 3.- ANNUAL GROWTH CONSUMPTION AND SMALL FIRMS LOANS

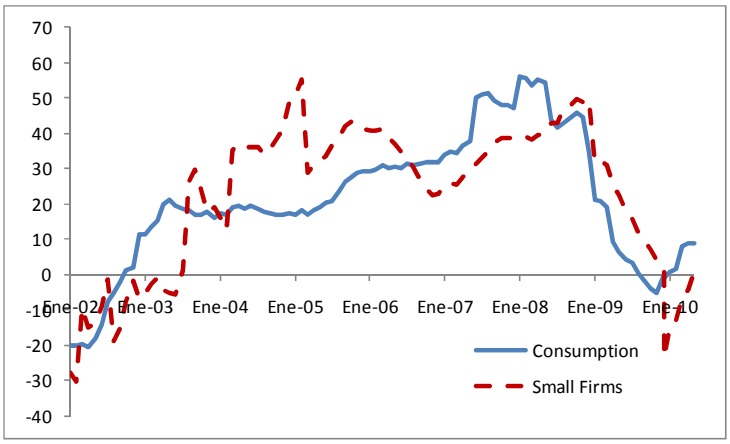
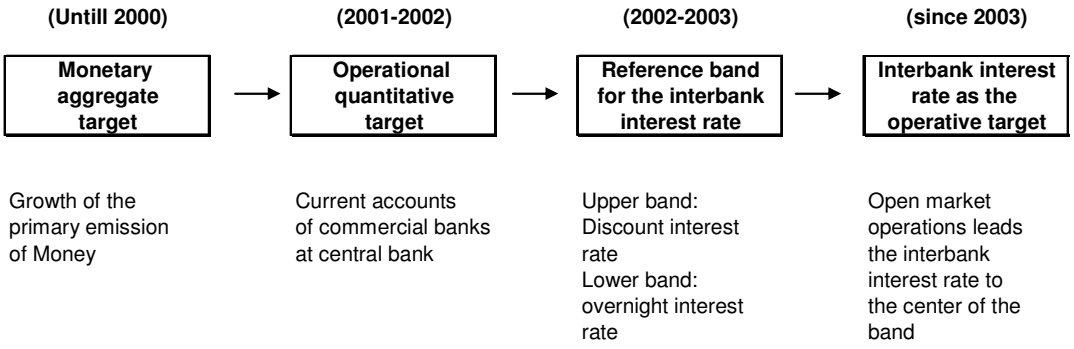


FIGURE 4.- EVOLUTION OF THE OPERATING TARGET



Source: Rossini and Vega (2006).

FIGURE 5.- INTERBANK INTEREST RATE

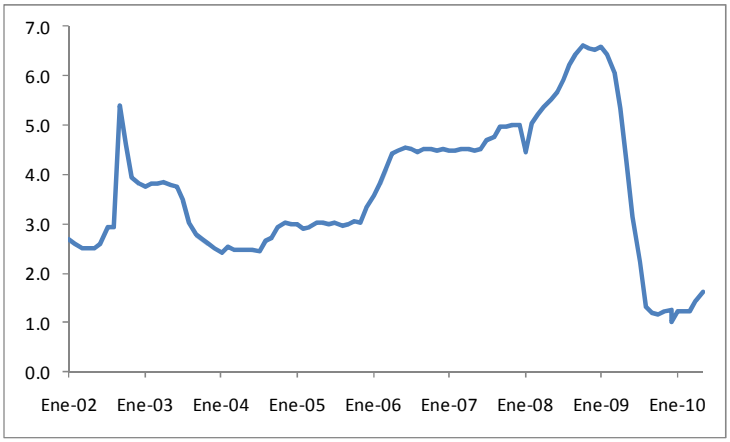


FIGURE 6.- ANNUAL GROWTH RATE OF THE CREDIT QUALITY RATIO

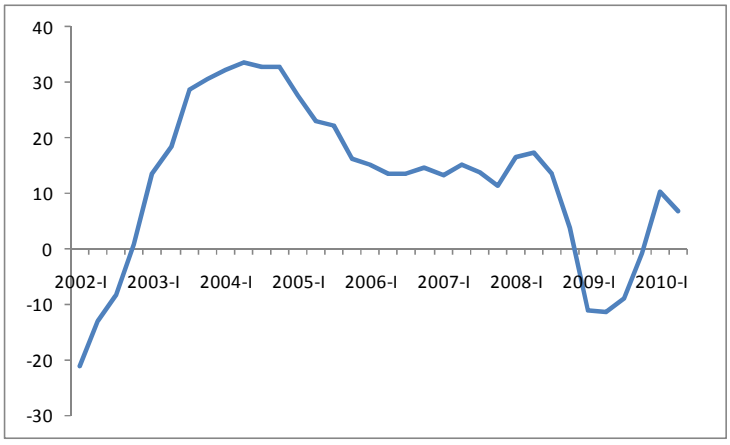


FIGURE 7.- ANNUAL GROWTH RATE OF THE GDP

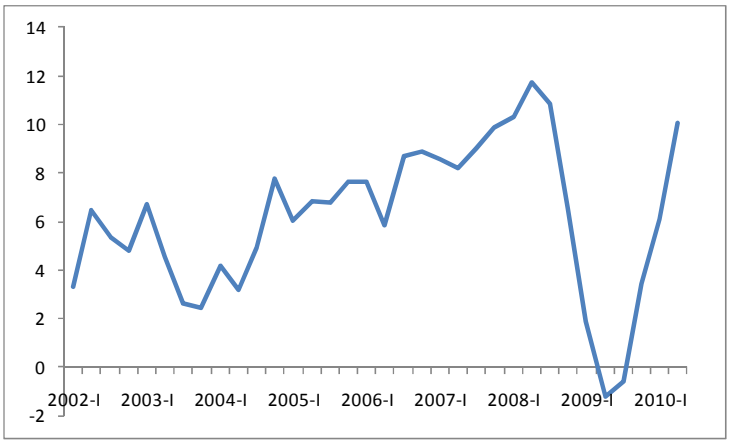


FIGURE 8.- INTERBANK INTEREST RATE

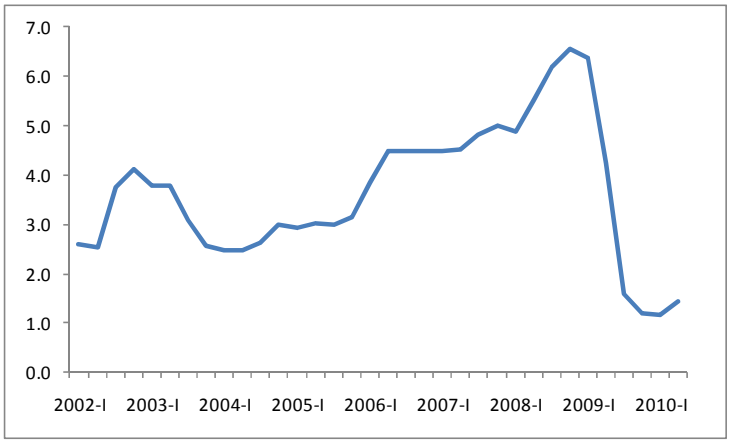
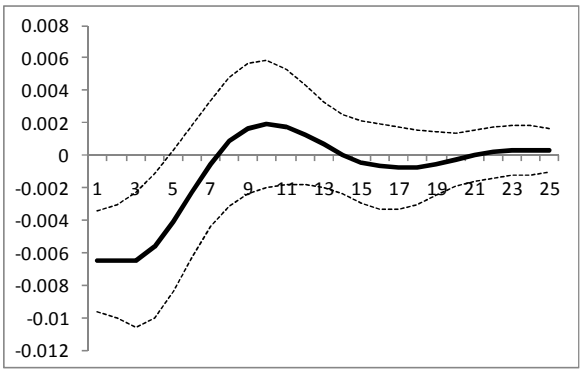
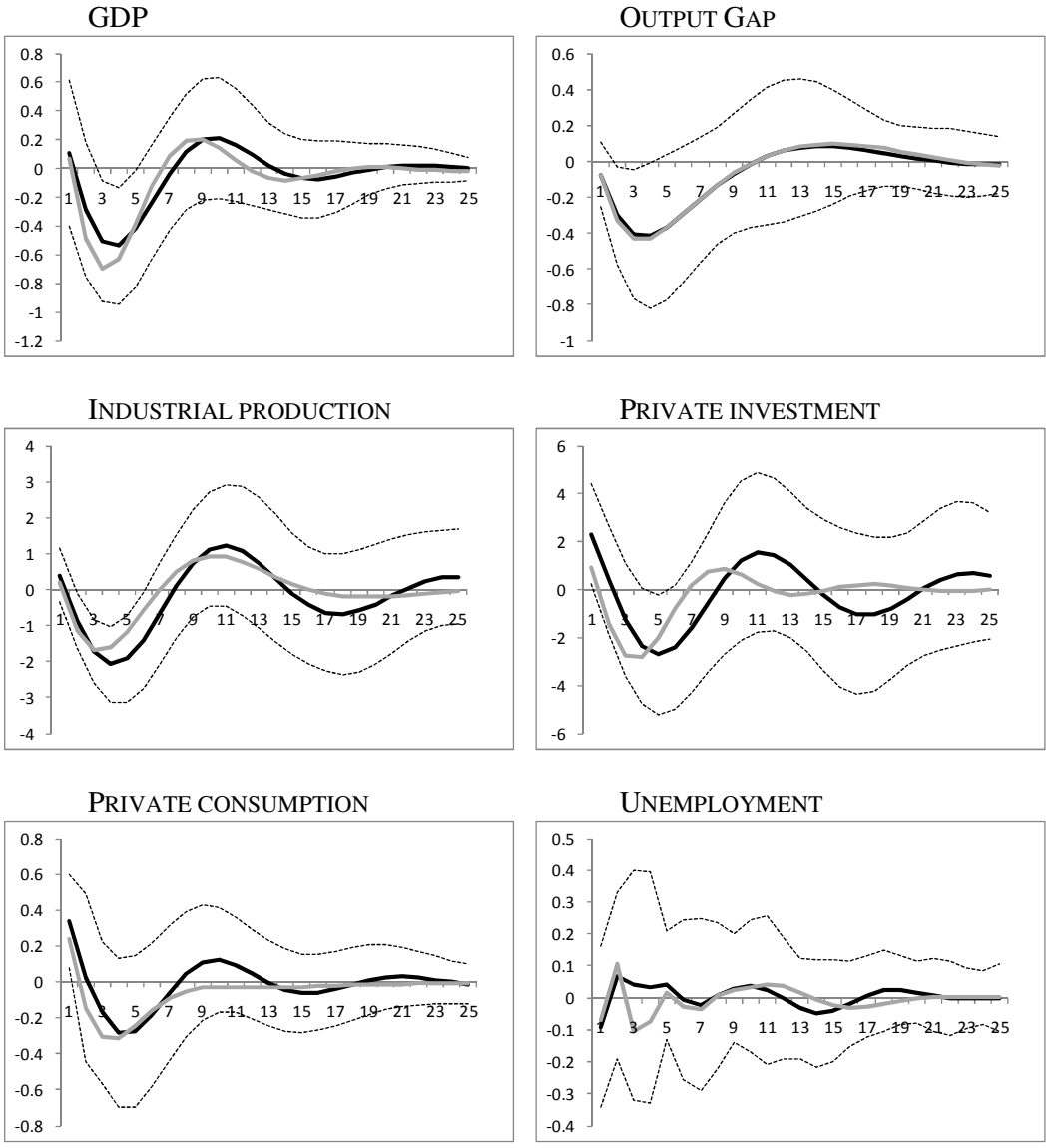


FIGURE 9.- MONETARY POLICY TRANSMISSION AND THE CREDIT QUALITY RATIO



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

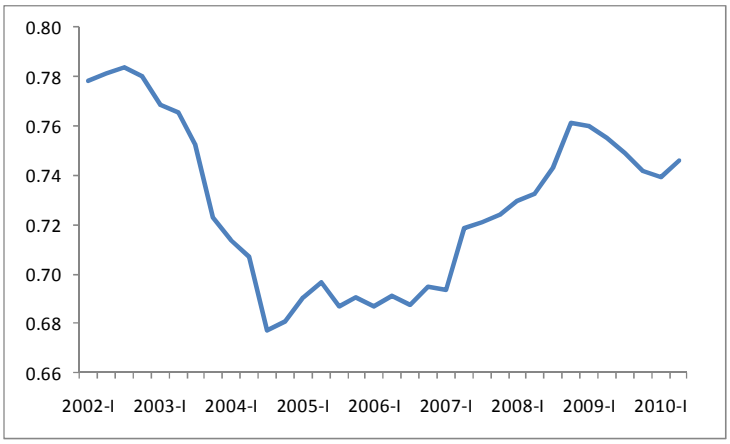
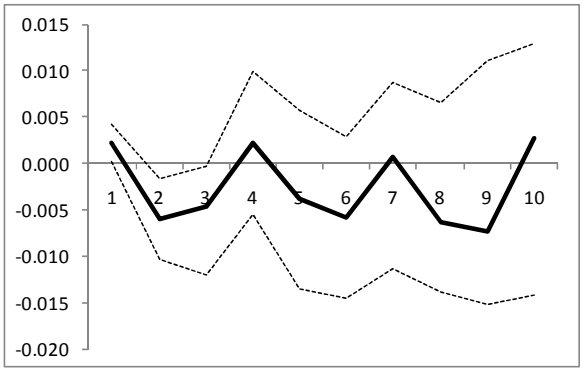


FIGURE 12.- MONETARY POLICY TRANSMISSION TO BANKING FINANCING RATIO



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