BANK LENDING CHANNEL IN SLOVENIA: PANEL DATA ANALYSIS

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Abstract:

Channels through which monetary policy affects aggregate demand can be divided into three groups: traditional interest rate channel, other asset price channels and credit channel composed of balance sheet channel (named also broad credit channel), only recently separated bank capital channel and bank lending channel. Banks face troubles in keeping their present or acquiring new financial sources, when central bank tightens its monetary policy. Banks characterized by differences in size, capitalization, liquidity and ownership face different levels of informational asymmetry and are therefore differently affected by changes in monetary policy. If larger, better capitalized, more liquid, state owned and/or domestically owned banks respond weaker to changes in monetary policy it is possible to argue that bank lending channel is effective. This hypothesis is tested on a panel of annual data for individual Slovenian banks in the period between 1993 and 2007 using general method of moments. Results largely confirm the existence of the bank lending channel in Slovenia.

Keywords: banking, monetary transmission mechanism, bank lending channel, Slovenia, panel data analysis

JEL Classification: C23, C44, E52, G21

1. Introduction

Bank lending channel is a part of the so called credit channel of monetary transmission mechanism that gained importance after the publication of Bernanke and Blinder's seminal paper in 1988. Its traditional mechanism as described by Bernanke and Blinder goes as follows: contractionary monetary policy reduces banks' reserves and deposits, which consequently reduces the quantity of bank loans available, further reducing output as a result of the fact that some borrowers are bank-loan dependent and cannot get adequate funds elsewhere. Several additions and corrections of the mechanism have been made in the subsequent theoretical and empirical analyses, especially by Stein (1998).

The goal of the paper is to explore, how strong is the presence of the bank lending channel in Slovenia. Structure of the paper is as follows: theoretical foundations are presented first, followed by explanation of the model, description of the data and

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finally panel data econometric analysis based on annual bank level data for the period 1994-2007.

2. Theoretical Overview

Monetary policy affects aggregate demand through three channels: (1) traditional interest rate channel; (2) asset price channels and (3) credit channel composed of balance sheet channel, bank lending channel and bank capital channel. When tight monetary policy decreases firms' net worth, information asymmetry¹ increases and banks become reluctant to lend (balance sheet channel or broad credit channel). Besides that contractionary monetary policy reduces banks' reserves and consequently deposits and accessibility of non-deposit sources, which consequently reduces the quantity of bank loans available, which forms bank lending channel (Mishkin, 2006; Ahtik, 2010b). If bank's capital falls (this happens when interest rates rise causing bank profits and value of bank capital to fall), it has to accommodate its balance sheet structure to fulfil solvency standards either by issuing new equity or by decreasing the amount of outstanding loans (Peek, Rosengren, 1995; Heuvel, 2002). The later possibility further lowers investment and output.

Conditions for the validity of the so called lending view² (as an opposite to the money view) are:

- (1) delayed accommodation of prices, which is a preposition common to all Keynesian models (Romer, 2006) and therefore will not be specially analysed,
- (2) dependency of some firms and households on bank loans and
- (3) the ability of a central bank to shift banks' loan supply schedules by conducting monetary policy operations (Kashyap, Stein, 1995).

Credit institutions specialize in gathering information, overcoming transaction costs by exploring economies of scale and monitoring the performance of borrowers. As a consequence, customer and auction market credit cannot be considered perfect substitutes (Bernanke, Blinder, 1988). Regardless of profound changes in information technology that reduced transaction costs and information asymmetry, imperfect substitutability pertains. Therefore, bank loans still have special status that cannot be equalised with the status of other debt instruments. This conclusion is especially valid for countries or regions that have a large share of bank dependent firms in their economies.³

Ability of the central bank to influence banks' loan supply was modelled in Bernanke and Blinder (1988). Their model is based on *IS LM* model and includes three types of

1 Situation, when one party has more or better information than the other party of the transaction.

2 Lending view is a specific case of the multi-asset models that have been present in the economic literature for a long period of time and feature imperfect substitutability among a number of assets, and allow for a number of different interest rates (Kashyap, Stein, 1995).

3 This is the case in the European Union, including Slovenia (more in: Ahtik, 2009).

assets: money, bonds and loans, while ordinary *IS LM* model treats separately only money and bonds. In Bernanke and Blinder's model borrowers choose between loans and bonds according to their interest rates. *LM* curve of the model is the same as in the standard *IS LM* model, while standard *IS* curve in the model changes to the so called *CC* (*commodities and credit*) curve. Similarly as *IS* curve it is negatively sloped, but unlike *IS* it is shifted also by monetary policy, which affects bank reserves (*R*), deposits and loans.

Existence of credit channel makes monetary policy more efficient than in a conventional *IS LM* model, since monetary policy influences both *LM* and *CC* curve. Central bank affects banks' demand for reserves and their willingness of granting loans by using monetary policy instruments, such as open market policy, required reserves ratio and standing facilities (Freixas, Rochet, 1999).

Banks cannot compensate for reduction in deposits caused by central bank with non-deposit sources without costs. Which model of accommodation is chosen by the bank, depends on the level of information asymmetry that it encounters. According to Stein's (1998) microeconomic model of bank lending channel banks' management let alone their investors (depositors, stockholders, *etc.*) are not familiar with the value of banks' assets that importantly determines probability and size of revenues on non-deposit sources of banks' financing.

Response of banks to tightening of monetary policy crucially depends on their balance sheets structure (Stein, 1998). Banks with lower quality of their assets face higher information asymmetry and are required to pay higher revenues to non-deposit investors,⁴ when their stance becomes familiar to their investors. Therefore they keep a precautionary amount of securities that can be reduced in case of a tight monetary policy. Another possible response is reduction of outstanding loans. Different responses of banks with different characteristics to changes in monetary policy can help to identify changes in bank loan supply.

Validity of both Bernanke and Blinder and Stein's theories can be questioned, but, as argued in Ahtik (2010b), it is possible to preserve the validity of the theory, despite the fact that the influence of the central bank on bank deposits is rather limited nowadays. Monetary policy may (although only limitedly) affect structure of deposits and their price, which has similar consequences as in a traditional model: more expensive deposits represent an obstacle to lending activity. More important change that happened in the pre-crisis period is greater dependence on non-deposit sources. Troubled banks usually experience difficulties in acquiring funds on financial markets after deposit outflow that follows the tightening of monetary policy (Stein, 1998). However, as explained in Ahtik (2010b), these difficulties are not necessarily connected to deposit outflow. Monetary policy may affect also the value of bank assets, which affects the price and availability of non-deposit funds, without influencing the amount of deposits. Therefore, monetary policy can affect banks' loan supply.

4 Deposit investors are not endangered by lower quality of bank assets since they enjoy deposit insurance.

3. Econometric Analysis

3.1 Overview of Previous Analyses

Slovenia has been included in researches mostly conducted for Central and Eastern European countries. Studies vary from VAR analyses to panel data analyses, later being mostly based on BankScope data.

Delakorda's (1998) VAR analysis for the period between 1992 and 1997 shows evidence of credit channel. However, effects of supply and demand on amounts of credit are not separated since the analysis was performed on macro level.

Jimborean (2006) conducted analysis using generalized method of moments (GMM) and using BankScope data for the period 1995-2005 testing if size, liquidity, capitalization and ownership influence the functioning of a lending channel in Slovenia. Money market interest rate is used as a monetary policy stance indicator. Size, liquidity and capitalization did not statistically significantly affect bank loans, while foreign ownership did affect loan activity of banks when monetary policy changed.

Contrary to Jimborean, Matousek and Sarantis (2009) on a sample of BankScope annual data for the period 1994-2003 with short term nominal interest rate used as an indicator of monetary policy stance found out that size, liquidity and capitalization statistically significantly influence the transmission of the monetary policy.

Coricell *et al.* (2006) conducted macroeconomic SVEC analysis on quarterly aggregate data for a period of 1995Q1-2005Q3 to find out that monetary policy shock lowers credit growth, which is an indication for the existence of a bank lending channel. Their microeconomic GMM firm-level analysis in a period of 1994-2004 has shown that sectors that need higher shares of external financing face slower growth of their sales when supply of loans falls, while bank and trade credit function as substitutes.

3.2 Model and Methodology Used

Model used in econometric analysis is simplified version of Bernanke and Blinder (1988), based on similar microeconomic empirical analyses conducted for United States (Kashyap, Stein, 1997) and European Union Member States (Ehrmann *et al.*, 2001). Analysis focuses on lending and deposit market leaving out the effects of loans on investment and product.

Demand for loans of an individual bank i (L_i^D) depends on central bank interest rate (i), economic conditions (y) and price stability (p) (Ehrmann *et al.*, 2001). Reaction of loan demand is independent of bank characteristics.

$$L_i^D = \alpha i + \beta y + \gamma p \quad (1)$$

Supply of loans of an individual bank (L_i^S) depends on deposit funds availability (D), on non-deposit funds availability (ND) and on central bank interest rate (i).

$$L_i^S = \delta i + \varepsilon D + \zeta ND \quad (2)$$

As explained previously monetary policy influences price and availability of deposit and non-deposit sources. Tightening of monetary policy reduces availability of non-deposit sources. Not all banks are equally hurt – information asymmetry (changed by monetary policy) affects possibilities of banks to acquire non-deposit funding. Capability of coping with information asymmetry might be detected through different characteristics of banks (X), among them being size, share of liquid assets, capital adequacy, revenues of banks, share of deposit financing and ownership structure. Share of non-deposit sources (ND) depends on monetary policy of the central bank (mp) and on characteristics of the bank (X). Those characteristics affect the share of non-deposit sources independently (X) and as interactions with monetary policy indicator (Xmp), meaning that availability of non-deposit sources changes with change of monetary policy differently for banks with different bank characteristics.

$$ND = \eta mp + \theta Xmp + \iota X \quad (3)$$

Deposit sources (D) are not dependent on bank characteristics because they enjoy deposit guarantees. They depend on monetary policy (mp) and on non-financial motives that cannot be modelled. Later share of deposits shall be included in the model as one of bank characteristics that affects the movement of loans. Monetary policy dependent deposits are shown in:

$$D = \kappa mp \quad (4)$$

Equilibrium on loan market can be written as

$$L_i^D = L_i^S, \quad (5)$$

Reduced form equation being:

$$L_i = \frac{\beta\delta}{\delta-\alpha} y + \frac{\gamma\delta}{\delta-\alpha} p - \frac{\varepsilon\kappa+\zeta\eta}{\delta-\alpha} mp - \frac{\zeta\theta}{\delta-\alpha} Xr - \frac{\zeta\iota}{\delta-\alpha} X \quad (6)$$

where X represents bank characteristics that after the change of monetary policy crucially determine possibilities for non-deposit financing. If simplified, equation writes as

$$L_i = \lambda_1 y + \lambda_2 p + \lambda_3 mp + \lambda_4 r X_i + \lambda_5 X_i \quad (7)$$

The coefficient λ_4 connects the reaction of bank lending to monetary policy changes with bank characteristic. If significant, parameter λ_4 implies that monetary policy affects loan supply. Reaction of loan demand across banks is presumed to be homogeneous in order to identify the loan supply effects of monetary policy.

Methodology used is panel data estimation. Since partial adjustment model (Gujarati, 2003) is used, fixed effects estimation method is biased and inconsistent due to the inclusion of a lagged dependant variable (Baltagi, 2008). Therefore general method of moments (GMM) was used. Lagged values of first differences of dependent variable were used as instruments as suggested in Arellano, Bover (1995). Validity of instruments was

tested using Sargan test of overidentifying restrictions, which tests the null hypothesis of overall validity of the instruments used. Failure to reject this null hypothesis (p-value above 0.1) gives support to the selection of the instruments (Sargan, 1958).

3.3 Data Description and Variables Selection

Annual data for period between 1993 and 2007 have been used. Year of the introduction of the euro, 2007, is included since it is assumed that monetary policy affects banks' activity with a lag. Period after introduction of the euro is excluded due to structural break and lack of sufficient data. Data for 45 cross-section units have been used, although they (because of mergers and acquisitions) do not necessarily represent independent legal subjects. Panel is unbalanced since some mergers, liquidations and green-field investments happened during the period analyzed. In comparison with previous analyses data for all banks functioning in Slovenia are used here.

Bank balance sheet and income statements data have been taken from publications Financial Statements of Banks in Slovenia (Banking Association of Slovenia; ZBS) or individual banks' websites, while monetary aggregates, interest rate, GDP and inflation rate data have been taken from Bank of Slovenia (BS) and Statistical Office of Slovenia (SURS) basis. Data have been adjusted for price growth using HICP.

Similarly as in other transition economies it is very difficult to choose monetary policy stance indicator. Monetary policy of Bank of Slovenia was strongly determined by its goal of keeping real exchange rate stable or slightly depreciating in order to support exporters. Excessive amount of money in circulation created through foreign exchange purchases was sterilized by issuance of Bank of Slovenia bills. Therefore several monetary policy stance indicators, such as monetary aggregate 2 (M2; composed of demand deposits, deposits with agreed maturity up to two years and deposits redeemable at notice up to three months, while currency was excluded in order to take into account the change of monetary policy regime in 2007), central bank interest rate (IR_CB) and money market interest rate (OM_DT) were considered. M2 exhibits endogeneity, since the movement of bank liabilities and assets is tightly connected. Main argument for choice of M2 is wide variety of monetary policy instruments⁵ used by Bank of Slovenia in period investigated that complicates the selection of the proper central bank interest rate. Money market rate is problematic due to low development of money market because of which movements of the money market interest rate did not exhibit central bank activity very well. Besides that money market rate was not the explicit target of central bank's activities. Considering central bank interest rate it is difficult to decide which interest rate to use due to large number of instruments used. Central bank interest rate used here is an interest rate on bills that BS was issuing in order to remove primary money from circulation and is determined for the period from 1997 on (Ahtik, 2009). All three monetary policy stance indicators were used in order to get a more complete picture of a monetary transmission mechanism in Slovenia.

5 More than fifteen instruments were used in 1994 and 1995 (Kranjec, Košak, 1996).

Table 1

Data Description, Descriptive Statistics and Data Sources

VARIABLE	DESCRIPTION	AVERAGE	MEDIAN	STANDARD DEVIATION	NUMBER OF OBSERVATIONS	SOURCE
CAR	capital adequacy ratio	0.16	0.13	0.09	257	ZBS
D_DRZAV	dummy for state ownership; value of 1, if in majority state ownership, otherwise 0	0.24	0.00	0.43	233	ZBS
D_LAST	dummy for home ownership; value of 1, if in majority domestic ownership, otherwise 0	0.75	1.00	0.43	375	ZBS
D_REVALOR	change in accounting standards; value of 1 between 1993 and 2001, otherwise 0	0.60	1.00	0.49	610	
DEPA	share of deposits in total liabilities	0.60	0.65	0.19	374	ZBS, own calculations
DT_R	real exchange rate	119.33	116.79	5.83	630	SURS
GDP	gross domestic product (million SIT ⁶)	2059912	2026910	395197	610	SURS
INFL	inflation rate	0.09	0.08	0.07	610	SURS
IR_CB	central bank interest rate (%)	7.29	7.13	2.99	450	BS
OM_DT	money market interest rate (%)	7.12	6.87	3.04	610	BS
K5	market share of five largest banks	0.65	0.65	0.03	610	ZBS, own calculations
KRED_NEBAN	loans to non-banking sector (million SIT)	169377	57051	346463	376	ZBS
LIKVA	liquidity, share of cash in total assets	0.03	0.03	0.02	374	ZBS
LIKV1A	liquidity, share of cash and debt securities in total assets	0.08	0.06	0.08	372	ZBS, own calculations
M2	M2 (million SIT)	919786	953516	287460	570	BS
ROA	revenue on assets	0.01	0.01	0.02	342	ZBS
SIZE	bank market share	0.04	0.02	0.06	378	ZBS, own calculations

Source: author's own calculations.

Real exchange rate (DT_R) is expressed in tolar (SIT) *per* euro and corrected for price growth in Slovenia and its major economic partners. Exchange rate affects the value of bank assets and liabilities in foreign currency. Since Slovenian banks mostly exhibited

6 Slovenian tolar.

short position, real depreciation could increase the value of their liabilities as compared with their assets and decrease capital (Ahtik, 2010a). On the other hand depreciation reduces the price of loans of domestic banks as compared with competition abroad (Ahtik, 2009), although this effect is not considered to be large. Anyway, effect of real exchange rate on bank loans remains dubious.

Gross domestic product (GDP) represents a proxy for demand. It is expected to have a positive effect on the amount of loans. Higher GDP is connected with greater optimism causing increase in consumer and investment spending.

Inflation rate (INFL) is also used as proxy for demand, although its influence remains ambiguous. On one hand higher inflation increases risk and decreases loan demand, while on the other hand increases spending due to the phenomenon of money illusion.

Market concentration (K5) is expected to negatively influence the amount of loans, both as stand-alone independent variable, as well as in interaction with monetary policy indicator. The later result would show that market concentration decreases monetary policy efficiency.

Introduction of new accounting standards that stopped the practice of obligatory revalorization of some balance sheet items that happened in 2002 was taken into consideration through dummy variable taking value of 1 in years 1993 till 2001, and 0 from 2002 on (D_REVALOR). Negative sign is expected since balance sheet values mostly increased after 2002.

Data for loans to non-banking sector (KRED_NEBAN) were used, since it is reasonable to expect that these types of loans actually affect investment, consumption and production.

Measures of bank characteristics included in equations are size, liquidity, capitalization, profitability and ownership structure.

As a measure of relative size of a bank (SIZE), share of bank assets in total banking sector (market share) is used. Larger banks explore economies of scale and scope more efficiently; acquiring information about them is less expensive, therefore they obtain non-deposit sources more easily. They are expected to diminish the efficiency of the monetary policy, since it has less effect on their capability to acquire non-deposit sources as compared with smaller banks.

Liquidity is measured as a share of cash in total assets (LIKVA). Alternatively sum of cash and securities to total bank assets are used (LIKV1A). As emphasized by Stein (1998) banks endogenously increase liquid assets when they expect problems with acquiring non-deposit sources. When compared with banks that did not manage to increase their liquid assets banks with higher levels of liquid assets are expected to reduce the efficiency of monetary policy (Ahtik, 2010a).

Official data for capital adequacy ratio (CAR) were used as measures for capitalization. Banks with higher CAR are expected to reduce the efficiency of monetary policy, since they are not limited with capital adequacy demands.

Banks with lower levels of deposit financing (DEPA) are expected to be less affected by monetary policy. As it was explained above, depositors are rather immobile, therefore deposits represent a buffer for changes in monetary policy.

Profitability was measured with revenue on assets (ROA). It is expected that it negatively affects the efficiency of monetary policy, since ROA affects the capability of acquiring additional funds.

Dummy for foreign ownership (D_LAST) takes the value of 1, if bank is in domestic ownership and the value of 0 if bank is foreign owned. It is expected that foreign owned banks enjoy the benefit of connection with their larger mothers from abroad that enable them to finance cheaper. Therefore it is expected that domestic ownership increases efficiency of monetary policy.

Dummy for state ownership (D_DRZAV)⁷ takes the value of 1, if bank is in state ownership and the value of 0 if bank is privately owned. Expected sign for this variable is ambiguous. On one hand, it is expected that state owned banks acquire funds in international financial markets more easily due to implicit (or explicit) guarantee of the state, while on the other hand they might be, because of state's influence on banks' management, "used" for conduct of monetary policy. Former case means that the efficiency of monetary policy is decreased, while the later one means an increase in its efficiency.

Most important variable in each equation is product of monetary policy stance indicator (M2, IR_CB or OM_DT) and individual banking characteristic (SIZE, LIKVA, LIKV1A, CAR, DEPA, ROA, D_LAST, D_DRZAV). If this combined variable has the same sign as monetary policy stance indicator, this means that efficiency of monetary policy is increased by the presence of a certain bank characteristic and *vice versa* if the sign is opposite as the sign of the independent monetary policy stance indicator (Ehrmann *et al.*, 2001).

Double interactions (product of two banking characteristics and monetary policy stance indicator) are used as well. They enable testing whether the effect of one bank characteristics depends on the presence of the other (Kashyap, Stein, 1997; Ehrmann *et al.*, 2001). Data on loans (KRED_NEBAN), monetary aggregate (M2) and GDP enter equations as first differences of logarithms (approximations of growth rates) and interest rates (IR_CB, OM_DT) as first differences⁸ in order to take care of non-stationarity of the data (Baltagi, 2008), while liquidity, capitalization, profitability and size data are expressed in percentages.⁹ Real exchange rate and market concentration enter in levels.

7 Variables D_DRZAV and D_LAST partly cover the same set of banks, since banks in majority state ownership functioning in Slovenian banking market were naturally also domestically owned.

8 In Tables 2-6 represented as "DLOG" and "D", respectively.

9 Precise description of variable formation is given in Table 1.

4. Results of The Analysis

Results of the analysis are presented in Tables 2-6, classified according to the monetary policy stance indicator used. First results of equations using monetary aggregate M2 are presented (Tables 2 and 3; Equations (1-12), followed by specifications with central bank interest rate (Table 4; Equations 1-7) and money market interest rate (Tables 5 and 6; Equations 1-12).

In Equation 1 (Table 2)¹⁰ exchange rate (DT_R), GDP, monetary aggregate M2, inflation rate (INFL), banking market concentration ratio (K5) and dummy for change in accounting standards (D_REVALOR) are regressed on loans to non-banking sector (KRED_NEBAN). All of the variables are statistically significant. GDP in accordance with expectations positively influences loans, while INFL, K5 and D_REVALOR exhibit negative influence on KRED_NEBAN. Also monetary policy variable (M2) exhibits expected positive influence on loans while negative influence of DT_R confirms theory that exchange rate depreciation causes revaluation of bank foreign assets and liabilities, which in case of their short foreign exchange positions leads to reduction of lending activity.

Equation 2 adds variable ROA and its product with monetary policy stance indicator (M2) to variables included in Equation 1. Higher ROA in average causes the efficiency of monetary policy to be lower.

In Equations 3 and 4 indicators of liquidity (LIKVA and LIKV1A, respectively) are used. Interaction of those variables with M2 indicates that more liquid banks (as expected) counter monetary policy measures easier than less liquid banks.

Measure of capital adequacy (CAR) used in Equation 5 is statistically insignificant.

It is possible to confirm that banks in majority state ownership (D_DRZAV, Equation 6) in average increase the efficiency of monetary policy, which might lead to the confirmation of the hypothesis that they were actually used for monetary policy conduct. Similarly, banks in majority domestic ownership (D_LAST, Equation 7) in average increase the efficiency of monetary policy as well. This is in accordance with expectations since banks in foreign ownership might expect support from their parent institution in case of contractionary policy of the host central bank.

Equations 8-12 are presented in Table 3. Equation 8 shows that banks with higher share of deposits among their liabilities in average decrease the efficiency of monetary policy.

10 Basic equation, out of which all other equations in Tables 2 and 3 are derived from by adding individual bank characteristics.

Table 2

Equations with M2 as Monetary Policy Stance Indicator¹¹

DEPENDANT VARIABLE: DLOG(KRED_NEBAN)	EQUATION						
VARIABLE	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5	Eq. 6	Eq. 7
DT_R	-0.0101***	-0.0098***	-0.0110***	-0.0101***	0.0138***	0.0147***	-0.0120***
t-stat	-5.86	-9.32	-6.00	-6.31	3.16	4.15	-6.71
DLOG(GDP)	1.304***	1.202***	1.317***	1.143***	-2.400***	-1.546***	1.382***
t-stat	6.03	10.08	5.32	5.39	-4.59	-7.19	7.98
INFL	-0.5734***	-0.7829***	-0.7306***	-1.090***	-3.265***	-1.690***	-0.7250***
t-stat	-6.68	-8.12	-3.30	-6.44	-10.68	-15.90	-3.79
DLOG(M2)	0.728***	1.629***	2.047***	1.447***	0.1513	0.0955	-0.1911
t-stat	9.21	15.12	6.51	16.73	0.30	0.92	-0.99
K5	-0.5395***	-0.2762*	-0.5118*	-0.2352	-0.6032***		-0.5708***
t-stat	-4.42	-1.83	-1.96	-1.28	-2.63		-3.63
D_REVALOR	-0.0130*		-0.0194**		-0.0330***	0.0555***	
t-stat	-1.83		-2.03		-3.69	5.65	
ROA		9.893***					
t-stat		7.10					
ROA*DLOG(M2)		-95.23***					
t-stat		-12.37					
LIKVA			3.586***				
t-stat			4.36				
LIKVA*DLOG(M2)			-43.66***				
t-stat			-4.02				
LIKV1A				0.7051***			
t-stat				8.20			
LIKV1A*DLOG(M2)				-8.701***			
t-stat				-11.49			
CAR					0.1348		
t-stat					0.68		
CAR*DLOG(M2)					-0.3195		
t-stat					-0.11		
D_DRZAV						-0.2951***	
t-stat						-3.35	
D_DRZAV*DLOG(M2)						1.207***	
t-stat						8.88	
D_LAST							-0.1260***
t-stat							-2.66
D_LAST*DLOG(M2)							1.375***
t-stat							4.73
SARGAN TEST (p-value)	0.43	0.28	0.36	0.35	0.35	0.36	0.43

Source: author's own calculations.

11 In all equations presented ***, **, * indicate significance at 0.01, 0.05 and 0.1 respectively. Results of two-tailed test are presented meaning that null hypothesis of "coefficient is equal to 0" is tested.

Table 3

Equations with M2 as Monetary Policy Stance Indicator - Continuation

DEPENDANT VARIABLE: DLOG(KRED_NEBAN)	EQUATION				
VARIABLE	Eq. 8	Eq. 9	Eq. 10	Eq. 11	Eq. 12
DT_R	-0.0111***	-0.0088***	-0.0078***	-0.0065***	-0.0169***
t-stat	-9.93	-5.41	-3.16	-5.78	-8.84
DLOG(GDP)	1.210***	1.913***	1.478***	1.732***	1.9074***
t-stat	9.63	8.30	3.47	11.73	8.05
INFL		-0.4522*	-0.6540**		0.2861**
t-stat		-1.67	-2.37		2.03
DLOG(M2)	2.783***	0.5736*	0.3500	1.6190***	20.74***
t-stat	12.68	1.74	0.56	4.15	8.52
K5	-0.2893***				1.4119***
t-stat	-3.06				5.58
D_REVALOR		-0.0162**			-0.0501***
t-stat		-2.36			-7.31
SIZE		-7.994***	-5.588***	-7.350***	
t-stat		-17.846	-4.4859	-9.2654	
SIZE*DLOG(M2)		31.68***	24.64***	37.91***	
t-stat		13.8067	6.064	14.1249	
ROA			15.13***	10.30***	
t-stat			8.76	6.66	
ROA*DLOG(M2)			-165.7***	-102.9***	
t-stat			-7.15	-5.77	
LIKVA		2.379***	2.833**		
t-stat		2.61	2.21		
LIKVA*DLOG(M2)		-35.80***	-28.72		
t-stat		-3.34	-1.57		
D_LAST			-0.4822***	-0.2616***	
t-stat			-5.97	-3.78	
D_LAST*DLOG(M2)			2.764***	0.748*	
t-stat			4.44	1.79	
DEPA	-0.3781***				
t-stat	-6.86				
DEPA*DLOG(M2)	-3.429***			-3.201***	
t-stat	-9.12			-4.28	
K5* DLOG(M2)					-31.03***
t-stat					-8.08
SARGAN TEST (p-value)	0.53	0.26	0.22	0.27	0.51

Source: author's own calculations.

Several banking characteristics are included in Equations 9-12. Bank size (SIZE) and liquidity (LIKVA) are used as regressors in Equation 9. Larger banks, contrary to expectations, increase the efficiency of monetary policy. This result might be connected to the fact that larger banks were also owned by the state. State ownership, as explained earlier, in average increases monetary policy efficiency. LIKVA, similarly

as in Equation 3, where it was used as the only bank characteristic negatively affects the efficiency of monetary policy.

Four banking characteristics (SIZE, ROA, LIKVA, D_LAST) are used in Equation 10. Bank size (SIZE) and domestic ownership (D_LAST) positively influence monetary policy efficiency, while profitability (ROA) and (LIKVA) affect it negatively.

Equation 11 uses share of deposit financing (DEPA) instead of LIKVA. Banks with higher level of deposit financing negatively affect monetary policy efficiency.

Equation 12 makes usage of a banking structure variable – banking sector concentration (K5). It shows that monetary policy in average affects bank loans (KRED_NEBAN) less in case of higher concentration.

Table 4 shows seven equations that use central bank interest rate (IR_CB) as a monetary policy stance indicator. Results are not as good as with M2, since a large share of variables used does not statistically significantly affect loans (KRED_NEBAN).

Similarly as in Table 2 Equation 1 represent basic equation with all variables except bank characteristics. Exchange rate (DT_R), differently as in Tables 2 and 3, positively affects loans (KRED_NEBAN). In opposite with expectations, GDP negatively influences loans. Banking market concentration (K5) negatively affects loans, which contradicts predictions as well. Sign of D_REVALOR is negative, similarly as with M2 as monetary policy stance indicator. Central bank interest rate (IR_CB) in accordance with expectations negatively affects loans.

Equation 2 uses bank size (SIZE) as a bank characteristics. Increase in banks' size (market share) in average decreases monetary policy efficiency – in case of contractionary monetary policy loans of larger banks reduce less in comparison with loans of smaller banks.

Higher ROA in average causes the efficiency of monetary policy to be lower (Equation 3).

Coefficient of variable liquidity (LIKVA) included in Equation 4 increases influence of monetary policy on loans (KRED_NEBAN), but it does not statistically significantly differ from zero.

Similarly as with M2 as monetary policy stance, indicator of state ownership (D_DRZAV) causes monetary policy to be in average more efficient (Equation 5).

Equations 6 and 7 include products of two banking characteristics and monetary policy stance indicator that enable us to identify influence of two co-existent banking characteristics.

Product of SIZE with monetary policy stance indicator (IR_CB) positively influences loans (KRED_NEBAN), meaning that bank size negatively affects monetary policy efficiency. It is possible to observe the same effect with LIKVA. Interaction of SIZE, LIKVA and IR_CB has a negative sign, meaning that smaller banks with lower level of liquidity in average increase monetary policy efficiency in comparison with banks of similar size, but with higher liquidity (Equation 6).

Equation 7 includes share of deposits (DEPA) instead of LIKVA. Product of size (SIZE) and central bank interest rate (IR_CB) as well as product of DEPA and IR_CB

exhibit positive influence on bank loans (KRED_NEBAN), while double interaction (DEPA*SIZE*IR_CB) with negative sign shows that smaller banks with smaller share of deposit financing increase monetary policy efficiency in comparison with banks of similar size, but with larger share of deposit financing.

Table 4:

Equations with Central Bank Interest Rate (IR_CB) as Monetary Policy Stance Indicator

DEPENDANT VARIABLE: DLOG(KRED_NEBAN)	EQUATION						
VARIABLE	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5	Eq. 6	Eq. 7
DT_R	0.0079***	-0.0057	0.0094**	0.0080***	0.0113***	-0.0061	0.0121*
t-stat	2.71	-1.09	2.14	2.92	4.51	-0.820	1.89
DLOG(GDP)	-15.02***	-10.31***	-15.82***	-16.27***	-15.14***	1.77*	-1.6334*
t-stat	-16.98	-6.56	-11.90	-15.24	-13.36	2.05	-1.67
INFL	-6.208***	-5.493***	-7.163***	-6.427***	-6.228***		
t-stat	-33.08	-12.08	-20.28	-19.52	-16.34		
D(IR_CB)	-0.1049***	-0.0758***	-0.1214***	-0.1158***	-0.1042***	-0.044***	-0.0224
t-stat	-15.92	-5.73	-12.37	-14.50	-14.25	-3.39	-1.56
K5	0.1632**	0.5374***	0.5728***			-1.444***	-0.7904***
t-stat	2.02	3.97	2.88			-4.87	-4.14
D_REVALOR	-0.0903***		-0.0718***	-0.1084***	-0.1221***	-0.081***	-0.1057***
t-stat	-8.30		-3.10	-12.24	-14.54	-5.21	-5.53
SIZE		-11.00***				-4.58***	-5.8916***
t-stat		-4.84				-9.22	-8.74
SIZE*D(IR_CB)		1.75***				3.73***	2.9283***
t-stat		3.79				7.83	4.42
ROA			-1.486				
t-stat			-1.29				
ROA*D(IR_CB)			1.215***				
t-stat			2.88				
LIKVA				0.079**		3.335***	
t-stat				2.31		3.31	
LIKVA*D(IR_CB)				0.032		1.094***	
t-stat				1.55		4.12	
D_DRZAV					0.031		
t-stat					0.71		
D_DRZAV*D(IR_CB)					-0.016**		
t-stat					-2.29		
DEPA							-0.4407***
t-stat							-4.51
DEPA*D(IR_CB)							0.0015
t-stat							0.07
LIKVA*SIZE*D(IR_CB)						-103.30***	
t-stat						-7.69	
DEPA*SIZE*D(IR_CB)							-4.254***
t-stat							-4.31
SARGAN TEST (p-value)	0.37	0.27	0.38	0.38	0.18	0.20	0.49

Source: author's own calculations

Twelve equations presented in Tables 5 and 6 use money market interest rate as monetary policy stance indicator. This set of equations is better than equations with central bank interest rate regarding statistical significance of variables.

Equation 1 shows basic equation. All of the variables used are highly statistically significant ($p < 0.01$) and have an expected sign. Inflation (INFL) and exchange rate (DT_R) whose predicted influence was dubious offer a conclusion that money illusion theory and revaluation of bank's assets and liabilities theories prevail, respectively. GDP positively influences loans (KRED_NEBAN). When market concentration (K5) is lower, loans (KRED_NEBAN) are on average lower. Similarly D_REVALOR shows change in accounting standards in 2002 statistically significantly affected loans.

Table 5

Equations with Money Market Interest Rate (OM_DT) as Monetary Policy Stance Indicator

DEPENDANT VARIABLE: DLOG(KRED_NEBAN)	EQUATION					
VARIABLE	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5	Eq. 6
DT_R	-0.0029***	-0.0019*	-0.0044**	-0.0043***		0.0031***
t-stat	-2.67	-1.65	-2.05	-3.30		4.16
DLOG(GDP)	1.420***	1.531***	1.076**	1.092***	0.5753***	-1.825***
t-stat	12.86	9.76	2.20	7.29	3.10	-9.55
INFL	0.6760***	0.4713***	0.1839*			-3.524***
t-stat	6.67	4.26	1.85			-21.52
D(OM_DT)	-0.0067***	-0.0133***	-0.0535***	-0.0364***	-0.0262***	-0.0284***
t-stat	-4.82	-6.68	-8.97	-8.18	-9.08	-4.43
K5	-0.6809***	-0.5170***	-0.2611**	-0.0671***	-0.3043	0.7103***
t-stat	-6.31	-4.02	-2.01	-14.86	-1.29	7.72
D_REVALOR	-0.0895***	-0.0703***	-0.0773***		-0.0819***	
t-stat	-35.10	-16.15	-7.67		-10.50	
SIZE		-3.955***				
t-stat		-30.61				
SIZE*D(OM_DT)		0.1775***				
t-stat		4.28				
ROA			1.834*			
t-stat			1.94			
ROA*D(OM_DT)			4.340***			
t-stat			7.53			
LIKVA				0.2354		
t-stat				0.93		
LIKVA*D(OM_DT)				0.7498***		
t-stat				5.70		
LIKV1A					-0.073*	
t-stat					-1.67	
LIKV1A*D(OM_DT)					0.1427***	
t-stat					6.62	
CAR						0.3010***
t-stat						9.08
CAR*D(OM_DT)						0.0713**
t-stat						2.27
SARGAN TEST (p-value)	0.48	0.54	0.40	0.31	0.45	0.37

Source: author's own calculations

Equation 2 uses regressor SIZE. Larger banks decrease efficiency of monetary policy which is in accordance with IR_CB results (Table 4 – Equation 3).

Table 6

Equations with Money Market Interest Rate as Monetary Policy Stance Indicator - Continuation

DEPENDANT VARIABLE: DLOG(KRED_NEBAN)	EQUATION					
VARIABLE	Eq. 7	Eq. 8	Eq. 9	Eq. 10	Eq. 11	Eq. 12
DT_R	-0.0019*		-0.0088**	0.0004	-0.0001	0.0083***
t-stat	-1.66		-2.05	0.11	-0.03	6.41
DLOG(GDP)	1.006***	0.7913***	0.402	1.6107***	-0.0552	1.184***
t-stat	4.72	3.44	0.48	5.20	-0.11	7.29
INFL	0.8595***	-0.4409***	-1.0002***			0.4916***
t-stat	6.03	-2.46	-2.42			3.31
D(OM_DT)	-0.0530***	-0.0492***	-0.1351***	-0.1453***	-0.1889***	-0.6323***
t-stat	-5.27	-7.22	-9.15	-5.87	-6.90	-8.69
K5				-1.0405***	-0.5524**	-0.1075
t-stat				-4.35	-2.16	-0.54
D_REVALOR	-0.0704***	-0.0558***	-0.0507***	-0.0805***	-0.0773***	-0.0989***
t-stat	-14.35	-12.11	-4.13	-7.06	-7.22	-19.81
SIZE		-4.581***	-4.966***	-5.0461***	-7.4302***	
t-stat		-25.53	-4.84	-6.00	-6.23	
SIZE*D(OM_DT)		0.2070***	-0.0988	6.063***	13.97***	
t-stat		3.15	-0.72	7.10	9.35	
ROA			3.684			
t-stat			1.36			
ROA*D(OM_DT)			7.254***			
t-stat			4.03			
LIKVA		-0.0844	0.5059	0.5768		
t-stat		-0.26	0.40	0.86		
LIKVA*D(OM_DT)		0.7961***	1.089***	3.7250***		
t-stat		4.44	2.90	5.84		
D_LAST			0.1799***			
t-stat			2.8			
D_LAST*D(OM_DT)			0.0048			
t-stat			0.2			
DEPA	-0.6687***				-1.0362***	
t-stat	-15.7				-20.88	
DEPA*D(OM_DT)	0.0716***				0.2670***	
t-stat	4.22				6.41	
LIKVA*SIZE*D(OM_DT)				-167.9***		
t-stat				-6.818176		
DEPA*SIZE*D(OM_DT)					-20.10***	
t-stat					-9.86	
DEPA*D_LAST*D(OM_DT)						
t-stat						
K5*D(OM_DT)						0.9940***
t-stat						8.54
SARGAN TEST (p-value)	0.57	0.46	0.30	0.64	0.56	0.66

Source: author's own calculations

Profitability (ROA) decreases monetary policy efficiency as well (Equation 3). Equations including indicators of liquidity LIKVA and LIKV1A (Equations 4 and 5, respectively) show that banks with higher level of liquidity on average decrease the effectiveness of monetary policy. Banks with higher capital adequacy ratio (CAR) decrease monetary policy efficiency as well (Equation 6). The same is true for banks with higher level of deposit financing (DEPA) as shown in Equation 7.

Equations 8 and 9 use several banking characteristics as regressors. SIZE and LIKVA included in Equation 8 both reduce monetary policy efficacy, similarly as in Equations 2 and 4. Four banking characteristics – SIZE, ROA, LIKVA and D_LAST are included in Equation 9. Higher market share of a bank on average increases monetary policy efficiency. Bank profitability (ROA) and liquidity (LIKVA) negatively affect monetary policy, while ownership dummy (D_LAST) lacks statistical significance.

Equations 10 and 11 besides single bank variable's product with monetary policy stance indicator include double interactions – product of two bank characteristics with money market interest rate used as monetary policy stance indicator.

Equation 10 includes liquidity (LIKVA) and bank size (SIZE). Larger and more liquid banks decrease monetary policy efficiency, while interaction of both variables with money market interest rate (OM_DT) shows that among smaller banks, institutions with lower liquidity on average positively affect monetary policy efficiency when compared with more liquid smaller banks.

Size (SIZE) and share of deposits in total bank liabilities (DEPA) are bank characteristics used in Equation 11. Products of SIZE and monetary policy stance indicator (OM_DT) as well as DEPA and OM_DT have the opposite sign as OM_DT, meaning that they decrease monetary policy effectiveness. Double interaction (SIZE*DEPA*OM_DT) shows that smaller banks with larger share of deposit financing on average accommodate loans (KRED_NEBAN) less than banks of same size and lower share of deposit financing.

Effect of bank market concentration (K5) has a positive sign, showing that higher concentration negatively affects monetary policy efficiency (Equation 12).

5. Conclusion

Banking characteristics exhibit similar influence on loans, regardless of the monetary policy stance indicator used. More profitable, more liquid banks and more deposit-dependant banks diminish the effectiveness of monetary policy. Those banks possess a buffer in their balance sheets that enables them to mitigate the effects of monetary policy on their lending.

Results are a bit more uncertain with size indicator. Equations that show that larger banks reduce monetary policy effectiveness include some other bank characteristics as well, while in specifications with size as the only banking characteristic expected negative influence on monetary policy efficiency is observed. This enables a conclusion

that other banking characteristics prevail and more successfully predict the movement of loans, which is confirmed when products of several banking characteristics (among them size) and monetary policy stance indicator are included in the equation. As predicted by Stein's theory (1998) smaller banks compensate this deficiency by shaping their balance sheets accordingly.

Capitalization is connected with lower monetary policy efficiency in equations with money market interest rate as monetary policy stance indicator, while it does not affect the effectiveness of monetary policy in equations with M2. Besides that inclusion of this variable causes some inconsistencies in signs of other coefficients. Influence of capitalization on monetary policy effectiveness is therefore not fully confirmed.

State ownership increases efficiency of the monetary policy, which is in accordance with the hypothesis that state owned banks can be used to achieve some macroeconomic or monetary policy goals. Similarly domestically owned credit institutions increase the efficiency of monetary policy, which is in accordance with expectations and findings of Jimborean (2006). It is possible to argue that subsidiaries of foreign banks can overcome changes in the monetary policy with help of their parent institutions. Changes in monetary policy affected them less, especially because parents belonged to different monetary policy area.

Higher concentration (which is a macro-level characteristics) has a negative effect on monetary policy efficiency which is in accordance with expectations. Banks that function in less competitive environment respond less to changes in monetary policy and shield their balance sheets from changes in monetary policy better.

Slovenian banks with different characteristics respond differently to changes in monetary policy, therefore it is possible to conclude that bank lending channel in Slovenia exists which confirms results of some previous analyses.

Despite the fact that Slovenia entered new monetary area in 2007, these findings remain very useful. Identification of bank characteristics that are important for monetary policy performance does not only help to identify bank lending channel, but it also shows area where it is still possible to influence the functioning of monetary policy. Regulatory powers that remain in capacity of Slovenian authorities are: regulating mergers and acquisitions, approving foreign take-overs, changing liquidity and (to some extent) capitalization demands, changing taxation of revenue and tax treatment of interest from deposits. Some of those measures have been successfully used by Bank of Slovenia and Slovenian government in the period of financial crisis.

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