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Non-Technical Summary

Monetary policy shocks are transmitted to the real economy through different channels, which are collectively known as the monetary transmission mechanism. The knowledge of this mechanism is important for monetary policy, since unawareness of the ways in which monetary shocks are transmitted to the real sector might lead to distortions and higher volatility of interest rates and inflation. After the accession of ten Central and Eastern European countries to the European Union (EU) in May 2004, the analysis of the channels of transmission is particularly relevant for the European Central Bank, which will be responsible for the monetary policy in a future enlarged European Monetary Union (EMU). The research so far has however mostly concentrated on the analysis of the transmission mechanism in the current member countries of the EMU, whereas the analysis of the channels of transmission in the new member states of the EU has lagged behind.

The intention of this paper is to fill this gap and to analyze the existence of a bank lending channel of monetary transmission in Estonia, Latvia and Lithuania for the period between 1997 and 2004. This channel emphasizes the role of banks and informational frictions in the transmission of monetary shocks. Due to these frictions banks face a liquidity constraint and have to reduce loan supply in response to a restrictive monetary policy shock. To identify the bank lending channel in the Baltics, the panel structural approach by Kashyap and Stein (1995) is used. This approach proxies informational frictions by the size, the liquidity and the capitalization of banks. The idea behind this approach is that smaller, less liquid and poorly capitalized banks face greater informational frictions and therefore react more strongly to a restrictive monetary impulse. The estimations indicate that distributional monetary policy effects are mainly caused by differences in liquidity, whereas bank size does not significantly influence the lending behavior of banks. The results also show that the lending behavior does not depend on the domestic, but on the euro money market rate due to the foreign exchange regime and the use of internal capital markets.

The Role of Banks in the Transmission of Monetary Policy in the Baltics

Matthias Köhler[†], Judith Hommel[‡], Matthias Grote [§]

January 2006

Abstract

Abstract: The paper empirically investigates the monetary transmission mechanism in the Baltic States. The analysis of the transmission channels through which monetary policy shocks are transmitted is particularly important for the European Central Bank that makes monetary policy in an enlarged European Monetary Union. The paper focuses on the bank lending channel of monetary transmission due to the importance of banks in the financial system of the Baltic countries. The existence of this transmission channel is tested by using a panel structural approach that distinguishes banks according to size, capitalization, liquidity and ownership structure. The results indicate that a bank lending channel is present in the Baltic States and mainly caused by differences in liquidity.

Keywords: Monetary Transmission, Bank Lending Channel, Transition Countries
JEL Classification: G15, G21, E 43, E44

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1 Introduction

Monetary policy shocks are transmitted to the real economy through different channels, which are collectively known as the monetary transmission mechanism. The knowledge of this mechanism is important for the conduct of monetary policy, since unawareness of the ways in which monetary shocks are transmitted to the real sector might lead to distortions and higher volatility of interest rates and inflation.

The analysis of the channels of monetary transmission is therefore an important part of the research work of a central bank. After the accession of ten Central and Eastern European countries to the European Union (EU) in May 2004, the analysis of the channels of transmission is particularly relevant for the European Central Bank (ECB), which will be responsible for the monetary policy in an enlarged European Monetary Union (EMU). The research so far has however mostly concentrated on the analysis of the transmission mechanism in the current member states of the EMU, whereas the analysis of the channels of transmission in the new member states of the EU has lagged behind.

The objective of this paper is to fill this gap and to analyze the existence of the bank lending channel of monetary transmission in the new member states of the EU by using balance sheet data for 36 banks for the period from 1997 to 2004. The study thereby focuses on Estonia, Latvia and Lithuania. The number of empirical analyses of the bank lending channel in these countries is limited to two studies by Juks (2004) and Schmitz (2003). By using a structural approach that distinguishes banks according to size, capitalization, liquidity and ownership structure, the latter analyzes the existence of a bank lending channel in eight central and eastern European Countries (including the three Baltic countries). Schmitz (2003) concludes that banks react strongly to changes of the euro, but only weakly to changes of the domestic money market rate. The author furthermore finds only weak evidence that bank size and no evidence that bank

capitalization and liquidity influence the lending behavior of banks. Juks (2004) comes to a different conclusion for Estonia. His results suggest that a bank lending channel is present in Estonia and mainly driven by differences in capitalization and mostly by differences in liquidity.

This paper extends these studies in three ways. First, it concentrate on a rather homogenous region due to the common history, similar financial systems and almost identical exchange rate regimes. This makes it possible to use a comprehensive dataset on bank balance sheets for panel data analysis without introducing potential biases resulting from different financial systems and exchange rate regimes. Secondly, the study extends the existing studies by further years and focuses on a period that was relatively stable in terms of the macroeconomic environment and monetary policy. Thirdly, the paper puts particular attention on the distinctive features that influence the transmission of monetary policy shocks, namely the foreign exchange rate regime, the dominance of foreign-owned banks and the structural characteristics of banks and their interactions in the Baltics.

The remainder of this paper is organized as follows. Part 2 gives a brief overview over the development of the financial system in the Baltic countries and describes it by traditional indicators. Due to the high importance of the bank loans for the financing of investments in the Baltics, we elaborate on the theory of the bank lending channel of monetary transmission in part 3. In part 4, we describe some features of the Baltic countries that are relevant for the transmission of monetary shocks, namely the foreign exchange rate regime, the dominance of foreign-owned banks in the region and selected bank characteristics like the size, the liquidity and the capitalization of banks. After having laid the theoretical ground, we use a panel data approach based on Kashyap and Stein (1995) in part 5 to test for the existence of a bank lending channel in the Baltic countries. Part 6 concludes.

2 Historical Overview

Since independence from the former Soviet Union in 1991 the Baltic States have gone through a remarkable transformation. The whole economy has been changed from a central-planned to a market-driven system. The banking and financial sector have also been affected by this development.

The development of the financial system in the Baltics started at the end of 1991 and at the beginning of 1992 when the Baltic branches of the central bank of the former Soviet Union were taken over by the newly established central banks of Estonia, Latvia and Lithuania. The transformation of the monobank system into a modern two-tier banking structure soon followed as these banks were split into one central bank and the surviving commercial banks. These banks were then transformed into independent joint-stock companies. Due to low entry requirements and a lack of supervision in the Baltics, the number of banks soon began to rise. This development was accompanied by the regain of monetary independence from the former Soviet Union through the issuance of the Estonian Kroon in 1992, the Latvian Lat in 1993 and the Lithuanian Litas in 1994. Estonia and Lithuania henceforth pegged their currency in a currency board arrangement to the Deutsche Mark and the US dollar, respectively. Latvia opted for a less rigid peg and chose the Special Drawing Rights of the International Monetary Fund (IMF) as nominal anchor for the Lat.

The years from 1992 to 1996 were characterized by efforts to stabilize the financial systems. The number of banks soon dropped due to several mergers among banks and the first banking crisis. As a result, new credit institution laws and modern accounting standards were introduced in all three Baltic States. Estonia was again the first nation which implemented new banking laws in 1995 and made International Accounting Standards (IAS) obligatory for Estonian banks. Latvia soon followed and raised the minimum capital requirements to 10 percent in 1996. Lithuania enacted a partial deposit insurance

law in 1996, before it implemented IAS for banks and higher capital requirements in 1997 (Barisitz (2002)).

2.1 Recovery from the Russian Crisis and the Accession to the EU

The Russian Crisis in 1998 led to massive withdrawals of capital by international investors and a massive economic downturn, particularly in Latvia (Adahl (2002)). Because of buoyant international demand and large capital inflows a strong economic recovery however soon followed in all three Baltic States.

This created a favorable environment for the development of the financial system in the Baltics. The Baltic banking sectors experienced a second intensive consolidation phase during this period, which continued up until 2004. The result of this consolidation process is the present banking structure. Several factors contributed to the wave of consolidations in the banking sector of the Baltics: First of all, low stock market prices of domestic banks during the crisis made Baltic banks attractive for take-overs by foreign banks. Secondly, the privatization of the last state-owned banks by the Estonian, Latvian and Lithuanian authorities significantly accelerated the consolidation and facilitated the entry of foreign banks in the domestic banking markets. Thirdly, the number of banks significantly decreased owing to stricter regulation and supervision, which forced many non-profitable banks to close business.

With the perspective of EU accession, the exchange rate policy was an issue in the Baltics as well. Since Estonia has already pegged its currency since 1999 to the euro, it did not have to change its anchor currency to join the European Monetary System II in 2004. Due to its dollar peg Lithuania switched to the euro in 2002. The Bank of Latvia also decided to re-peg its currency to the euro in 2005. These factors have together with a parallel economic recovery

led to increasingly similar developments in all three Baltic banking markets.

2.2 The Structure of the Financial System in the Baltics

The first indicator that is often used to measure the overall size of financial intermediation is the ratio of M2 to GDP, which is also called the degree of monetization. During the period from 1997 and 2004 the degree of monetization significantly increased in the Baltic States (see Table 1). The comparison with the EU-15 however also indicates that the level of intermediation and the size of the financial system are still well below the EU-15.[1]

To assess the importance of banks and capital markets in the financial system of the Baltics, two indicators are used. The first indicator is the ratio of total banking sector assets to GDP. This indicator is a proxy for the size of the banking sector. The second indicator is the ratio of stock market capitalization to GDP. This indicator measures the size of the stock market. Both indicators increased between 1997 and 2004 (except of the degree of stock market capitalization in Lithuania). There is however still a large difference between the banking sector development in the Baltic States and the EU. This shows that the banking system in the three Baltic States is still in development and rather shallow. The indicator for the size of the banking sector is however significantly larger than the indicator for the size of capital markets. This indicates that the financial system in the Baltics is bank-based. The ratio of stock market capitalization reaches sizeable values only in Estonia. Due to the low liquidity of the market and the small number of listed shares it is however questionable if stock markets can be used as an alternative source of finance in Estonia.

[1]The EU-15 comprises the EU members before the enlargement in 2004, namely Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.

Table 1: Structure of the Baltic Financial System

	Estonia		**Latvia**		**Lithuania**		**EU-15**	
	1997	**2004**	**1997**	**2004**	**1997**	**2004**	**1997**	**2004**
M2 to GDP in Percent	28.3	39.9*	26.6	35.7*	18.8**	31.5*	2283	2465
Total Assets as Percent of GDP	63.0	94.4	49.0	101.3	25.0	47.5	419.0	416.4
Total Credit as Percent of GDP	24.7	65.4	9.7	56.5	10.6	30.4	128.7	146.1
Market Capitalization as Percent of GDP	8.8**	41.5*	6.1	9.6*	17.7	17.2*	70.8	91.0

Source: International Financial Statistics (2005), Allen, Bartillo, and Kowalewski (2005) and EBRD (various issues). * Data from 2003, ** Data from 1998.

A widely used indicator that measures the importance of bank intermediation is the ratio of domestic credit provided by credit institutions divided by GDP. This ratio shows that bank lending is less developed than in the EU, although the importance of credit finance increased between 1997 and 2004. This can be explained by the sharp economic downturn and several banking crises at the beginning of the transformation, which led to massive bad-loan problems in the corporate sector. These problems forced banks to cut back loans. This is also reflected in the data for 1997. During the recovering period the credit volume increased again. Financial intermediation was however still between 2 (Estonia) and 5 times lower (Lithuania) in the Baltics than the average for the EU-15 in 2004.

2.3 The Structure of the Banking System in the Baltics

The transformation and the Russian Crisis had had a significant influence on the banking structure in the Baltic States. After the initial explosion of the number of banks shortly after independence the number of banks in Estonia and Latvia soon dropped and followed the trend of consolidation that also reduced the average number of banks in the EU-15 (see Table 2). The number of commercial banks

increased between 1997 and 2004 only in Lithuania.

Table 2: Structure of the Baltic Banking System

	Estonia		**Latvia**		**Lithuania**		**EU-15**	
	1997	**2004**	**1997**	**2004**	**1997**	**2004**	**1997**	**2004**
Number of Banks (of which foreign-owned)	12 (4)	7(4)	32 (5)	23 (10)	12 (4)	13 (7)	647	482
Share of Foreign Bank Assets of total Bank Assets	29.0	98.0	55.0	57.8	41.0	94.1	19.4	22.8
Herfindahl-Hirschmann Index (HHI)	4312	3887	1679	1021	3353	1854	712	931

Source: EBRD (various issues) and Allen, Bartillo, and Kowalewski (2005).

Baltic States were fast in inviting foreign investors after the Russian Crisis in 1998. This crisis led to a further consolidation of the banking market and the privatization of the last state-owned banks. As a result of this restructuring process, foreign banks, which had already been present in the Baltics, gained an even higher share of the local market. This development is also reflected by the share of bank assets that is held by non-residents, which is significantly higher in the Baltics than the EU-15 average. Foreign-owned banks have reached a dominant market position, particularly in Estonia and Lithuania. The dominant position of foreign banks is also reflected in the high market concentration of the Baltic banking markets. This can be illustrated by the Herfindahl-Hirschman Index (HHI).[2] Although the degree of concentration of the banking markets decreased between 1997 and 2004, the HHI Index still exceeds the critical value of 1800 indicating that the banking sectors in the Baltics are highly concentrated. In particular, in Estonia the level of concentration is very high according to the HHI Index. This is mainly due to the domi-

[2]The Herfindahl-Hirschman Index measures the concentration of the banking market based on the sum of squared market shares of individual banks. The upper value of this index is 10000 in the case of a monopolist and tends to be zero in a case of a large number of firms with very small market shares. Values higher than 1800 indicate that markets are fairly concentrated.

nant role of the Swedish-owned Hansabank, which owns more than 70 percent of total banking sector assets.

3 The Theory of the Bank Lending Channel

Due to importance of banks in the financial systems of the Baltic countries and the high presence of foreign-owned banks the aim of this paper is to analyze the emergence of a bank lending channel and the influence of foreign-owned banks on the monetary policy transmission mechanism in the Baltics.

The traditional mechanism through which monetary shocks are transmitted to the real economy is the interest rate channel (Mishkin (1996)). Central to this transmission channel is the change in loan demand following an interest rate rise due to lower demand for investments. This finally depresses economic activity. The banking sector is not explicitly modeled and it is assumed that the supply of loans is not affected by interest rate changes. A reduction in the loan growth rate is therefore only due to a lower demand for loans and not due to reduced loan supply. The interest rate channel relies on the Modigliani-Miller Theorem according to which banks are indifferent at the margin between refinancing with the issuance of demand and time deposits (e.g. certificates of deposit).[3] A reduction of bank reserves resulting from restrictive open market operations therefore does not lead to a reduction in loan supply, since banks can easily compensate the loss of reservable demand deposits through an increase in nonreservable time deposits (Kishan and Opiela (2000)). Demand deposits decrease, since the interest rate rise makes other investments more profitable for customers. The replacement of demand deposits by time deposits assumes that both are perfectly substitutable.

[3]The Modigliani-Miller Theorem states that a company's investment decision is independent of its capital structure (Modigliani and Miller (1958)).

The theory of the bank lending channel depends on the failure of this proposition and postulates that banks face a liquidity constraint that forces them to reduce loan supply in response to a restrictive monetary policy shock (Kashyap and Stein (2000)). The reason for the existence of a bank lending channel is information asymmetries between banks that issue and banks that buy time deposits. Since these deposits are not insured, the information on the default risk of the issuing banks becomes important and demand and time deposits are no longer perfect substitutes. Banks therefore face a liquidity constraint and have to reduce the supply of loans in response to a restrictive monetary policy shock. The importance of information asymmetries for bank lending is criticized by Romer and Romer (1990)). They claim that banks can easily switch between reservable and nonreservable deposits and therefore argue that the size of the bank lending channel is rather limited. Empirical analyses of the bank lending channel, however, suggest the opposite and find evidence that the strength of the bank lending channel is *inter alia* determined by the size, the liquidity and the capitalization of banks.

Kashyap and Stein (1995) and Kishan and Opiela (2000) argue that bank size affects the reaction of banks to restrictive monetary shocks. Since small banks encounter more asymmetric information problems on the capital market than large banks and therefore may find it more difficult to raise uninsured funds in response to monetary tightening, larger banks are expected to react less strongly to monetary policy shocks (Kashyap and Stein (1995)). However, not only the size of the bank, but also the size of the borrowers matters. Since banks encounter greater information asymmetries when borrowers are small, restrictive monetary shocks also have distributional effects among customers. These asymmetries create a gap between the cost of internal and external financing for borrowers (Bernanke and Blinder (1988)). A contractionary monetary policy shock can increase this gap and therefore raise the costs for information-intensive borrowers. Open market operations consequently reduce the loan supply of banks by raising the costs of capital for bank-dependent borrowers (Kishan and Opiela (2000)). This credit rationing particularly af-

fects households and small firms that depend on banks as a source of external finance, since they are informationally opaque and do not have the opportunity to acquire external financing from capital markets like large companies (Berger, Klapper, and Udell (2001) and Görgens, Ruckriegel, and Seitz (2005)). However, even when information is distributed symmetrically, capital markets would not represent an alternative source of financing in the Baltic countries, since they are fairly underdeveloped with a market capitalization well below the levels of European bank-based financial systems (see Table 1).

Kashyap and Stein (2000) moreover argue that restrictive monetary policy shocks reduce bank reserves and therefore force banks to reduce lending if they cannot switch to other forms of finance or easily liquidate assets other than loans. More liquid banks are hence expected to react less strongly to changes in the monetary policy indicator than less liquid banks (Kashyap and Stein (2000)).

Kishan and Opiela (2000) furthermore give empirical evidence that the capitalization of banks significantly influences the lending behavior of banks, since loans are subject to capital requirements like the capital adequacy ratios of the Basel Accord. Banks operating near or below this level consequently cannot expand lending without additional equity. Since the market value of bank equity decreases in response to a restrictive monetary impulse, banks have to reduce the supply of loans in order to stick to the capital requirement. Since banks with a high level of equity should have it easier to meet this requirement, well capitalized banks are expected to react less strongly to changes in the monetary policy indicator than poorly capitalized banks (Kishan and Opiela (2000)). The decline in equity value furthermore leads to a higher leverage position of banks (less risky assets are backed with equity) which translates into higher risk premia charged in the interbank market (Van den Heuvel (2002)). This further increases the cost of refinancing and thus the strength of the bank lending channel.

Another reason for the existence of a bank lending channel arises from the structure of the banking sector. According to Kamin, Turner, and Van't dack (1998), factors that influence the degree of response to monetary policy shocks are not only bank characteristics, but also the level of competition within the banking sector. When the level of competition is high, changes in the cost of funds are very likely to have a fast impact on the quantity and the rates of loans and deposits, whereas in a banking sector with a low level of competition borrowers are subject to oligopolistic pricing behavior. Loan rates are therefore expected to respond less strongly to changes of the monetary policy indicator (Kamin, Turner, and Van't dack (1998)).

To summarize, the existence of the bank lending channel in the Baltic depends *inter alia* on the following determinants: Firstly, bank capitalization and liquidity influence the pass through of monetary policy impulses to the real economy. More liquid and better capitalized banks react less strongly to a restrictive monetary policy impulse than less liquid and poorly capitalized banks. Secondly, the ability and sources of refinancing affect the liquidity position of banks and therefore the availability of loans after a restrictive shock. Refinancing via capital markets, interbank loans or internal markets of banking corporations depends furthermore on underlying informational frictions. Since large banks face less informational asymmetries than small banks, the costs of funding are expected to be lower for large banks. The impact of monetary policy shocks on bank loan aggregates is thus expected to be smaller for large banks than for small banks. The refinancing costs can also be influenced by the market structure of the banking sector, which is the third factor that contributes to the existence of a bank lending channel. In banking markets with a low level of competition, loan supply and/or loan interest rates react less strongly to changes in refinancing costs reducing the strength of the bank lending channel.

In part 5, these three hypotheses are tested in order to find out if banks play a particular role in the monetary transmission mechanism in the Baltics. Particular attention is thereby put on the distinctive

features that influence this mechanism. These are (I) the foreign exchange rate regime, (II) the dominance of foreign-owned banks and (III) the structural characteristics of the banking market in the Baltics.

4 Distinctive Features of the Monetary Transmission Mechanism in the Baltics

4.1 The Foreign Exchange Regime

The first important feature of the Baltic countries lies in the nature of the monetary policy regime. Since all Baltic States have adopted a currency board arrangement monetary policy is determined by the central bank in the anchor country. Such an exchange rate regime is characterized by a fixed exchange rate, the convertibility rule, which restricts base money supply to foreign reserves, and a strong legal commitment to maintain the arrangement in the long-term. The most important monetary policy instruments of such a regime are the unlimited foreign exchange window and the reserve requirement. Since the monetary base in countries with currency board arrangements is limited by the existing stock of foreign currency reserves, the exchange window is used by banks in these countries to exchange foreign reserves for domestic currency coins and banknotes. The importance of foreign reserves as liquidity buffer becomes clear by the large amount of net foreign liabilities, which amounted to about 23 percent in Estonia and 19 percent of GDP in Latvia at the end of 2004 (Backe and Zumar (2005)).

Closer integration with foreign markets, the use of foreign reserves as a liquidity buffer and a fixed exchange rate regime have therefore improved the preconditions for foreign interest rate signals to better pass through to the domestic financial sector (Lepik and Tors (2002)). In particular, interest rate changes in the anchor currency are expected to have a significant impact on domestic loans. The transmission of foreign interest rate changes is intensified by the

large share of foreign interest rate linked loans. Over half of real sector loans are granted under a floating interest rate linked to the euro interest rate in Latvia (Bitans, Stikuts, and Tillers (2003)) and Estonia (Kaasik, Kattai, Randveer, and Sepp (2003)).

4.2 Foreign Ownership of Banks

The privatization of the banking sector and the liberalization of capital flows have resulted in large inflows of foreign direct investment in the banking sector of the Baltic countries (Adahl (2002)). Due to the process of consolidation in the late nineties and the increased M&A activity by foreign banks the Baltic banking markets are now highly concentrated and mainly foreign-owned. The ownership structure reveals a high stake among European banks and a high involvement of Scandinavian banks, in particular from Sweden.[4] Whereas in Latvia and Lithuania most of the foreign banks are subsidiaries, main foreign branches were established by German and Swedish banks in Estonia.[5]

The presence of foreign banks in the banking sector of the Baltic countries has different implications for the bank lending channel. Better risk evaluation procedures introduced by foreign banks work in favor of this channel. Efficient risk management enables banks to better evaluate the creditworthiness of borrowers. This is due to a better assessment of changes in a borrower's debt service ability and the faster adjustment of credit volumes. At first glance, this reduces the strength of the bank lending channel resulting from the decrease in information asymmetries. But in reliance to the equity position of a bank, especially during operating near the margin, riskier projects can be identified and rationed more easily. Economically inefficient rationing can therefore be reduced. The response of foreign-owned banks to monetary policy actions of the Baltic central banks is likely to be limited and overshadowed by monetary policy decision in the

[4]Ownership information of banks has been taken from the homepages of the banks, the central banks and local banking associations in these countries.

[5]This seems noteworthy since there is an important legal distinction between subsidiaries and branches. Branches form an integral part of a legal banking entity, a subsidiary is a separate legal entity with capital of its own and therefore more sensitive to national monetary policy actions.

host countries of the foreign investor (Bitans, Stikuts, and Tillers (2003)). This reduces the impact of domestic interest rate changes on the loan portfolio of Baltic banks, but implies a stronger reaction to foreign interest rate changes.

Domestic subsidiaries of foreign banks are furthermore part of an internal capital market. Foreign parent banks might use these markets to allocate mostly book capital to subsidiaries to support them with tier 1 and 2 capital as well as liquidity (De Haas and Naaborg (2005)). This reduces the strength of the bank lending channel, since subsidiary banks can make use of the internal capital allocation to cover policy induced liquidity drains. Parent banks furthermore use internal capital markets to set risk-weighted asset limits which correspond to certain credit growth or market share targets set by the parent bank. It can therefore be assumed that subsidiaries credit growth is mainly determined by the consolidated group amount of capital (De Haas and Naaborg (2005)).[6] The euro money market is for these reasons expected to have a larger impact on the loan aggregates of the Baltic banks than the domestic money market rate.[7]

4.3 Structural Characteristics of the Baltic Banking Market

The monetary transmission mechanism is also influenced by the strength and the size of the banks, the level of competition and the ownership structure of banks (see part 3). The strength of a bank can be assessed by the capitalization and the liquidity. Most of the banks in the Baltics have capital ratios (equity capital ratio) well above the 10 percent level. In 2004, the average capital ratio was 12.45 percent in Estonia and about 15 percent in Latvia and in Lithuania. In the case of liquidity, banks with a high average liquidity ratio defined as the

[6]Tier 1 (shareholder's equity and retained earnings) and tier 2 (hybrid financing instruments) capital represent specific classes of equity or equity like capital for supervisory capital adequacy requirements to hold a certain amount of equity capital for risky assets.

[7]It has to be noted that Sweden has not adopted the euro, but still exchange rates and interest rates movements are very close not to say almost the same as can be seen in the euro area. Therefore, a further distinction did not appeal to bring more information.

ratio of liquid assets (e.g. cash, interbank deposits and securities) to total bank assets are located in Latvia (21.29 percent in 2004) and Lithuania (24.81 percent in 2004). In Estonia, this ratio is significantly lower (1.15 percent in 2004). The impact of monetary policy shocks on the loan growth rate is therefore expected to be stronger in Estonia than in Latvia and Lithuania. Bank size also affects the monetary transmission mechanism. The average bank size measured by the ratio of bank assets to total banking sector assets is 11.11 percent in Lithuania and 4.6 percent in Latvia (in 2004). In Estonia, huge differences exist in the size of the banks, since the largest bank holds 73.67 percent and the smallest 0.11 percent of the total banking assets. The measure of average bank size alone might therefore be misleading.

Table 3: Banking Market Characteristics

	Small		**Large**		**Foreign-Owned**		**Domestic-Owned**	
Liquidity	EST	0.8%	EST	1.9%	EST	1.2%	EST	0.8%
	LIT	27.9%	LIT	19.0%	LIT	21.7%	LIT	28.6%
	LAT	22.2%	LAT	15.9%	LAT	22.4%	LAT	19.0%
Capitalization	EST	14.1%	EST	11.1%	EST	12.5%	EST	n.a.
	LIT	15.7%	LIT	11.1%	LIT	14.4%	LIT	15.5%
	LAT	14.5%	LAT	21.1%	LAT	16.1%	LAT	16.4%

Source: International Financial Statistics (2005), Allen, Bartillo, and Kowalewski (2005) and EBRD (various issues). * Data from 2003, ** Data from 1998.

For this reason, we distinguished into small and large as well as foreign and domestic-owned banks and analyzed the capital and liquidity position of these banks in Table 3. In Estonia, large (mostly foreign-owned) banks (on average 1.9 percent in 2004) have a higher liquidity ratio than small banks (on average 0.8 percent in 2004). This implies a stronger reaction of small banks to restrictive monetary policy shocks. A different picture can be seen in Latvia and Lithuania. In these countries, smaller (mostly domestic-owned) banks are on average more liquid than large (mostly foreign-owned) banks. Large banks are therefore expected to be more sensitive to monetary policy shifts in Latvia and Lithuania. Regarding capitalization,

small and large banks are both well capitalized with average capital ratios well above 10 percent. In Latvia and Lithuania, small banks are again on average better capitalized than large banks, whereas in Estonia larger banks are better capitalized than smaller banks. Since small banks are on average more liquid and well capitalized than large banks, the effect of differences in bank size on the loan supply might be counter-balanced by liquidity and capitalization effects and therefore be indeterminate. With regard to the ownership structure, foreign-owned banks are more poorly capitalized than domestic-owned banks. This indicates a weaker effect of monetary policy impulses on smaller (domestic-owned) banks than on large (foreign-owned) banks.

The level of competition within the banking sector also represents an important factor influencing the monetary transmission process. The banking sectors in Estonia and Lithuania are more concentrated according to the Herfindahl-Hirschman Index (see Table 2) than in Latvia. This should result in a weaker reaction of bank lending to a monetary policy impulse in Estonia and Latvia and a stronger reaction of banks in Lithuania as a consequence of the aforementioned characteristics.

5 Empirical Analysis

5.1 The Data

Data on annual nominal GDP and the monetary policy indicator come from International Financial Statistics (IFS) of the IMF. As monetary policy indicator, we used the 3-month EURIBOR as the reference rate for the euro money market and the respective 3-month money market rates for Estonia, Latvia and Lithuania.[8] The obser-

[8]The money market rate in Estonia is 3-month Tallin Interbank Offered rate (TIBOR), in Latvia the 3-month Riga Interbank Offered Rate (RIGIBOR) and in Lithuania the 3-month Vilnius Interbank Offered Rate (VILIBOR).

vations start in 1997 and end in 2004.

Data on bank lending and bank characteristics have been taken from the BankScope database of Bureau van Dijk. This database contains annual information on bank balance sheet position as well as profit and loss data for 36 commercial banks in the Baltic region for the period between 1997 and 2004. Most of these banks are located in Latvia followed by Lithuania and Estonia. The balance sheet positions are reported either in local currency or in US dollars. To prevent that exchange rate fluctuations of the local currency against the dollar reduce the comparability of balance sheet positions among banks in different countries and years, we used the positions reported in local currency to calculate the loan growth rate, the bank size, liquidity as well as the capitalization ratio. Instead of unconsolidated balance sheets, we furthermore used consolidated balance sheets in order to assess the financial constraints and informational asymmetries of a bank.

A problem with BankScope data in general is that small banks are underrepresented which might lead to biased regression results. Another problem is that BankScope only contains data on foreign subsidiary banks and not on branches of foreign banks. This is however not a problem for our analysis, since branches are an integral part of a larger bank. Bank balance sheet data therefore do not necessarily reflect the business of foreign branches, but might be rather the result of the internal capital policy. The BankScope dataset furthermore covers more than 90 percent of total banking sector assets and is hence reasonably representative of the banking sectors in the Baltics.

5.2 The Model

The empirical analysis of the bank lending channel in the Baltics is based on an approach introduced by Kashyap and Stein (1995) and Kashyap and Stein (2000). This approach has frequently been used to

analyze the existence of a bank lending channel in the eurozone and tests if the reaction of banks to changes in refinancing costs depends on the size, the liquidity and the capitalization of banks.[9] This has usually been done by introducing interaction terms between interest rates and bank discriminatory variables. Beside these variables the nominal loan growth rate is also regressed on the log of the nominal GDP to control for demand-side effects on loan growth. Since the non-stationarity of the time-series cannot be dismissed *a priori* and unit root tests do not seem to be appropriate due to the short sample period, we took the first difference of the log of the nominal loan stock, the monetary policy indicator and the log of nominal GDP. Based on Kashyap and Stein (1995) the model is therefore formulated according to the following general regression equation:[10]

$$\Delta(\log L_{it}) = \alpha_i + \sum_{j=0}^{l} \beta_j (\log Y_{it}) + \sum_{j=0}^{l} \gamma_1 x_{i,t-1} + \sum_{j=0}^{l} \gamma_2 (x_{i,t-1} * \Delta MM_{t-j}) + \epsilon_{it} \tag{1}$$

where i = 1,...N and t = 1,...T and where N denotes the number of banks and l the number of lags. $\Delta(\log L)$ is the nominal loan growth rate in year, MM the monetary policy indicator, $\Delta(\log Y)$ the nominal GDP growth rate and α_i a bank-specific intercept to control for unobserved time-invariant differences between each cross-section unit. Since we estimate equation (1) with a coefficient for the monetary policy indicator (γ_1) and the GDP growth rate (β_j), the demand for loans is assumed to be homogeneous among countries with respect to income and interest rate elasticity. The bank characteristic variables are captured by x_{it} and have been defined

[9]Studies that have analyzed the strength of a bank lending channel in the eurozone countries are De Haan (2001), Gambacorta (2001), Ehrmann, Gambacorta, and Martinez-Pages (2001) and Loupias, Savignac, and Sevestre (2001).

[10]This equation slightly deviates from the equation introduced by Kashyap and Stein (1995) to analyze the existence of a credit channel in that it contains the growth rate of nominal GDP instead of the growth rate of real GDP and the rate of inflation. We used this specification in order to reduce the number of parameters to be estimated due to the small numbers of observations available.

according to Ehrmann, Gambacorta, and Martinez-Pages (2001)) in the following way:

$$Size_{it} = \log A_{it} - 1/N \sum \log A_{it} \tag{2}$$

$$Liq_{it} = L_{it} - 1/T \sum (1/N \sum L_{it}/A_{it}) \tag{3}$$

$$Cap_{it} = C_{it} - 1/T \sum (1/N \sum C_{it}/A_{it}) \tag{4}$$

Bank size (Size) is measured as the log of total assets of bank i in year t, liquidity (Liq) as the ratio of liquid assets L to total bank assets and capitalization (Cap) as the ratio of capital C to total bank assets. This generates variables that add up to zero over all observations and allows us to interpret the coefficient of the monetary policy indicator (γ_1) directly as the average measure of the monetary policy effect on the loan growth rate (Ehrmann, Gambacorta, and Martinez-Pages (2001)). The normalization of the size variable furthermore eliminates general trends in the financial sector of the Baltics, as for example, the general deepening of the financial sector. The specification of liquidity and capitalization moreover removes the overall average across banks and over time from each observation. This might be relevant, since general trends of decreasing liquidity and capitalization might affect the transmission of monetary policy shocks in the Baltics.

The bank characteristic variables are used together in single regressions, since including them separately in a model is likely to generate an omitted variable bias, when the variables are related to each other. The coefficient of these variables is significant if the relationship between bank lending and the bank discriminatory variables is linear. The bank characteristics are furthermore interacted with the monetary policy indicator to find out if monetary shocks have distributional effects on the banking sector in the Baltics. The assumption is that small, less liquid and poorly capitalized banks react more strongly to interest rate changes. This is equivalent with a sig-

nificant positive coefficient of the interaction terms and means that banks with these characteristics reduce their loan growth rate more strongly in response to a restrictive monetary shock than large, liquid and well capitalized banks.

5.3 Estimation Method

Because of the lack of long time-series data the degree of financial integration is estimated only for the group and not for each country separately. This panel approach has the advantage that information from cross-sectional and time-series data is used to estimate the relationship between credit growth and the bank characteristic variables. To control for autocorrelation of the residuals, we introduce a first-order autoregressive term instead of a lagged dependent variable. That makes it possible to estimate equation (1) with Ordinary Least Squares (OLS) instead of the Generalized Methods of Moments (GMM).[11] Although the latter is the standard estimator in analyzing the existence of a credit channel (see, for instance, De Haan (2001), Gambacorta (2001), Ehrmann, Gambacorta, and Martinez-Pages (2001) and Loupias, Savignac, and Sevestre (2001)), the small number of cross-section units and years makes OLS the appropriate estimator for our sample.

To estimate equation (1), we proceed as follows. In the first step, we regress the nominal loan growth rate on the current and the first lag of the nominal GDP growth rate, as well as the contemporaneous and the first lag of the money market rate. If the first lags of these variables turn out to be insignificant and if Wald tests do not reject the hypothesis that insignificant coefficients are jointly equal to zero, we drop the insignificant variables and re-estimated equation (1) without the insignificant lags. To allow for heterogeneity among banks and to test for a linear relationship between bank charac-

[11]The presence of a lagged dependent variable among the regressors to control for autocorrelation in a regression with individual effects (α_i) leads to the correlation of a right-hand side regressor with the error term. In this case, Ordinary Least Squares (OLS) estimation would be biased and inconsistent and the Generalized Methods of Moments (GMM) the better estimation method. See Baltagi (2001) for a detailed and complete analysis of panel data estimation.

teristics and loan growth, the size, liquidity and the capitalization of banks are introduced as additional explanatory variables. Since these variables depend on the loan growth rate, the first lag of these variables is used as regressor instead of the contemporaneous variable to prevent a simultaneity bias. In the second step, we subsequently add interaction terms between the monetary policy indicator and the bank characteristic variables to find out if interest rate changes have a different impact on the loan growth rate depending on the size, the liquidity and the capitalization of the bank.[12] The existence of asymmetries across banks in their reaction to a monetary policy tightening can then be assessed from the sign of the interaction coefficients. Time dummy variables were used to control for structural breaks that might have been caused, for example, by changes in the foreign exchange rate regime. These dummies however turned out to be insignificant and were consequently dropped from all regressions.

5.4 Estimation Results with Interaction Terms

The results of these regressions are presented in Table 4 on page 23 for the standard regression model with the domestic and European monetary policy indicator.[13] Since the lags of the GDP growth rate and the domestic money market rate turn out to be (jointly) insignificant in all regressions, the model is re-estimated without lags. The R^2 of these regressions lies between 0.22 and 0.25. This is relatively low, but in line with other studies on the bank lending channel in Central and Eastern Europe (Schmitz (2003)). The low fit of the model can partly be explained by the domestic monetary policy indicator, which has a positive sign and turned out to be insignificant in all regressions. This indicates that the growth rate of loans is not determined by the domestic monetary policy indicator. This result might be explained by the large proportion of foreign-currency and floating rate loans, whose interest rate depends upon an international reference rate. Another explanation for the insignificance of the do-

[12] The influence of size, liquidity and bank capitalization on the effect of an interest rate change on the loan growth rate is hereafter called size, liquidity and capitalization effect.

[13] The intercept dummies of these regressions and the following regressions have not been reported, but are available from the authors on request.

mestic money market rate as determinant of domestic loan growth is the large number of foreign-owned banks, which have easier access to the international capital market and use internal capital markets to refinance themselves. The choice of the exchange rate regime is a further explanation for the insignificance of the domestic money market rate in the standard regression model. Since all Baltic countries have pegged their currency to the euro in a currency board arrangement, this might indicate that the euro money market rate is likely to be a better determinant for the loan growth rate in these countries. This is also suggested by the large amount of debt that is denominated in euro and the large proportion of loans whose interest rate is pegged to a euro reference rate.

The nominal GDP growth rate conversely enters the regression equation with the expected positive sign and is highly significant in all regressions. The coefficient of this variable is relatively stable and fluctuates (with exception of the regression with the capitalization interaction term) around 4, which indicates that a one percentage point increase in the nominal GDP growth rate leads on average to a 4 percentage point increase in the nominal growth rate of loans. The bank characterizing variables are also significant and seem to be linearly related to the nominal loan growth rate. Since the bank characteristics have been normalized, these coefficients give the impact of monetary policy on bank lending for the average characteristic in the sample and are hard to be interpreted. The interpretation of these variables hence concentrates only on the sign of the respective coefficient for the bank size, liquidity and capitalization ratio. The negative sign of the bank size variable indicates that the loan growth rate is on average lower for large banks. This result is also found by Schmitz (2003) for central and eastern European countries. An explanation for this result is that smaller banks lend more aggressively to private borrowers in order to increase their market share. Larger banks are conversely more risk-prone due to a larger stock of non-performing loans inherited from the past when most large banks were state-owned. They hence have on average a lower loan growth rate than smaller banks. The coefficient of the liquidity ratio also

Table 4: Results for the Standard Regression Model with the Domestic Monetary Policy Indicator

	Dependent Variable: Nominal Loan Growth Rate			
	1	2	3	4
MM Rate	38.750	3.23	3.69	0.77
	(3.23)	(3.34)	(3.52)	(3.32)
GDP Growth Rate	3.98**	4.13**	3.79**	3.21*
	(1.64)	(1.64)	(1.64)	(1.65)
Size(-1)	-36.11	-37.93*	-40.48*	-57.98**
	(22.28)	(22.04)	(22.60)	(22.95)
Liquidity(-1)	-1.03***	-1.07***	-1.03***	-0.89**
	(-1.03)	(0.38)	(0.39)	(0.38)
Capitalization(-1)	1.83***	1.82***	1.84***	1.40***
	(0.33)	(0.33)	(0.33)	(0.37)
MM Rate*Size(-1)		-8.25		
		(5.82)		
MM Rate*Liquidity(-1)			0.59	
			(0.51)	
MM Rate*Capitalization(-1)				0.38**
				(0.16)
Observations	159	159	159	159
Adjusted R-squared	0.22	0.23	0.23	0.25

Note: ***,**,* indicate significance at the 1, 5 and 10 percent level, standard errors in parenthesis. The bank-specific intercepts have not been reported, but are available from the authors at request.

has a negative sign and points out that more liquid banks seem to have on average lower loan growth rates than less liquid banks. This can be explained by the fact that banks with a larger amount of liquid assets tend to build up a high liquidity buffer and remain very cautious in their lending activities maybe due to a former large share of accumulated non-performing loans. Since the capital adequacy ratio in the Baltic banking sector remained fairly high in recent years, less liquid banks furthermore might have lent more aggressively to increase their market share. The sign of the capitalization ratio is, in contrast, positive. This indicates that better capitalized banks have on average higher loan growth rates than poorly capitalized banks.

In order to find out if monetary shocks have distributional effects on the banks in the Baltic region the domestic monetary policy indicator is subsequently made to interact with the discriminatory bank variables. The results of these regressions are presented in column 2 to 4 of Table 4. The regressions indicate that bank size and liquidity do not significantly influence the response of banks to changes in the nominal interest rate. This might indicate that the discriminatory bank variables are not good proxies for the information asymmetries of banks or that there is no bank lending channel in the Baltics. Another explanation for the insignificance of the interaction terms is that the lending decision of banks in the Baltics does not depend on the domestic monetary policy indicator. Bank characteristics thus cannot have asymmetric effects among banks, when made to interact with the domestic money market rate.

To test if the European monetary policy indicator determines the loan growth rate in the Baltics, we substituted the European 3-month money market for the domestic money market rate and re-estimate equation (1). To account for serial correlation of the residuals, we again introduce a first-order autoregressive term and used bank-specific dummy variables to take time-invariant differences between each cross-section unit into consideration. Since the lags of the GDP growth rate and the money market rate turn out to be (jointly) insignificant in all regressions, the model is re-estimated without lags.

The results of these regressions are presented in Table 5 on page 26.

The euro money market rate enters the regression equation significantly and with the expected negative sign. According to our estimates, a one percentage change in the European money market rate reduces the growth rate of nominal loans on average between 12 and 20 percent. Since the euro money market is significant, the R^2 significantly increases and reaches values of up to 0.50. The coefficient for the growth rate of nominal GDP is also highly significant and enters the regression equation with an expected positive sign. As for the model with the domestic money market rate, the coefficient is relatively stable and fluctuates (with exception of the regression with the capitalization interaction term) around 4. The bank characteristic variables are also highly significant and enter the regression equation with the same sign as in the regression for the domestic monetary policy indicator. To analyze if banks reduce their loan supply in response to a monetary tightening, the European money market rate is subsequently interacted with bank size, liquidity and capitalization. The results of these regressions are presented in columns 6 to 8 of Table 5. The interaction terms turned out to be highly significant and further improved the fit of the regression. The signs of these coefficients can now be used to assess the existence of asymmetries across banks in their reaction to a monetary policy tightening. The positive coefficient on the interaction of the monetary policy indicator and bank size means that smaller banks react more strongly to changes in the interest rate. Small banks hence encounter more asymmetric information problems on the capital market than large banks and therefore may find it more difficult to raise uninsured funds in response to a monetary tightening (Kashyap and Stein (1995)).

The positive sign of the interaction variable of the European money market rate with bank liquidity furthermore suggests that the degree of liquidity impacts the loan supply and that less liquid banks react more strongly to a change in the monetary policy indicator than more liquid banks. The underlying reason is that banks with more liquid balance sheets can use their liquidity reserves to maintain their loan

Table 5: Results for the Standard Regression Model with the European Monetary Policy Indicator

	Dependent Variable: Nominal Loan Growth Rate						
	5	6	7	8	9	10	11
MM Rate	-16.17***	-20.33***	-11.97***	-14.99***	-12.21***	-15.17***	-13.61***
	(3.70)	(3.69)	(3.66)	(3.21)	(3.37)	(3.54)	(3.76)
GDP Growth Rate	4.10***	4.08***	4.15***	4.76***	4.78***	4.77***	4.39***
	(1.27)	(1.20)	(1.21)	(1.10)	(1.03)	(1.14)	(1.09)
Size(-1)	-50.87**	-39.62**	-43.99**	-49.61***	-41.76**	-34.95*	-41.65**
	(19.55)	(18.36)	(20.37)	(15.97)	(16.06)	(19.55)	(15.94)
Liquidity(-1)	-0.91***	-0.80**	0.04	-0.65**	0.47	-0.11	-0.62**
	(0.33)	(0.30)	(0.42)	(0.27)	(0.35)	(0.40)	(0.26)
Capitalization(-1)	2.02***	2.25***	2.16***	2.13***	2.30***	2.43***	2.24***
	(0.29)	(0.27)	(0.30)	(0.24)	(0.24)	(0.28)	(0.24)
MM Rate*Size(-1)		23.47***			7.02	17.98***	5.43
		(6.59)			(6.36)	(6.28)	(6.92)
MM Rate*Liquidity-1)			2.48***		2.52***	2.29***	
			(0.56)		(0.51)	(0.51)	
MM Rate*Capitalization(-1)				-1.53***	-1.48***		-1.33***
				(0.25)	(0.26)		(0.27)
MM Rate*Size(-1)*Liquidity(-1)						-3.14***	
						(0.92)	
MM Rate*Size(-1)*Capitalization(-1)							0.90**
							(0.45)
Observations	167	167	167	167	167	167	167
Adjusted R-squared	0.33	0.39	0.41	0.47	0.55	0.49	0.49

Note: ***,**,* indicate significance at the 1, 5 and 10 percent level, standard errors in parenthesis. The bank-specific intercepts have not been reported, but are available from the authors at request.

portfolio and as such are less affected by a monetary policy tightening (Kashyap and Stein (1995)). The coefficient of the single interaction term of the monetary policy indicator and the capitalization ratio is, in contrast, to the other interaction coefficients, negative. This indicates that better capitalized banks react more strongly to a monetary tightening than poorly capitalized banks. This result contradicts our expectations. Since well capitalized banks should find it easier to raise time deposits, the effect of an interest rate change on the loan supply is expected to be larger for poorly capitalized banks (Kishan and Opiela (2000)).

Due to the potential interrelations between size, liquidity and capitalization, we run a regression with all interaction terms together to test if omitted variables have biased the regression with only one interaction term. The result of this regression is presented in column 9 of Table 5. The variation that is explained by this model is higher than in the regression with only one interaction term. This indicates that the reaction of banks to changes in interest rates does not depend on single bank characteristics, but rather on a combination of these characteristics and that omitted variables might have biased the regression results in the regression with only one interaction term. To test this hypothesis, we made the money market rate interact with the size and the liquidity variable according to Ehrmann, Gambacorta, and Martinez-Pages (2001). The basic idea is that the relief from additional liquidity is larger for smaller banks (Kashyap and Stein (1995)). The result of the standard regression model with a double interaction term is presented in column 10 of Table 5. Since the single interaction terms for size and liquidity are both highly significant, the omitted variables bias cannot come from liquidity. The double interaction term also turned out to be highly significant. The negative coefficient moreover indicates that the liquidity effect is felt more strongly by the smaller banks in the sample.

Because the interaction term of size and the money market rate is significant in the last regression, the omitted variable bias can only come from the capitalization ratio. This is confirmed by the regres-

sion of the standard model with single and double interaction terms for size and capitalization (see column 11 of Table 5). Since the interaction term of size with the monetary policy indicator turned out to be insignificant, capitalization seems to be the omitted variable. The double interaction term allows us to further analyze the relationship between size and capitalization. This term turned out to be significant. The positive coefficient of the double interaction term moreover indicates that the negative coefficient of the interaction term between capitalization and the money market rate is mainly driven by the smaller banks in the sample.

To summarize, the results indicate that the loan growth rate is not determined by the domestic money market rate, but rather by the European monetary policy indicator. Bank size furthermore does not significantly influence the lending behavior of banks. This might be due to the fact that liquidity and capitalization have counterbalancing effects, since interest rate changes are, on the one hand, less strongly felt by small and liquid banks. On the other hand, however, small and well capitalized banks react more strongly to monetary policy shocks. Therefore, the effect of an interest rate change on small and liquid, but highly capitalized banks is indeterminate and the coefficient of size insignificant. The regression results furthermore suggest that distributional monetary policy effects are mainly caused by differences in liquidity. This result is also found by Juks (2004) for Estonia.

5.5 Estimation Results with Foreign Ownership Dummy Variables

Since a large number of banks in the Baltics are owned by multinational banks, which make it easier for domestic banks to re-finance themselves in the international capital market, the next step of the empirical analysis is to find out if foreign banks react differently to changes in the monetary policy indicator than domestic banks. This is done by introducing an ownership dummy variable, which takes

a value of 1 in every year in which a bank is at majority owned by a foreign bank and a value of 0 in all other years.[14] The coefficient is expected to be positive, since foreign banks are assumed to react less strongly to changes of the interest rate because of the possibility to refinance themselves over the internal capital market at lower costs. Instead of estimating the standard model with interaction terms between the bank characteristic variables and the monetary policy indicator, in this section we combine the monetary policy indicator with the ownership dummy. To account for serial correlation of the residuals, we furthermore introduce an autoregressive term and use bank-specific dummy variables to take time-invariant differences between each cross-section unit into consideration. Since the lags of the GDP growth rate and the money market rate turned out to be (jointly) insignificant in all regressions, the model is re-estimated without lags. The regression results are presented in Table 6 on page 30. The lower adjusted R^2 for the model with the European interest rates indicates that the interaction terms of the bank discriminatory variables and the monetary policy indicator have significantly contributed to a better fit of the standard model. As in the earlier regressions the domestic money market rate did not turn out to be significant. The European monetary policy indicator on the contrary enters the regression equation significantly and with the expected negative sign.

The GDP growth rate is also significant in all regressions including an ownership dummy variable. The coefficient is positive and fluctuates around 4. This indicates that the size value of the coefficient for the growth rate does not depend on the econometric specification and is therefore rather robust. The bank characterizing variables are also highly significant (except the size variable in the standard model with the domestic interest rate). The sign of these coefficients thus prove to be robust to the econometric specification as well, since the bank size and the liquidity variable have still a negative and the capitalization variable still a positive sign. The ownership dummies in the

[14] Banks that were owned by foreign private investors were not labelled as foreign-owned banks, since these banks do not have access to an internal capital market.

Table 6: Results for the Standard Regression Model with an Ownership Dummy Variable

	Dependent Variable: Nominal Loan Growth Rate	
	12	13
Domestic MM Rate	1.55	
	(3.64)	
Euro MM Rate		-20.67***
		(4.40)
GDP Growth Rate	3.99**	4.37***
	(1.65)	(1.26)
Size(-1)	-36.82	-47.69**
	(22.43)	(19.59)
Liquidity(-1)	-1.04***	-1.00***
	(0.39)	(0.33)
Capitalization(-1)	1.83***	2.12***
	(0.33)	(0.29)
Domestic MM Rate*Ownership	1.65	
	(5.63)	
Euro MM Rate*Ownership		13.93*
		(7.54)
Observations	159	167
Adjusted R-squared	0.22	0.34

Note: ***,**,* indicate significance at the 1, 5 and 10 percent level, standard errors in parenthesis. The bank-specific intercepts have not been reported, but are available from the authors at request.

domestic money market rate regression appeared to be insignificant. Because the domestic monetary policy indicator was not significant in the previous regressions at all, this result is not surprising. In the regression with the European monetary policy indicator, the ownership dummy conversely turned out to be significant at the 10 percent level and has the expected positive sign. Although the evidence is rather weak, this result might indicate that the foreign banks in this region use internal capital markets to refinance themselves at lower costs than domestic-owned banks.

6 Summary and Conclusions

With the accession to the EU in March 2004 Estonia, Latvia and Lithuania will soon join the EMU and adopt the euro as their single currency. Therefore the transmission process of monetary shocks in these countries is of interest not only for national central bankers, but also for the ECB. So far research has however mostly concentrated on the transmission mechanism in countries that are already member of the EMU. The intention of this paper was to fill this gap and to analyze the existence of a bank lending channel of monetary transmission in the Baltic States.

The Baltic States represent a rather homogenous group among the new member states owing to an almost identical foreign exchange system, the currency board arrangement pegged to the euro. Their financial systems evolved out of the non-existence under socialist heritage into an almost fully fledged bank-based financial system with a remarkable large share of foreign owned banks. Due to the process of catching-up of the real economy and due to underdeveloped capital markets bank loans have turned out to be the main source of finance for household and nonfinancial corporations. In this context, the presented study has focused on one of the channels of monetary transmission, namely the bank lending channel. This transmission channel stresses the role of asymmetric information that forces banks to reduce the supply of loans in response to a restrictive monetary policy shock. Bank characteristics and the structure of the banking sector influence the extent to which loan supply has to be reduced and therefore determine the strength of the bank lending channel. According to theory, larger, better capitalized and more liquid banks react less strongly to restrictive monetary impulses as well as banks in oligopolistic markets. Foreign banks also seem to play a major role in the transmission of monetary shocks due to the possibility to use internal capital markets and better access to international capital markets.

Estimations show that changes of domestic monetary policy rates do not significantly influence the lending behavior of banks. The domestic money market indicator was insignificant, while the euro money market rate turned out to be highly significant in all regressions. This can be attributed to the large share of foreign currency denominated loans mostly with a floating foreign interest rate commitment. Foreign ownership and the use of internal capital markets also help to explain the large foreign indebtedness of the banking sector. A large proportion of these foreign currency loans is denominated in euro. This together with the peg to the euro suggests that the euro money market rate is likely to be a better determinant of the loan growth rate in the Baltics.

The results furthermore indicate that bank size does not significantly influence the lending behavior of banks. This might be due to the fact that liquidity and capitalization have counter-balancing effects, since interest rate changes are, on the one hand, less strongly felt by small and liquid banks. On the other hand, however, small and well capitalized banks react more strongly to monetary policy shocks. Therefore, the effect of an interest rate change on small and liquid, but highly capitalized banks is indeterminate and the coefficient of size insignificant. The regression results moreover suggest that distributional monetary policy effects are mainly caused by differences in liquidity.

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