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Chapter

MONETARY TRANSMISSION AND BANK LENDING CHANNEL UNDER THE CURRENCY BOARD: THE CASE OF BULGARIA, 1999-2010

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Abstract

How do transitional economies' banking sectors transmit monetary policy? In particular, how does monetary policy interact with bank lending under a currency board regime? In the Bulgarian currency board regime, the lev is irrevocably fixed in terms of the anchor currency, the euro, and the Eurozone monetary shocks are mainly transmitted to the Bulgarian economy through changes in the key interest rates and the monetary base. Moreover, Bulgarian banks, mostly foreign owned, remain dependent on parent banks located in the Eurozone economies for funding corporate loans. These special features of the Bulgarian monetary and banking environment warrant a detailed study of the monetary transmission of the Eurozone shocks to its domestic financial sector, in particular, to the bank system and its ability to extend loans. After assessing the relative strength of monetary integration between Bulgaria and the Eurozone by means of cointegration methodology, this chapter studies the bank lending channel of monetary transmission using a panel of quarterly time series of Bulgarian commercial banks for the period 2001-2010 with a focus on the differential effects of monetary policy shocks on the growth rate of loans for banks with different characteristics. The econometric results, based on dynamic panel specifications of the Generalized method of moments (GMM) methodology suggest that banks respond strongly, in terms of their lending, to monetary impulses as measured by the base interest rate but the degree of its intensity varies with several bank specific measures, such as size, capitalization, and liquidity. This is taken as evidence for the presence of the lending channel in the Bulgarian case. The chapter also claims that the policy reaction of the BNB to the credit boom of 2002-2007 and the subsequent global financial crisis implies an active macro-prudential oversight on the financial sector despite the limited number of instruments at its disposal. Although the data is brief, an attempt is also made to capture the impact of the global financial crisis (2007-2009) on the bank lending channel in the Bulgarian context.

Introduction

The currency board regime is considered a success in generating and maintaining stability and growth in the Bulgarian economy since its introduction in July 1997 following the worst economic and financial crisis (1996-1997) the country endured in its history. As a precondition

for its enduring credibility, this regime had to be supported by prudent fiscal policy.[1] Indeed, it had a disciplining effect on the public finances and debt management while taming inflation and fostering real growth.[2] In 1998-2006, annual inflation came down to 7.2 percent from over 210 percent between 1991 and 1997 and the economy achieved 5 percent steady increase in real GDP.

In the Bulgarian version, the currency board takes the euro as the anchor currency and fixes the domestic currency in terms of the euro at about 1.95 levs to the euro since 1999. The choice of the anchor currency reflected its aspirations to become a full member of the European Union which became a reality in January, 2007, and its current plans to become part of the Euro zone. In a small open economy with a high degree of capital mobility, this special mechanism means that the country imports the monetary policy of the European Central Bank (the ECB) and the Bulgarian National Bank (the BNB) has only limited independence or discretion in influencing the domestic interest rates and the money supply.

As the sole authority to supervise and regulate the banking sector, and armed with discretionary powers to set the minimum required reserve ratio, to maintain capital and liquidity standards for banks, and to operate a discount window for short-term liquidity needs, the BNB has been an active monetary authority, ready to intervene in the financial markets when needed. The BNB implemented regulatory and monetary measures to curb credit growth during the credit boom period, 2002-2007. Later, with similar instruments, it fought against the global financial crisis (2007-2009) and maintained stability in the banking sector in support of the countercyclical ECB policies. Hence, the bank deserves to be credited for minimizing its adverse impact through its vigilant supervision on the banking sector which weathered the storm with significant resilience.[3]

Despite the existence of numerous studies on the workings of the Bulgarian currency board regime (Nenovsky and Hristov, 1999, 2002; Hanke, 1997; Miller, 1999; Hanke and Sekerke, 2003) and its capacity to absorb monetary shocks from the ECB (Minea and Rault, 2008), still, relatively little is known about how well the Bulgarian currency board has accomplished monetary and financial integration with the Eurozone, and whether there exists an operative bank lending channel of monetary transmission as in other European countries.

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[1] Bulgarian fiscal policy is rule-bound since 2003. Two fiscal rules are in place: a debt rule, in force since 2003 and an expenditure rule, in force since 2006. The debt rule, enshrined in law, sets a ceiling of general government debt at 60 percent of GDP. Its adoption reflects the commitment to comply with the Stability and Growth Pact and the Maastricht criteria of the European Union. The expenditure rule defines a ceiling for general government expenditure, excluding contributions to the EU budget, at 40 percent of GDP (IMF Country Report, 2010).

[2] Bulgaria's fiscal position averaged annual surpluses of 1.4 percent between 2000 and 2008. This was nearly unprecedented among EU transition economies; only Estonia followed a similar tight stance. Bulgaria's public debt-to-GDP ratio fell from 77 percent in 2000 to 17 percent in 2009. This was the second lowest of the EU new member states (after Estonia). While rapid catch-up growth was the major factor in reducing debt, the fiscal contribution was also significant (IMF Country Report, 2010).

[3] The operating environment for the banking sector continues to be challenging, however, with low credit growth, rising non-performing loans and a modest economic recovery following the sluggish real GDP growth of 0.2 per cent during 2010. In July 2011, Moody's upgraded Bulgaria's government debt ratings to Baa2 with a stable outlook from Baa3, citing Bulgaria's ongoing fiscal discipline, improving institutional strength and the financial system's relative resilience in a volatile regional environment.

In this context, the Bulgarian case deserves special attention because of several features characterizing its monetary, financial and banking environment. First, because of the currency board regime, the BNB has no complete autonomy in setting an independent monetary policy, but it still possesses several instruments to indirectly influence monetary indicators such the base interest rate (the money market interbank rate) and the reserve money. Hence, it's important to see how the Eurozone monetary shocks are transmitted to banks with a potential impact on their loan volume. Second, because Bulgarian financial system is bank-based with a limited role for equity and bond markets in corporate financing, firms rely almost exclusively on bank credit for funding. However, many companies still remain credit constrained due to the existence of financial frictions. Under these circumstances, a bank-lending channel is plausibly an important source of monetary transmission. Third, a great majority of Bulgarian banks are foreign owned with parent banks of these subsidiaries exclusively located in the European Union such as Austria, Greece and France. These banks crucially depend on parental funding due to the low deposit base. As a result, the credit conditions and the financial strength of the parent banks in the Eurozone have a direct bearing on the Bulgarian banks' ability to extend loans.[4] Stagnation and reversal of some fund flows from such sources are known to have impaired banks' ability to make loans during the global crisis making the economic downturn worse. Finally, numerous studies on the European economies with bank-based financial sectors confirm the presence of a bank lending channel and its importance in influencing the real economy (Altunbas et al., 2002; Angeloni et al., 2003; Ferreira, 2007; Huang, 2003).

All these specific characteristics of the Bulgarian environment make it an interesting candidate to assess the efficacy of this rigid but rule bound monetary regime in achieving convergence with the Eurozone and to study the relevance of the bank lending channel of monetary transmission. If confirmed, the existence of the bank lending channel implies that a special role should be ascribed to banks in business cycle outcomes and their willingness to supply loans can be an important determinant of the real economic activity. A monetary tightening could worsen the downturn in the economy by seriously contracting bank lending, in addition to the contraction in firm output and investment spending associated with the direct effect of rising interest rates on the cost of capital ('the interest channel"). The health of the banking sector could also matter for the credit supply and the real economy. By contrast, a monetary easing could be rapidly transmitted to the banking sector which may be ready to finance a credit boom, however unsustainable.

This study covers periods characterized by both monetary expansion and contraction with significant implications for the relevance of the bank lending channel in the Bulgarian context; the first period (2002-2007) was characterized by sharply declining interest rates associated with a general trend towards monetary easing at the ECB and the global level, and there was an

[4] During the crisis, capital flows from parent banks dried up and several banks turned to the traditional depositors to fund their credit portfolios. A credit crunch ensued after years of a credit boom. There was also a major risk of contagion from the Greek banks as all major Greek banks were downgraded in December 2009, pulling down the credit ratings of their subsidiaries later in Bulgaria (e.g. United Bulgarian Bank (UBB) by Moody's in June 2011). The action was prompted by a weakening of the banks' stand-alone financial strength, combined with the rating agencies' reassessment of Greece's ability to support its banking system. Greece's government debt rating was reduced to "junk" status in June 2011amidst concerns over Greek public debt sustainability.

accompanying credit boom in Bulgaria. In the second period running from 2007 to 2009, financial turbulence in the global markets overshot the interest rates only to be tamed by the substantial monetary easing attempted by the ECB and by the BNB. It is important to mention at this stage that the BNB played an active role in both periods and resorted to counter-cyclical policies and prudential measures; to curb the credit growth (with only limited success) in the former case and to cure the credit crunch in the latter. Arguably, the contraction in bank credit could have been worse in the latter case, when foreign funds reversed their course or dried up, without such measures of the BNB.

Next section describes the design of monetary policy in Bulgaria with an emphasis on the special features of its currency board. This discussion is followed by an evaluation of the policy instruments available for the BNB to pursue autonomous counter-cyclical policies independently of the ECB. There is also an analysis of the degree of integration with the Eurozone financial markets based on the cointegration and vector error correction methodology. In the next stage, the bank lending channel of monetary transmission is described theoretically in reference to the existing literature, and in particular, to the Kashyap and Stein model(1995). The empirical verification based on the generalized method of moments (GMM) strategy concludes the chapter.

The Design of Monetary Policy under the Currency Board in Bulgaria

Characteristics of Currency Boards

A classical (orthodox) currency board is a rule-based monetary system in which the monetary authority has no discretionary power to conduct independent monetary policy. As a central bank, the currency board issues notes and coins fully convertible into a foreign currency reserve, i.e. the anchor currency at a fixed rate and the monetary base (high-powered money or reserve money) is fully backed by the foreign reserves of the country. Typically, such systems are adopted in countries with a history of high inflation, abuse of monetary policy in financing government deficits and lack of monetary independence in order to impose fiscal discipline and maintain low inflation.[5]

In a classical currency board, the monetary authority does not act as a lender of last resort, does not accept deposits in any form or regulate commercial banks. Hence, it enjoys high credibility, is protected from political pressure and operates under full transparency (Hanke and Schuler, 2000). In this system, the money supply is determined by the market forces alone, or by the amount of balance of payments surplus or deficit. Moreover, unlike regular fixed exchange rate regimes, the fixed peg is not susceptible to speculative attacks because in the event of a panic, all liquid money assets (monetary base) can be converted into foreign exchange.[6]

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[5] See Hanke and Schuler (1994) and Schuler (1992) as the strongest proponents of currency-board monetary systems, in particular, in developing countries and transitional economies. The goal is to create a fully convertible currency unit, to eliminate government deficit finance and to maintain low inflation based on a transparent and a rule-based monetary system.

[6] Roubini (1998), however, argues against currency board regimes on the grounds that currency boards do not prevent speculative attacks and in the case of an attack, monetary tightening and interest rate hikes can bankrupt the domestic financial system. In his view, fixing exchange rates for a prolonged period to parities that are not consistent with fundamental values can disrupt the system through the collapse of the currency peg in the long run.

Table 1: Basic Economic Indicators for Bulgaria, 1999-2010

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Real GDP Growth, %	2.3	5.4	4.1	4.9	4.5	5.6	5.5	6.5	6.4	6.2	-5.5	0.2
Inflation, CPI, %			7.4	5.9	2.3	6.1	5.0	7.3	8.4	12.3	2.8	2.4
Inflation, PPI, %			3.6	1.3	4.9	5.9	6.9	8.6	10.2	0.2	0.9	12.2
Base Interest Rate[1], %	4.5	4.6	4.7	3.35	2.67	2.36		2.69	3.93	5.12	2.4	0.2
Unemployment Rate, %	16.0	17.9	17.3	16.3	13.52	12.16		9.1	6.9	6.3	9.1	9.2
Government Budget Balance, %	0.2	-0.6	-0.6	-0.6	0.0	1.7	3.2	1.9	1.1	1.7	-4.7	-3.2 -3.6

Source: BNB

1/ The base interest rate equals the simple average of the index LEONIA (Lev overnight interest average, a reference rate of the concluded and settled Bulgarian lev overnight deposit transactions, for the business days of the preceding month (base period).

The domestic interest rate movements are also closely tied to the anchor currency's mone policy.[7]

Hanke and Schuler (2000) define a special or a *quasi currency board* that retains some features of the orthodox currency board (such as maintaining a fixed peg, covering at least percent of issued notes and coins with foreign reserves, and lack of financing for governm debt or deficit), yet, at the same time, deviates from it in some important aspects. First, it ser as a lender of last resort under very limited conditions. Second, it has limited discretion o monetary policy (through manipulations of reserve requirements). Third, it creates deposits the government depository and commercial bank reserves). And finally, it maintains convertibility of the current account. Hence, a quasi currency board has some limited discre over monetary policy under some very specific conditions, for instance, in case of systemic and retains to different degrees central bank ability of performing lender of last resort funct (LOLR).[8]

The 1996-1997 Financial Crisis

Since the transition to market economy, the Bulgarian National Bank (BNB- "Bulgarski Naro Banka") conducted monetary policy (from 1990 until June 1997) with a high degree discretionary power in an environment of flexible exchange rate regime but "under challeng macroeconomic conditions and enormous political pressure" (Assenov, 2006). Half-hea attempts at privatization of loss-making state enterprises, lack of commitment to fiscal discip and structural reform coupled with excessive state enterprise deficits ("soft budget constrain forced the BNB to monetize fiscal deficits and public debt.

Sluggish banking reform and lax supervision meant unsound banking practices that led to accumulation of bad loans in the banking sector. The BNB lost its control over the mone aggregates due to its discretionary lending to imprudent banks and monetization of fiscal defi Concurrently, it experienced a drastic depletion of its foreign currency reserves to a critical le of USD 440 million in early 1997. In a hyperinflation environment (43 percent in January 240 percent in February in 1997), currency substitution intensified towards the end of 1996 v a sharp depreciation of the lev against the US dollar and the German mark. The BNB suffere major loss of credibility in the eyes of the public and the process culminated in a severe finan crisis and political turmoil in January-February 1997.[9]

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[7] A balance of payment deficit implies a contraction of the domestic monetary base leading to a drop in the for currency reserves and vice versa.

[8] Such flexibility does exist in different forms in Hong Kong, Argentina, Estonia, Lithuania and Bulgaria (Ca Dooley, and Walsh, 1996; Miller, 1999). Hanke and Schuler (2000) criticize such quasi regimes on the grounds by deviating from the orthodox currency board's operating principles, they diminish the system's credibility expose the currency board-like arrangement to higher risk of currency speculation and currency attack.

[9] At the heart of the banking problems were the severe macroeconomic instability due mostly to econo mismanagement, half-hearted attempts at banking reform and loss-making enterprises, lax supervision undercapitalized and insolvent banks with a large bad debt problem. The 1997 crisis wiped out some 30 percen the entire banking sector with the closure of 18 banks (Erdinç, 2003).

Specific Features of the Bulgarian Currency Board

In the aftermath of April 1997 elections, the new parliament voted for the introduction of the currency board effective as of July 1, 1997, and authorized the government to conduct long-overdue economic reforms in the context of the new stabilization program supported by the IMF. The establishment of the currency board in July 1997 as the centerpiece of this program was expected to create macroeconomic stability via fixed exchange rate regime, fiscal discipline, monetary independence, in short, an environment conducive for economic growth and structural reform. With the advent of the Board, the BNB underwent the most profound institutional change since its establishment in 1879 (Nenovsky and Hristov, 1999).

Indeed, the Bulgarian currency board so far has been a tremendous success: In the immediate aftermath of the crisis, the economy recovered rapidly from hyperinflation and resumed growth at a modest 3-4 percent per year while interest rates came down to 5 percent in a few months after reaching 200 percent at the height of the crisis. But the greatest success was the discipline imposed on the fiscal accounts and the fundamental transformation of the banking sector, under the new banking law (July 1997), towards safety, prudence and efficiency.[10] Major Bulgarian banks were rapidly privatized through sales to foreigners currently controlling more than 85 percent of bank assets and the sector was put under the tight supervision of the BNB. Over time, the Bulgarian banking sector facilitated a process of financial deepening, improved profitability and efficiency while expanding credit to the private sector (Erdinç, 2003).

The Bulgarian currency board, however, differs from a classical currency board since its inception in many significant ways, and as such, it is better described as a quasi currency board-like regime (Nenovsky and Hristov, 2002).[11] The BNB's Issue department[12] serves de facto as the currency board and it maintains a full coverage for the monetary liabilities of the BNB at all times by redeeming them for the reserve currency (first DM, and since 1999, the euro) at the official exchange rate on demand and without limit. The BNB is banned from participation in open market operations or lending to the government as in a classical currency board.

The main policy implication of the orthodox currency board is that the monetary authorities lacks any discretion to conduct monetary policy, the base money creation to follow the overall balance of payment surplus or deficit and the financial system is guided by the anchor currency's monetary authority. The monetary liabilities consists only the monetary base which is backed *fully* with the foreign reserves and there is no lending to commercial banks under *any* circumstances.

[10] With the discretionary lending of the Central Bank to commercial banks severely curtailed, bank financing of state enterprises stopped and this forced banks to restructure under foreign ownership. Two sources of bank risks, interest and exchange rate risks, were drastically reduced as the lev was pegged to DM at 1:1 till 1999, and later to the euro.

[11] The currency board in Bulgaria chose the deutsche mark (DM) as a reserve (anchor) currency at one lev to DM and switched to the euro upon its introduction on January 1, 1999 at about 1.95 lev to the euro, the choice reflecting Bulgaria's trade structure and its hopes to join the European Union. Bulgaria became a full member of the European Union in 2007 and is currently aspiring to join the eurozone.

[12] Under this regime, the BNB is divided into three departments: the Issue Department, the Banking Department, and the Banking Supervision Department.

The peculiarities of the Bulgarian currency board are inconsistent with some of the orthodox currency board's operating principles (Assenov, 2006). As one of the major distinctive features of the Bulgarian currency board, there is a lack of an upper limit for the coverage of the board's monetary liabilities with foreign reserves. This stipulation creates the opportunity for the BNB to engage in discretionary monetary policy. Second, the BNB can lend to commercial banks under exceptional circumstances such as a systemic financial or liquidity crisis.[13]

Table 2: Structure of the Bulgarian National Bank under the Currency Board (June 30, 2011)

Assets (in thousands of levs, actual values in parentheses)	Liabilities
Issue Department	
❖ *Foreign Reserves* ➢ Cash and foreign currency denominated deposits (5998693) ➢ Domestic Monetary Gold (2611562) ❖ *Investment in Securities* (15523969) *Total Assets* (24134224)	❖ *Monetary Liabilities* ➢ Notes and Coins in Circulation (7788269) ➢ Commercial Bank Required Reserves (5681446) ➢ Government Deposits (the Fiscal Reserve) (4534329) ➢ Liabilities to Other Depositors (1044912) ❖ *Banking Department Deposits (***5085268***)* *Total Liabilities* (24134224)
The Banking Department	
❖ *Gold and other Precious* (37571) ❖ *Receivables from the Government* (0) ❖ *Capital Investments and the IMF Quota* (1419319) ❖ *Fixed Tangible and Intangible Assets* (187842) ❖ *Other Assets* (9326) ❖ *Deposits at the Issue Department* (**5085268**) *Total Assets* (6739326)	❖ *Borrowings from IMF* (0) ❖ *Liabilities to international financial institutions* (2637069) ❖ *Other Liabilities* (14109) ❖ *Total Equity* (4088148) ➢ Capital (20000) ➢ Reserves (3960047) ➢ Retained Earnings (108101) *Total Liabilities* (6739326)

Source: BNB

[13] Article 33, section 2 and 3 of the Law on the BNB list the circumstances under which the BNB can extend credit to the commercial banks. First, it may extend credit in case of an emergence of a liquidity risk that may affect the stability of the entire banking system. Second, if the borrower is a solvent bank, the credit is fully collateralized by liquid foreign assets for up to three months.

The excess cover of the monetary liabilities with foreign reserves is the *net worth* of the currency board and is equal to the Banking Department deposit at the Issue Department.[14] It is this excess amount that may be employed for lender of last resort function such as secured lending to banks against collateral in a time of acute crisis.[15] Third, the BNB's monetary liabilities comprise not only the monetary base such as the currency in circulation (notes and coins) and bank reserve deposits, but also the government deposits, the so-called "the fiscal reserve account", and the deposits by the Banking Department. Forth, under certain circumstances, the BNB may extend credit to the government solely against purchases of special drawing rights from the IMF. Finally, the BNB has the authority to change the commercial banks' reserve requirements.

Several studies such as Hanke (1997), Miller (1999), Nenovsky and Hristov (2002) and Hanke and Sekerke (2003) point out that these specific characteristics enable the BNB Bulgarian currency board to engage in limited discretionary monetary policy[16] like a traditional central bank through several channels: government deposits with the currency board (Issues department), [17] the changes in the bank reserve requirement, and the limited possibility for the BNB to act as a lender of last resort.

Monetary Policy Tools and Money Supply Process under the Quasi-Currency Board

The liabilities side of an *orthodox* currency board balance sheet contains currency in circulation only, and the assets side contains foreign reserves only, and the money supply process is determined mainly by movements in the monetary base (reserve money). The sources of the monetary base can be expressed as in equation (1):

$$H \equiv F \equiv C + R \tag{1}$$

where H is supply of reserve money, F is supply of reserve money issued against the (net) foreign assets and C is currency in circulation and R is commercial bank reserve accounts. Note that reserve money, H increases (decreases) one-for-one with foreign reserves, F.

Table 2 shows the integrated balance sheets of the Issue and the Banking departments of the BNB under the currency board. In the Bulgarian quasi-currency board regime, equation (1) is altered with the inclusion of the fiscal reserve as in the following equation:

$$H \equiv C + R \equiv F + NR - GD - OD - B \tag{2}$$

[14] The Banking department deposit is the link between the balance sheets of those relatively independent BNB departments; consolidated they represent the BNB balance sheet.

[15] Bulgarian National Assembly (2005), Article 20, Section 2 states: "In case any systematic risk for the stability of the banking system arises, the Banking Department shall perform the lender of last resort function."

[16] According to Hanke (1997), Bulgaria should have adopted an orthodox currency board. Instead, the IMF approved a currency board law that was corrupted by provisions that gave the Bulgarian National Bank discretionary powers resembling those of a central bank.

[17] Hanke and Sekerke (2003) focus on the risk that the government's fiscal reserves pose. They suggest that Bulgaria's government retire the fiscal reserve from the BNB, took the foreign reserve counterpart and place it in foreign commercial banks. This step would eliminate one of the conditions for government interference, and return the independence of the monetary authority thereby reinforcing the credibility of the board and the lev.

where GD is the government deposit or the difference between government revenues and expenses,[18] $GD = T - G$, OD other deposits, B banking department deposit (net worth of the currency board) and NR net accrued interest receivable. $F + NR$ is equivalent to the total assets of the Issue department or alternatively, international reserves.

Equation (2) implies that reserve money decreases (increases) proportionally with an increase in the government budget surplus (deficit), as long as these changes are unrelated to foreign reserves. When the government deposits increase, for instance, the currency board puts aside foreign reserves to cover its liabilities toward the government, and since the foreign reserve does not change, the reserve money must fall. Conversely, a decrease in government deposits will free the foreign reserve cover and trigger reserve money creation in the equivalent amount. Tranches by the IMF to the government increase both the foreign reserve F and the government deposits and hence, have no impact on the supply of reserve money.

Most importantly, reserve money increases whenever there is an increase in foreign reserves, F that is not associated with changes in G, OD or B, either separately or together. The foreign reserves will increase (decrease) when the country is running a balance of payments surplus (decrease). This is the counterpart of the traditional channel of reserve money creation tied strictly to balance of payment dynamics in the orthodox currency board regime.

When the Banking Department exercises the lender of last resort function, its deposits at the Issue Department decrease and this opens the door for discretionary monetary policy. Equation (2) and the Issue department balance sheet in Table 2 make it clear that this action will lead to an immediate increase in reserve money which is not offset by changes in foreign reserves, F.

Behavior of the Minimum Required Reserve Ratio

Upon the introduction of the currency board, the minimum required reserve ratio was initially set at 11 percent of the commercial bank deposit base but later in July 2000, it was reduced to 8 percent. Since then, the required reserve ratio has been modified several times, especially during the credit boom (2002-2008) and the global financial crisis (2008-2009).[19] When the credit boom was deemed excessive with real loan growth reaching over 20 percent annually during 2004-2006, the BNB raised the ratio to 12 percent in September 2007, only to reduce it again to 10 percent in December 2008.

During the boom period, the bank stepped in with several measures to slow down the credit growth while strengthening prudential supervision: In 2004-2005, the BNB extended 8 percent minimum reserve ratio to all types of attracted funds of the banks and introduced credit ceilings and marginal reserve requirements.[20] The bank also toughened loan classification and

[18] An extended version of the government deposit is described in Nenovsky and Hristov (1999) where $GD = T - G + (-P - dBn - dI)$ such that P is the receipts from privatization, dBn is the value of securities financing (net), dI he value of tranches from IMF and other IMFs (net).

[19] In the early years of the currency board, the BNB did not attempt to use required reserve ratio as a policy tool to alter the monetary base, possibly, to build credibility, despite the country's exposure to adverse external shocks related to the Russian financial crisis and the war in Kosovo.

[20] The banks were allowed to expand credit by up to 6 percent per quarter or faced a penalty in the form of marginal reserve requirements. Some banks observed the limits while others circumvented the new constraints or preferred to

provisioning rules, changed the minimum capital requirements calculation, introduced minimum liquidity requirements, increased the reserve requirements on previously excluded liabilities, and reduced further the proportion of cash in the vault that can be used for fulfilling reserve requirements.[21] These measures had only limited effectiveness in putting a brake on the potentially unsustainable credit growth. Some observers (e.g. Erdinç, 2010) warned about the impending risks of credit defaults for the banking sector and other sources of fragility in the event of an economic downturn which became a reality during the global financial crisis, 2008-2009 (Table 5).

Table 3: Monetary Indicators

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
(% of GDP)									
M1					31.0	34.4	28.7	26.5	26.1
M3	42.9	48.0	53.3	60.2	61.9	69.9	66.1	69.8	72.0
Domestic Credit	23.7	29.7	35.9	43.6	40.7	55.6	64.3	69.6	71.0
Claims on gov sector	3.9	2.2	-0.9	-0.9	-4.2	-7.1	-7.5	-5.9	-3.2
Claims on non-gov sector	19.8	27.5	36.8	44.5	44.9	62.8	71.7	75.5	74.2
Claims on Households	4.3	7.2	11.4	16.5	17.5	22.9	26.1	28.0	26.9
Time Deposit Rate (%)	2.99	3.12	3.16	3.25	3.83	4.39	6.01	6.8	5.53
ST Loan Rates (%)	9.18	8.56	8.94	8.67		9.39	11.27	9.91	9.89
LT Loan Rates (%)	14.25	13.46	12.74	10.92		10.08	11.54	11.06	10.89
Interbank money market					2.87	4.08	5.29	2.43	0.30
SOFIBOR 3 months					3.69	4.90	7.14	5.72	4.12
Yield on LT gov securities					3.89	4.17	4.99	5.50	4.72

Source: BNB

Since the onset of the global crisis, the BNB has relaxed or reversed policy measures taken during the boom in 2008-2009. Effective December 1, 2008, the BNB decreased the minimum required reserves on all attracted funds of the banks from 12 percent to 10 percent. It also reversed a measure taken in 2004 by allowing 50 percent of cash in vault to count towards the fulfillment of reserve requirements. Meanwhile, reserve requirements, in particular for funds

continue lending and pay the penalty. A form of circumvention was the selling of part of the loan portfolio to foreign banks or to Bulgarian nonbank financial institutions. After the credit ceiling measures were discontinued at the end of 2006 due to their relative ineffectiveness, some loan sales were reverted.

[21] In July 2004, the reserve requirement ratio was set at 4 percent on long-term attracted resources (with maturity over two years) and repos of end-clients and in December 2004, the ratio was raised to 8 percent on all liabilities except interbank deposits. Also, the cash-in-vault accepted to fulfill reserve requirements was reduced to 0 percent. These measures were insufficient as banks were able to freely borrow from abroad and banks were keen to fight for their market share. However, they contributed to the building of capital and liquidity buffers in the banking sector and gave them flexibility to avert the global crisis when non-performing loans increased from 2.41 percent in late 2008 to 18.1 percent of banks' loan portfolio in February 2011 (BNB).

attracted from abroad were substantially reduced.[22] Later in 2009, the bank relaxed the loan classification and provisioning requirement rules[23] and its conservative regulatory standards on bank capital in February 2010.[24]

Hence, during 2004-2010, the BNB implemented an active countercyclical monetary policy by manipulating the required reserve ratio (the key policy measure at its disposal) and other regulatory changes to impact the nation's money supply during the boom-bust cycle of credit. The bank was also keen on preserving the stability of the banking sector through various regulatory measures to halt the process of unsustainable credit expansion (2004-2008) and to mitigate the impact of the global crisis on the banking sector with the advent of a severe downturn in real economy.[25] Notwithstanding these policy changes, according to the IMF, "the BNB still has several instruments to implement further a counter-cyclical macro-prudential policy within the confines of the EU regulation" (IMF Country Report, 2010: 63).

Lender of Last Resort (LOLR)

The BNB is restricted by law to provide short-term lending to banks (LOLR assistance) only to solvent banks experiencing an acute need of liquidity that cannot be satisfied from other sources, and for a maximum of three months, in cases of a liquidity risk that may jeopardize the stability of the banking system. LOLR could be performed within the framework of the CB monetary rule, i.e. up to the level of CB excess reserves (banking department deposits).[26] Clearly, the banking department deposit could be treated as a monetary policy instrument for use in a discretionary manner to influence the amount of liquidity in banks, and hence, the domestic interest rates and the credit volume (as well as M3). Should severe liquidity tensions emerge in the banking sector, the BNB has the capacity to provide liquidity for the banking sector through this venue. According to IMF (Country Report, 2010), the government could also act as a lender of last resort by drawing on the fiscal reserve. Moreover, the Treasury can also place deposits with commercial banks provided they have eligible collateral.[27]

[22] Effective January 1, 2009, the minimum required reserves on funds attracted by the banks from abroad is decreased from 10 percent to 5 percent; and no minimum required reserves is imposed on funds attracted from the state and local government budgets.

[23] The loan classification was relaxed by increasing the number of days a loan can be overdue before moving to a worse category. The reclassification to the standard category was allowed after three standard installments, as opposed to up to six installments in the previous regulation (passed in April 2005). Finally, an extension of the loan maturity for up to 2 years was allowed without the exposure being considered restructured. Such a maturity extension without reclassification was previously impossible.

[24] The minimum regulatory capital is set at 12 percent in Bulgaria, compared to 8 percent at the EU level.

[25] The Bulgarian economy contracted by 5.5 percent in 2009.

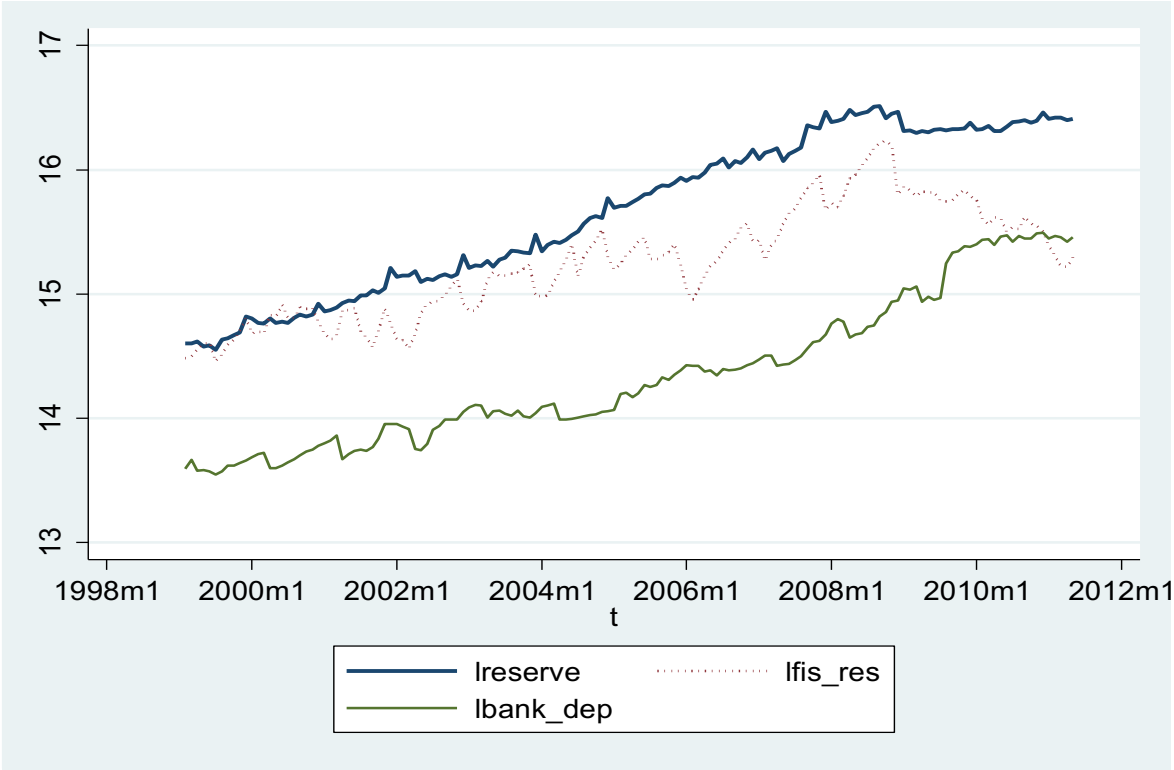
[26] The LOLR function is retained within the framework of a quasi CB because it is believed that in case of systemic banking crises, supply of liquidity by the monetary authority is the only effective way of overcoming a banking panic (Diamond and Dybvig, 1984, Fischer, 1999).

[27] Eligible collateral is limited to monetary gold, some foreign currencies (euro, US dollar and Swiss franc) and liquid securities issued or guaranteed by the Bulgarian government or by some foreign governments and central banks (Law on BNB, Article 33 and BNB Ordinance No. 6).

The Fiscal Reserve

The key argument for the inclusion of fiscal reserves in the liabilities of the currency board that should be covered by the international reserves is its role in reducing the reserve money volatility. The fiscal reserve deposits could smooth reserve money and interest rate fluctuations that could result from large capital flow volatility while enhancing the credibility of the currency board.[28] Still, the fiscal policy of the government can indirectly, intentionally or not, influence the amount of monetary base with a potential impact on the economy, leaving room for budgetary discretion to influence money supply dynamics.

Figure 1: Behavior of Log(reserve), Log(fiscal reserve) and Log(Banking deposit) during 1999-2011, monthly data



[28] The main arguments for the inclusion of fiscal reserves are the following: High capital mobility potentially causes large capital flow volatility which reflects directly on reserve money and interest rates as they are automatically linked to the balance of payments. In these circumstances government fiscal policy approximated with fiscal reserve dynamics in the balance sheet of the quasi CB may offset shocks and help smooth reserve money and interest rate fluctuations. In addition, it is argued that for countries like Bulgaria which have a huge external debt and large annual service obligations inclusion of government reserves in CB liabilities and their backing with international reserves helps enhance quasi CB credibility. At the same time, such design reduces reserve money volatility as large payments on external debt are accommodated by government reserves (Miller, 1999).

Table 4: Balance of Payments, External Debt and Reserve Assets, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Real GDP Growth	4.9	4.5	5.6	5.5	6.5	6.4	6.2	-5.5	0.2
Gross External Debt (% GDP)	63.5	58.1	61.7	66.7	82.0	94.3	104.9	108.0	101.8
Public Sector External Debt (% GDP)	46.9	38.5	31.6	22.3	18.0	13.3	11.1	12.0	11.9
Private Sector External Debt (% GDP)	16.5	19.6	30.1	44.3	64.0	81.0	93.8	96.0	89.9
Short term debt (% GDP)	8.9	8.3	12.0	16.9	24.4	30.5	37.1	35.3	31.9
Gross External Debt service (% of GDP)	8.3	7.3	12.9	25.9	18.2	20.4	20.5	21.1	19.7
FDI/ CA deficit (%)	243.5	190.3	209.3	116.5	133.9	116.7	82.4	77.4	460.0
(% of GDP)									
Current Account	-2.4	-5.3	-6.4	-11.6	-17.6	-25.2	-23.0	-8.9	-1.0
Trade Balance	-11.1	-13.2	-14.5	-19.0	-21.0	-23.5	-24.3	-11.9	-6.7
Capital and Financial Account	10.9	12.7	12.1	18.1	27.4	42.5	33.2	4.8	0.8
Financial Account	10.9	12.7	11.3	17.1	26.8	44.4	32.4	3.4	0.0
FDI	5.8	10.1	13.4	13.6	23.5	29.4	19.0	6.9	4.5
BNB reserve assets (in million Euro) [1]	4574.8	5308.6	6770.4	7370.3	8926.4	11936.6	12713.1	12918.9	12976.7
Net External Debt (% GDP)	22.8	18.8	15.1	20.7	24.7	39.0	55.1	55.6	49.4
BNB reserve assets/ Short term debt	301.9	348.1	277.3	187.4	145.0	127.2	96.8	104.8	112.8
BNB reserve assets (%)/ FX deposits of population	196.8	213.6	257.9	221.3	206.9	202.1	179.0	158.7	154.9
Nominal effective exchange rate (index June 1997=100)	121.6	126.8	127.9	124.1	126.4	127.5	131.2	134.0	130.5
Real effective exchange rate (index June 1997=100)	131.4	140.0	141.7	141.5	149.0	162.0	173.9	174.3	172.0

1/ Including monetary and non-monetary gold.

Source: BNB.

Table 5: Financial Soundness Indicators, 2006-2009 (in percent)

	2006	2007	2008	2009 III	2009 IV
Capital adequacy					
Capital to Risk- weighted assets	14. 5	13.8	14.9	17.6	17.0
Tier 1 Capital to Risk- weighted assets	11.8	10.8	11.2	13.9	14.0
Asset Quality					
Non-performing Loans to Gross Loans	2.2	2.1	2.5	4.5	6.4
Non-performing Loans net of provisions to capital	2.5	2.4	4.3	10.1	15.1
Earnings and Profitability					
Return on Assets (ROA)	2.2	2.4	2.1	1.4	1.1
Return on Equity 1/	25.0	24.8	23.1	13.4	10.2
Net Interest Income to Gross Income					
Liquidity					
Liquid assets to total assets	31.0	25.0	19.1	18.4	18.8
Liquid assets to total liabilities	35.7	29.2	22.6	21.1	21.8
Capital to Assets 2/	7.3	7.7	8.5	10.8	10.8
Trading income to total income	2.7	2.6	2.8	3.8	4.2
Foreign-currency denominated loans to total loans	45.6	50.4	56.9	57.8	58.6
Foreign-currency denominated loans to total loans	54.5	58.6	60.0	61.3	64.4

Source: IMF Country Report No. 10/159, 2010 and BNB Reports

1/ Return on equity is calculated with Tier I as denominator

2/ Capital to assets is based on Tier I capita

As argued by Nenovsky and Hristov (1999), "the government may conduct, intentionally or not, discretionary monetary policy by manipulating the fiscal reserve." A decrease (increase) in tax revenue, for instance, causes automatic monetary expansion (contraction). With an increase (decrease) in government expenditure, reserve money expands (contracts). Moreover, "this mechanism destroys the automatic link between balance of payments dynamics (or net foreign assets of the BNB) and the reserve money dynamics."

According to Minea and Rault (2008), monetary policy means intentionally affecting money supply dynamics and monetary policy instruments should mean different monetary variables that a policy-maker can control and change in a discretionary way. They argue, however, that "it is hardly conceivable that the government should proceed to this kind of (fiscal) changes for monetary objectives" while admitting to the influence of budgetary policy on monetary conditions.

Until 2004 the fiscal stance was tightened in order to consolidate the budgetary position, drive down public debt and support the credibility of the currency board. As Figure 1 shows, this budgetary position was reflected in a steady growth in the fiscal reserve account. Between 2004 and 2008, expansionary fiscal policy with significant expenditure increases, matched by surges in tax revenue, contributed to fuelling the demand boom, but despite significant nominal fiscal surpluses, fiscal reserve showed a rather erratic pattern. In 2008-2009, fiscal policy was tightened again to close the widening current account deficit and to adhere to the constraints of the currency board in an environment of high risk of contagion of balance of payment crises in the region. Yet, falling tax revenues associated with the recession of 2009-2010, generated government budget deficits (Table 1). This pattern is also evident in the steady decrease in the fiscal reserve (Figure 1).

Convergence with the Eurozone under the Currency Board

Under fixed exchange regimes, as in the case of a currency board, domestic interest rates are expected to follow closely (or converge to) the interest rate of the anchor country. In the absence of any monetary policy discretion and under conditions of perfect capital mobility, the domestic interest rate (along with the reserve money) displays a fully endogenous behavior and is expected to be strongly cointegrated with the anchor-country interest rate.

In a quasi-currency board regime as in Bulgaria, however, this convergence process depends on a number of factors such as: the degree of integration of financial markets, the degree of risk premium on the domestic economy[29] and the degree of autonomy enjoyed by the BNB in monetary policy discretion. As discussed before, foreign ownership of Bulgarian banks facilitated integration and access to the Eurozone funding markets and was instrumental in financing the credit boom during 2002-2007. The process of financial integration intensified since 2004, when the country was declared to join the European Union in 2007.

[29] Obviously, if there is a risk premium on the domestic economy, then the domestic interest rate is expected to converge to the anchor interest rate plus the premium.

Figure 2: Behavior of Base Interest Rate (BIR) and EONIA during 1999-2011, monthly data (%)

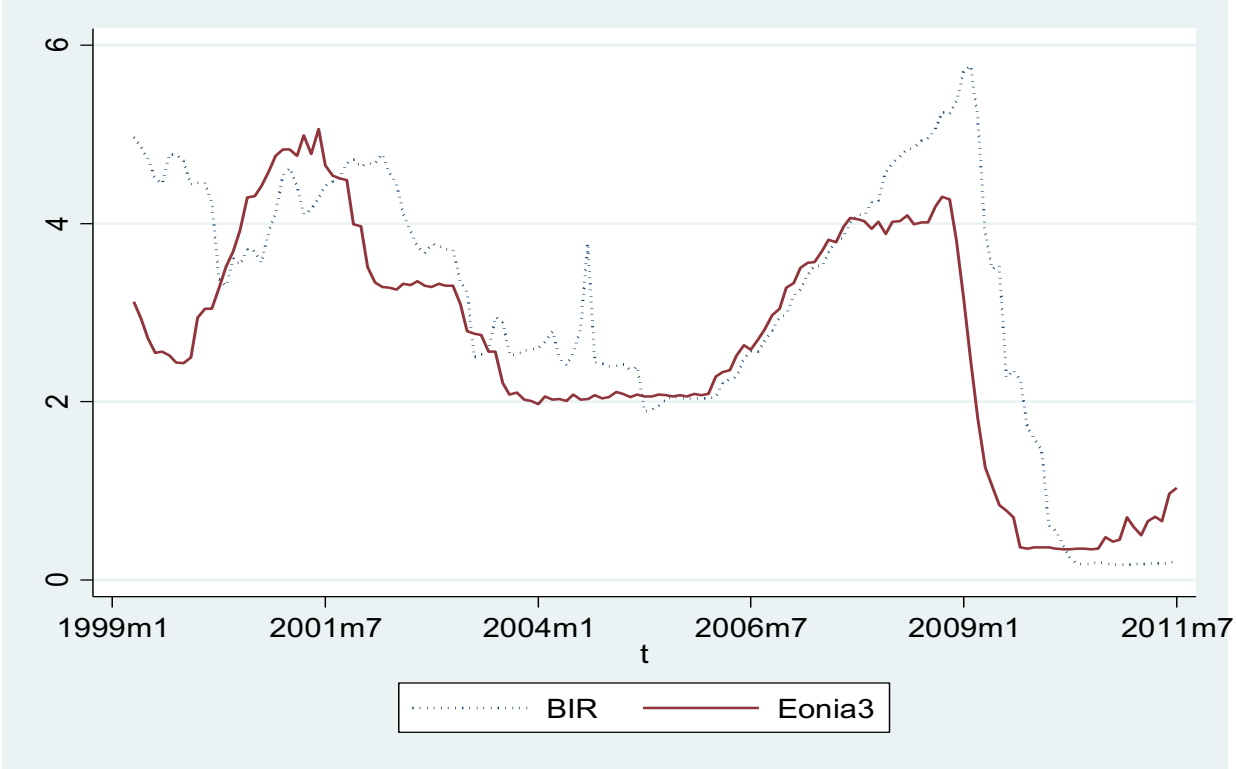
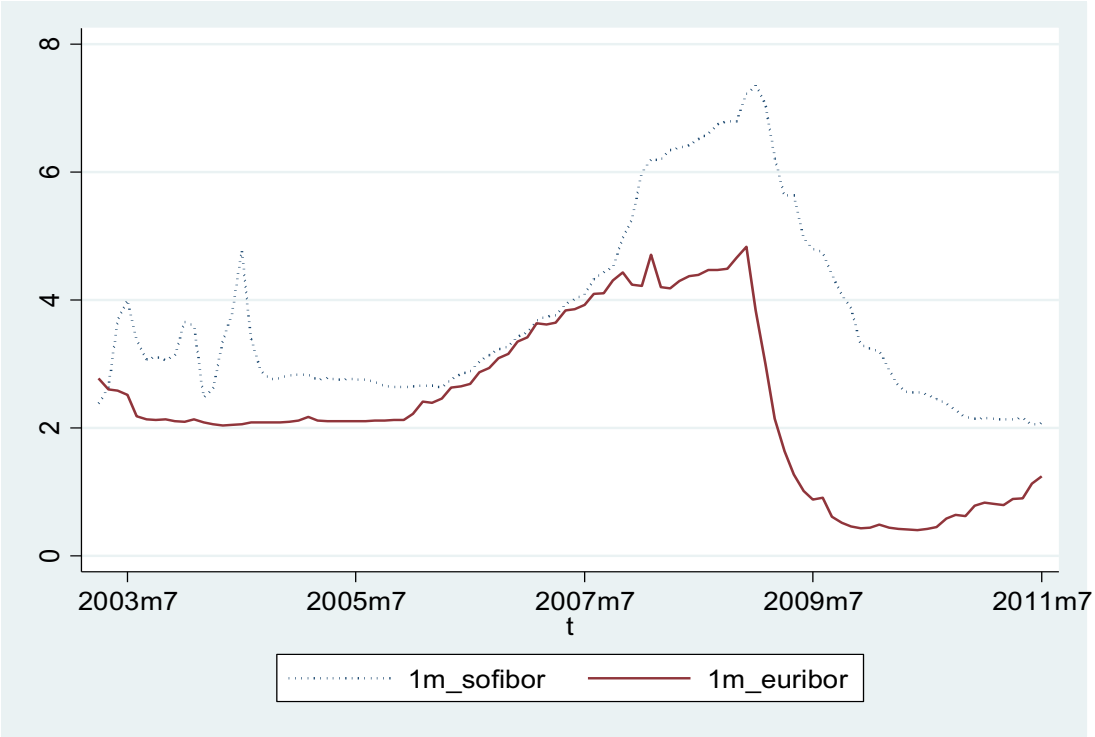


Figure 2 shows the monthly behavior of the Bulgarian base interest rate and the EONIA (overnight Euro rates)[30] over 1999-2011. It is evident that the Bulgarian rates significantly converge to the Eurozone rates, especially since 2004. And the overall path of the Bulgarian interest rates point to a strong co-movement with the Eurozone rates, which could be interpreted as a sign of increasing monetary integration with the Eurozone over the medium and long run. Still, there exist some significant deviations in the short-run between these rates which became particularly discernible in the midst of the global crisis. A serious tension on the money market rates became obvious since September 2007 following the collapse of Lehman Brothers, as evidenced by the increase in bid-ask spreads between short-term loan rates and the base rate (Table 3) and in spreads over Euro area market rates (Figures 2 and 3). Except for the overnight base rate (BIR), 1 and 3 month SOFIBOR spreads over the comparable EURIBOR rates substantially increased in recent years, and still remain well above pre-crisis levels. The reduction of the reserve requirement ratio by the BNB and the provision of liquidity to banks at reduced cost[31] were probably effective in taming the markets as 1-month spreads began to fall and the overnight rates decreased below the EONIA levels in 2010.

[30] The policy instrument for the ECB is in fact the refinancing interest rate. This is the rate the ECB controls and manipulates in order to direct the economy on the desired path. But, infrequent changes in this rate make it an unsuitable candidate for data analysis. Instead, EONIA is used for comparison.

[31] During the global financial crisis, as foreign funding dried up and liquidity concerns emerged for banks, the BNB reduced the interest rate on LOLR window borrowing for banks from 150 percent of the interbank rate to 120 percent, signaling its willingness to provide emergency liquidity assistance to banks within the limits and strict rules of the currency board arrangement.

Figure 3: Behavior of 1 month SOFIBOR and EURIBOR during 1999-2011, monthly data (%)



Given the strict monetary linkage of Bulgaria with the Eurozone through the currency board, the divergences between the Bulgarian interest rate and the ECB rate in the short term should not be considered permanent. Still, the short-run behavior of the interest rates suggests that there is room for monetary discretion at the BNB level. For instance, the BNB has permitted the domestic interest rate to come down below the Eurozone rates which may have enhanced economic activity through investment and consumption. The Bank so far effectively employed all the instruments at its disposal to maintain stability in the banking sector through its influence on the money markets, the reserve money and prudential standards. Probably, these policies in support of the easing of the monetary policy by the ECB (as observed from the general pattern of decline in the money market rates) were influential in aiding the recovery from the credit slump and the recession since 2011.

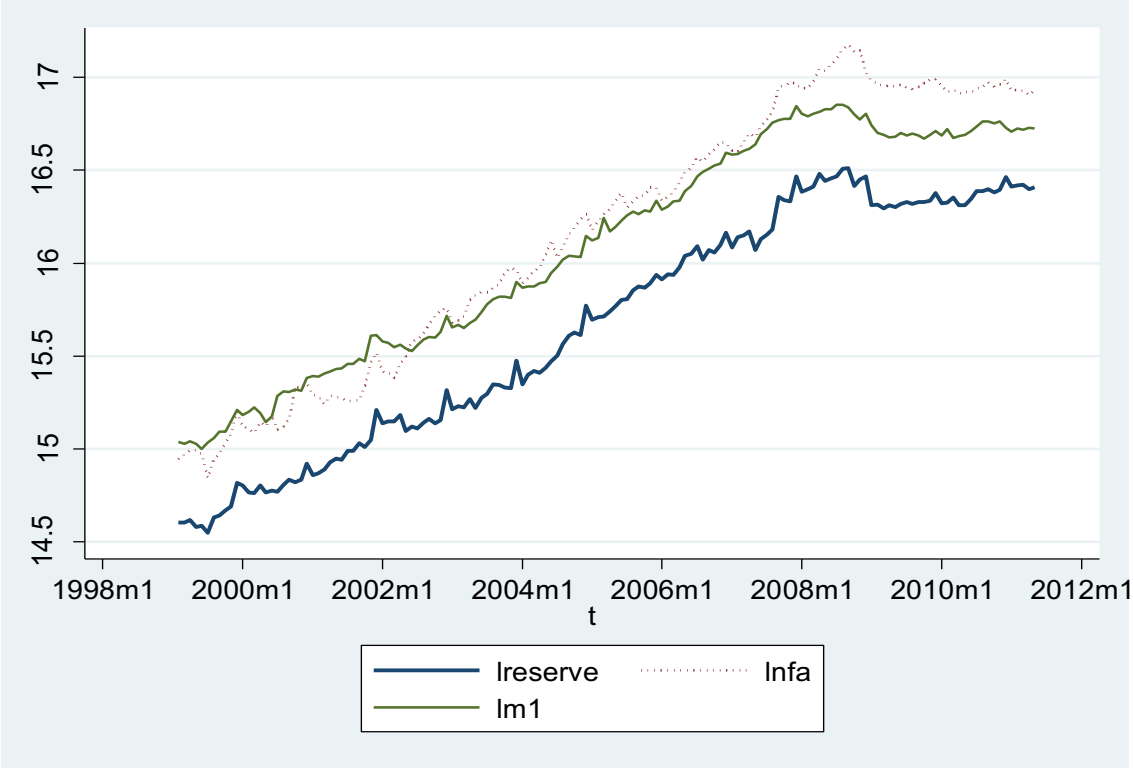
Cointegration and Vector Error Correction

In an orthodox currency board, the reserve money dynamics depends *only* on changes in foreign currency reserves: a resultant value of the balance of payments position, and hence, these two variables are expected to be strongly cointegrated.[32] In order to see if the Bulgarian currency board conforms or significantly deviates from the main principles of the orthodox currency board, I conduct a formal analysis based on cointegration (i.e. long-run relationship) and vector error correction method (i.e. short run balancing dynamics) on a selected number of variables of interest: First, how closely do the changes in reserve money (reserve) follow changes in foreign

[32] If non-stationary time series form a long run relation, i.e., they are cointegrated.

currency reserves (nfa), i.e. the net foreign assets of the BNB as a proxy for official international reserves? Are these two variables cointegrated such that they lead to a long-run equilibrium? If so, what is the nature of the short run dynamic adjustment towards the long-run equilibrium? Second, is there any evidence of cointegration among reserve money, M3 and M1? Third, is reserve variable cointegrated with the fiscal reserve (fis_res) and banking department deposit (bank_dep)? How does the inclusion of fiscal reserve affect reserve money dynamics and its adjustment process? Does fiscal reserve have a stabilizing effect on the short-run adjustment of log(reserve) to log(nfa)? Finally, how do the Bulgarian interest rates converge to those in the Eurozone?

Figure 4: Behavior of Log(reserve), Log(nfa) and Log(m1) during 1999-2011, monthly data



For this analysis, monthly data from the BNB monetary statistics for the period February 1999 - May 2011 are used. After running Augmented Dickey-Fuller (ADF) tests (with constant and trend), it has been observed that log(reserve), log(nfa), log(m1), log(m3), log(bank_dep), log(fis_res) are all integrated of order 2 (I(2)). Because these series are of the same order of integration, Johansen's cointegration test has been applied to determine if cointegration exists. It has been found that log(reserve) and log(nfa) are cointegrated (with trace statistic (2.3215) less than 5 percent critical value (3.76)). In addition, log(reserve) is also cointegrated with log(nfa) and log(m1) (with trace statistic (3.6264) less than 5 percent critical value (3.76)) and log(m3) (with trace statistic (2.9613) less than 5 percent critical value (3.76)). Lagrange-multiplier tests indicated no serial correlation in the VEC specifications. Lag order selection statistics based on AIC (Akaike Information Criterion), HQIC (Hannan-Quinn) and SBIC (Schwarz-Bayesian)

indicate lag order (2) as the suitable lag order for the VEC estimation. Stability condition for VEC estimates has been also checked and they are stable.

Table 6: Cointegration and Vector Error Correction (1999Q3-2011Q5)

Dependent Variable (log(reserve))	Cointegration Equation	
	Coefficients	
constant	1.334	1.8501
log(nfa)	0.8837(0.000)***	0.9205(0.000)***
Dependent Variable (d.log(reserve))	VEC (I)	VEC (II)
Error correction	-0.1338(0.027) **	-0.1571(0.016)***
(d.log(reserve))_1	-0.4268 (0.000)***	-0.2224 (0.069)*
(d.log(nfa))_1	0.2299(0.020)**	-0.1057(0.537)
constant	0.0139(0.000)***	0.03515 (0.960)
(d.log(fis_res))_1	----------	0.1676(0.017)**
No. of Obs.	146	146
Log Likelihood	48.8912(0.000)***	56.5605(0.000)***
R-sq	0.2561	0.2863

Notes: P-values are reported next to the estimates. Results are based on robust standard errors. ***: significant at 1 percent level, **: significant at 1 percent level, *: significant at 10 percent level.

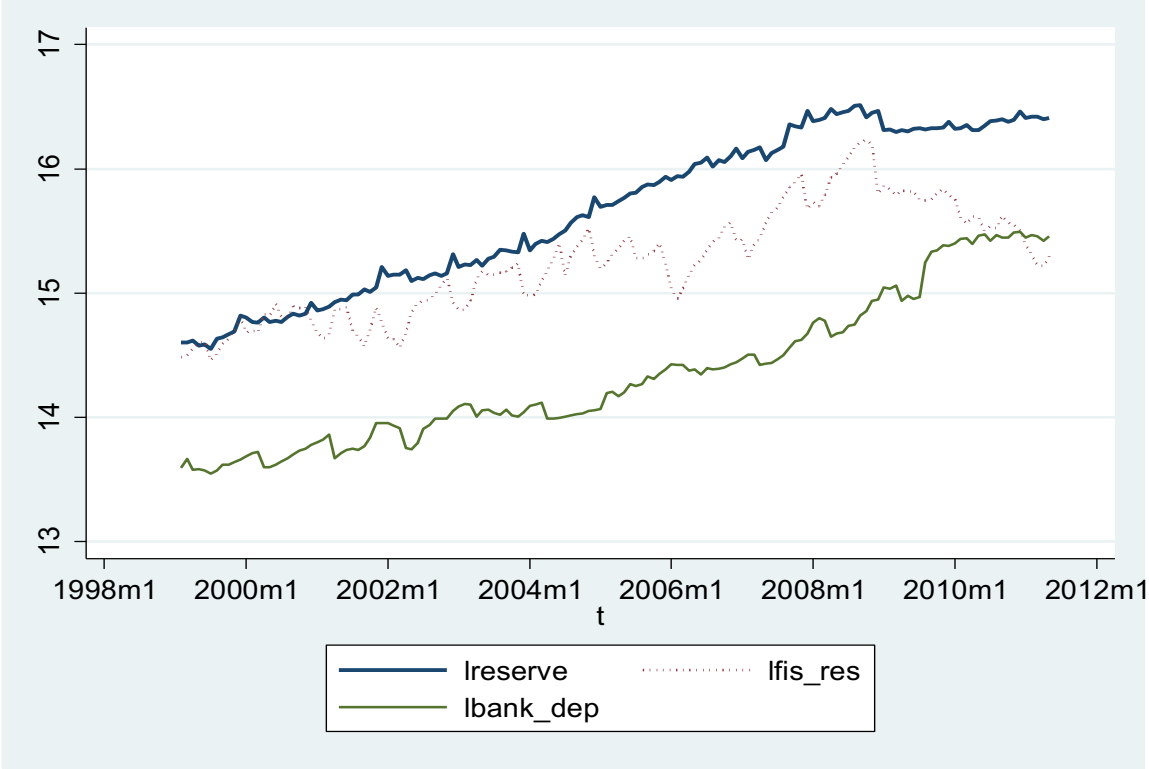
Under an orthodox currency board, the cointegration coefficient in front of log(nfa) is expected to be equal to unity, i.e. one for one increase (decrease) in reserve money following an increase (decrease) in foreign currency reserves. My estimation results yield a value of 0.8837 and 0.9205 respectively for the cointegration coefficients for the models (I) and (II). This discrepancy from unity could be attributed to the special features of the Bulgarian (quasi) currency board, in particular, to the limited autonomy the BNB enjoys in terms of monetary policy and the fiscal stance of the government.

Still, these figures are very close to the theoretical expectation from an automatically adjusting currency board, despite being lower than unity. Moreover, the inclusion of the fiscal reserve (VEC (II)) not only strengthens the cointegration relation between reserve and net foreign assets (compare 0.8837 and 0.9205) but also enhances the short-run adjustment process towards this long-run equilibrium as is evident from the improving significance of the short run error

correction term and its increasing value (Table 6). This result is contrary to the findings of Nenovsky and Hristov (1999) that covers the early years of the currency board in Bulgaria.[33]

There is also cointegration between the growth rate of reserve money and the growth of net foreign assets with a coefficient 0.4232 (significant at 1 percent), R-sq=0.7009 and the short-run adjustment coefficient significant with a value -1.7546. In addition, I find no evidence of cointegration for the pairs, log(reserve) and log(fis_res) and log(reserve) and log(bank_dep).

Figure 5: Behavior of Log(reserve), Log(bank_dep) and Log(fis_res) during 1999-2011, monthly data



Finally, the overnight interest rates, BIR and EONIA display a strong degree of cointegration, confirming my findings based on the graphical analysis. There is also a statistically significant (at 1 percent) short-run adjustment towards the long-run equilibrium, validating the existence of significant interconnectedness between the money markets in Bulgaria and the Eurozone. However, there is no evidence of cointegration between 1-month and 3-month SOFIBOR and EURIBOR rates, although long-run trends indicate comovement or lagged response, possibly

[33] My analysis here follows closely the methodology used in Nenovsky and Hristov (1999). Using monthly data for the early years of the currency board (1997-1999), they find that the fiscal reserve has a *destabilizing* effect on the reserve money dynamics and this breaks the parallel dynamics between the reserve money and the balance of payments (or net foreign assets). My results are based on the period after 1999 and cover more observations than their sample, improving precision. Moreover, I cover a period when the currency board enjoyed significant credibility with a steady increase in fiscal surpluses, except 2009-2010.

reflecting the absence of complete financial integration as well as the plausible influence of the BNB's discretionary policies.

Bank Lending Channel of Monetary Transmission

Brief Literature Review

The mechanism by which the monetary policy is transmitted to the real economy has been a topic of extensive theoretical and empirical research in the literature which identified various channels that include interest rate, asset price, exchange rate and credit channels.[34] Yet, the exact mechanism is still not completely unveiled. The standard view of monetary policy transmission, known as the 'money view', explains the monetary policy transmission through the interest rate channel. A change in the stance of monetary policy towards tightening, for instance, reduces the money supply, and given money demand, alters the short-term equilibrium nominal interest rates. Given price rigidities, the increase in the real interest rate reduces aggregate demand, mainly through investment as cost of capital rises and the demand for bank loans falls. Many critics argue, however, that this channel provides an incomplete story of how monetary policy works, especially because it ignores the independent or the special role played by the banks and the possibility of financial market imperfections based on asymmetric information which are completely ignored (Bernanke and Blinder, 1988, 1992; Bernanke and Gertler, 1989).

Specifically, the proponents of the credit channel theory stress that monetary policy may directly affect not only the liability side of bank balance sheets[35] and the demand for loans, but also the flow of bank credit or the supply of loans. The "credit view" consists of two channels: the balance sheet channel and the bank lending channel. In the former case, a rise in interest rate reduces the value of firm net worth because of high interest expenses and raises the external finance premium. This constrains smaller firms in terms of access to bank finance, cutting their investment more than large firms (Bernanke and Gertler, 1989).[36] The bank lending channel rests on two main assumptions (Gertler and Gilchrist, 1993; Kashyap, and Stein, 2000; Kashyap et al., 1993; Gambacorta, 2005; Kishan and Opiela, 2000). First, bank loans and other forms of financing through bond or equity markets are imperfect substitutes for many firms due to asymmetric information regarding their creditworthiness. High screening and monitoring costs make it prohibitively costly for such firms to access direct debt and equity markets, making them dependent on bank credit.[37] Consequently, a monetary tightening which makes banks unable or unwilling to extend credit, affect "bank dependent" firms worst, leading to a sharp contraction in their investment and other forms of spending as compared to less "bank dependent" companies.[38]

[34] For a detailed exposition of each channel, see Mishkin (1995; 2001).
[35] The emphasis of the interest rate channel is on the money supply which is part of the bank liabilities (deposits).
[36] A rise in interest rates reduces the cash flow and weakens balance sheets of firms that rely heavily on bank credit while a drop in asset prices shrinks the value of collateral. This increases the "external finance premium," making it harder to access bank credit. Smaller firms with lower net worth have greater difficulty in obtaining bank credit as compared to large ones and may remain credit-constrained in times of monetary tightening.
[37] Verifying empirically whether the broad credit channel is operative is not straightforward. For this reason, the empirical literature resorts to rather indirect evidence of enterprises facing credit constraints.
[38] For the existence of the bank lending channel in Europe, see Altunbas et al. (2002), Kakes (2000), Kakes and Sturm (2002), Huang (2003) and Bondt (1999).

Second, a monetary contraction reduces the bank reserve money, hence the supply of loans, constraining the spending of bank dependent firms. Hence, it is the "supply of credit" effect (bank lending channel) rather than "the cost of capital" (interest rate channel) that has a more pronounced impact on aggregate spending.

Empirical evidence on the existence and the relative importance of the bank lending channel, however, is not quite decisive as some of these studies based on aggregate data (e.g. Bernanke and Blinder, 1992) suffer from the well-known identification problem; the decline in bank loans following a monetary contraction may reflect the fall in demand for credit or the supply of credit or both. Alternatively, using firm-level disaggregated data, some authors (e.g. Gertler and Gilchrist, 1993) study the effect of a monetary contraction on small and large firms: Large firms with alternative forms of financing such as commercial paper, they argue, are less sensitive to a monetary tightening than bank dependent small firms, taking this as evidence in support of the credit view. But these findings are consistent with the balance sheet effect rather than the bank lending channel.

In order to resolve some of these doubts about the existence of the bank lending channel, Kashyap and Stein (1995) empirically investigate based on a disaggregated data how banks change their supply of credit in reaction to monetary policy shocks. The bank lending channel theory ascribes a special role to banks in the monetary transmission mechanism and stipulates that the responses of banks, in terms of their lending, in the aftermath of a monetary policy tightening might not be the same across banks.[39] They focus on the cross-sectional differences across banks of different sizes. This heterogeneous response to monetary policy impulses, if it exists, confirms the importance of the bank lending channel. Their study is based on quarterly data that employ bank balance sheets (growth rate of loans, deposits and securities) categorized into small and large banks, real output growth, inflation, and the change in the Federal Funds Rate (as a measure of monetary policy shock) over 1976:Q1-1992:Q2. They find that a monetary tightening leads to a larger decline in the lending of small banks than that of large ones for a given contraction in deposit base and this differential impact of the monetary impulse supports the existence of a broad lending channel.[40]

[39] The broad credit channel theory rests on the assumption that banks are special in resolving the problem of asymmetric information that pertains to the character of the relationships between borrowers and lenders at the expense of incurring high screening and monitoring costs. But credit rationing and underinvestment still emerge in times of monetary tightening, adversely affecting the real economy.

[40] They also find that securities holdings (the liquid assets) decline more rapidly for small banks for a given decline in deposits. Their results rest on the assumptions that the loan demand does not differ a great deal across banks of different sizes and the loan demand is sufficiently inelastic. For a given contraction in monetary policy with loan demand more or less unchanged, the initial reaction of banks is to reduce their credit volume at different degrees. But the decline in loan volume will lead to a large increase in loan and security spread, leading small banks to favor loans over their holdings of securities. This will reduce the amount of their securities so as to maintain their lending volume.

Econometric Evidence

Model specification

The econometric model is based on specification introduced by Kashyap and Stein (1995) and Pruteanu-Podpiera, 2007) and is described below. This specification captures whether bank lending responds to monetary policy shocks, and if so, whether there are important cross-sectional differences in the responses of banks with varying characteristics. In this model, the observed variation in the growth rate of bank loans is related to its lags, a monetary policy indicator such as money market rate, several control variables to account for the general economic situation (for demand factors and business cycles), certain bank characteristics, and – the key term of the analysis – to the interaction between the bank characteristic and the monetary policy indicator.

Loan supply is a function of the spread, the difference between the lending rate and the bank lending opportunity costs proxied by the base interest rate, i.e. the interbank money market rate. The base rate serves for banks as the cost of source of funds as well as a return on their investment in case of their excess supply of funds. In this model, instead of the spread, I use the base interest rate (*BASE_Q*) as it represents the stance of the monetary policy and changes in its value can account for monetary shocks in Bulgaria. To account for loan demand, in this reduced form model, I use the growth rate of real GDP ($\Delta lrGDP$) and inflation (*INF*) as proxies for demand shocks.

$$\Delta lrLOAN_{it} = \sum_{j=1}^{l} \alpha_{it} \Delta lrLOAN_{i(t-j)} + \sum_{j=1}^{l} \beta_j \Delta r_{t-j} + \gamma z_{i(t-1)} + \sum_{j=1}^{l} \delta_j [\Delta r_{t-j} z_{i(t-1)}] + \sum_{j=0}^{l} \zeta_j INF_{t-j} + \sum_{j=0}^{l} \eta_j \Delta lrGDP_{t-j} + \nu_{it} + \varepsilon_{it} \quad (3)$$

where

subscript *i*	denotes individual bank
subscript *t*	denotes quarter
ΔlrLOAN	differenced log of real loans i.e. the growth rate of real loans in 2005 prices (***the dependent variable***)
r	the base interest rate, (base_q)
INF	inflation rate
lrGDP	log of real GDP in 2005 prices
z	bank specific characteristics, size_m (log(assets)), cap1 (equity/assets) or liq (liquid assets/total assets[41])
rz	several bank characteristics interacted with the base interest rate
v_i	individual bank effects
ε_{it}	random error term

[41] Liquid assets comprise cash, interbank deposits and securities.

The bank characteristics (z) are those motivated by the underlying theory of the bank lending channel (i.e., bank size, capitalization, liquidity). I refrain from using ownership dummies to differentiate between foreign and domestic banks as more than 85 percent of Bulgarian banks are foreign owned. Bank size (*SIZE_M*) is measured as the logarithm of total assets as a deviation from cross-sectional mean in each period so as to remove its trend, liquidity (*LIQ*) by the ratio of liquid assets to total assets and capitalization (*CAP1*) by the ratio of capital and reserves to total assets. The last two measures are measured as the overall means. The parameter in front of the *BASE_Q* (or r in the above specification) captures the direct overall impact of monetary policy changes on the growth in bank lending. Additionally, the coefficients in front of the interactive terms, rz, account for the differential impact of the monetary policy shocks on banks. They are defined as follows: *BRCAP=BASE_Q*CAP1, BRSIZE= BASE_Q*SIZE_M* and *BRLIQ= BASE_Q*LIQ.* Significance of these interaction terms implies that the effect of monetary shocks depends on certain bank characteristics, validating the existence of a broad lending channel.

In line with the literature, the expected sign of the coefficients in front of *BASE_Q* (r) is negative suggesting that a monetary easing (a fall in the base rate) increases the growth rate of real (and nominal) loans and vice versa. Similarly, the growth rate of real GDP is supposed to have a positive impact on bank lending. Inflation is also expected to have a positive impact on lending but to the extent that it indicates macroeconomic instability, the sign can be reversed.

Less capitalized banks are also expected to react more strongly to monetary policy changes, which is equivalent to a significant positive parameter in front of the *BRCAP* variable. In the case of *BRSIZE* as the bank characteristic, a significant positive coefficient implies that larger banks with better access to external funding are less sensitive to monetary policy impulses and display a weaker reaction than smaller banks. Similarly, the sign of the *BRLIQ* coefficient is supposed to be positive, indicating that less liquid banks react more strongly to monetary policy changes. The coefficients in front of the bank characteristics (z), such as *SIZE_M, CAP1* and *LIQ* measure their direct impact on bank lending with all positive expected signs.

Data and Econometric Methodology: A Dynamic Panel Approach

The sample covers quarterly data for the period 2001:Q1 to 2010:Q4. All the variables are based on the quarterly balance sheets and income statements of 29 Bulgarian banks provided by the Bulgarian National Bank (out of 30 banks total). I use a panel data approach to explain the influence of the bank characteristic on bank lending as well as the response of bank lending to macroeconomic variables and monetary policy indicators. My specification of the dependent variable is in growth rates rather than in levels because I focus on the short-run relationships of bank lending and monetary shocks across different time periods, not on long-run relationships (which would call for a specification in levels) as in Pruteanu-Podpiera (2007). This specification is also supposed to circumvent the unit root problem since some of the variables included in the regressions are non-stationary (based on the panel unit root tests by Fisher and Im-Pesaran-Shin). Also, tests show that the growth rates of bank loans depend on their lagged values, the weight being on the first and/or second lags.

The initial estimations have been carried out with fixed (FE) and random effects (RE) static models to account for bank specific effects but they are not reported here. Observed persistence in the growth rate of real (and nominal) loans make techniques of dynamic panel estimation,

Arellano-Bond generalized method of moments (GMM) a more suitable method to capture the underlying dynamics of bank lending in response to monetary policy shocks. Hence, it permits the inclusion of a lagged dependent variable as an explanatory variable without bias (unlike FE and RE). The GMM strategy also generates efficiency gains in estimation over the fixed or random effects methods by using all available lagged values of the dependent variable and independent variables provided that the model is not subject to serial correlation in the error term. This methodology also accounts for the possible endogeneity of some explanatory variables as is potentially the case with the bank characteristics in loan growth equations.

The GMM estimators in first differences allow controlling for both unobserved country-specific effects and potential endogeneity of the explanatory variables (Arellano and Bond, 1991) but it may suffer from potential biases and imprecision associated with the usual difference estimators (Arellano and Bover, 1995; Blundell and Bond, 1998). An alternative is the system estimator (system GMM) that deals with these problems by combining in one system, the regressions in difference and the regressions in level. Since results were qualitatively similar, I report only the Arellano-Bond type GMM results.

I also employ Sargan's test for over-identifying restrictions to test for the validity of the instruments used in the GMM technique, along with the specification test, i.e. the AR test. The AR test implies absence of serial correlation in the errors if it generates a significant negative first-order serial correlation but no evidence of second-order serial correlation in the differenced residuals. I control for potential endogeneity by using "internal instruments," that is, instruments based on lagged values of the explanatory variables and impose restrictions on the maximum number of lags of variables at 2. Since the time dimension is relatively long with 40 quarterly observations, this way, the number of instruments can be reduced so as to improve the precision of Sargan and AR tests. I also base my inferences on one-step estimation results.[42]

Estimation Results

The estimation period running from 2001 to 2010 was characterized by a sharp convergence of the domestic (base rate) to the Eurozone money market rates, implying a rapid integration of the Bulgarian banking to the Eurozone financial sector. Additionally, a fast expansion in reserve money and a credit boom in an increasingly sophisticated, well-capitalized and liquid banking sector were also observed up until the global cirisis (2007-2009). In the same period, the base interest rate has been declining steadily but this trend has been reversed with the advent of the crisis and a general tightening in the European interbank markets despite efforts of the ECB at monetary easing and supportive policy of the BNB.

Still, in Bulgaria, real lending growth stagnated, even dropped and bid-ask spreads as well as the spread of the base interest rate (BIR) over Euro area money market rates (EONIA) widened. As external funding from parent banks dried up, most Bulgarian banks turned to the interbank

[42] Arellano and Bond (1991) design both one-step and two-step estimation procedures. The two-step estimation uses the one-step's residuals, so it is considered more efficient. However, they mention, based on Monte-Carlo simulations, the asymptotic standard errors for the two-step estimators can be a 'poor guide' and the inferences should be made using the one-step estimators.

market and tried to tap the limited deposit base of the country, raising the spread between the base interest and the deposit rates. The disassociation of the base interest rate from the euro rates during the crisis was mainly the result of these dynamics, and despite the efforts of the BNB, the 2007-2009 period is to be considered as one of monetary tightening and rising interest rates, reversing the previous trend.

Table 7: Estimation Results (dependent variable: growth rate of real loans)

Dependent Variable (ΔlrLOAN)	GMM (I)	GMM (II)
ΔlrLOAN		
ld	-0.549 (0.000)***	-0.5026 (0.000)***
l2d[43]	-0.382 (0.000)***	-0.4882 (0.000)***
INF	0.0087 (0.313)	0.0461(0.000)***
ΔlrGDP	0.758 (0.001) ***	2.2152(0.000)***
ΔBASE_Q	-0.0578 (0.081)*	-0.0447 (0.120)
SIZE_M	1.9066 (0.000)***	----------
CAP1	----------	0.03515 (0.960)
ΔBRSIZE	0.0760 (0.046)**	----------
ΔBRCAP	----------	-0.4781 (0.001)***
Constant	-0.2114	-0.3037 (0.016)**
No. of Obs.	997	997
No. of Groups	28	28
AR(1) test (p-value)	0.0056***	0.0000***
AR(2) test (p-value)	0.3063	0.3144
Sargan Test (p-value)	1.000	1.000
Wald statistics (chi-sq)	5337.97	3794.49

Notes: P-values are reported next to the estimates. Results are based on robust standard errors. ***: significant at 1 percent level, **: significant at 1 percent level, *: significant at 10 percent level.

[43] Maximum lag length for the dependent variable, the growth rate of real loans, is determined to be equal to 2, indicating significant amount of persistence.

Table 7 presents the GMM estimation results with size (GMM-I) and capital (GMM-II) as the bank specific characteristics, appearing individually and in interaction with the base interest rate in the equations. The estimation results in GMM-I and GMM-II show that the growth rate of real loans reacts strongly and in a significant negative manner to monetary policy changes captured by the base rate, in line with expectations. A similar result obtains for the impact of the demand and business cycle effects; lending responds positively to the growth rate of real GDP. A dummy variable to capture the impact of the crisis on bank lending, however, turns out to be insignificant despite having the correct negative sign but it is not reported here.

The GMM-I estimation with size as the selected bank specific characteristic reveals that there is a significant positive relationship between bank size and the growth rate of real loans, in addition to the significant differential effects of monetary policy changes on banks of different sizes. More specifically, I find a significant interaction coefficient with a positive sign, implying that the larger the bank, less sensitive lending becomes to the monetary impulses. That is, in periods marked by monetary policy tightening (an increase in the base rate), large banks' growth rate of loans decreases less than that of the smaller banks. By contrast, a general easing of monetary policy (a drop in the base rate, which was the trend till the global crisis in 2007-2008 period) is associated with a stronger response of large banks in terms of lending as compared to the small banks. In other words, their lending grows at a faster pace than that of the small banks and contracts less than that of small banks in times of rising rates. I interpret this result as evidence for the existence of a broad bank lending channel.

The GMM-II estimation with bank capital included in the regression reveals that capital base is not a strong inducement for bank lending, with an insignificant but still positive coefficient of the capital variable (*CAP1*). Yet, the coefficient of the interaction term with the base rate (*BR_CAP*) is negative and highly significant, implying that more capitalized banks are *more* sensitive to the changes in the base interest. When base rates rise, better capitalized banks reduce lending more strongly than less capitalized banks and in periods of falling rates, they expand loans faster than less capitalized banks. This result is in conflict with the findings of the literature which suggest that well-capitalized banks have easier access to external financing and insulate themselves better against rising interest rates. Hence, they are expected to react *less*, rather than more, to the monetary conditions.

This counterintuitive result may be accounted for by the special characteristics of the Bulgarian banks; they are mostly foreign owned with relatively easy access to outside funding, regardless of their capitalization, especially in the euro markets. Hence, there must be another channel that could explain this result, one based on the risk perceptions of banks towards lending. It is well-known that better capitalized banks may be more risk averse towards credit defaults associated with a general increase in interest rates and a decline in economic activity and hence, may curtail credit more strongly than less capitalized (and less risk averse) banks. Similarly, they can expand credit faster in good times characterized by falling rates and a surge in economic activity. Alternatively, better capitalized banks are more reliant on external funding from their parent banks located in the Eurozone economies and a monetary tightening in the euro zone implies severe funding difficulties for such banks which may force them to contract loans more than less capitalized banks that rely on the domestic markets for funding. Similarly, a monetary easing

can enhance access to parental funding leading such banks to expand loans more than less capitalized banks. The fact that capitalization explains the lending behavior in interaction with the policy indicator speaks for the existence of a lending channel of monetary policy.

In the GMM set-up, the consistency of the coefficient estimates depends on whether lagged values of explanatory variables are valid instruments. The criteria for the selection of instruments are two specification tests (Arellano and Bond, 1991). The Sargan test does not reject the null hypothesis of the overall validity of instruments' orthogonality conditions (over-identifying restrictions). The second test is about the serial correlation of residuals which rejects the null hypothesis of no first-order serial correlation of differenced residuals (AR (1) test) but fails to reject the null hypothesis of no second-order serial correlation of differenced residuals (AR(2) test). Thus, I conclude that the residuals are serially uncorrelated and orthogonality conditions are correct.

It must be also noted that the estimation with the liquidity variable has generated some counterintuitive results with a negative (but significant) coefficient, suggesting that liquid banks are less likely to expand loans and liquidity does not enhance lending in the Bulgarian context. The interaction term with the interest rate (*BR_LIQ*) also proved to be insignificant and hence, there is no indication of the lending channel based on the cross differences among banks in terms of liquidity. As a robustness check for the above findings, I reestimated the regression with non-performing loans to total loans (proxied by the loan-loss reserves to total loans) as an explanatory variable and as an interaction term with the interest rate. It has been found that banks with more non-performing loans to total loans are also more responsive to the interest rate movements: They contract (expand) loans by a larger amount when interest rates increase (decrease) suggesting that yet another bank specific characteristic influences monetary transmission.

Conclusions

In a typical currency board, monetary authorities can control neither the interest rate nor the money supply and the domestic interest rate and the monetary base (reserve money) are both endogenous as there is no policy autonomy for the central bank. By contrast, under a quasi-CB as in Bulgaria, the BNB commands some limited degree of policy autonomy through its manipulation of minimum required reserve ratio, changes in the government fiscal reserve and the size of the banking department deposit.

After a brief introduction to these peculiar features of the Bulgarian currency board and the limited number of monetary policy tools at BNB's disposal, this chapter started by confirming the existence of an increasing financial integration between Bulgaria and the Eurozone despite some short-term potentially policy induced deviations from this long run path. Cointegration and vector error correction (VEC) analysis has revealed that the reserve money, net foreign assets, M1 are all cointegrated with a strong comovement over the long-run. In addition, overnight interest rates move closely in the long-run. Obviously, the currency board regime played a significant role in this convergence process along with the dominance of foreign-owned banks with easy access to the European funding markets. The BNB proved to be an active institution in

pursuing countercyclical monetary policy but this mostly meant a stabilizing influence on the banking sector and the real economy.

This chapter also investigated the relevance and effectiveness of the bank lending channel of monetary transmission in order to shed light on the dynamics of bank lending and its role in transmitting monetary shocks under the specific conditions of the Bulgarian currency board arrangement. Based on a panel of quarterly time series for Bulgarian commercial banks for the 2001-2010 period, employing the Kashyap and Stein model (1995), the empirical findings of this chapter confirmed the existence of an operative bank lending channel of monetary transmission because bank characteristics have exerted an independent influence on the credit volume, after controlling for the impact of the domestic interest rate (the interest channel), the rate of growth of real GDP (business cycles) and inflation. Specifically, Bulgarian banks with differing degree of capitalization and size respond differently in terms of lending to the monetary policy shocks. Hence, bank specific characteristics matter for this transmission mechanism. In addition, the fact that bank lending is directly impacted by the changes in the interest rates, irrespective of bank characteristics, signifies the efficacy of the monetary policy or the strong transmission of the European monetary impulses into the Bulgarian financial markets, a process enhanced by the presence of foreign banks, the existence of the currency board and the growing sophistication of the banking sector.

During the period under investigation, there was a general trend of declining interest rates accompanied by a credit boom in the banking sector but this trend was reversed with the onset of the global financial crisis (2007-2009). Hence, unlike the literature which focus on the relevance of the bank lending channel in times of monetary tightening, this study confirmed the existence of the bank lending channel irrespective of the stance of monetary policy.

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