STAFFORDSHIRE UNIVERSITY
BUSINESS SCHOOL:
ECONOMICS

THE INTEREST RATE AND BANK LENDING CHANNELS IN A SMALL, OPEN AND EUROISED ECONOMY WITH FIXED EXCHANGE RATE – THE CASE OF MACEDONIA

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A thesis submitted in partial fulfilment of the requirement of Staffordshire University for the degree of Doctor of Philosophy

June, 2011

ABSTRACT

This thesis explores the possibility of conducting a more independent monetary policy through the adoption of an inflation targeting regime in a small, open and Euroised transition economy where banks are dependent on foreign financing. The major aim of this research programme is to investigate the effectiveness and determinants of the interest rate and bank lending channels in the case of Republic of Macedonia, since their effectiveness is seen as one of the preconditions for adoption of an inflation targeting regime. This thesis contributes to the existing literature for transition economies in two main ways. Firstly, it investigates the size and determinants of individual bank's lending rate adjustments to changes in the 'cost of funds' rate. Secondly, it examines two loan functions according to the currency disaggregation of loans, and investigates what bank-specific characteristics are the major determinants. The findings with respect to the first research contribution indicate that the size of the short-run adjustment of lending rates to changes in the 'cost of funds' rate is quite sluggish and heterogeneous among Macedonian banks. Moreover, bank-specific characteristics and macroeconomic variables play different roles in individual bank's lending rate setting decisions. These results are consistent with the presence of aggregation bias in previous research that uses sector-level data, due to the suppression of banks' heterogeneous behaviour. The results regarding the second research contribution imply that the bank lending channel in Macedonia works mainly through foreign currency loans and the foreign reference rate, whereas the responsiveness of domestic currency loans to the changes in the domestic reference rate is quite low. Moreover, different banks react differently to changes in the domestic and foreign reference rates due to their specific characteristics. These findings suggest that the impact of domestic monetary policy on the Macedonian economy through the interest rate and bank lending channels is quite limited. Therefore, the current monetary policy regime of a fixed exchange rate may be more effective in achieving the price stability aim than adoption of an inflation targeting regime in economies like Macedonia.

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ABBREVIATIONS

ADF	Augmented Dickey Fuller
CB Bills	Central Bank Bills in Macedonia
CC	Credit commodity curve
CDs	Certificate of deposits
CM	Credit market curve
CPI	Consumer Price Index
CR3	Concentration ratio of the three largest banks on the market
CR5	Concentration ratio of the five largest banks on the market
CC-LM	Bernanke and Blinder's (1988a, b) model for the bank lending channel
CSEE	Central and South Eastern Europe
DSUR	Dynamic Seemingly Unrelated model
EBRD	European Bank for Reconstruction and Development
ECM	Error-correction model
ECT	Error-correction term
EMU	European Monetary Union
ERM	Exchange Rate Mechanism
EU	European Union
E-G	Engle-Granger
FE	Fixed effects
FED	Federal Reserve System
FFR	Federal Funds Rate
FGLS	Feasible Generalised Least Squares
FDI	Foreign direct investment
GDP	Gross Domestic Product
GLS	Generalised Least Squares
GMM	Generalised Method of Moments
HHI	Hirschman-Herfindahl Index

IPI	Industrial production index
IS	IS curve that represents the equilibrium on goods market
IS-LM	IS-LM model that represents the equilibrium on money and goods markets
IV	Instrumental variable
KPSS	Kwiatkowski-Phillips-Schmidt-Shin
LIML	Limited Information Maximum Likelihood
LM	LM curve that represents the equilibrium on money market
MBKS	Weighted average money market rate in Macedonia
MLE	Maximum likelihood estimator
NBRM	National Bank of the Republic of Macedonia
NPL	Non-performing loans
OLS	Ordinary Least Squares
PAM	Partial Adjustment Model
PFMOLS	Panel Fully-Modified Ordinary Least Squares
RE	Random effects
REER	Real exchange rate
RMSE	Root mean squared error
PP	Phillips-Perron
SSO	State Statistical Office of the Republic of Macedonia
SUR	Seemingly Unrelated Regression
SURECM	Seemingly Unrelated Regression Error-correction model
TAR	Threshold autoregressive models
VAR	Vector Autoregression
VECM	Vector Error Correction Model
WGE	Within Groups Estimator

ACKNOWLEDGMENTS

First and foremost I want to thank both of my supervisors Professor Jean Mangan and Professor Nick Adnett for their useful comments and suggestions that were keeping me on the right track and have significantly improved the quality of this thesis. I am also grateful to Professor Iraj Hashi for all of his moral support during my PhD studies as well as to Jenny Herbert and Marion Morris for helping me in sorting out all the administrative issues during the four year period of study. I own my gratitude to Professor Goran Petrevski for giving me some helpful suggestions in preparing the research proposal for applying for this PhD programme.

I would also like to thank to Open Society Institute and Staffordshire University for providing me with the scholarship for this PhD studies.

I am indebted to my colleagues from the National Bank of Republic of Macedonia: Aleksandar Spasevski, Petar Debnikov and Natasa Angelovic for helping me construct some of the data series used.

Finally, I own my gratitude to all my family and friends for their moral support during the four year period in doing this research. I owe many thanks to my partner, Biljana, for her patience and support during the whole period, especially when I have been away from home. I am grateful to my uncle Vanco for helping me in sorting out some technical difficulties in combining this whole document. I owe special gratitude to my grandfather Professor Dr. Ksente Bogoev (1919 – 2008), who has been my greatest motivation to start and complete my PhD studies and to whom I dedicate this thesis.

CHAPTER 1: INTRODUCTION – THE BANKING SECTOR IN MACEDONIA

1.1 Introduction

Since the 1980s the legal status of central banks has changed rapidly towards gaining greater independence. Along with this, the major goal of almost all central banks has become price stability. For instance, this is the ultimate goal of the monetary policy for the European Central Bank (ECB), the rest of the European Union (EU) countries e.g. the United Kingdom, Sweden and Denmark, and the transition economies from the Central and South Eastern Europe (CSEE), including the Republic of Macedonia.

Achieving this aim is seen to be one of the main preconditions for macroeconomic stability and sustainable growth. In seeking to achieve this price stability goal, monetary policy makers apply various monetary policy regimes. The most frequently applied monetary policy regimes in the past and in recent time are: inflation targeting, exchange rate targeting (including various types of exchange rate regimes such as a fixed exchange rate, currency board, crawling peg etc.), money supply targeting and nominal income targeting.

The Republic of Macedonia as a European Union (EU) candidate country is faced with the issue of what will be the most appropriate monetary policy regime. More precisely, the monetary policy makers are faced with the issue of whether the current regime of a *de facto* currency peg to the Euro is still appropriate or whether an inflation targeting regime may be more effective in achieving the price stability aim. This may be especially important to consider before it fully liberalises its capital account. Hence, examining the effectiveness of some of the channels of the monetary transmission mechanism, such as the interest rate and bank lending channels and their major determinants, is of crucial importance in order to inform the monetary policy-makers in designing and implementing the most appropriate monetary strategy. More precisely, examining whether, and if so to what extent, these two channels of monetary transmission are operational and how various bank specific and macroeconomic characteristics affect them, may indicate if some of the initial conditions for adoption of an inflation targeting regime are met. These issues are also of importance to other transition economies that have a fixed or currency board regime and the approaches to investigate these questions and the findings for Macedonia may also have relevance there. Carere et al. (2002) argue that one of the initial conditions for adopting an inflation targeting regime is the efficient transmission of monetary policy defined as: ".... connection between the changes in the monetary stance and their effect on the operating target, and ultimately, the inflation." (p. 19). Furthermore, Batini et al. (2006) also argue that the existence of an effective monetary transmission mechanism is one of the 'technical' requirements for conducting the inflation targeting regime.

In that respect, the main research questions of the thesis are:

1) What is the size of the lending rate adjustment to changes in the domestic 'cost of funds' rate and is it homogeneous and synchronised among Macedonian banks?
2) What factors affect the size of banks' lending rate adjustment?
3) Does the bank lending channel exist in an economy with a fixed exchange rate like Macedonia and what is the size of the adjustment of banks' loans to changes in the reference rate?
4) Is the adjustment of the quantity of loans heterogeneous among various banks and what are the major determinants for any heterogeneous adjustment?
5) Do the interest rate and bank lending channels work in the same direction (complement each other) or in the opposite direction (conflict with each other) and are they operational from the monetary policy point of view?

In order to answer these main research questions of the thesis, the major aim of this chapter is to provide an assessment of the main characteristics of monetary policy in the Republic of Macedonia and the banking sector. The rationale for doing this is that it will provide a general review of the banking sector and changes in the banks' specific characteristics that are directly related to the major research aims of this thesis. More precisely, this will help us in conducting the empirical analysis presented in chapters 3 and 5 later in this thesis, whose major aims are directly related to the interest rate pass-through and bank lending channel. For this reason, an assessment of the general characteristics of the banking sector will be provided accompanied by a consideration of the aggregated banks' assets and liabilities. Additionally, a detailed appraisal of the loan market and structure of loans will be provided, as well as the interest rate series.

This chapter is organised as follows: section 1.2 provides a brief overview of monetary policy in Macedonia in the context of this research. Section 1.3 explains the aims and objectives of the thesis. Section 1.4 presents a general picture about the structure of the banking sector. Section 1.5 provides an assessment of the aggregated banks' assets and liabilities in Macedonia. Stylised facts about the loan market and the structure of outstanding loans in Macedonia are presented in section 1.6. Section 1.7 analyses the interest rate movements, while the conclusions of this chapter are presented in the final section.

1.2 Monetary policy in Macedonia in the context of this research

Since gaining its monetary independence in April 1992, the type of the monetary policy regime in the Republic of Macedonia has changed once. From the period of gaining its monetary independence till the end of 1995, a money supply regime was applied by targeting the narrow monetary aggregate M1 that consists of currency in circulation and demand deposits [National Bank of the Republic of Macedonia (NBRM, 2006c)]. The rationale for applying this monetary regime was due, at that time, to the undeveloped financial markets and institutions and a non-functional interest rate channel (Trajkovic, 2006). Given these conditions, it was argued that this was the most appropriate monetary policy regime at that time (Trajkovic, 2006). However, during this monetary regime macroeconomic performance was generally unsatisfactory. For example, the inflation rate was quite high and volatile, the real GDP growth rate in all years during that period was negative, the unemployment rate grew from 27.7% in 1993 to 35.6% in 1995 and the nominal exchange rate depreciated[1] substantially (see

[1] The exchange rate of the Macedonian denar is expressed as units of domestic currency per unit of foreign currency.

table 1.1). The nominal exchange rate depreciation and the relatively high trade openness of the Macedonian economy at that time (see table 1.1) may be one the reasons for the relatively high and volatile inflation during that period. This 'poor' macroeconomic performance was one of the major reasons for the monetary policy makers to re-examine this monetary regime and to assess the possibility for switching to another. Consequently, as a result of the instability of the money demand function, the weakening of the correlation between the money growth and aggregate demand and the high openness of the Macedonian economy, the monetary policy makers from 1996 adopted a nominal exchange rate targeting regime by *de facto* pegging the Macedonian Denar to the German Mark and latterly to the Euro. Applying this strategy so far has been quite successful in stabilising the price level and has coincided with the improvement of the rest of the macroeconomic performance. For instance, since the adoption of this regime, inflation was reduced to below 6%, real GDP started to grow (except in 2001 due to the armed conflict in the country), foreign exchange reserves increased substantially and foreign trade increased (see table 1.1).

Table 1.1: Main macroeconomic indicators of the Republic of Macedonia

	Average annual inflation*	GDP (real growth rates)	Unemployment rate (in %)***	Average exchange rate MKD/DEM and from 2002 to the EURO	Gross foreign reserves (millions of US dollars, stock - end of period)	Trade openness: (Exports f.o.b. + Imports f.o.b.) / GDP
1993	349.8	-7.5	27.7	14.2	123.2	82.4
1994	121.8	-1.8	30.0	26.6	172.4	69.6
1995	15.9	-1.1	35.6	26.5	282.9	59
1996	3.0	1.2	31.9	26.6	277.5	59.1
1997	4.4	1.4	36.0	28.7	258.7	76.6
1998	0.8	3.4	34.5	31.0	323.9	86.5
1999	-1.1	4.3	32.4	31.0	449.9	78.3
2000	5.8	4.5	32.2	31.1	699.5	92.5
2001	5.5	-4.5	30.9	31.1	755.6	82.6
2002	1.8	0.9	31.9	61.0	725.3	80.4
2003	1.2	2.8	36.7	61.3	903.4	77.2
2004	-0.4	4.1	37.2	61.3	975.3	83.6
2005	0.5	4.1	37.3	61.3	1324.7	88.5
2006	3.2	4.0	36.0	61.2	1865.8	95.5
2007	2.3	5.9	34.9	61.2	2239.6	106.3
2008	8.3	4.8	33.8	61.3	2107.6	110.5
2009	-0.8	-0.7**	32.2	61.3	2290.5	100.4

* Up to 1999, this is the retail price index, since 2000 it is the consumer price index.
** Estimated data (source: State Statistical Office of the Republic of Macedonia).
*** For the period 1993-1995 this is the unemployment rate estimated by the State Statistical Office of the Republic of Macedonia, while for the period 1996-2003 this is the unemployment rate from the Labour force survey of Statistical Office of the Republic of Macedonia.
Source: NBRM and State Statistical Office of the Republic of Macedonia.

1.3 Aims and objectives of the thesis

The major research aims of this thesis are to empirically investigate the effectiveness of two channels of the monetary transmission and their major determinants. The first one is the interest rate channel from the 'cost of funds' rate to banks' retail rates (the lending rates). The second one is the so-called bank lending channel that, according to the literature (see sections 4.2 and 4.3), may either amplify or attenuate the interest rate channel. Therefore, we aim to assess if these two channels of monetary transmission are operational in the Macedonian banking system and whether the bank lending and the interest rate channels 'work' in the same direction by complementing each other. Additionally, we aim to explore what are their major determinants, mainly from the bank-level perspective. In particular, we attempt to investigate how banks' specific characteristics affect the effectiveness of these two channels of monetary transmission. Assessing the effectiveness and the determinants of the interest-rate and bank lending channel in Macedonia will provide evidence on one of the key research questions of this thesis: whether the current monetary policy regime is appropriate, or if a different policy regime should be applied.

Regarding the first channel of the monetary transmission (the interest rate channel), we intend to explore the major determinants of lending rate adjustment to changes in the 'cost of funds' rate. In that respect, we explore the impact of various bank-specific characteristics, two macroeconomic control variables and the impact of the concentration in the banking system on the size of the lending rate adjustment to changes in the 'cost of funds' rate.

Concerning the second channel of monetary transmission that is also a subject of our investigation (the bank lending channel), we aim to investigate the impact of various bank specific characteristics in order to determine if there is heterogeneous loan adjustment function among the Macedonian banks.

In order to answer to the main research questions of the thesis considered in section 1.1, the chapters of the thesis cover the following aspects:

- Related to the first and second research questions, the major aims of chapter 2 are to provide a critical appraisal of the theoretical literature that establishes the main models of how banks set their retails rates and what factors are seen to affect banks' lending rate setting decisions. Additionally, to provide a basis for our empirical chapter we critically survey empirical studies and their estimation methods. Hence, this may also help us in selecting an estimation strategy and method, arguably correcting for possible weakness in the existing empirical studies for Macedonia.
- Chapter 3 directly examines the first and second research questions by empirically investigating what is the size of short-run adjustment of lending rates to changes in the 'cost of funds' rate and is it homogeneous among banks in Macedonia. Investigating this issue will enable us to draw a conclusion regarding whether the interest rate channel is effective in the Macedonian banking system. This is an important issue from the monetary policy makers' perspective because it will enable us to draw conclusions later on in the thesis as to whether one of the main preconditions for adopting an inflation targeting monetary regime is met. Moreover, in chapter 3 we also intend to identify the major determinants that affect the size of banks' lending rate adjustment to changes in the 'cost of funds' rate. For this reason, we use a set of variables of up to eight bank balance sheet items, two macroeconomic control variables and an indicator for the concentration in the banking system. These variables are identified as the major factors that have been claimed to affect the size of retail rates adjustment and lending rate setting behaviour among banks in various economies in the theoretical and empirical literature.
- To investigate the third and fourth research questions, chapter 4 assesses the theoretical literature that establishes the basis of the bank lending channel and identifies the major determinants of the loan adjustment. In order to conduct our empirical investigation of the determinants of the bank lending channel in the case of Macedonia, we intend to critically survey previous empirical studies and their estimation methods. By fulfilling this aim we will be able to identify the main empirical methods of estimation and thus, to identify any problems. This will help us in selecting an appropriate estimation strategy, in order to

correct for the possible weakness related to the estimation method(s) previously applied in empirical studies.

- Questions three and four are directly addressed in chapter 5 whose aim is to empirically investigate if the bank lending channel exists in the case of the Macedonian banking system, having in mind its specific structure (see sections 1.4, 1.5 and 1.6), the high trade openness of the economy as well as the monetary policy strategy of *de facto* fixed exchange rate regime (see section 1.2). Moreover, we aim to explore whether the Macedonian banks react identically in adjusting the stock of loans when the reference rate changes. There is no previous study (to the author's knowledge) that empirically investigates if the bank lending channel exists in the Macedonian banking system and, if so, what are its major determinants. This can be seen as an important issue having in mind that the financial market in Macedonia, as in many other transition economies, is still underdeveloped compared to western economies and remains bank dominated (see section 1.4).
- In the context of the last research question, the aims of chapter 6 are to consider whether the bank lending channel amplifies or attenuates the interest rate channel and are these two channels operational from the monetary policy point of view. Hence, chapter 6 provides a policy recommendation regarding whether the precondition for effective interest rate and bank lending channels are met. By achieving this research aim we should be able to provide a policy recommendation regarding whether the current monetary policy regime of a *de facto* fixed exchange rate should be maintained, or whether there is a rationale for a shift towards inflation targeting.

1.4 Overview of the banking sector in Macedonia

This section aims to provide a general assessment of the structure of the banking sector in Macedonia. It assesses the level of competitiveness and concentration in the banking sector, as well as the progress achieved in the area of banking sector reforms and interest rate liberalisation assessed by the European Bank for Reconstruction and Development (EBRD) index. In this section is also presented an analysis of the structure of the banks according to their type of ownership. Furthermore, this section briefly explains the main monetary instruments used by the monetary authorities in Macedonia, and the reasons for changes in their use through time.

In analysing the banking sector in Macedonia throughout the whole of this thesis we consider the privately owned banks and hence, we do not consider the only state owned bank - “Macedonian Bank for Development Promotion” a.d. Skopje. The reason for not including this bank is that it is entirely state-owned and was established only for the purpose of supporting certain underdeveloped industrial areas of the Macedonian economy. Hence, this bank is not working according to market-based principles and has a negligible average loan market share of 3% during the 2000-2009 period.

Table 1.2: Characteristics of the banking sector in Macedonia

	Number of banks	Share of the banking assets in the total financial assets (in %)	HHI* of total assets	Share of total banks' assets owned by the three largest banks (in %)	Share of total outstanding loans owned by the three largest banks (in %)	EBRD's index for banking reform and interets rate liberalisation
1998	22	/	/	63.1	/	2+
1999	22	/	/	62.0	/	2+
2000	22	/	/	64.0	/	2+
2001	21	/	1738	55.8**	46.8	2+
2002	21	/	1667	54.1**	46.9**	2+
2003	21	/	1842	55.5**	48.3	2+
2004	21	/	1685	66.8	66.2	2+
2005	20	/	1607	66.1	69.2	2+
2006	19	88.9	1595	66.1	69.2	2+
2007	18	90.5	1625	67.1	70.3	2+
2008	18	89.2	1579	66.1	69.0	3
2009	18	88.6	1636.7	67.5	70.1	3

* HHI is calculated by the following formula: $HHI = (\sum_{j=1}^{n} (s)_{j}^{2}) * 10000$; where S is the market share of each bank on the loan market; n is the total number of banks.
** The share of the two largest banks.
Source: NBRM Annual Report (1998, 1999b - 2009b) and EBRD Transition Report, November 2009.

The financial sector in the Republic of Macedonia, as in many other transition economies, is bank dominated. Banks’ share in the total financial assets[2] is around 90% in the last 4 years (see table 1.2). From 1998 the number of commercial banks has varied. The reasons for this variation are due to mergers,

[2] Total financial assets are defined as a sum of the assets of all financial institutions that operate in the territory of the Republic of Macedonia. The financial institutions are defined as legal entities that are involved in any type of financial intermediation and include: commercial banks, saving houses, leasing companies, investment funds etc.

acquisitions, the entrance of new banks and some becoming bankrupt (NBRM Annual Report, 1998, 1999b - 2007b). However, despite the decline in the number of banks, the level of concentration in the banking sector, measured through the Hirschman-Herfindahl index (HHI) for total banks' assets, has been quite stable since 2005, being around 1600 index points (see table 1.2). Compared to the new EU member states from CSEE and the Euro zone, the value of the HHI is among the highest (see table 1.3). This implies that the Macedonian banking sector lacks the same degree of competition as found in most other European countries.

Table 1.3: HHI for the CSEE economies and the EMU, 2008

Country:	**HHI**
Bulgaria	834
Czech Republic	1,000
Estonia	3,120
Euro zone	1,084
Hungary	822
Latvia	1,205
Lithuania	1,714
Macedonia*	1675
Poland	562
Romania	922
Slovakia	1,197
Slovenia	1,268

* The value of the HHI for Macedonia is for 2009.
Source: NBRM Annual Report, 2009b; and ECB, 2010.

The relatively high level of concentration in the Macedonian banking sector can also be seen from the share of total assets and total outstanding loans owned by the three largest banks. For instance, the three largest banks from 1998 to 2009 (apart from the period 2001-2003), owned more than 60% of total assets of the banking sector and more than 66% of total outstanding loans during the period 2004-2009 (see table 1.2). Moreover, during this period there has been a tendency the number of large- and medium-sized banks grouped according to their asset size to increase (see table 1.4).

Table 1.4: Number of large, medium and small sized banks in Macedonia, 2002-2009

	2003	2004	2005	2006	2007	2008	2009
Large banks	2	3	3	3	3	3	3
Medium banks	6	2	3	7	8	8	8
Small banks	13	16	14	9	7	7	7

According to the classification done by the NBRM, large sized banks are those whose assets are worth more than 15 billions of denars, medium sized banks are those whose assets are worth between 4.5 and 15 billions of denars and small sized banks are those whose assets are worth less than 4.5 billions of denars (source: NBRM Annual Report, 2006b).
Source: NBRM Annual Report, 2002b - 2009b.

The degree of banking sector reforms and interest rate liberalisation can be assessed by the index constructed by the EBRD that comprises set of various indicators related to the legal requirements of the banking system[3]. As shown in table 1.2, the only improvement in this index was from 2008. This may imply that the reforms related to the banking sector and interest rate liberalisation are still progressing slowly and additional reforms have to be completed in order to achieve the maximum score of 4+. If we compare this index to the other transition economies from CSEE, as shown in table 1.5, the Republic of Macedonia, together with the Western Balkan countries, has the lowest value of the index. This implies again that the Macedonian banking sector still requires additional reforms in order to reach the level of the more advanced CSEE economies.

Table 1.5: EBRD's index for banking sector reform and interest rate liberalisation for various economies from CSEE, 2009

Albania	3
Bosnia and Herzegovina	3
Bulgaria	4-
Croatia	4
Estonia	4
Hungary	4
Latvia	4-
Lithuania	4-
Macedonia	3
Montenegro	3
Poland	4-
Romania	3+
Serbia	3
Slovakia	4-
Slovenia	3+

Source: EBRD Transition Report, November 2009.

Regarding the type of the ownership structure of the banking system, expressed as percentage of total banking capital, the predominant part is privately

[3] For more details of how this index is constructed and what indicators does it comprise, see EBRD 2009 Transition Report, November 2009, p. 249.

owned. Since 1999 from when the data is available, public ownership takes around or less than 10% of total banking capital (see table 1.6) and has declined to less than 1% by 2009. This relatively small share of public ownership in the banking sector is dispersed among various banks. It accounts for a negligible part of banks' shareholders capital left unsold after the process of privatisation begun at the beginning of 1990s. Accordingly, the state does not have any significant shareholder capital in any banks and hence, cannot influence the decision-making process in any of the banks.

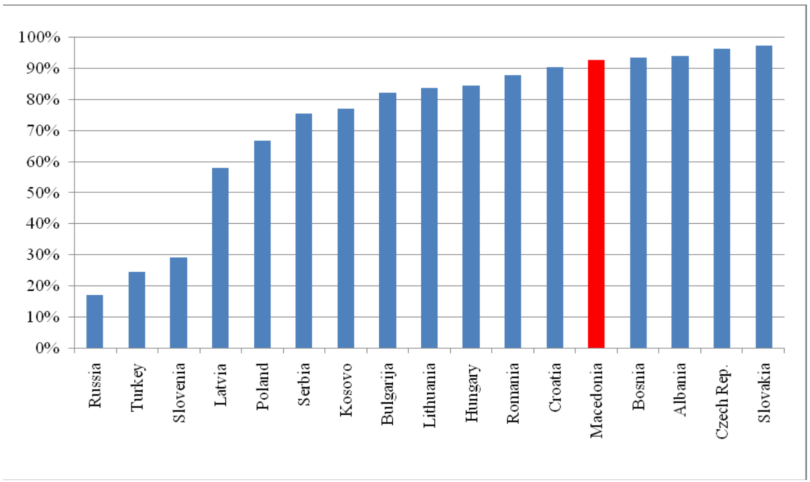
Table 1.6: Characteristics of the banking sector in Macedonia

	Share of private capital in total banking capital (in %)	Share of foreign ownership of total banking capital (in %)	Number of foreign owned banks (more than 50% of banking capital)
1998	/	15.5	/
1999	86.7	19.3	5
2000	87.8	40.1	7
2001	88.6	40.1	8
2002	90.3	44.6	7
2003	91.4	48.6	8
2004	95.6	50.4	8
2005	97.0	52.5	8
2006	98.4	56.1	8
2007	98.7	69.1	11
2008	98.9	74.3	14
2009	99.3	68.6	14

Source: NBRM Annual Report (1998, 1999b - 2009b).

Foreign capital as a percentage of total banking capital, used as an indicator for the presence of the foreign ownership in the banking sector, was less than 20% before 2000. However, since that year its share in the total banking capital has more than doubled. Hence, from the year 2000, foreign ownership has increased continually and by the end of 2008 it reached the peak of 74%. However, in 2009 there was a decline of the foreign capital in the total banking capital due to the world economic recession and the related withdrawal of portfolio investments from the Macedonian banking system (Source: NBRM Annual Report, 2009b). Regarding the number of banks that are predominantly foreign-owned (where the foreign capital combines more than 50% of total shareholders capital), from 2007 it has increased rapidly, i.e. from 8 banks in 2006 up to 14 in 2009 (see table 1.6). If we compare the share of foreign-owned banks in the structure of total banks' assets for various economies from CSEE for 2007, from figure 1.1, the share in the Republic of Macedonia is among the highest.

Figure 1.1: Percentage share of foreign-owned banks in total assets for various economies from CSEE, 2007



Source: NBRM Annual Report, 2008b, p.10.

Related to the foreign ownership in the banking sector in Macedonia, it has to be taken into account the divergence between the legal definition of foreign-owned banks (*de jure*) and the one in practice (*de facto*). In the case of the Macedonian banking system, the *de jure* foreign-owned banks are defined as foreign-owned banks that are owned by non-residents. Nonetheless, the non-residents may be domestic residents who have established their own company abroad and have established or acquired a bank in Macedonia that is not linked to any other 'parent' financial institution. Moreover, the *de jure* foreign-owned banks may also be owned by a couple of individual shareholders from abroad that are again not linked to any other 'parent' financial institution. From the point of view of the aims and objectives of the thesis (see section 1.3), in defining the foreign ownership we are primarily interested if the foreign-owned bank is related to another 'parent' financial institution due to the existence of an internal capital market and/or easier access to foreign financing. This may be defined as a *de facto* foreign-owned bank. Accordingly, in the case of Macedonia, it may not always be clearly determined which banks are *de facto* and which *de jure* foreign-owned and hence, how the internal capital market affects banks' lending rate setting decisions and the quantity of loans supplied. The reason for this is that many domestically-owned banks are dependent on foreign financing and may have the possibility to borrow funds (short- and long-term) from another institution from abroad by a relatively 'cheaper' price. These factors bring problems with defining a variable ‘foreign ownership’ from the context of the research aims of the thesis.

Another specific characteristic of the Macedonian banking system is that up to 2000 there was a general shortage of liquid assets (NBRM Annual Report, 2000a - 2004a). Accordingly, the NBRM in order to increase banks’ liquidity to a satisfactory level, as a main monetary policy instrument conducted an auction of deposits. However, from 2000 onwards, Macedonian banks entered into structural excess liquidity, defined as having more liquid assets than required. Consequently, at the beginning of 2000 the NBRM changed its main monetary policy instrument from the auction of deposits into auctions of Central Bank Bills (CB Bills). The main purpose of issuing CB Bills was to absorb the excess liquidity of the banks. After this change in the main monetary policy instrument in 2000, in the ensuing period, depending on the liquidity of the banking system and the pressures on the foreign exchange market; the type of the auctions of CB Bills was changing from an “interest rate tender” to “volume tender”. The major characteristic of the former is that the NBRM administratively sets the amount of CB Bills that banks may buy, whereas the commercial banks bid for the interest rate they want to offer in order to buy CB Bills. The major characteristic of the latter is that the NBRM administratively sets the interest rate of the CB Bills, whereas the commercial banks bid for the amount of CB Bills they want to buy. The periods characterised by “volume tender” or “interest rate” tender are presented in the table below.

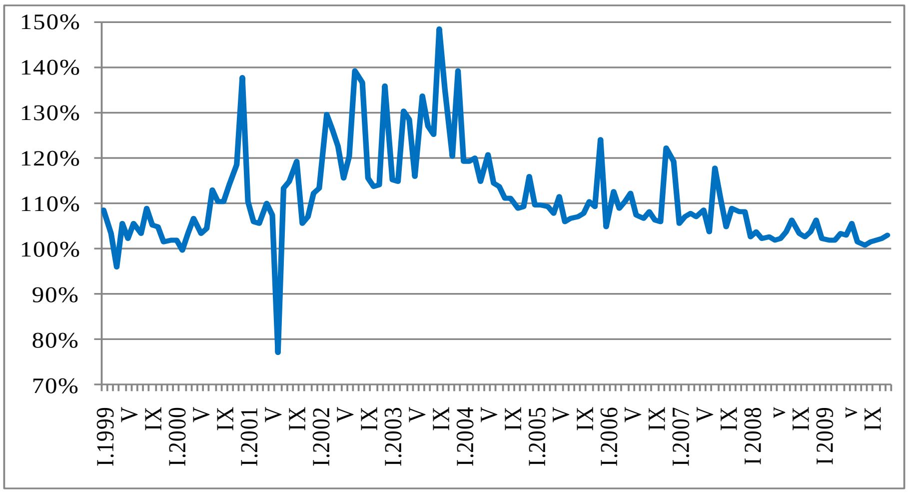
Table 1.7: Periods of conducting “volume tender” and “interest rate tender” auctions of CB Bills, 2000-2009

"Volume tender"	January 2000 - November 2000		May 2001 - June 2002		May 2003 - October 2003		February 2004 - October 2005		February 2008 - December 2009	Total months: 76
"Interest rate tender"		December 2000 - April 2001		July 2002 - april 2003		November 2003 - January 2004		November 2005 - January 2008		Total months: 44

Source: NBRM Annual Report, 2000a - 2009a.

However, nowhere in the NBRM Annual Reports is there a discussion of the cause(s) as to why the banks suddenly moved from a position of a shortage of liquid assets to one with an excess of liquid assets. Moreover, nowhere in the NBRM Annual Reports or the official documents issued by the NBRM is given any indicator by which we can assess the shift from banks’ shortage of liquid assets into banks' excess liquidity. As a rough indicator we may provide information on banks' fulfilment of the reserve requirement presented in figure 1.2.

Figure 1.2: Banks' fulfilment of the reserve requirement (%)



Source: NBRM.

As can be seen from figure 1.2, banks more than fulfilled their reserve requirement before 2000, with a range of between 100% and 110% of their required holdings. During 2002-2004 holdings were again much above the NBRM's required reserves reaching a peak of 140% at the end of 2003. This occurred notwithstanding that the reserve requirements were changing depending upon changes in banks' liquidity. The only period when banks' reserve requirement was below 100% was in the middle of 2001 due to the armed conflict in the country. In the more recent period banks' excess holdings have been declining. This may be due not only in the changes in the quantity of liquid assets by the banks, but also to the changes in percentage of value of the reserve requirement that banks have to fulfil and the accounting and methodological changes in calculating the reserve requirement fulfilment. More precisely, in 2001, 2005 and 2009 there has been increase of the percentage of value of fulfilment of the reserve requirement[4], whereas in 2006 and 2008 there have been a major changes in the methodology of calculating the fulfilment of banks' reserve requirement[5]. Regarding the latter, the figures may not be directly comparable before and after the periods of these alterations.

[4] For details see NBRM Annual Report (2001a; 2005a and 2009a).
[5] For details see NBRM Annual Report (2006a and 2008a).

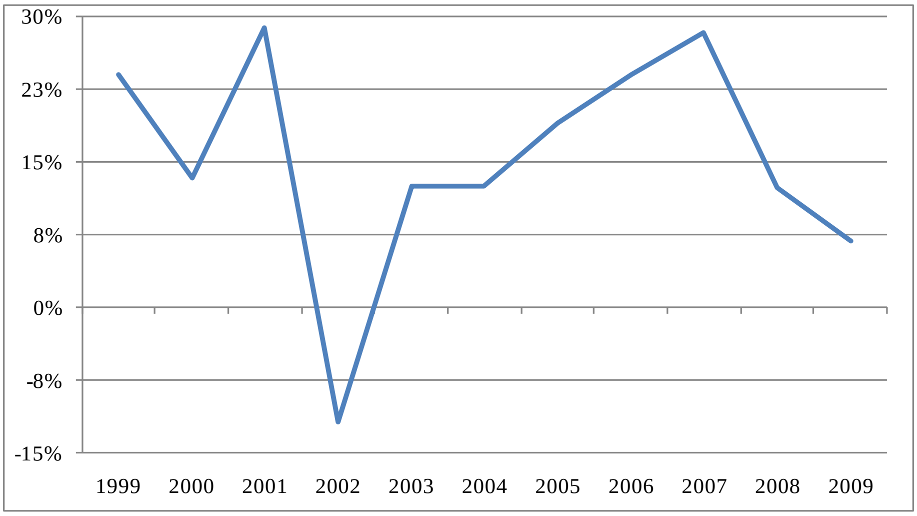
As an additional proxy indicator for the banks' excess liquidity we may examine the share of banks' cash and balances within the NBRM (see section 1.5 and figure 1.6). As shown on figure 1.6, this share in total banks' assets has gone up over time. However, this indicator represents a narrow definition of total banks' liquid assets and it does not include the rest of the liquid assets.

Overall, after presenting the main characteristics, it can be seen that the Macedonian banking system is still in the process of development. For example, the concentration in the banking system is still among the highest in the CSEE economies. Moreover, the EBRD's index for banking sector reform and interest rate liberalisation indicates that apart from in 2008, no other reform has been completed. Hence, compared to the more advanced transition economies from CSEE, Macedonia has amongst the lowest values of this index. This implies that additional reforms need to be completed in the banking sector, such as in the liberalisation of entrance and exit in the market, in order to reach the level of the more advanced transition economies from CSEE. The entrance of foreign capital in the banking system has been more pronounced in recent years. Compared to the other economies from CSEE, the share of foreign-owned banks in the total banks' assets is relatively high. However for a complete analysis of the developments of the banking system, it is necessary to provide a general overview of aggregated banks' assets and liabilities, and the structure of banks' outstanding loans and banks' retail rates, which are the subject of more detailed analysis in the following sections.

1.5 Overview of the assets and liabilities of the banking sector in Macedonia

The main aim of this section is to provide a general assessment of the aggregate assets and liabilities of the Macedonian banking sector. We use aggregated balance sheet data for the period 1998-2009, taken from Banks' Regulation and Banks' Supervision Departments of the NBRM. The data set(s) used are constructed according to the same methodology and same definitions as the data used in the two empirical chapters 3 and 5 in this thesis. Data is not available before 1998.

Figure 1.3: Annual rates of growth of aggregated banks' assets and liabilities (%)



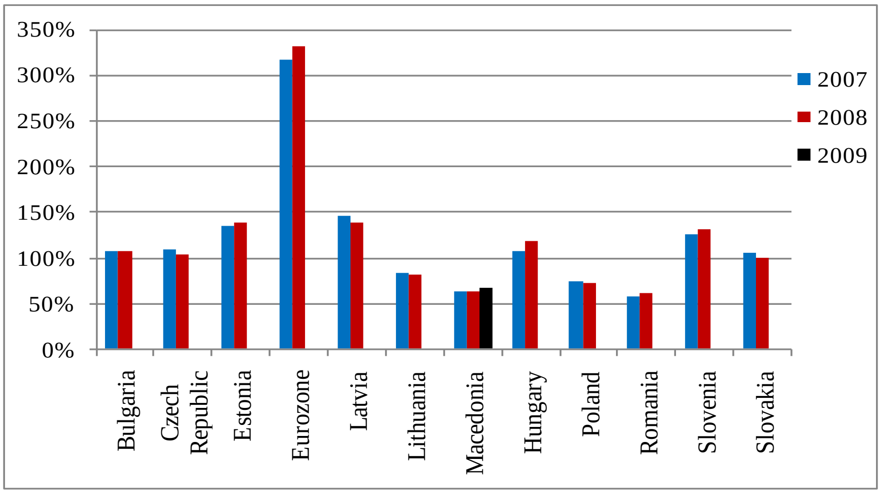
Source: NBRM.

The total assets of the banking sector in Macedonia, apart from 2002, have been increasing through time (see figure 1.3), with an average annual rate of growth of 15%. Hence, since 1998 banks' assets have almost quintupled. The highest annual rates of growth occurred in 2001 and 2007, reaching 29% and 28% respectively. It might be thought surprising that given the armed conflict in 2001, banks' assets grew rapidly however, this can mainly be explained by the Euro conversion of the foreign currencies of the private sector in that year.

More precisely, in the last quarter of 2001, due to the forthcoming process of Euro conversion, the private sector (especially the households), deposited their foreign currency savings that were kept in form of cash 'under the mattresses' in the banks, mainly in the form of foreign currency sight deposits that affected banks' assets and liabilities (NBRM Annual Report, 2001a, b). However, during the following year, as soon as the process of Euro conversion was completed, the private sector (mainly the households) started to withdraw their previously deposited foreign currency sight deposits. This was the major cause of the annual decline of banks' assets and liabilities in 2002 (NBRM Annual Report, 2002a, b).

Between 2003 and 2007 banks' assets and liabilities were growing steadily. Nonetheless, from the last quarter of 2008 and throughout 2009, there was a substantial slow down of their growth (see figure 1.3). This can be largely explained by the world economic recession and the spill-over effects on the domestic economy.

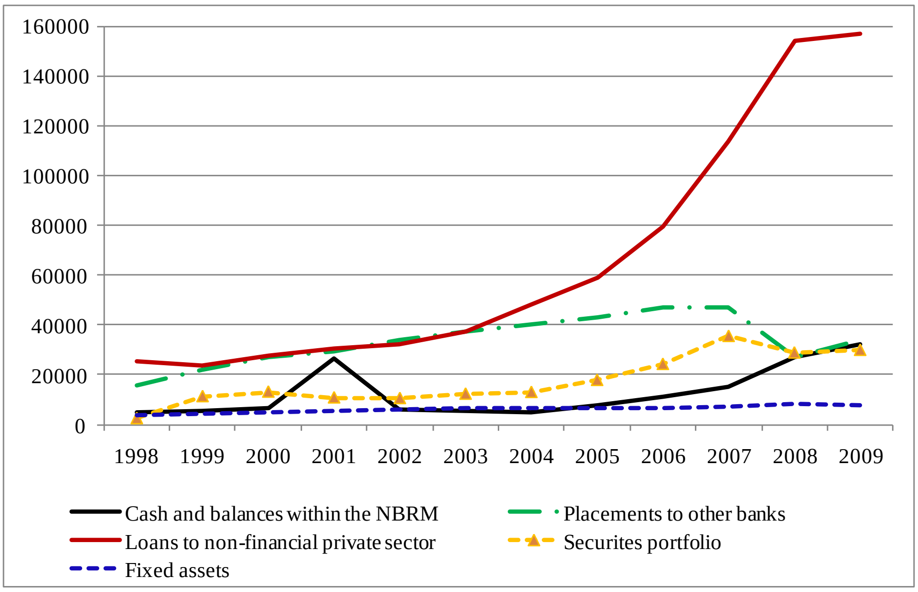
Figure 1.4: Banks' total assets-to-GDP ratio among various economies from CSEE, Eurozone and Republic of Macedonia (%)



Source: Author's own calculations upon the data from ECB, 2010 and NBRM and State Statistical Office for the Republic of Macedonia.

The ratio of the total assets of the banking system to the GDP, as an indicator of the level of financial intermediation, in most years (the exception being in 2002), has been growing steadily over time. Hence, from 30% in 1998 it had more than doubled in 2009, reaching 67% of the GDP. However, compared to the other more advanced transition economies from CSEE that are already members of the EU, the Republic of Macedonia together with Romania has the lowest level of asset-to-GDP ratio (see figure 1.4). This indicates that the Macedonian banking system is still relatively underdeveloped.

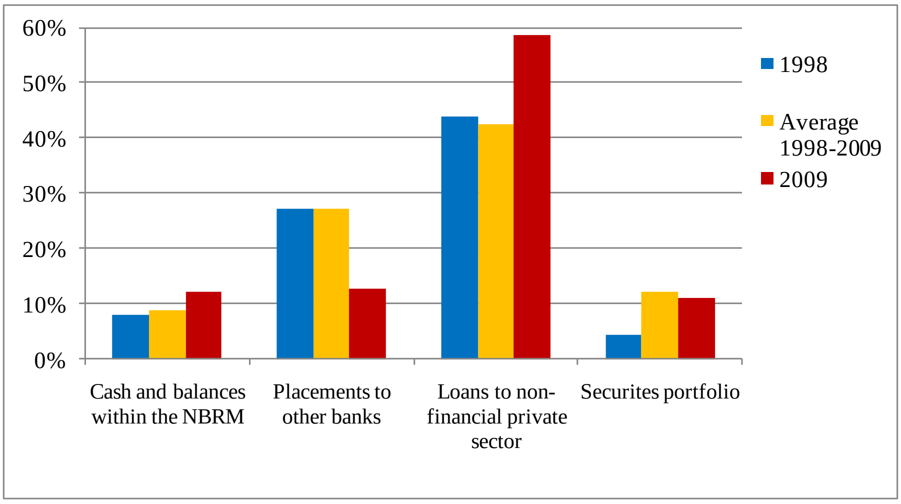
Figure 1.5: Total banks' assets and their main components (millions of denars)



Source: NBRM.

Analysing the structural components of total banks' assets (see figures 1.5 and 1.6), the dominant role of banks' outstanding loans to the non-financial private sector is evident. However, during this period, the structure of banks' assets has been changing. For instance, between 1998 and 2003, banks' outstanding loans to non-financial private sector and the placements to other banks had almost an equal part in the structure of total banks' assets. Nevertheless, since 2004 banks were mostly oriented towards their lending activities. The share of banks' outstanding loans to non-financial private sector in the total asset structure started to increase steadily and in 2008 and 2009 it reached 60%. During these two years they have been the major driving force of the growth of total banks' assets, contributing 80% of the annual growth, whose detailed structure is explained in the next section.

Figure 1.6: Structure of total banks' assets (%)



Source: NBRM.

The second largest component of total banks' assets is the total placements to other banks (see figures 1.5 and 1.6). The biggest element of this component is accounts with foreign banks driven by the foreign currency sight deposits of the domestic non-financial private entities, mainly the households. Banks for various reasons transfer these funds into accounts abroad, for which no explanation is given in the NBRM Annual Reports. Banks' placements in accounts with foreign banks have been growing continually through time until 2008, when they suddenly declined by 40% causing a decline of total banks' placements with other banks in 2008 and 2009 (see figures 1.5 and 1.6). The major reason for their sharp decline is likely to have been psychological fears of the domestic private entities caused by the uncertainty related to global economic developments. Accordingly, the domestic entities, mainly the households, started to withdraw their foreign currency deposits from the banks, scared by the possibility of a general banking failure, as it was the case in some of the developed economies during the second half of 2008.

The third largest component of total banks' assets is their securities portfolio (see figures 1.5 and 1.6). Banks' securities portfolio is predominantly composed of CB Bills, long-term bonds issued by the state and treasury bills. The average share of the CB Bills in the total securities portfolio of the banks during the analysed period was 36%. Analysed through time, their share in the total securities portfolio has been changing rapidly. For instance, the average share of CB Bills in the total banks' securities portfolio in 1998-1999 was only 16%, but from 2000 this share starts to grow rapidly, reaching a peak of 68% in 2008. This is not surprising having in mind that in the period before 2000 the main monetary policy instrument was the auction of credits, whereas since 2000 the main monetary policy instrument has been auctions of CB Bills (see section 1.4). The next two largest components of the total securities portfolio of banks are long-term bonds issued by the state for various purposes and the treasury bills. Regarding the treasury bills, their stock starts to grow from the beginning of 2004 when they were firstly issued as a separate financial instrument by the state. In 2009 their share in the total securities portfolio rose sharply (see table 1.8), due to the intensive government borrowing on the primary market in order to finance its expenditures in the face of falling tax incomes as a result of the economic recession. The rest of banks' portfolio includes securities like equity securities in domestic non-financial and financial entities; whose role in the total banks' securities portfolio is marginal (see table 1.8).

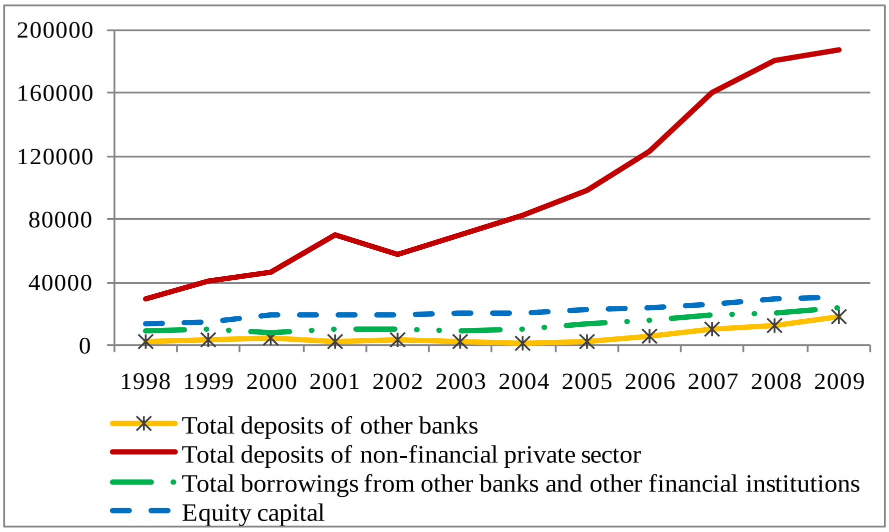
Table 1.8: Structure of the total banks' securities portfolio

Banks' securities portfolio	**Amount in millions of denars**			**Percentage share in total banks' securities portfolio**		
	2007	**2008**	**2009**	**2007**	**2008**	**2009**
Total banks' securities portfolio	**28967**	**25495**	**27967**	**100%**	**100%**	**100%**
Debt securities by the state and CB Bills of which:	**27609**	**24186**	**26954**	**95%**	**95%**	**96%**
CB Bills	20999	17437	15736	72%	68%	56%
Total long-term bonds by the state of which:	6170	5803	3344	21%	23%	12%
- Bond for privatisation of "Stopanska Banka" AD Skopje	3676	3162	/	13%	12%	/
- Bond for old foreign currency savings and denationalisation	1734	1860	/	6%	7%	/
- Continuous Government bond securities	760	781	/	3%	3%	/
Treasury Bills	6530	3362	7873	23%	13%	28%
Other securities by the state	440	946	1075	2%	4%	4%
Equity Securities of which:	**1358**	**1309**	**1014**	**5%**	**5%**	**4%**
- Securities in domestic non-financial legal entities	436	357	52	2%	1%	0%
- Securities in domestic banks and other financial organisations	731	761	962	3%	3%	3%
- Other equity securities	191	191	/	1%	1%	/

Source: Author's own calculation upon the data from NBRM.

The fourth largest component of total banks' assets is the cash and balances within the NBRM (see figures 1.5 and 1.6). This type of assets is mainly composed of the required reserves and excess cash in domestic currency that banks hold for precautionary reasons.

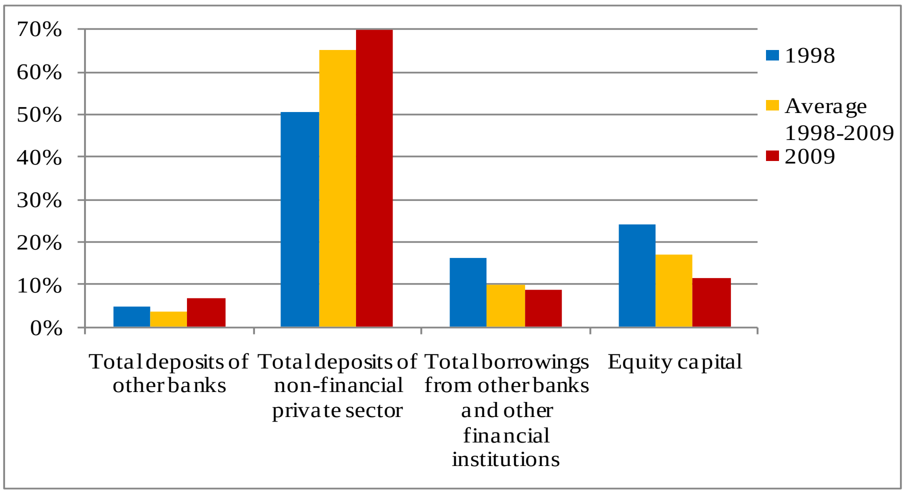
Figure 1.7: Total banks' liabilities and their main components (millions of denars)



Source: NBRM.

Analysing the structure of banks' liabilities, the major component is the total deposits of the non-financial private sector (see figure 1.8). By analysing the annual movements of banks' deposits, it can be noticed that they have also been growing steadily through time (see figure 1.7).

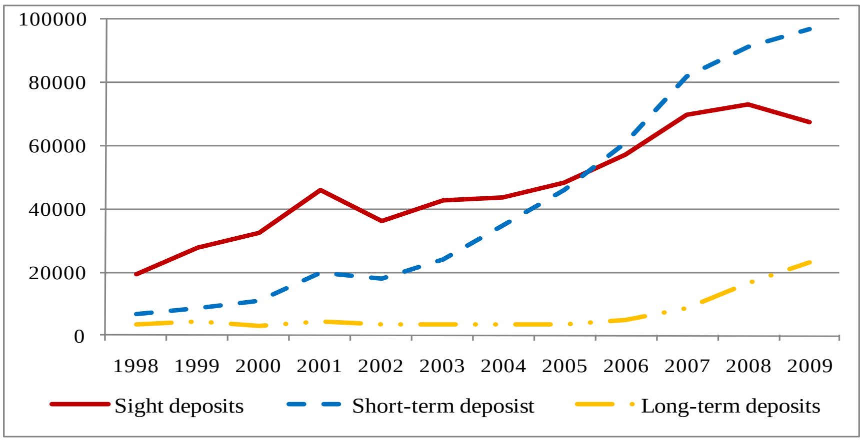
Figure 1.8: Structure of total banks' liabilities (%)



Source: Author's own calculations upon the data from the NBRM.

Regarding the structure of banks' deposits, the dominant share till the end of 2005 was sight deposits with an average over 1998-2005 of 62% of total deposits. From the beginning of 2006, there was a gradual shift in the structure of banks' deposits towards short-term deposits. These became the dominant component in the structure of total banks' deposits, with an average share over the period 2006-2009 of 51%. The share of the long-term deposits is much lower, with an average share over this period of 7%, although in 2009 there was an upward trend (see figure 1.9) that can probably be explained by the increase in the deposit rates by the commercial banks during 2009 (NBRM Annual Report, 2009a).

Figure 1.9: Structure of total banks' deposits from the non-financial private sector (millions of denars)



Source: NBRM.

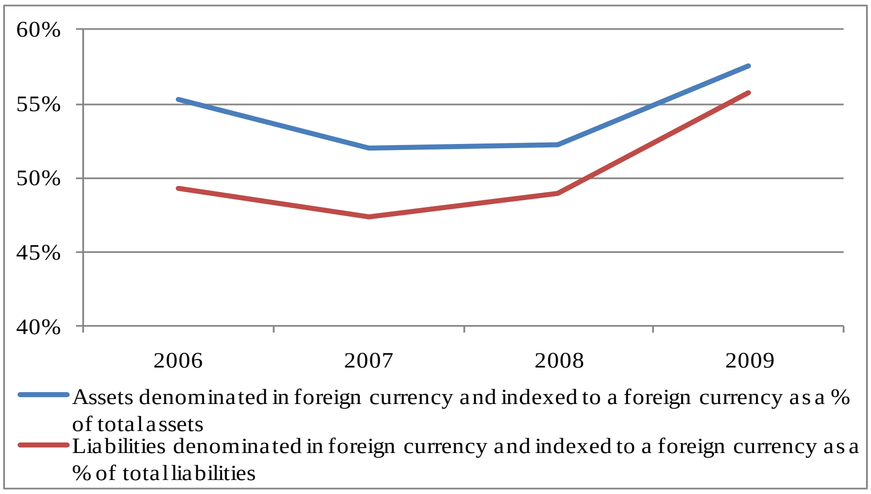
The second largest component of banks' liabilities is equity capital (see figures 1.7 and 1.8). However, their share in the total banks' liabilities has been decreasing continually over the years (see figures 1.7 and 1.8). This equity capital is mainly composed of equity plus reserves that combine up to 98% of total equity capital.

The third largest component of total banks' liabilities are banks' short- and long-term borrowings from other banks and other financial institutions (see figures 1.7 and 1.8). Regarding the structure of total borrowings from other banks and other financial institutions, the dominant share of more than 70% during 1998-2009 is composed of short- and long-term borrowing from abroad, whose average share in the total banks' liabilities during 1998-2009 equals 7%. This ratio has been quite stable throughout the years, ranging from 6% to 9%. However, for some banks and in some periods this ratio has been much higher, reaching a share of 35% in some individual bank's liabilities. This indicates that banks in Macedonia are to some extent dependent on foreign financing by taking funds from other banks and/or financial institutions from abroad in the form of short- and long-term foreign currency borrowing including the subordinated deposits. The latter is defined as a foreign currency deposit with maturity over 1 year that is borrowed by the foreign-owned bank(s) in Macedonia from their 'parent' institution from abroad. Hence, banks' borrowing from abroad may indicate that domestic banks may be involved in some kind of 'arbitrage'. More precisely, domestic banks may borrow funds from abroad at lower interest rates and lend those funds in the domestic loan market at much higher interest rate (see section 1.7 and figure 1.26). Although it may be argued that the differences between domestic and foreign interest rates may be due to a premium reflecting the risk of depreciation of the Macedonian currency; however banks in Macedonia try to transfer this type of risk to their borrowers by either granting foreign currency loans or foreign currency indexed loans. Nonetheless, the banks are not fully hedged against the risk of currency depreciation because if depreciation happens, then their borrowers may not be able to fully repay their loans that may result in losses for the banks.

The rest of the items in the structure of total banks' liabilities such as the item 'other liabilities' that include payable interest, other liabilities in domestic and foreign currency is negligible, with an average share of 2% in during the period of analysis.

If we assess the currency structure of both banks' assets and liabilities, as shown on figure 1.10, we can notice that more than 50% of total banks' assets and liabilities are denominated and/or indexed to a foreign currency. Moreover, the shares of foreign currency and foreign currency indexed assets and liabilities in the structure of total banks' assets and liabilities respectively, have been increasing in the last two years.

Figure 1.10: Structure of total assets and liabilities according to their currency denomination, in percentage of total assets/liabilities, respectively



Source: NBRM.

Overall, this section has provided a general assessment of the assets and liabilities of the banking sector and changes in their structure over the years. It can be concluded that banks' assets and liabilities have been growing steadily through time, especially since 2003. Accordingly, the asset-to-GDP ratio, as an indicator of the level of financial intermediation, has also been increasing steadily over time. This implies that the level of financial intermediation in Macedonia has also been growing continually. However, compared to the more advanced transition economies from CSEE, the level of financial intermediation (measured by this ratio) remains low. Regarding the structure of banks' assets and liabilities, the dominant components are banks' outstanding loans and deposits respectively. Another important part of the structure of banks' liabilities is banks' foreign currency borrowing from abroad. Thus, we argued that banks may get involved in a kind of an 'arbitrage'. Another characteristic of the structure of the banks' assets and liabilities is that a majority of them (more than 50%) is denominated or indexed to a foreign currency. Having in mind that the dominant component of banks' assets is banks' outstanding loans to the non-financial private sector, and that these have importance in fulfilling the main research aims of the thesis (see section 1.3), a more detailed assessment of these is provided in the next section.

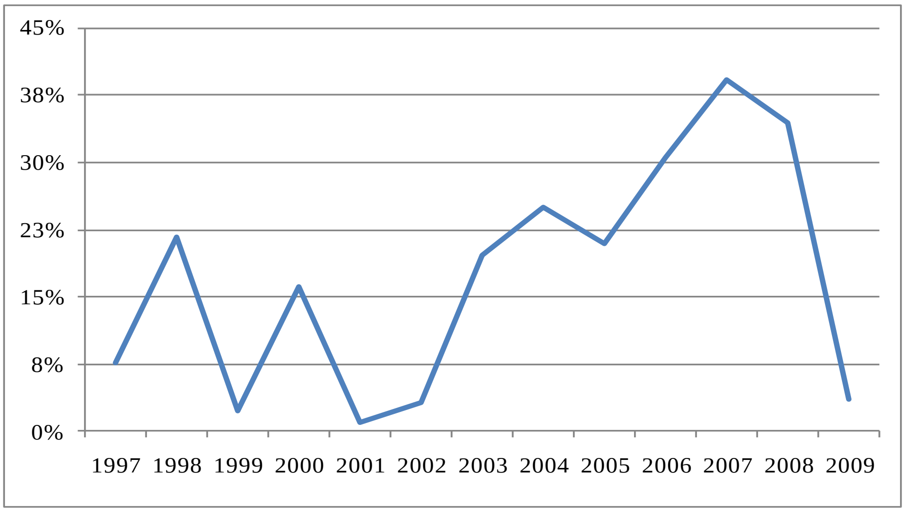
1.6 Stylised facts about banks' outstanding loans to the non-financial private sector in Macedonia

This section provides an assessment of the main developments of the loan market for the period 1997-2009. It presents a general overview of the movements of the total outstanding loans and the level of financial intermediation, measured by indicators such as credit-to-GDP ratio. In addition, this section analyses the main changes over time in the currency, maturity and sectoral structure of the total outstanding loans, and the share of non-performing loans (NPL) relative to total outstanding loans.

The reason for restricting the period of analysis from 1997 is due to data unavailability. The data used in this section is according to the new accounting methodology that took place from the beginning of 2009. Hence, the stock of outstanding loans and the rates of growth presented in this section may be different from those reported in the annual reports by the NBRM because the series used have been revised backwards. Some of the loan series such as the maturity structure, have only been revised backwards to 2002 and no earlier data is available.

The stock of banks' outstanding loans to the non-financial private sector in Macedonia has been increasing during the whole period of analysis (see figure 1.11), with an average annual rate of growth of 20%. Analysing the annual rates of growth of the outstanding loans throughout the years, two subperiods can be distinguished.

Figure 1.11: Annual growth rates of total outstanding loans (%)



Source: NBRM.

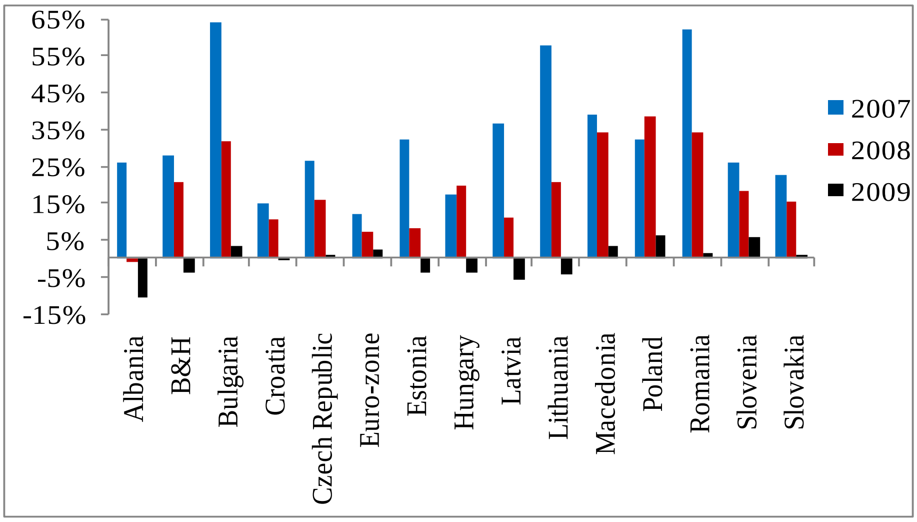
The first one is from 1997 to 2003, characterised by a relatively low credit growth and with considerable fluctuations, likely due to the political and military instability in neighbouring countries, as well as in the Republic of Macedonia in 2001. The average annual rate of growth during this period was around 9%, whereas the lowest rates of growth of total outstanding loans occurred in 1999 and 2001. The low credit growth in 1999 can be explained with the political instability caused by the military NATO intervention in Kosovo and Republic of Serbia. The instability is likely to have caused a lower demand for new loans by the private sector, as well as reduction in the loan supply by the banks due to the fears of possible borrowers' default (NBRM Annual Report, 1999a). In 2001 the loan growth reached its lowest rate during the period of analysis and this was the period of armed conflict in the western part of the country that affected the whole economy (see NBRM Annual Report, 2001a).

The second subperiod is from 2003 to 2009, with an average annual rate of growth of 25%. This period is characterised by a more stable economic and political environment in the region. Accordingly, the credit growth reached its highest levels of 39% and 34% in 2007 and 2008, respectively.

During this second subperiod (2003-2009), the lowest rate of credit growth occurred in 2009 probably due to the effects of the economic recession in the Macedonian economy (NBRM Annual Report, 2009a). The decline in economic activity resulted in lower loan demand and banks reduced the loan supply due to fears of borrowers' default and inability to realise their loan collateral (NBRM, 2009d, 2009e, 2009f and 2010). The reduction in the loan supply by banks was also enforced by the monetary policy measures that took place due to the economic recession. These included an increase in the reference policy rate (CB Bills rate) by 2 percentage points followed by an increase of the money market rate (MBKS) (see section 1.7 and figure 1.20); imposing constraints on the credit growth of banks and giving an increase in banks' reserve requirements (NBRM Annual Report, 2009a).

If we compare the annual rates of credit growth with those of other transition economies from CSEE and the Euro zone in 2007 and 2008 (the period before the economic recession; see figure 1.12), the credit growth in Macedonia was among the highest within these economies. This should not be surprising, having in mind the initial low level of financial intermediation measured through the credit-to-GDP ratio. The high credit growth rates in 2007 and 2008 in Macedonia may reflect a catching-up process due to the relatively underdeveloped loan market and low level of financial intermediation.

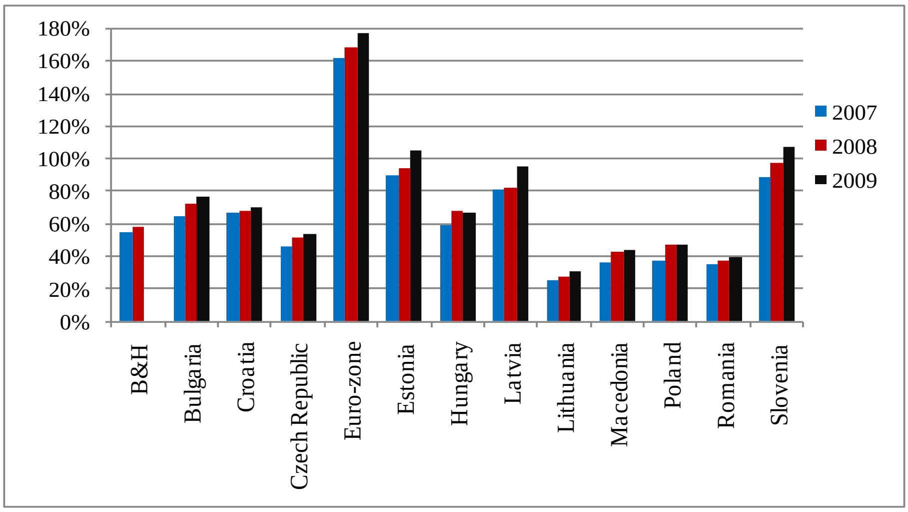
Figure 1.12: Annual rates of growth of total outstanding loans to non-financial private sector in CSEE and the Euro-zone, 2007-2009



Source: EUROSTAT and the web-sites of the respective central banks of the economies included in the figure.

Other indicators of the level of financial intermediation in Macedonia, i.e. the credit-to-GDP ratio tell a similar story. Before 2005, the credit-to-GDP ratio was below 20%. A rapid annual increase of around 6 percentage points of this ratio occurred during 2006-2008 and in 2008 it reached 41%. Nonetheless, the rate of growth of credit-to-GDP ratio was substantially reduced in 2009 due to the reduced growth in the stock of the outstanding loans, similar as with the other transition economies from CSEE (see figure 1.13). By comparing the credit-to-GDP ratio with the other economies from CSEE, it can be noticed that Macedonia had almost the lowest level of credit-to-GDP ratio during 2007-2009 (see figure 1.13). This suggests that the loan market in Macedonia is still underdeveloped and it needs more time to 'catch-up' with the level of development of the more advanced transition economies.

Figure 1.13: Credit-to-GDP ratio among CSEE and the Euro-zone, 2007-2009 (%)



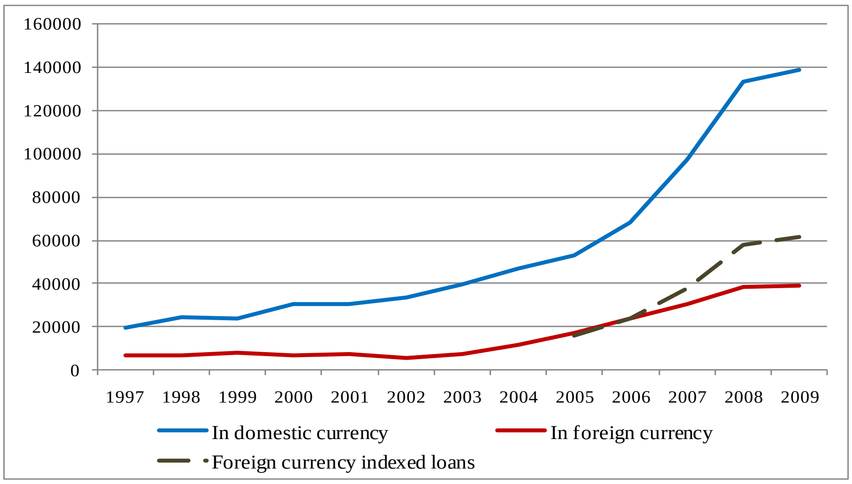
Source: EUROSTAT and the web-sites of the respective central banks of the economies included in the figure.

The currency structure of the banks' outstanding loans indicates that the dominant share, around 80% (average for 1997-2009) of the total outstanding loans, were in domestic currency (figure 1.14). However, when analysing domestic currency loans, we have to take into account that a relatively high proportion of them is composed of loans indexed to a foreign currency[6]. Their share in the domestic currency loans has been growing steadily through time, i.e. from 30% in 2005 to 44% in 2009. Analysing the dynamics of the foreign currency loans (see figure 1.14), two subperiods can be distinguished. The first one is up to 2003 and the second one from 2004 to 2009. During the first subperiod, the stock of foreign currency loans was more or less on a constant level. However, from 2004 this stock has been increasing continually, as was the

[6] The data is available from 2005.

case with the foreign currency indexed loans. The main reason for the former may be the amendments in the Law of Foreign Exchange Operations in the end of 2003 that allowed lending in foreign currency to all entities and for all purposes[7]. Consequently, after these amendments the annual rates of growth of the foreign currency loans in 2004 and 2005 reached around 57% and 51% respectively and their share in the total outstanding loans has also increased from 16% in 2003 up to 22% in 2009. However, in order to get a better picture of the level of currency substitution and the extent to which banks are hedged against the risk of currency depreciation of the Macedonian denar, we should take into account the share of foreign currency and foreign currency indexed loans in the total outstanding loans. The share of both of them has increased from 46% in 2005 to 57% in 2009 of the total outstanding loans. This may suggest that borrowers have become more and more exposed to the risk of currency depreciation over the years.

Figure 1.14: Currency structure of total outstanding loans (millions of denars)

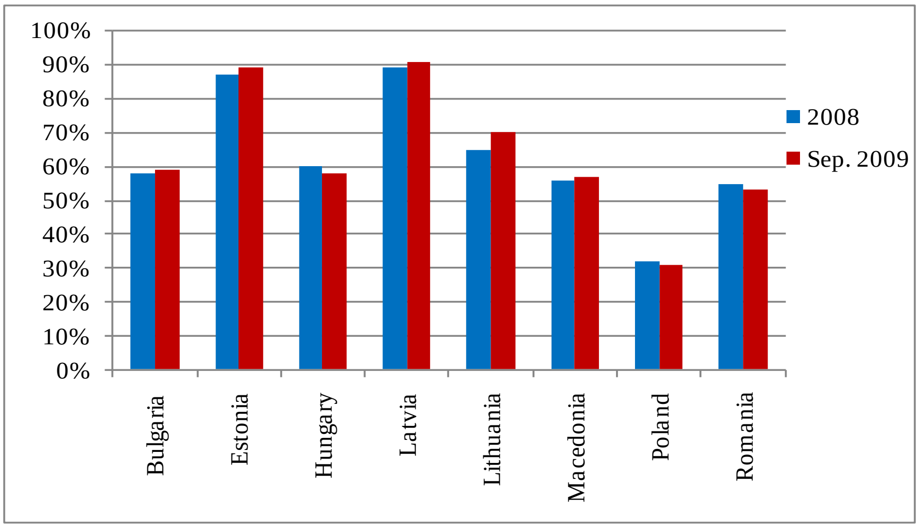


Source: NBRM.

A comparison of the share of foreign currency loans plus the foreign currency indexed loans in the total outstanding loans to the non-financial private sector among other more advanced countries from CSEE that are already members of the EU, is presented in figure 1.15. This may suggest that the presence of currency substitution in the Macedonian loan market may be on par with the average of the more advanced transition economies from the CSEE.

[7] Source: NBRM, Annual Report, 2004a.

Figure 1.15: The share of foreign currency and foreign currency indexed loans in the total outstanding loans to non-financial private sector among economies from CSEE (%)

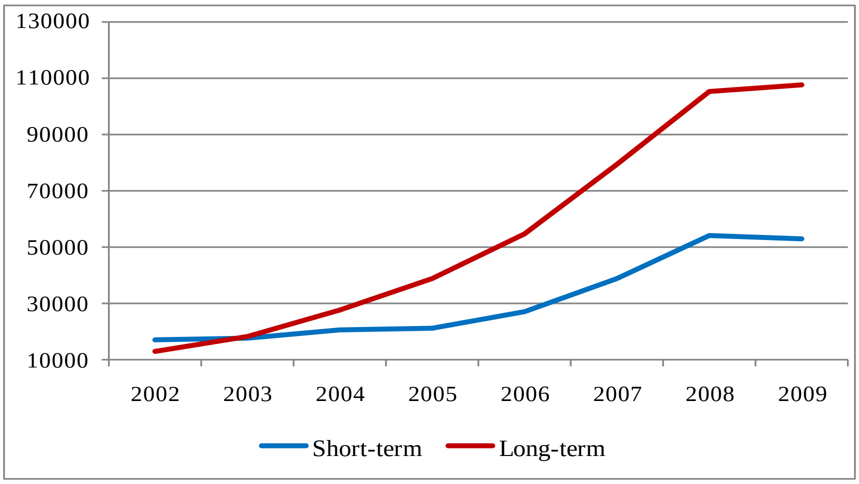


Source: ECB Financial Stability Review, December 2009. The data for Republic of Macedonia are from the NBRM.

The maturity structure of the domestic and foreign currency loans indicates that the majority is composed of long-term loans (average for the 2003-2009).

In assessing the maturity structure of the total outstanding loans, it can be noticed that up to the third quarter of 2003 short-term lending had the largest share in the structure of the total outstanding loans. However, since the last quarter of 2003 till present, there was a shift in the maturity structure of the total outstanding loans towards long-term lending (see figure 1.16) whose share in the total loans reached 60% in 2008 and 2009.

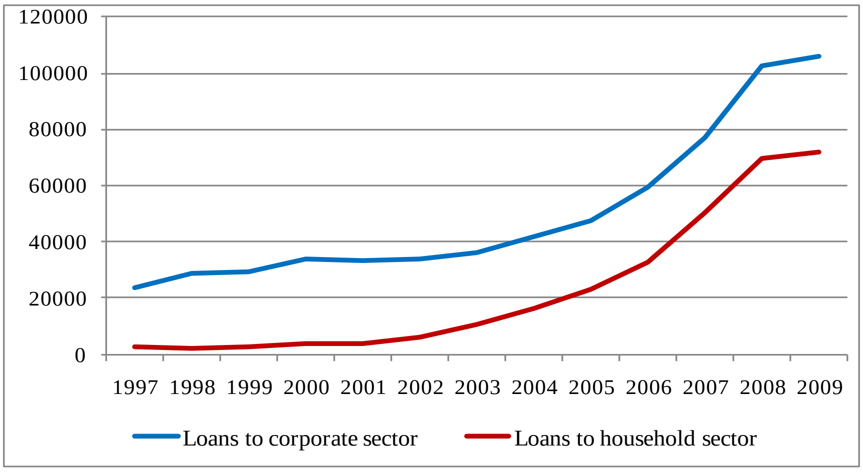
Figure 1.16: Maturity structure of total outstanding loans (millions of denars)



Notes: short-term loans are those with a maturity of up to one year, whereas long-term loans are those with a maturity over one year.
Source: NBRM.

The sectoral breakdown of total outstanding loans indicates that the largest proportion of banks' loans is extended to the corporate sector (figure 1.17). However, the share of households' loans has been increasing rapidly in recent years. For example, the average share of loans to the household sector relative to total loans during the period 1997-2003 was 10%, whereas their average share for the more recent period 2006-2009 has risen to 40%.

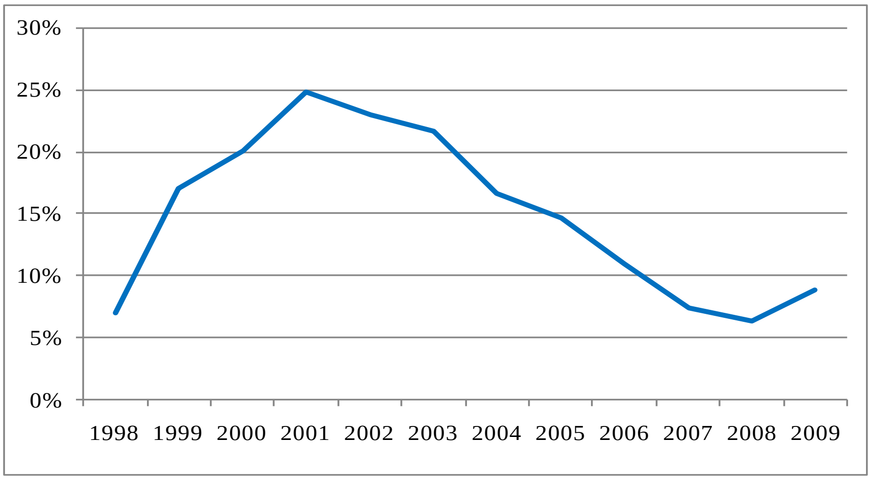
Figure 1.17: Sectoral structure of total outstanding loans (millions of denars)



Source: NBRM.

Another important part of the total outstanding loans, that may indirectly indicate the quality of the loan portfolio of the banks, is the share of the non-performing loans in total outstanding loans (NPL ratio). From figure 1.18 it can be seen that the share rose rapidly during the period 1998-2001. The sharpest annual increase occurred in 2001 at the time of armed conflict in the country. However, since 2001 the NPL ratio has been declining steadily and till the end of 2008 it had declined by approximately 19 percentage points, indicating an improvement in the quality of the loan portfolio of the banking system. However, in 2009, the NPL ratio increased again due to the economic recession in the Macedonian economy.

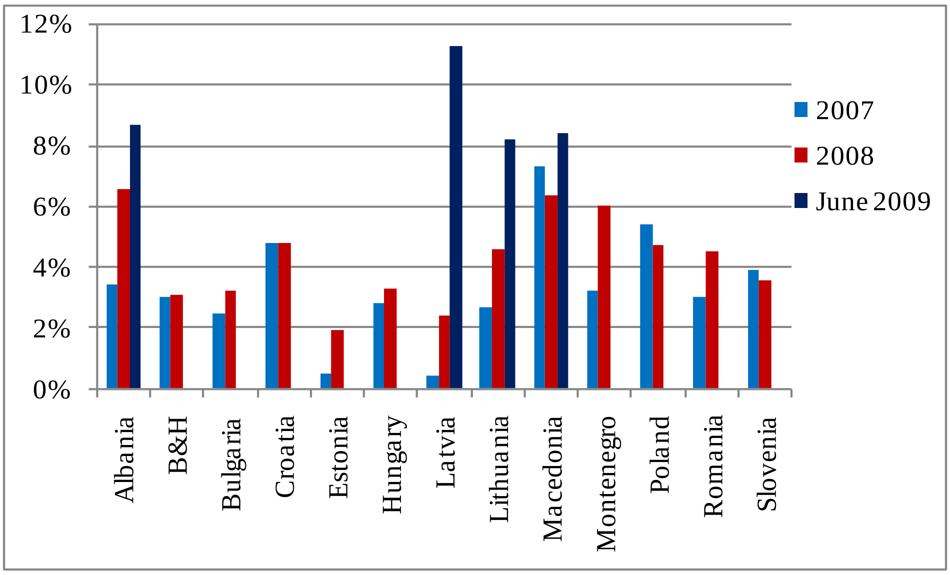
Figure 1.18: Non-performing loans as a percentage of total outstanding loans - NPL ratio (%)



Source: NBRM

The comparison of the NPL ratio with that of other economies from CSEE in figure 1.19, indicates that the Macedonian banking system in 2007-2009 had amongst the highest NPL ratio. Although the data in figure 1.19 are taken from a single source, they may not be consistent given the various definitions of the NPL in each economy. Therefore, the presented figures should be interpreted cautiously and should be taken as a rough indicator for the quality of the loan portfolio among CSEE economies.

Figure 1.19: Non-performing loans as a percentage of total outstanding loans to non-financial private sector (NPL ratio) among economies from CSEE (%)



Source: EBRD Transition Report, November 2009. The data for Macedonia are from NBRM.

In summary, it can be concluded that during the two years before the start of the economic recession in 2009, the credit sector developed rapidly. This is illustrated by the relatively high rates of credit growth and growth of the credit-to-GDP ratio, suggesting an increased level of financial intermediation. Another characteristic of the structure of the loan market is the gradual improvement in the quality of the loan portfolio, as illustrated by the continual decline in the NPL ratio up to 2009. Additionally, it can be concluded that currency substitution, as measured by the share of the foreign currency loans and foreign currency indexed loans, is relatively high. This is typical of many other transition economies that have either fixed exchange rate regime or a currency board, such as the Baltic States and Bulgaria (see figure 1.15). What determines banks' lending decisions is the subject of detailed empirical analysis in chapter 5. Hence, in order to get a clearer picture about the development of the banking sector, it is necessary to assess the movements of the main interest rate series, which is the subject of analysis of the next section.

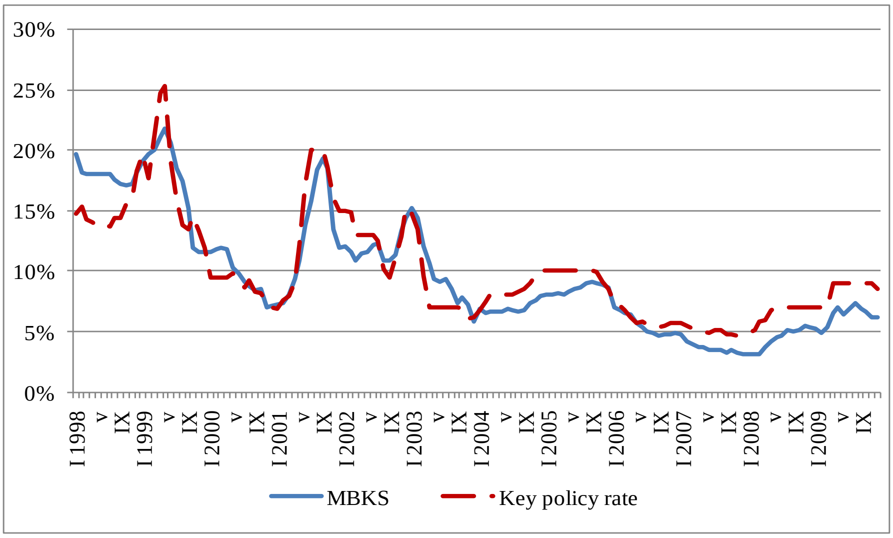
1.7 Overview of interest rate movements

This section aims to provide an overview of interest rate movements. Accordingly, we aim to assess the movements of the key policy rate, money market rate and banks' lending and deposit rates for the period ranging from 1998 to 2009.

In analysing the movements of the key policy rate, it is important to mention that during the period of analysis, as already mentioned in section 1.4, there was a change in the main policy instrument and thus, the key policy rate. Until the end of 1999 the key policy rate was the interest rate from the auctions of deposits by the NBRM with a maturity of 7 days, while from 2000 the key policy rate has been the interest rate on central bank bills (CB Bills rate).

In general, starting from 1998, the key policy rate had a downward trend (figure 1.20). This rate declined from around 15% at the beginning of 1998 to around 5% at the end of 2007. Over the analysed period, as can be seen from figure 1.20, the sharpest increase in the key policy rate occurred in May 1999 when it reached its peak of 25%. The main reason for this sharp increase were the military actions and the armed conflict in the neighbouring countries, Serbia and Kosovo, that created psychological fears among economic agents in Macedonia. Consequently, there was a sudden withdrawal of deposits from the banks and difficulties with the loan repayments that resulted in a deterioration in the liquidity of the banking sector in a period already characterised as a period with deficiency of liquid assets of the banking system (see section 1.4; NBRM Annual Report, 1999a). Therefore, the demand for liquid assets by the banks increased sharply, for which the main source were the auctions of deposits by the NBRM. This ultimately resulted in a sharp increase in the key interest rate. However, after the end of the armed conflict and the political stabilisation of the region, the liquidity of the banks started to return to normal levels and the demand for deposits declined, resulting in reductions in the key policy rate.

Figure 1.20: Movements of the nominal key policy rate and the money market rate (MBKS) in Macedonia, 1998-2009 (%)



Source: NBRM.

From 2000, due to the change in the characteristics of the banking system from deficient to structural excess liquidity, the main monetary instrument became the sale of CB Bills[8] with maturities of 7, 14 and 28 days. However, the causes of the excess liquidity of the banks in Macedonia and on what empirical evidence the decision of the monetary policy authorities to shift in the key monetary policy instrument is based, is not mentioned anywhere in the annual reports of the NBRM.

Throughout 2000, the new referent policy rate (now the CB Bills rate with maturity of 28 days) has been declining continually. In 2001, a sharp increase in the key policy rate occurred again. The main reason for this sharp increase was the armed conflict in the country. More precisely, due to large fiscal and related military expenditures by the government, banks' liquidity increased substantially and that created pressures on the foreign exchange market for a depreciation of the Macedonian denar. Accordingly, for the purpose of maintaining the fixed nominal exchange rate, the NBRM had to intervene in the money market by withdrawing liquidity from the banking system through auctions of CB Bills whose interest rate increased to 18% in September 2001. After 2001 with the end of the armed conflict and greater political and economic stability, and with the

[8] Throughout the period, depending from the monetary developments and economic environment, the type of the auctions of CB Bills was changing from "interest rate tender" to "volume tender" (see table 1.7).

ensuing reduction in the level of liquidity of the banking system, the CB Bills rate in general had a downward trend.

It is worth noting that after the armed conflict and due to the economic and political stabilisation of the country, the CB Bills with maturity of 14 and 7 days were abolished in January 2002 and March 2005, respectively (source: NBRM Annual Report, 2002a and 2005a). Accordingly, the only CB Bills used as an instrument by the Central Bank was the CB Bills with maturity of 28 days.

During the last two years of the sample period (2008-2009), the key policy rate started to increase again. The major reason for the gradual increase in the key policy rate during 2008 was the inflationary pressures caused by the sharp increase of the world prices on some of the imported goods such as food, oil and energy products. Additionally, due to the relatively high expansion of the economic activity in 2008 (see table 1.1); there was also a demand pressure on the domestic price level. Consequently, although the NBRM is not an inflation targeter, it gradually increased the referent rate in order to reduce the inflationary pressures in the domestic economy, with the assumption that those changes in the key policy rate will be transmitted on banks' retail rates.

Regarding the gradual increase in the key policy rate during 2009, the major reason was the beginning of the economic recession in the domestic economy. Accordingly, due to reduced exports and the substantial reduction in foreign direct and portfolio investment and private transfers, the inflow of foreign currency went down sharply. This caused pressures for depreciation of the domestic currency in the foreign exchange market. An additional reason that reinforced these pressures for depreciation of the domestic currency was the psychological fear in the household sector of possible depreciation of the domestic currency, which led households to suddenly start to convert their savings, mainly into Euros. As a reaction to that, the NBRM increased the key policy rate in order to reduce the liquidity of the banks and hence, the pressures of the foreign exchange market (NBRM Annual Report, 2009a). As can be seen from table 1.9, this reaction of the NBRM is the reverse of the reaction of the central banks for almost all economies from CSEE and the European Central Bank (ECB).

By comparing the referent policy rate for the economies from CSEE (table 1.9) during the period before the economic recession (before 2009), it can be noticed that the key policy rate of the Republic of Macedonia was in the middle range among the countries of comparison, but much higher than that of the ECB. During 2008, due to the increase in world prices of many commodities, all of the economies were faced with higher inflationary pressures and reacted in the same direction by increasing policy rates. However, in 2009 the reactions of the central banks in adjusting their key policy rates were different, due to the differences in the monetary poly regimes. Namely, almost all the rest of the central banks included in table 1.9 (apart from Croatia), during the economic recession in 2009 reacted by reducing their referent rates in order to stimulate consumption and investment demand in their national economies. However, it should be taken into account that majority of them have a different monetary regime, i.e. inflation targeting, whereas the NBRM together with the Croatian National Bank conducts a regime of a *de facto* fixed exchange rate regime that imposes a different reaction of the monetary policy makers in different phases of the economic cycle.

Table 1.9: The key nominal policy rates of ECB and CSEE economies, end of period (%)

	2003	2004	2005	2006	2007	2008	2009
Albania	6.50	5.25	5.00	5.50	6.25	6.25	5.25
Bulgaria	2.83	2.37	2.05	3.26	4.58	5.77	0.55
Croatia	/	/	3.50	3.50	4.06	6.00	6.00
Czech Republic	2.00	2.50	2.00	2.50	3.50	2.25	1.00
Eurozone	2.00	2.00	2.25	3.50	4.00	2.50	1.00
Hungary	12.50	9.50	6.00	8.00	7.50	10.00	6.25
Macedonia	6.15	10	8.52	5.74	4.77	7.00	8.50
Poland	5.25	6.50	4.50	4.00	5.00	5.00	3.50
Romania	20.40	17.96	7.50	8.75	7.50	10.25	8.00
Serbia	10.63	16.30	19.16	15.35	9.57	17.75	9.50
Slovakia	6.00	4.00	3.00	4.75	4.25	2.50	1.75

Source: Central Bank web-sites of the respective countries and the ECB.

In order to assess the movements of the money market interest rate, we consider the average weighted interbank interest rate (MBKS) that includes all transactions on the money market whose longest maturity is up to 3 months.

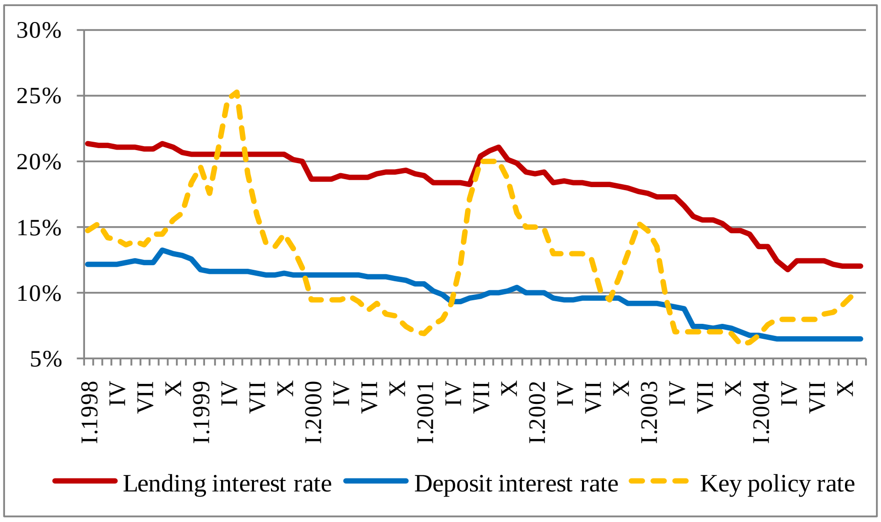
As shown on figure 1.20, the movements in the MBKS rate, in general, are similar to the key policy rate; indicating that there may be a relatively high correlation among the two rates. For example, the correlation coefficient of the levels of both rates for the period 1998-2009 is 0.93 and is statistically significant at 5% level. In general, the MBKS, similar to the key policy rate, had a downward trend over the analysed period. More specifically, the MBKS declined from nearly 20% at the beginning of 1998 to nearly 3% at the end of 2007. However, there is a divergent movement between the MBKS rate and the key policy rate in 2009. More precisely, in April 2009, the key policy rate was increased by 2 percentage points and afterwards it was kept constant till the end of the year. In contrast, the MBKS rate in 2009 fluctuated (see figure 1.20).

In analysing banks' retail rates two subperiods will be discussed. The first one is from 1998 to 2004 and the second one from 2005 till present. The reason for dividing the sample period into two is changes in the methodology of collecting and constructing the banks' retail rates series. During the first subperiod, as a result of a simplistic statistical methodology, there is only one interest rate series available for both lending and deposit rates, respectively. During the second subperiod, the interest rate series are collected and constructed according to a new accounting methodology (for details see later in this section).

In the first subperiod, banks' lending rate is calculated as a weighted average of short-term denar loans with maturities up to 1 year, including both household and corporate sectors. The banks' deposit rate represents the interest rate of short-term denar deposits, with a maturity of 3 months for the household sector only[9].

[9] Source: NBRM, 2001c.

Figure 1.21: Movements in the nominal lending, deposit rates and the key policy rate in Macedonia for the period, 1998-2004 (%)



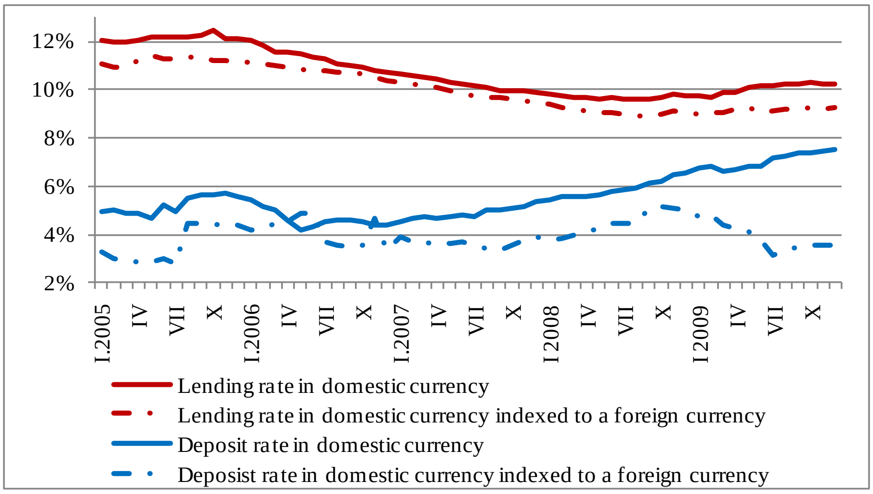
Source: NBRM.

Examination of the lending and deposit rates during the first subperiod, 1998-2004, indicates a downward trend (see figure 1.20). The sharpest increase of the lending rate occurred in 2001, whereby in September it reached almost the same level as at the beginning of 1998 of 21%. The same change can be noticed for the deposit rates that increased substantially during 2001 (see figure 1.20), but not at the same pace as the lending rates. A possible explanation for this sharp increase in the lending rates may be the higher risk of borrowers' default and worsening of the quality of the loan portfolio associated with the armed conflict in the country (see section 1.6 and figure 1.18). Another explanation mentioned in the NBRM Annual Report (2001a) was that banks followed the pattern of the key policy rate and/or MBKS rate in adjusting their lending rates. An explanation for the gradual increase of the deposit rate during 2001 is that banks' were faced with a withdrawal of deposits due to the psychological fears among the people about the security and economic uncertainty in the domestic economy due to the armed conflict. Consequently, the banks, in order to maintain their stock of deposits, reacted by increasing deposits rates, making them more attractive for the savers (NBRM Annual Report, 2001a). Nonetheless, in the annual report these explanations are not empirically tested and no more detailed explanation is offered.

After the end of the armed conflict and the political and economic stabilisation of the country from 2002, banks' lending and deposit rates started to decline rapidly. During the assessed period, it is worth noting that after the armed conflict in 2001, also the interest rate spread between the lending and deposit rates started to decline continually (see figure 1.25). According to the NBRM Annual Report (2002a - 2004a) as well as the working paper series published by the NBRM (Kadievska-Vojnovic and Georgievska, 2006); the major reasons for the gradual decline in banks' retail rates and the interest rate spread after 2001 are the following factors: *a)* increased competitiveness through the years; *b)* entrance of foreign capital; *c)* increased political and macroeconomic stability in the region (especially from 2001); *d)* improvement in the quality of the loan portfolio since 2001 and *e)* the more favourable macroeconomic environment in Macedonia since 2001. Nonetheless, for all of these explanations no detailed empirical evidence is offered. Consequently, testing if some of these factors have really affected banks' retail rates will be subject of analysis later on in chapter 3.

During the second subperiod 2005-2009, the lending and deposit interest rates were calculated according to a new statistical methodology. More precisely, both interest rate series are now available disaggregated according to their currency structure. They are calculated as a weighted average of their maturity and sectoral structure, including the interest rates on short and long term loans/deposits of both household and corporate sectors (source: NBRM, 2006d).

Figure 1.22: Movements of the nominal lending and deposit rates in domestic currency and in domestic currency indexed to a foreign currency in Macedonia respectively, 2005-2009 (%)



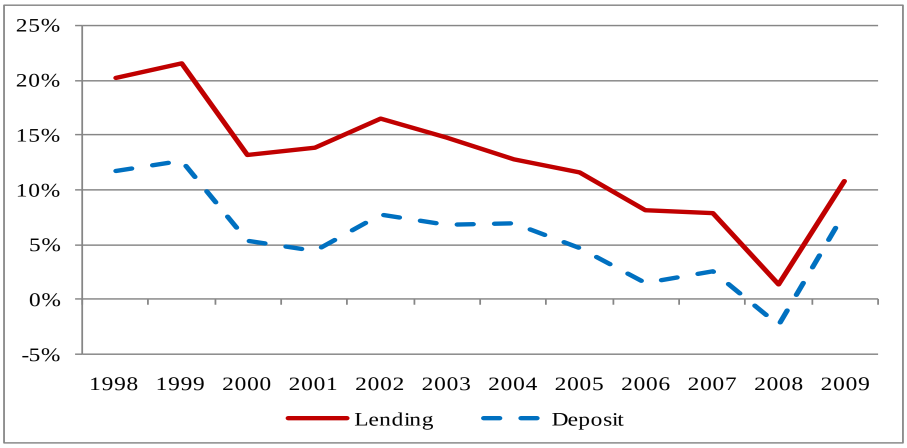
Source: NBRM.

Analysing the movements of lending rates in domestic currency and in domestic currency indexed to a foreign currency respectively, from figure 1.22, it can be seen that they have very similar patterns. The major difference is that the lending rate indexed to a foreign currency has a lower level by approximately 0.6 percentage points (average for 2005-2009), compared to the lending rate in domestic currency. This may be due to the lower risk premium associated with the risk of currency depreciation. Hence, the banks may charge lower rates. The downward movement of both types of lending rates continued till the last quarter of 2008 when they started to rise again due to the beginning of the economic recession in the country.

Assessing the movement of deposit rate in domestic currency and in domestic currency indexed to a foreign currency from figure 1.22 it is clear that they have different patterns, especially since the beginning of 2009. Since that time, the deposit rate in domestic currency has continued to rise, whereas the deposit rate indexed to a foreign currency has declined gradually. The latter may be again explained by the higher risk of currency depreciation since the beginning of economic recession in the domestic economy for which the banks reduced the deposit rate indexed to a foreign currency. In contrast, the banks increased the deposit rates in domestic currency in order to attract additional savings a source of financing their lending activities (NBRM Annual Report, 2009a).

Regarding the movements of the banks' retail rates in real terms, figure 1.23 suggests that their movement is quite similar to those of the nominal rates (see figures 1.21 and 1.22). The exception is the deposit rate in real terms in 2008 when it became negative due to the higher inflation (see figure 1.23), though the deposit rate in nominal terms did increase (see figure 1.22). The falling trend of the banks' retail rates in real terms during 2006-2008 coincides with the falling country risk premium during the same period (see figure 1.27).

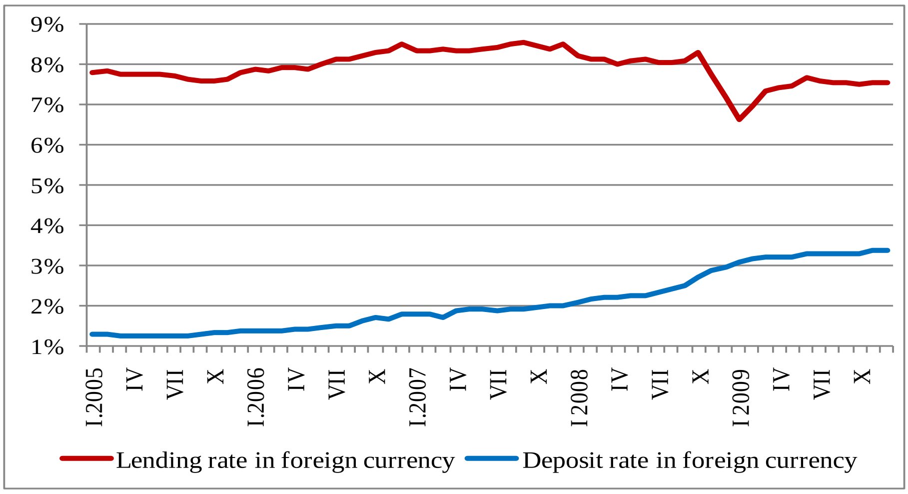
Figure 1.23: Movements of the lending and deposit rates in real terms in Macedonia, 1998-2009 (%)



Source: author's own calculations upon the data from the NBRM and State Statistical Office.

Analysing the movements of banks' retail rates in foreign currency, lending rates increased marginally till the end of 2008 whereas the deposit rates increased more rapidly (see figure 1.24). However, since the beginning of 2009, there is a divergent movement between these two rates, i.e. the lending rate in foreign currency has declined, whereas the deposit rate in foreign currency continued to rise. Another characteristic of the retail rates in foreign currency is that both of them during the whole period of analysis (2005-2009), have been at a lower level compared to the banks' retail rates in domestic currency. This may reflect the lower currency depreciation risk premium by the banks. Additionally, both retail rates in foreign currency have a lower variability than the same series denominated in domestic currency. The standard deviations of lending and deposit rates in foreign currency equal 0.0041 and 0.0072 respectively; while the standard deviations of the same series in domestic currency equal 0.0094 and 0.0093 respectively.

Figure 1.24: Movements of the nominal lending and deposit interest rates in foreign currency in Macedonia, 2005-2009 (%)



Source: NBRM.

By comparing the movements of banks' retail rates in domestic currency among the CSEE economies, from table 1.10 it can be seen that all of them before the beginning of economic recession in 2009 had a downward trend. By comparing the levels of banks' retail rates, we can notice in Macedonia had among the highest levels of banks' retail rates in CSEE (see table 1.10).

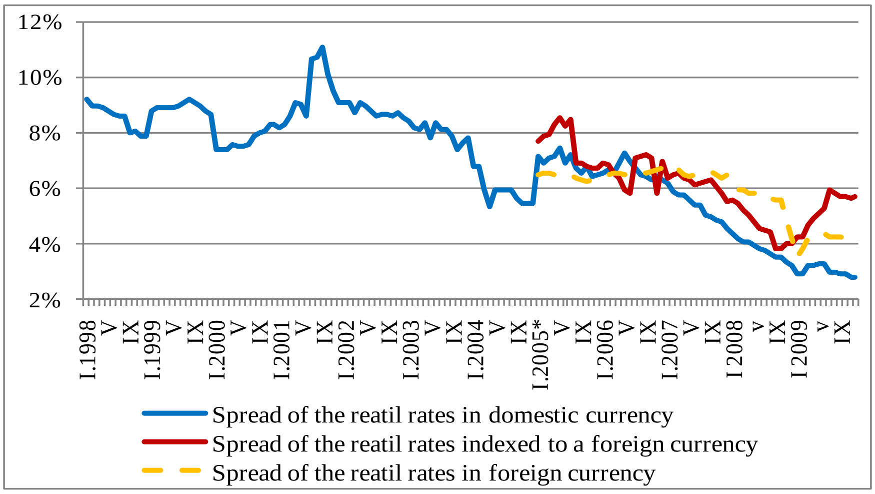
Table 1.10: Nominal lending and deposit rates in domestic currency for the economies from CSEE, 2004-2009 (%, end of period)

	2004		2005		2006		2007		2008		2009	
	Lending	Deposit	Lending	Deposit	Lending	Deposit	Lending	Deposit	Lending	Deposit	Lending	Deposit
B&H	10.28	3.72	9.61	3.56	8.01	3.69	7.17	3.56	6.98	3.49	7.93	3.60
Bulgaria	8.87	3.05	8.66	3.08	8.89	3.17	10.00	3.68	10.86	4.44	11.34	6.18
Croatia	11.75	1.87	11.19	1.71	9.93	1.72	9.33	2.34	10.07	2.82	11.55	3.20
Czech Republic	6.03	1.28	5.78	1.17	5.59	1.19	5.79	1.32	6.25	1.61	5.99	1.27
Estonia	5.66	2.16	4.93	2.13	5.03	2.84	6.46	4.37	8.55	5.72	9.39	4.82
Hungary	12.82	9.09	8.54	5.17	8.08	7.45	9.09	6.81	10.18	9.92	11.04	5.82
Latvia	7.45	3.27	6.11	2.78	7.29	3.53	10.91	6.06	11.85	6.34	16.23	8.04
Lithuania	5.74	1.22	5.27	2.40	5.11	2.97	6.86	5.40	8.41	7.65	8.39	4.81
Macedonia	11.90	6.52	12.12	5.60	10.70	4.37	9.88	5.34	9.76	6.55	10.26	7.49
Montenegro	/	4.87	/	4.84	11.15	5.06	9.20	5.08	9.24	3.82	9.36	3.81
Romania	25.61	11.54	19.60	6.42	13.98	4.77	13.35	6.70	14.99	9.51	17.28	11.99
Serbia	15.53	3.60	16.83	3.71	16.56	5.06	11.13	4.08	18.11	7.32	11.78	5.06
Slovenia	8.65	3.82	7.80	3.18	7.41	2.80	5.91	3.60	6.66	4.05	/	/

Source: IMF, IFS and the NBRM.

In analysing the interest rate spread in Macedonia between the lending and deposit rates, frequently used as a rough indicator of the efficiency of the banking sector, it can be noticed that it was relatively volatile and at a high level during the period 1998-2001 (see figure 1.25). The average interest rate spread of the retail rates in domestic currency for this period was 8.7 percentage points. It reached the maximum level of 11 percentage points in September 2001 when the lending rate in domestic currency also reached its peak. However, afterwards it started to decline continually, and by the end of 2009, it equalled around 3 percentage points. A similar downward trend of the interest rate spread can be noticed for the retail rates in foreign currency, whereas the pattern of the interest rate spread of the retail rates indexed to a foreign currency shows a different (upward) pattern from the beginning of 2009 (see figure 1.25).

Figure 1.25: Movements of the interest rate spread between the various types of nominal lending and deposit rates in Macedonia, 1998-2009 (percentage points)



* From 2005, the lending and deposit rates are calculated according to a different accounting methodology and are not directly comparable with the previous period.
Source: Author's own calculation upon the data from NBRM.

If we compare the dynamics of the interest rate spread among the economies from CSEE, as shown in table 1.11, in general we can observe a downward trend in almost every economy till the beginning of the economic recession in 2009. In 2009 in majority of the economies, the interest rate spread has increased, however this was not the case with the Republic of Macedonia, Romania or Serbia. The interest rate spread during the period of analysis in the Republic of Macedonia has been among the highest in CSEE, indicating that banking sector efficiency is still lagging behind the more advanced economies from CSEE and is still among the most concentrated ones (see table 1.3). This indicator provides consistent implications with the EBRD's index for the banking sector reform and interest rate liberalisation (section 1.4 and table 1.2).

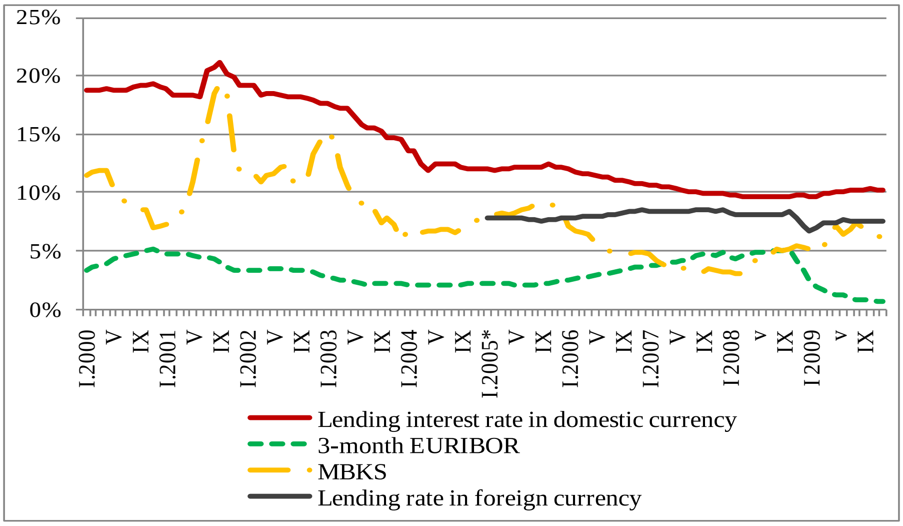
Table 1.11: Nominal interest rate spread between the lending and deposit rates for the economies from CSEE, 2004-2009 (%, end of period)

	2004		2005		2006		2007		2008		2009	
	Lending	Deposit	Lending	Deposit	Lending	Deposit	Lending	Deposit	Lending	Deposit	Lending	Deposit
B&H	10.28	3.72	9.61	3.56	8.01	3.69	7.17	3.56	6.98	3.49	7.93	3.60
Bulgaria	8.87	3.05	8.66	3.08	8.89	3.17	10.00	3.68	10.86	4.44	11.34	6.18
Croatia	11.75	1.87	11.19	1.71	9.93	1.72	9.33	2.34	10.07	2.82	11.55	3.20
Czech Republic	6.03	1.28	5.78	1.17	5.59	1.19	5.79	1.32	6.25	1.61	5.99	1.27
Estonia	5.66	2.16	4.93	2.13	5.03	2.84	6.46	4.37	8.55	5.72	9.39	4.82
Hungary	12.82	9.09	8.54	5.17	8.08	7.45	9.09	6.81	10.18	9.92	11.04	5.82
Latvia	7.45	3.27	6.11	2.78	7.29	3.53	10.91	6.06	11.85	6.34	16.23	8.04
Lithuania	5.74	1.22	5.27	2.40	5.11	2.97	6.86	5.40	8.41	7.65	8.39	4.81
Macedonia	11.90	6.52	12.12	5.60	10.70	4.37	9.88	5.34	9.76	6.55	10.26	7.49
Montenegro	/	4.87	/	4.84	11.15	5.06	9.20	5.08	9.24	3.82	9.36	3.81
Romania	25.61	11.54	19.60	6.42	13.98	4.77	13.35	6.70	14.99	9.51	17.28	11.99
Serbia	15.53	3.60	16.83	3.71	16.56	5.06	11.13	4.08	18.11	7.32	11.78	5.06
Slovenia	8.65	3.82	7.80	3.18	7.41	2.80	5.91	3.60	6.66	4.05	/	/

Source: IMF, IFS and the NBRM.

Another characteristic of the lending rate series in Macedonia, regardless of which currency they are denominated, is that they have been much higher than the referent foreign money market rate (3-month EURIBOR rate taken as a proxy indicator) (see figure 1.26). This may be consistent with the argument, as already discussed in sections 1.5 and 1.6, that banks may have actually been involved in some kind of an 'arbitrage' by borrowing from aboard by a lower interest rate and placing those funds in the domestic loan market by a much higher interest rate.

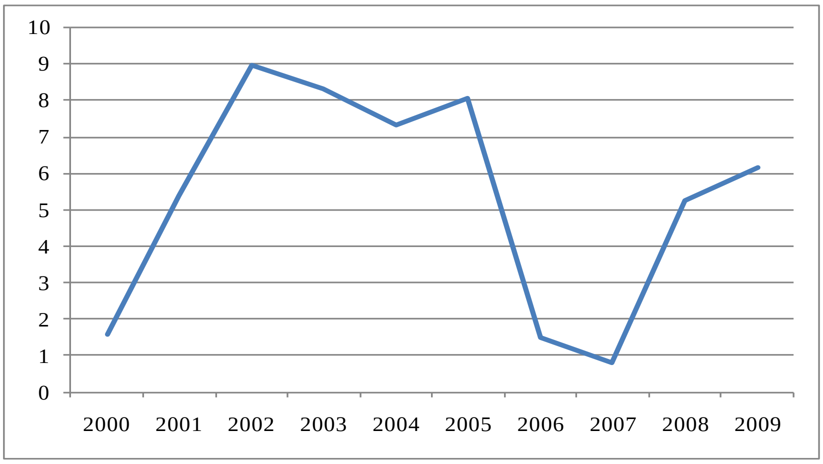
Figure 1.26: Movements of the foreign referent money market rate (3-month EURIBOR), domestic lending rates and the MBKS rate, 2000-2009 (%)



* From 2005, the lending rate in domestic currency is calculated according to a different accounting methodology and is not directly comparable with the previous period.
Source: EUROSTAT and NBRM.

Regarding the assessment of the country risk premium, in absence of any official data series, we roughly assess it by the movements of the interest rate spread between the Macedonian money market rate (MBKS) and the EMU money market rate (the 3-month EURIBOR), both of them in real terms. As can be seen from figure 1.27, this indicator increased sharply during 2001 and 2002 probably due to the armed conflict in the country. However, with the economic and political stabilisation of the country, it started to decrease in 2006-2008 and again it increased sharply in 2009. This is probably due the economic recession in the economy when the pressures on the foreign exchange market were quite high which increased the risk of depreciation of the domestic currency.

Figure 1.27: Movements of the country risk premium for the period 2000-2009 (percentage points)



Source: author’s own calculations upon the data from NBRM and EUROSTAT.

In summary, it can be concluded that in general, all interest rate series assessed in this section since 1998 till the end of the armed conflict in 2001, were relatively high. Since the end of the armed conflict and the economic and political stabilisation of the country, i.e. from 2002 till the beginning of the economic recession in 2009, there was a declining trend at all interest rate series. This trend can be observed in the key policy rate, money market rate and lending and deposit rates in domestic currency and lending rates indexed to a foreign currency. However, this is not the case with the banks’ retail rates in foreign currency. Compared to the other economies from CSEE, the Republic of Macedonia together with Bulgaria, Croatia, Romania and Serbia, has the highest retail rates. A similar conclusion can be obtained for the interest rate spread between the lending and deposit rates that has be declining continually during the whole period of analysis and may indicate increased efficiency in the banking sectors over time. Nonetheless, the level of interest rate spread is still among the highest in economies from CSEE, implying that the efficiency in the Macedonian banking sector is lagging behind the more advanced transition economies from CSEE. Additionally, the domestic lending rates as well as the MBKS rate have been much higher than the foreign referent money market rate, pointing that banks may have been involved in an 'arbitrage'. The country risk premium, although falling during in 2006-2008, it started to rise in 2009.

1.8 Conclusions

The objective of this chapter was to provide a general introduction to the overall thesis by presenting the main aims and objectives of the thesis. In this chapter we have identified the main characteristics of monetary policy in Macedonia and how it has been conducted in recent years. We have also provided an assessment of the structure of the Macedonian banking sector, followed by an initial assessment of banks' assets and liabilities, the major developments in the loan market and interest rate movements.

It can be concluded that the banking sector in Macedonia is still in the process of development. This can be noticed from the relatively high level of concentration in the banking sector and the relatively slow pace of banking sector reforms assessed by the EBRD's index. Regarding the former, the Macedonian banking sector is among the most concentrated in CSEE. Regarding the latter, Macedonia has completed the lowest level of banking sector reforms amongst these economies. Considering the ownership structure, more than 90% of banking sector capital is privately owned, whilst foreign capital has been increasing rapidly in recent years as the number of banks that are predominantly foreign-owned has also increased rapidly. Compared to the other economies from CSEE, the share of predominantly foreign-owned banks in the total banks' assets is among the highest.

Regarding banks' assets and liabilities, they have been developing quite rapidly in Macedonia, especially during the period before the recent economic recession. They have been growing at a relatively high pace, indicating a catching-up process with the more advanced economies in transition and developed economies in the Euro-zone. This higher level of financial intermediation is reflected in the growing rates of assets-to-GDP ratio, though it remains amongst the lowest in CSEE. This is similar with the loan market where it was also developing rapidly before the beginning of economic recession. This can be inferred from the relatively high rates of growth before 2009 as well as the rapid growth of credit-to-GDP ratio. Concerning the currency structure of the outstanding loans, the share of foreign currency and foreign currency indexed loans has always been above 50% of total outstanding loans. Compared to the more advanced economies from CSEE, this ratio is still not as high as in other economies such as Estonia and Latvia. The quality of the loan portfolio (measured by the NPL ratio), has been improving gradually, up to the recent recession, however it is still among the highest in CSEE. Moreover, the indicator used for the country risk premium started to increase again in 2009.

Another indicator of the positive changes in the structure of the financial and the banking sectors is the general reduction in the major interest rates up to the beginning of 2009. Despite the falling banks' retail rates, they remain amongst the highest in CSEE. An additional indicator of the positive changes in the banking sector is the falling interest rate spread between the lending and deposit rates. However, compared to the other CSEE economies, the interest rate spread in Macedonia remains among the highest. This may indicate that the efficiency of the banking sector in Macedonia is still lagging behind the more advanced CSEE economies. What are the main reasons for the declining trend of banks' retail rates and what determines their lending rate adjustment decisions will be the subject of a comprehensive empirical analysis in chapter 3.

After assessing the main developments in the banking sector, loan market and interest rates and raising some key questions, the next step is to begin to address the main research questions of this thesis: are the interest rate and bank lending channels effective, what determines banks' lending rate and loan supply decisions and is there a possibility for an ‘arbitrage’ by borrowing at a cheaper price from abroad and placing those funds in the domestic loan market at much higher prices. Accordingly, in order to fulfil the major aims of the thesis and to explore these issues, we aim to conduct a detailed empirical analysis on these aspects later in the thesis. Hence, the main task of the next chapter is to assess the various theories and empirical studies that investigate what determines banks’ retail rate setting decisions as a foundation for the later economic and statistical analysis.

CHAPTER 2: REVIEW OF THE THEORY AND EMPIRICAL EVIDENCE ON THE DETERMINANTS OF INTEREST RATE PASS-THROUGH

2.1 Introduction

This chapter is related to the second and the third research questions of this thesis; the size of lending rate adjustment and what factors have a significant impact upon it (see section 1.1). The main aims are to critically assess the key theoretical aspects of how banks set their retail interest rates and to explore what are the major factors that affect banks' retail rates setting decisions. This chapter also provides a critical survey of the existing empirical studies that investigate the main determinants of interest rate pass-through in various economies, classified according to the different empirical approaches applied. The main value added of this chapter to the overall thesis is that it provides a comprehensive survey of the theoretical models of how banks set their retail rates. It also examines different empirical approaches applied in the literature that will help us in conducting the empirical analysis in chapter 3, aiming to investigate what factors affect the size of adjustment of lending rates among banks in Macedonia.

The main underlying theoretical models that analyse how banks' set their retail rates are those of Rousseas (1985) and Ho and Saunders (1981). They are the basic formal models that consider banks' retail rate adjustment based on the mark-up pricing model typically applied in a non-perfect competitive environment. Additional approaches that are also critically surveyed in this chapter are the theories of asymmetric information, switching costs, relationship lending and "menu costs".

The survey of empirical studies concentrates on how the underlying theoretical model has been developed and modified through time in respect of the basic macro and microeconomic factors that are seen to affect the interest rate pass-through as well as the various econometric approaches applied. This part of the chapter investigates what are the common factors that are found to significantly affect banks' retail rates setting decisions and explores the strengths and weaknesses of different econometric methods applied, which will later inform our empirical investigation of retail rate setting in Macedonia.

This chapter is structured as follows: section 2.2 examines the theoretical models that explain how banks' determine the retail rate setting. Section 2.3 critically surveys the empirical studies that investigate the determinants of retail rates setting in various economies. In the final section of the chapter, a summary of the findings is presented.

2.2 Theories of how banks set their retail interest rates

This section aims to critically assess various theories and models of how banks set their retail rates. It is divided into separate subsections according to the specific theory examined.

2.2.1 The mark-up pricing theory

One of the main formal theories of how banks set their retail rates was developed by Rousseas (1985). The author develops a mark-up pricing model for a non-perfect competitive banking sector, since it is argued that banks exhibit some degree of market power because the typical banking retail market is "...dominated by a few large banks of national and international character." (Rousseas 1985, p.136). Hence, a starting argument of Rousseas is that banks in the loan market are price setters that set their retail interest rates as a mark-up (profit margin) over their prime costs, expressed with the equation:

$$i = k(u) \qquad (2.1)$$

where, i is the interest rate on loans, u represents the unit prime or variable costs and k is the mark-up or the profit margin over the variable costs. The profit margin is determined by the market power acquired by bank(s) such that in less competitive markets, where banks exhibit greater market power, the mark-up (profit margin) will be higher. The prime or variable costs are composed of labour costs and 'raw materials'. In the case of the banking sector, according to Rousseas (1985), labour costs are taken as fixed because, unlike manufacturing firms, the number of employees does not vary much with the level of financial activities. Therefore, banks' variations in prime costs are mainly determined from the variations in 'raw material' component which represents the costs of funding of their lending activities ('cost of funds'). It is the interest rates that banks pay on deposits, interest rates on their borrowing in the money market and some other costs. For example, in the case of the US, those other costs partly reflect the costs arising from the required reserves that banks must hold at the Federal Reserve and the insurance fees on deposits that banks are obliged to pay to the Federal Deposit Insurance Corporation.

Rousseas's (1985) model assumes that 'cost of funds' rates, represented mainly by the funds raised in the money market, are exogenously determined because banks in these market segments are price takers due to the relatively high level of competitiveness. However, this is not the case on the retail market. Thus, Rousseas argues that changes in the lending rates are mainly determined by changes in the 'cost of funds' because the profit margin is taken to be constant over the business cycles. However, this is a large assumption that may not always coincide with the reality because the model is based on the assumption that the banking environment and banks' financial characteristics are static over time. According to some other extensions of the model (Allen, 1988 and Angbazo, 1997), it is argued that some of these factors may affect the mark-up margin.

Rousseas's (1985) argument of a constant mark-up pricing over time is empirically supported in the paper. The main hypothesis is that changes in the representative loan interest rate (in this case, the prime rate[10]) should follow the changes in the 'cost of funds' rate (proxied by the Federal Funds Rate (FFR)), while the interest rate margin, indicating the mark-up between the two, should be constant. By analysing the interest rate fluctuations and the interest rate spread during the period 1955-1984, the author found that changes in the prime rate coincide with the changes in the FFR and in general, the interest rate spread was constant with small fluctuations, except for the periods of 1955-64, 1973-76 and 1982-83. The reasons for the fluctuations in the first two periods are interpreted as a consequence of exogenous factors such as, the post-war recovery and oil shocks.

[10] The prime rate is the administered loan interest rate set by the banks in the US economy.

The fluctuations in the last period are attributed to changes in the US monetary policy, such as the shift of the monetary policy regime from interest rate to money supply targeting and the abandonment of the Regulation Q. An additional proposed reason for the sharp increase in the spread in the last period was the tendency for increased loan riskiness according to which banks increased their profit margin in order to compensate for the increased probability of borrowers' default. With this explanation, Rousseas implicitly introduces another factor that may affect the mark-up margin, i.e. the riskiness of loans. However, these interpretations of variations in the spread are mainly based on descriptive statistics and not on more sophisticated statistical methods that may provide different conclusions.

A direct criticism of Rousseas's (1985) empirical work is provided by Niggle (1987) who argues that the selection of both representative rates, the prime rate and the FFR as representative loan and 'cost of funds' rates respectively, may not be appropriate especially after the late 1970s. The argument why the prime rate may not be taken as the representative loan rate is because the interest rates on small loans in the US (up to 1 million US Dollars), as well as the rates on loans higher than 1 million US Dollars, have been set on a 'prime-plus' basis based mainly on short term money market rates such as 90 day Certificate of Deposits (CDs), the London Interbank Offer Rate or prime commercial paper rate. Therefore, the loan rates on small and large loans have almost always been below the prime rate and are determined differently on a variable mark-up basis based upon the money market rates. On that basis, Niggle (1987) also argues that the FFR was no longer the best representative 'cost of funds' rate because banks use various money market rates with different maturities as a 'cost of funds' rate in setting their loan rates. Consequently, Rousseas's conclusions of a 'constant' mark-up over the business cycle may be misleading because they are based on inappropriate representative loan and 'cost of funds' rates.

Laudadio (1987) additionally criticises Rousseas's view on the basis that not all loan markets are oligopolistic and thus, the mark-up may not be stable in various segments on the loan market. For example, Laudadio argues that the market for large short-term loans in the USA is highly competitive because the demand side is dominated by large well-known corporations with large assets who have other available options for external finance, while the supply side is represented by large number of domestic and international banks. This leads to competitive pricing by the banks with them setting the mark-up as low as possible in order to attract more borrowers. In contrast, the loan market for small short-term loans in the USA is characterised by an oligopolistic structure because on the supply side exist small local banks whose number is limited and thus, have relatively high market power. The demand side is dominated by small firms with limited assets whose banks' loans are their major source of external finance. Hence, due to their acquired market power, local banks may set up a higher mark-up. But even in this case, Laudadio argues that the mark-up is not seen as a stable because it may be determined by other factors such as switching costs and the existence of 'customer relations' (see section 2.2.3).

The main weakness of Rousseas's (1985) theory is related to the argument that variations in banks' retail interest rates are mainly determined by the variations in the 'cost of funds' rate, without specifying the extent to which those variations are transmitted. Another possible weakness of this model is that it lacks a consistency in explaining how the mark-up margin is set and whether it is defined as a constant proportion of the 'cost of funds' rate or a constant in absolute terms, although in his empirical work the author argues that it is a constant in absolute terms.

A more comprehensive model, also based on a mark-up pricing strategy, was established by Ho and Saunders (1981). The major value added of this model is that it explicitly defines how the mark-up margin is determined. The model is defined as a static one-period decision model where loans and deposits are taken as a single product with one type of maturity that is equal between the two. The main hypothesis of the model is that banks exhibit some kind of market power and act as risk averse intermediaries between the suppliers of funds (depositors) and those who require funds (the borrowers). Hence, the model works under the assumptions that loan demand and deposit supply are exogenously determined and changes in these quantities are not synchronised. Thus new deposit arrivals and/or a new loan demand are unforeseen by banks. Consequently, banks try to match the new deposit arrival with the new loan demand by lending and/or to borrowing on the money market, which incurs some risks such as the interest-rate risk composed of reinvestment and refinancing risks. More precisely, when banks perceive a higher loan demand or face new loan demand without having sufficient pull of deposits to fully cover the new loan demand, then they have to borrow in the money market. This increases their refinancing risks. In the opposite case, when banks have a new deposit supply but have insufficient new loan demand, then they have to place their deposits in the money market. This increases their reinvestment risk. Due to these risks banks adjust their mark-up margin as a hedging instrument against the interest-rate risks they face in the money market in order to maximise their utility. The details of how the mark-up margin is adjusted when banks are faced with refinancing and reinvestment risks are explained in the following paragraph.

In the model, prices of loans (p_l) and deposits (p_d), that are inversely related to loan and deposit interest rates respectively, are defined as follows:

$$p_l = p - b \tag{2.2}$$

$$p_d = p + a \tag{2.3}$$

where p is the so-called 'true' or 'pure' price of loan and deposit. "b" and "a" are fees charged by the bank for the provision of their financial services to the borrowers and depositors, respectively. Thus, the interest rate spread between the loan and deposit rate (the mark-up margin - β_1) is a sum of the two fees ($\beta_1 = a + b$). By manipulating these two fees, banks may actually affect the loan demand and deposit supply and consequently may establish the mark-up margin that will protect them from the interest-rate risks they face on financial markets. For example, in the case when banks face higher deposit inflow than loan demand, then they may increase fee "a", which will increase the price of deposits (reduce the deposit interest rate), and will discourage a new deposit supply. On the other hand, banks may also react by reducing fee "b" that will increase the price of loans (a decrease in loan interest rates) that will stimulate new borrowing on the loan market.

Ho and Saunders (1981) argue that banks simultaneously change the two fees, depending from the supply and demand of funds on the loan market. Similar to Rousseas (1985), Ho and Saunders argue that banks set their lending rates on a mark-up margin over the 'cost of funds' rate (the money market rate), where the mark-up margin is determined in absolute terms by the banks.

The Ho and Saunders (1981) mark-up pricing model was amended by Allen (1988) and Angbazo (1997), who considered some additional important factors that affect the mark-up margin. Allen (1988) abandons the assumption of equal maturity of loans and deposits (the single-product assumption), and argues that another important factor in setting the mark-up margin is the cross-product diversification of loans and deposits in respect to their maturity. According to Allen (1988), banks actually try to match deposits and loans with similar maturities in order to minimise the interest-rate risk. For example, when the coverage ratio of long-term loans with long-term deposits is higher, then lower will be the interest-rate risks and thus, the mark-up margin. The reason for this is that banks are less likely to have to borrow additionally on the money market in order to satisfy the long-term loan demand and vice versa.

Angbazo (1997) considers another additional factor that may affect the mark-up margin: the borrowers' default risk. Accordingly, those banks that have a higher default risk set a higher mark-up margin in order to compensate for the expected higher default losses.

Overall, within the "mark-up" margin theory there is inconsistency in specifying whether the mark-up margin is constant through time and if so, whether it is constant in absolute or in relative terms. For example, Rousseas's (1985) empirical findings suggest that banks keep their mark-up margin constant in absolute terms through time. However, he also argues that the mark-up margin may vary in some periods due to the increased riskiness of banks' loans and/or disturbances by some regulatory requirement changes. In contrast, Laudadio (1987) argues that the mark-up margin varies according to the market segment in which banks operate and the level of market power that banks have. Ho and Saunders (1985) argue that banks adjust their mark-up margin according to the interest risk they face and that the macroeconomic environment (aggregate demand) may affect the size of adjustment. In their empirical examination they argue that the risk neutral mark-up margin (when there are no interest rate risks on the financial market), is constant in absolute terms. As the mark-up pricing model has been modified through time, Allen (1988) suggests that banks' mark-up margin is determined by the stability of the sources of financing their loans, i.e. their coverage of long-term loans with long-term deposits, and is also seen to vary through time in relative terms. Angbazo (1997) argues that the mark-up margin is additionally determined by the level of riskiness of loan portfolio that may also affect the size of the pass-through

Based upon the mark-up pricing models of Rousseas (1985) and Ho and Saunders (1981), de Bondt (2005) has defined the retail rate setting with the following equation:

$$i = \beta_1 + \beta_2 u \tag{2.4}$$

where, i is banks' retail rate (deposit or loan rate), β_1 is the constant mark-up in absolute terms, u is the 'cost of funds' rate and β_2 represents the demand elasticity of deposits or loans in respect of deposit (loan) interest rate, respectively; i.e. the size of the pass-through coefficient. According to this equation, variations in retail rates are determined by the variations in the 'cost of funds' rate, but the extent to which those variations are transmitted to banks' retail rates, depends upon the size of β_2 coefficient, which may vary. It can be less than one, implying an incomplete pass-through from 'cost of funds' rate to banks' retail rates; equal to one, referring to complete pass-through; or higher than one.

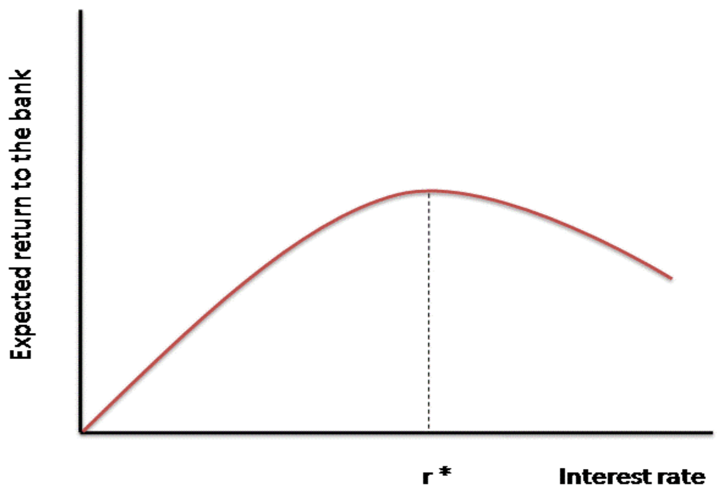
After Rousseas (1985) and Ho and Saunders (1981) set up the "mark-up" pricing theory of banks' retail rates setting, the main field of interest now is to explore what factors affect the β_2 coefficient. In the theoretical literature, various theories provide different explanations. For example, Niggle (1987) argues that the size of the loan demand elasticity may be important factor for the banks in setting their loan interest rates, especially for those borrowers who have access to other external sources of finance. Other authors such as Rousseas (1985), Ho and Saunders (1981), Angbazo (1997), provide some indications that the size of the β_2 coefficient may depend on some general macroeconomic factors, market structure in the banking sector and banks' specific characteristics but do not clearly specify which. The explanations of theories that examine the factors that affect the size of the β_2 coefficient in equation 2.4, are presented in the following sub-sections.

2.2.2 Theory of asymmetric information and lending rate stickiness

One of the most cited theories about the reasons for an incomplete pass-through is the theory of asymmetric information and lending rate stickiness by Stiglitz and Weiss (1981). According to these authors, lending rates exhibit upward stickiness and thus, incomplete upward adjustment to the 'cost of funds' rate, for which the main reason is the asymmetry of information that leads to adverse selection and moral hazard problems. The starting point of their hypothesis is that when there is an excess demand in the loan market, the equilibrium is not achieved through interest rate adjustment but through credit rationing.

The model of Stiglitz and Weiss (1981) is based on the simplifying assumption that only two groups of borrowers exist, i.e. risk averse and risk seekers and each group of borrowers are homogeneous. Based upon this assumption, the authors argue that in a situation of excess demand for loans, or when the 'cost of funds' rate increases, it may not be in the banks' interest to fully adjust their lending rate upwards to the 'cost of funds' rate or to raise it high enough to clear the excess demand. The reason for this is that informational frictions in the loan market will worsen. If a bank increases the loan interest rate high enough to clear the excess demand, then they will disproportionately attract riskier borrowers who are eager to invest in riskier projects, causing adverse selection. Another reason why the bank may refrain from increasing their loan interest rate is that, even in the case when the bank has successfully selected low risk borrowers; by increasing the interest rate it will affect borrowers' behaviour towards investing in riskier projects in order to compensate for the higher costs caused by the higher interest rate. This will result in a moral hazard problem. Both of these outcomes caused by increase of the loan interest rate are undesirable for the bank because they will negatively affect its rate of return. Therefore, the bank decides not to fully increase the loan interest rate beyond a certain level and instead, it decides to ration credit. The shape of the optimal interest rate that provides the optimum rate of return is presented in figure 2.1.

Figure 2. 1: Banks' rate of return as a function of the loan interest rate



Source: Stiglitz and Weiss (1981) p.394.

By increasing the loan interest rate up to r*, the expected rate of return of the bank rises reaching the maximum at r*. Additional increases of the interest rate will result in a lower expected rate of return due the previously mentioned adverse selection and moral hazard problems. In other words, under the assumed structure of the population, up to interest rate r^* both safe and riskier borrowers will apply for a loan. However, by increasing the loan interest rate beyond the level of r*, safe borrowers start to withdraw from the loan market and mainly the riskier borrowers apply.

Stiglitz and Weiss (1981) argue that credit rationing and the upward lending rate stickiness cannot be solved by raising the collateral requirements either. In their model, by assuming that smaller projects are riskier than larger projects and by assuming that those borrowers who have accumulated higher amount of capital are less risk averse because in the past they have invested in riskier projects in order to get higher return; the authors analyse two situations. The first one is when all borrowers have the same amount of capital, regardless of the size of the project. The second one is when the size of the project is fixed (the same), but potential borrowers have different amount of capital. In the first situation, by raising the collateral requirement relative to the size of the project, mainly the small-project borrowers will apply for a loan (the adverse selection problem). In the second situation, if the bank raises the collateral requirements, then mainly those borrowers who have accumulated higher amount of capital will apply. Both situations will cause an adverse selection problem and will increase the risk of borrowers' default that ultimately, may reduce the rate of return of the bank. Similar to the interest rate, the bank will get the optimum rate of return for a collateral requirement at a unique level. However, by increasing the collateral requirements beyond that level, the rate of return will start to decrease because mainly the riskier borrowers will still apply for a loan, while risk averse borrowers will start to withdraw from the loan market.

Overall, even though the theory of Stiglitz and Weiss (1981) offers a solid explanation for the upward lending rate stickiness, it has some general shortcomings. For example, the theory is based on a static one-period model that disregards the possible interaction between the borrower and the lender through repeated transactions. If the borrower is well known to the bank and has previously invested in relatively safe projects, then the bank may offer a lower interest rate to that borrower in future in order to maintain their relationship (the relationship lending theory, explained in section 2.2.3). Furthermore, their arguments for the upward lending rate stickiness are not empirically tested and are not supported by any empirical evidence in their paper. Nevertheless, Berger and Udell (1992) presented statistical evidence consistent with the theory of Stiglitz and Weiss (1981) for the US banking sector. Their results, based on a logit model conducted for the period 1977-1988, indicate that lending rates exhibit upward rigidity adjustment to increases in the 'cost of funds' rate. They also find statistical evidence that banks in USA ration credit.

Another drawback of the Stiglitz and Weiss (1981) model is that no assumption is made about the distribution of risk averse and risk seeker agents. Additionally, their explanation for lending rate stickiness through the collateral requirements is built upon two basic assumptions. The first assumption assumes that smaller projects are riskier than larger projects, whereas the second assumption assumes that wealthier borrowers are less risk averse. However, both assumptions made may not always hold in practice. The reason for this is that the authors disregard the possibility that wealthier borrowers may be risk averse too and by investing in multiple relatively safe projects for a longer period of time, have managed to accumulate higher amount of capital. This possibility is excluded from the model because it is designed as a one-period static model.

2.2.3 Switching costs and relationship lending theories

A different section of literature explains banks' retail rates adjustment (the size of the β_2 coefficient in equation 2.4) through the existence of switching costs and related to that, the so-called, 'relationship lending' between the bank and its customers. These two theories are interrelated and provide possible explanations for incomplete pass-through from the 'cost of funds' rate to the banks' retail rates, i.e. why the size of β_2 coefficient from equation 2.4 may be less than 1.

The switching cost theory is formally associated with Klemperer (1987) and later developed by Laudadio (1987), Sharpe (1997), and Lowe and Rohling (1992). According to this theory, switching costs exist on both the borrowers' and lenders' sides. On the borrowers' side, the switching costs are basically transaction costs that arise from searching for the lenders, known as 'shoe leather' costs (Lowe and Rohling, 1992), and learning costs that arise from gaining knowledge of the conditions of getting a new loan. On the lenders' side, switching costs are related to the costs and time incurred in screening the financial position of the borrowers due to the adverse selection problem and the costs related to monitoring the borrowers due to the moral hazard problem.

Klemperer's (1987) model explains switching costs mainly through the borrowers' side in a two period model. They basically occur in the second period due to *ex-post* product differentiation that reduces the interest rate elasticity of demand for loans. The main characteristics of this model are that switching costs and the market share of the banks are taken as exogenous in the loan market. According to this model, if we analyse the credit market as a two period game, loans as a financial product in the first period are considered as homogenous by the borrowers regardless of the characteristics of the bank. In that respect, in the first period, each bank is competing aggressively in order to attract as many 'new' customers as it can. However, in the second period, when the transaction is repeated by the borrower, loans become *ex-post* differentiated due to the existence of the switching costs. In other words, in the second period when the same borrower wants to obtain another loan, the borrower is no longer indifferent to which bank it applies and usually applies to the same bank that has issued the previous loan. The reason for this is because if the borrower changes the lender, then it would incur additional costs in searching for a new lender. Consequently, Klemperer (1987) and Lowe and Rohling (1992) argue that switching costs reduce the interest elasticity of the demand for loans and ultimately reduce banks' incentives to fully adjust their retail rates to changes in the 'cost of funds' rate. This may cause the size of the β_2 coefficient to be less than one ($\beta_2 < 1$, equation 2.4). This model implies that when the switching costs are high, then the more rigid will be banks' retail rate adjustment to changes in the 'cost of funds' rate (lower value of β_2). The model also implies that switching costs are associated with the market power of the banks in the loan market, i.e. the higher the market power of the banks, the higher will be the switching costs.

Flannery (1982) argues that the extent of interest rate smoothing depends upon who bears the costs of switching. For example, if the switching costs are on the borrowers' side, then banks can smooth their retail rates and extract higher borrowers' surplus because borrowers will be more reluctant to change their bank and vice versa. If the switching costs are on the lender's side, then banks will adjust their retail rates more fully to the 'cost of funds' rate because otherwise, if a borrower decides to change their bank, then it is the bank that bears the costs of switching. Furthermore, some authors argue that switching costs and the extent of interest rate smoothing depend upon the size of the loan. For instance, Laudadio (1987) argues that switching costs are typically fixed in absolute terms and do not vary with the size of the loan and thus they represent a higher proportion of small loans compared to large loans. Accordingly, when the switching costs exist, the rigidity of retail rates adjustment to the 'cost of funds' rate will be more pronounced for small loans.

However, concentrating on the assumption that switching costs are exogenously given to the market, Lowe and Rohling (1992) criticise Klemperer's model (1987). They argue that in an oligopolistic market, switching costs are not always exogenously given because banks may introduce artificial switching costs in order to additionally reduce the loan demand elasticity and extract a higher borrowers' surplus. The imposed artificial switching costs depend on the concentration and market power of the banks in the loan market. When concentration is higher and when banks exhibit higher market power, then they may impose higher artificial switching costs. Another weakness of Klemperer's model (1987) arises from the assumption that banks' market share is exogenously determined. According to Lowe and Rohling (1992) and Berger and Hannan (1989), this assumption may not hold because the market share may be endogenously determined by banks' market strategy and their loan and deposit interest rates offered. For instance, if banks compete more aggressively in the first period by offering more favourable lending conditions, then those banks that have attracted more new customers in the first period will have a higher market share in the loan market in the second period if the transaction is repeated by the borrower.

Vesala (2005) additionally criticises Klemperer's model because it assumes that higher switching costs incurred on the borrowers' side would result in higher lenders' benefit (surplus). In that regard, Vesala (2005) modifies Klemperer's model by modelling banks' benefits as a "V" shaped function of the switching costs. Namely, according to Vesala's model, benefits for the lenders are high when the switching costs are relatively low. Later on, as the switching costs increase, lenders' benefit becomes a negative function of the switching costs up to a certain threshold level, thereafter with an additional increase in the switching costs lenders' benefits will start to rise again.

An explanation for the "V" shaped switching cost function is that when the switching costs are low, then every borrower regardless of the riskiness of the project or its financial indicators, may easily switch their bank. However, this increases the threat of adverse selection because the 'bad' borrowers will be more likely to change their bank. In contrast, the 'good' borrowers may more easily get another loan renewal or other financial service from the same bank. According to this argument, new loan applicants will be mainly perceived as ‘bad’ borrowers. Hence, this increases the adverse selection problem that forces banks to refrain from making too aggressive bids (offering more favourable lending conditions). In this case, the incentives for the ‘good’ borrowers to change their bank would be reduced because they may be perceived as ‘bad’ borrowers in the loan market and accordingly they will try to stick with their existing bank. Consequently, this threat of an adverse selection problem in the loan market will increase a bank’s benefits from an incomplete retail rate adjustment, even when the switching costs are low. However, when the switching costs start to rise, then the threat of adverse selection problem will start to fade away because now it is mainly the ‘good’ borrowers (those with good financial performances) that can afford to bear the costs of switching (Vesala, 2005). This will force other banks to offer more aggressive terms in order to attract the ‘good’ borrowers. In order to maintain its existing ‘good’ customers, a bank would offer more favourable lending conditions and more complete retail rate adjustment to the ‘cost of funds’ rate that will reduce the bank’s benefits. Nevertheless, after a certain threshold level of the switching costs, the benefits of the bank would start to rise again because the switching costs would now become relatively high and unbearable even for the ‘good’ borrowers. Thus, changing their existing bank would become economically irrational. On the other hand, the competing banks would be discouraged from taking new customers by making aggressive bids, because the offered lending conditions would bring a relatively low marginal benefit for the bank. This provides a “V” shape form of the benefit function in respect to the size of the switching costs.

The main pitfall of Vesala’s (2005) and Klemperer’s (1987) models is that they do not take into account the asymmetric adjustment of retail rates. For example, incomplete upward adjustment of the lending rate increases the borrowers’ surplus, while incomplete downward adjustment increases the lenders’ surplus, whereas the opposite holds for the deposit rates.

Another strand of literature, directly related to switching cost theory, is relationship lending theory (Petersen and Rajan, 1994; Sharpe, 1997; Boot, 2000), or as Weth (2002) refers to as the “hausbank” phenomenon. Relationship lending arises through the repeated transactions between the lender and the borrower that may make both sides better off. Sharpe (1997) refers to relationship lending as: ".... markets where significant information or transaction costs exist, but they are probably most influential where such costs appear to give rise to long-term relationships and repeated transactions." (p.79).

The benefits for the borrower of relationship lending, according to Petersen and Rajan (1994), are mainly in the form of getting more favourable lending conditions in obtaining a new loan (lower interest rates charged by the bank), other related financial services from the bank and higher credit availability in periods of economic downturn and credit rationing. On the lender's side there are benefits as well. For instance, Boots (2002) argues that relationship lending reduces information asymmetries between the lender and the borrower. Thus, the lender can more closely monitor the financial activities of the borrower and can obtain proprietary information that is not available to other parties, which can help the lender to reduce the risk of borrower's default when granting a loan (Weth, 2002).

According to relationship lending theory, banks can smooth the loan interest rate adjustment and increase their benefits. Namely, when the 'cost of funds' rate declines, a bank may decide to reduce the lending rate proportionately less and consequently, it may extract a higher borrower's surplus (Laudadio, 1987). In this case, the borrower will be reluctant to change their existing bank because such behaviour will worsen 'customers' relations that may result in lower credit availability from that bank in the future. This is especially important in periods of credit rationing. In the opposite case, when the 'cost of funds' rate increases, in some circumstances, the bank may decide not to fully adjust their lending rate if it perceives that it will worsen borrower's cash flow and increase their risk of default.

Boot (2002) identifies two risks (costs) of relationship lending. The first one is on the lenders' side because in some circumstances it may lead the bank to follow a policy of soft budget constraints. In periods of economic downturns, the bank may not want to refuse a borrower a new loan renewal or extension to the time length for loan repayment, in order not to disturb its relations with the customer. This is especially true if the relationship between the bank and the borrower has been built over a longer time horizon and the borrower is identified as a 'good' one. Thus, the bank in order to satisfy borrower's needs, it has to raise more funding which incurs additional costs and risks for the bank. The second risk of relationship lending is on the borrowers' side through creation of a so-called "locked-in" effect. According to Boot (2002), when the bank has collected 'enough' proprietary information, it may charge higher interest rates than its competitors or it may not fully adjust its lending rates to the 'cost of funds' rate downward because the borrower may be reluctant to change the bank for the following reasons: *a)* the borrower is afraid that the acquired proprietary information by the bank may be misused and *b)* if the borrower decides to change its bank, it may be identified as a 'bad' borrower in the loan market due to the adverse selection problem.

Regarding the characteristics of the borrowers, Arak et al. (1983) argue that relationship lending and thus, the extent of interest rate smoothing is partly determined by the size of the firm. Interest rate smoothing is lower for large firms because usually they get sources of finance from more than one bank and have built relations with all of them. Consequently, the bank that offers the most favourable lending condition will get the deal. In contrast, small firms usually get finance from only one or two banks. Therefore, the small firm does not have much choice and accepts the loan from their existing bank, although it may be offered under less favourable lending conditions.

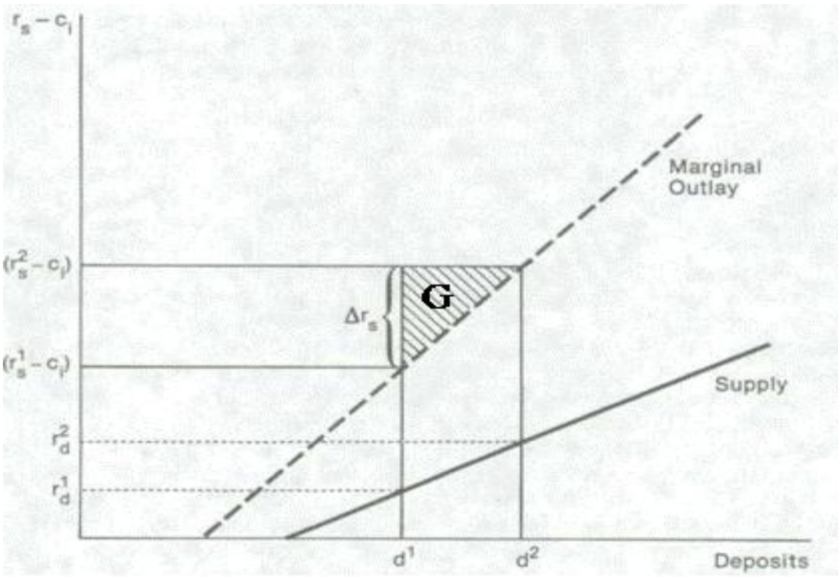
The impact of the relationship lending on the interest rate pass-through has been empirically tested. For instance, Petersen and Rajan (1994) examine how relationship lending affects loan interest rates and availability of credit. Using data from US firms on their loan interest rate charged, the results from tobit regressions indicated that relationship lending did not have any statistically significant impact on their lending rates charged. However, these results suggested that relationship lending has a significant impact on credit availability, which is consistent with the theory. Additionally, the analyses by Weth (2002) and Gambacorta (2008) provide empirical evidence that relationship lending may significantly affect the short-run interest rate pass-through. Hence, this factor is seen to be one of the reasons for the banks' short-run retail rate adjustment rigidity (for details see section 2.3.1).

2.2.4 "Menu costs" theory

Another influential theory that explains reasons for the incomplete adjustment of banks' retail rates to changes in the 'cost of funds' rate is the "menu costs" theory by Hannan and Berger (1991). The main anchor of this theory is that the size of adjustment of banks' retail rates to 'cost of funds' rate depends upon the 'menu' costs incurred by changes in the retail rates. The model implies that only if benefits of changing the retail rates are higher than the costs incurred, then banks will decide to adjust their retail rates to the 'cost of funds' rate.

The model is based on the assumption of imperfect competition in the loan market where banks exhibit some kind of market power. The 'cost of funds' rate in the model is represented by the security rate in USA which in reality, according Hannan and Berger (1991), coincides with the main policy rate or the representative money market rate. The deposit rate is taken as a representative banks' retail rate. The graphical representation of the model is shown on figure 2.2.

Figure 2.2: the "menu costs" model by Hannan and Berger (1991)



Source: Hannan and Berger (1991) p.939.

The model is based on two main curves, the deposit supply curve and marginal outlay curve and two interest rates, the security rate (r_s) and deposit rate (r_d), where the former is assumed to be exogenously determined and exhibits a random walk. "*c*" is the non-interest cost of transferring the deposits into securities that is exogenously determined and taken as constant through time.

In the initial period, at a given security rate r_s^1 and the gain from buying securities ($r_s^1 – c$); banks maximise their profits by setting their deposit rate at level r_d^1. At this deposit rate, banks will attract the amount of deposits d^1, which is determined by the slope of the deposit supply curve. A marginal increase in the security rate from r_s^1 to r_s^2 and hence, the increase of the gain from buying securities from ($r_s^1 – c$) to ($r_s^2 – c$), causes banks to adjust their equilibrium deposit rate to level r_d^2 and to attract the amount of deposits d^2, only if the marginal cost of increase in deposit rate ("marginal outlay") is equal or lower than the marginal gain from changing the deposit rate. This marginal gain is presented with the shaded area "*G*" in figure 2.2.

According to the model, the marginal gain is modelled as $(1/4)*b_i*(\Delta r_s)^2$ and banks' retail rate setting decisions are determined as follows:

$$(1/4)*b_i*(\Delta r_s)^2 > F \qquad (2.5)$$

where F is the cost of changing the deposit rate ("menu cost"), b_i is the inverse of the slope of the deposit supply curve and Δr_s is the marginal increase of the security rate. In the model, according to Hannan and Berger (1991), it is assumed that the absolute slope of the marginal outlay curve is greater than the absolute slope of the deposit supply curve (see figure 2.2) because the costs of changing the deposit rate are taken as an increasing function of the quantity of new deposit supply. Namely, when the deposit rate increases, then banks not only incur greater costs of paying a higher deposit rate on the newly deposited funds but also they incur greater costs of paying it on the previously deposited funds under the assumption that a certain proportion of the those funds are under a flexible deposit rate contract. This is a similar argument to the one for the relationship of the demand curve (the average revenue curve) and marginal revenue.

In the model, the cost of changing the deposit rate (*F*) is determined by variations in the amount that banks have to pay to their depositors if they decide to change the deposit rate and the share of the costs of changing the deposit rate relative to the size of the bank. Regarding the latter, bigger banks may have lower costs of adjusting their retail rates due to efficiency gains from economies of scale, i.e. lower operating costs and/or lower costs of transferring their deposits into securities relative to their asset size. Moreover, *F* is seen to depend asymmetrically on the direction of deposit rate adjustment (upward or downward). For example, in some circumstances, *F* may be higher for upward than for downward deposit rate adjustment, due to the time lag that arises from the moment of deposit rate increase till the moment of depositors' reaction to the interest rate increase. More precisely, banks' have to bear some additional costs from the time of deposit rate increase until the time they attract new deposits, due to the higher deposit rate they have to pay to their already existing depositors. In other circumstances, *F* may be higher for downward than for upward deposit rate adjustment due to the collusive price arrangements between the bank and some of its depositors. For example, if the bank violates the price arrangement by decreasing its deposit rate low enough, then depositors may withdraw their funds, which will incur some additional costs to the bank related to the loss of its customers.

The marginal gain of retail rate adjustment in the model is mainly determined by the value of b_i that, according to Hannan and Berger (1991), depends on factors that affect the slope of deposit supply curve such as, market concentration and banks' 'customer base' in the deposit market[11]. Namely, higher market concentration implies a steeper deposit supply curve because in more concentrated markets, the interest rate elasticity of deposit supply is lower, indicating a lower value of b_i. This reduces banks' incentives for adjusting the retail rates to the 'cost of funds' rate, resulting in a higher rigidity in the retail rate adjustment and vice versa. Regarding the second factor, it works in the opposite direction: a higher banks' 'customer base' implies a flatter deposit supply curve due to the higher interest elasticity of deposit supply. This may result in a higher

[11] This is defined as "…the deposits that would be supplied to bank *i* if all firms in the market were to offer the same rate.", (Hannan and Berger, 1991, p.940).

value of b_i that increases banks' incentives for more flexible retail rate adjustment and vice versa.

The "menu costs" model is empirically tested by Hannan and Berger (1991). The results, based on multinomial logit model conducted for the US banking sector for the period 1983-1986, were consistent with the predictions of this model. Namely, higher market concentration is associated with higher retail rate adjustment rigidity, while a higher 'customer base' in the deposit market and higher asset size of the banks results in higher retail rate adjustment flexibility. The results also indicated that banks exhibit a higher upward adjustment rigidity of their deposit rate, which is consistent with the theoretical claim that F varies asymmetrically in the direction of adjustment, being greater for the upward deposit rate adjustment.

According to Hannan and Berger (1991), even though their "menu costs" model is based on the deposit rate as a representative bank retail rate, it is also applicable to loan interest rates. The major difference is that, though the same factors that determine the costs and benefits of adjusting the deposit rate, also apply to the lending rates and they work in the opposite direction.

The main weakness of the Hannan and Berger (1991) model is that it is based on the assumption of a linear deposit supply curve that may not always be the case. Another weakness is that in this model, bank's 'customer base' in the deposit market is taken as exogenous factor. This may not be an appropriate assumption because banks' 'customer base' may depend on the banks' strategy and behaviour to their customers (Lowe and Rohling, 1992 and Berger and Hannan, 1989). For example, if they behave more aggressively in the market, then they may acquire more customers and get a higher 'customer base'. Another possible weakness is that, apart from asset size, it does not take into account the other banks' financial characteristics as a factor that may affect banks' retail rate setting decisions such as, the loan riskiness or maturity mismatch that may also affect the size of adjustment.

2.2.5 A critical assessment of the surveyed theories

The general weakness of the mark-up pricing models is that they do not analyse to what extent banks adjust their retail rates to changes in the 'cost of funds' rate, i.e. the size of the pass-through (β_2 coefficient from equation 2.4) and what factors may have a significant impact over it. Regarding the latter, there are some indications by Allen (1988) and Angbazo (1997) that it may be determined by the maturity mismatch of loans and deposits and the level of riskiness of loan portfolio. Moreover, some authors such as Rousseas (1985), Ho and Sounders (1981) and Angbazo (1997) argue that the size of the pass-through may be affected by the macroeconomic environment but nonetheless, they do not explicitly point to specific macroeconomic factors. This leaves an open space for the empirical studies to include some *ad-hoc* variables for macroeconomic conditions (see section 2.3).

All surveyed theories are mainly based on mathematical models and provide some implications for further empirical investigation. However, the majority of these theories do not provide an empirical justification and do not provide any indication of how the empirical model(s) should be operationalised and specified. Consequently, all these theories have left some open issues in designing an empirical model. For example, an open issue is their functional form, how some of the factors which are argued to have a significant impact on the size of the pass-through may be included and how they can be measured or proxied, such as the switching costs. Additionally, the majority of these theories do not examine whether the interest rate series (banks' retail rates and 'cost of funds' rate) can be expected to be stationary or not, either in nominal and real terms. An exception may be the "menu costs" theory that indicates that the 'cost of funds' rate exhibits a random walk. Moreover, having in mind that almost all theories were developed in the 1980s and early 1990s, they do not raise the issue of a possible cointegrating relationship between the retail rates and 'cost of funds' rate, i.e. whether they are in long-run equilibrium. We can only draw an implicit inference about this issue by analysing whether the assessed theories suggest if the mark-up margin is constant through time and whether we can expect the size of pass-through coefficient (β_2 coefficient from equation 2.4), to be stable over time.

The mark-up pricing theory is not clear whether the mark-up margin is constant through time because some inconsistencies exist within this theory (see section 2.2.1). Moreover, the mark-up margin theory does not analyse the size of the adjustment, although there are some partial explanations by Rousseas (1985), Ho and Saunders (1981) and Angbazo (1997) as to what possible factors may affect it. The rest of the theories that investigate the possible determinants of the size of the adjustment (the β_2 coefficient from equation 2.4), argue that it may be determined by various factors. Due to those factors, they implicitly suggest that the size of the retail rate adjustment may not be stable over time. Nonetheless, there is also a lack of explanation among the theories whether those various factors may affect the size of adjustment only in the short-, the long-run or both. The switching costs and relationship lending theories are concerned with both short- and long-run dimensions. The "menu costs" and the theory of asymmetric information and lending rate stickiness are not clear on this issue. Moreover, the theories that explore the possible determinants of the size of the adjustment, do not consider the possibility that there may be a long-run equilibrium relationship between the structural factors that affects the size of pass-through and banks' retail rates.

Overall, according to these theories it is not clear if the interest rate variables should be expected to be stationary or not. This may be an empirical question, the answer to which may depend on the length of period studied, the monetary regime etc. In terms of a cointegrating relationship, we can conclude that the mark-up pricing theory is not clear. The rest of the theories point some possible reasons why the interest rates may not be in equilibrium. Regarding the structural factors that affect the size of the adjustment, none of the theories assessed consider the possibility for the existence of long-run equilibrium relationship between them and banks retail rates.

2.3 A critical survey of empirical studies

This section critically assesses empirical studies that investigate the determinants of interest rate pass-through in various economies around the world. This assessment will be structured according to the conceptual framework of what is investigated, how it is estimated and how the underlying theoretical mark-up pricing model has been developed and modified through time.

In selecting the empirical studies to be assessed in more detail in the subsequent subsections we have considered those studies that are most relevant for the aims and objectives of the thesis. Those studies that are considered as 'original' and 'most frequently' cited articles and/or have had a significant influence on the empirical literature have been selected. Moreover, in selecting the empirical studies we have also taken into account the estimation method applied and the sample considered. Regarding the latter, we have included all of the empirical studies conducted for the CSEE economies because their banking and financial environment is similar to the one in Macedonia.

Many of the empirical studies that are critically surveyed in the next subsections include some *ad-hoc* variables, probably for the reason that the theoretical models assessed in previous subsections have left open issues as to how the empirical model should be specified (see section 2.2.5). For example, most of those *ad-hoc* variables included refer to the macroeconomic environment such as inflation, GDP growth and GDP per capita. Additionally, some empirical models include *ad-hoc* variables from the financial and the banking system like, the presence of private and foreign ownership and measures of financial deepening for which no clear theoretical justification is provided. Furthermore, regarding bank specific characteristics some studies include profitability for which again no clear theoretical justification is provided.

The empirical studies can be divided into three sub-categories in respect of whether they examine the determinants of *I)* the size of the banks' retail rate adjustment (the pass-through multipliers); *II)* the average level of retail rates setting or *III)* the interest margins between banks' retail rates and 'cost of funds' rate. The first group of studies empirically investigate what factors determine the size and/or the speed of adjustment of banks' retail rates to changes in the 'cost of funds' rate, i.e. they investigate what factors affect the β_2 coefficient in equation 2.4. These empirical studies mainly differ according to their estimation strategy and methods applied, which are explained in more detail in section 2.3.1. The second strand of the empirical literature examines the average impact of various structural factors on banks' retail rate setting decisions, assuming a linear relationship between the structural indicators and banks' retail rates. The main difference between these analyses compared to the first group of empirical studies is that they do not directly explore the size of adjustment coefficient. They only investigate the differences among the average level of interest rates charged among banks in respect of various structural indicators. These studies are based on an augmentation of equation 2.4 by adding a vector $\overline{x}$ of structural indicators, to give the model:

$$i = \beta_1 + \beta_2 m + \beta_3 \overline{x} \qquad (2.6)$$

These type of studies are assessed in more detail in section 2.3.2.

The third category of empirical analyses investigate what fundamental factors directly affect the spread between banks' retail rates and 'cost of funds' rate and are examined in more detail in section 2.3.3. These studies calculate the interest rate spread as a simple difference between banks' retail rates and the 'cost of funds' rate, and then they regress this spread on a set of structural indicators that are expected to have an impact on it. I.e. these empirical analyses calculate the β_1 coefficient in equation 2.4 as explained in the previous sentence and then they regress this on a set of structural indicators ($\overline{x}$), presented in the equation below:

$$\beta_1 = C + \alpha_1 \overline{x} \qquad (2.7)$$

In all the three groups of empirical studies, individual studies differ according to their estimation strategy and methods applied, and data used. Some studies are based on aggregate data for the whole banking system, while others use bank-level data. The latter are of more interest to us because our empirical investigation, presented in chapter 3, of the determinants of the size of the interest rate pass-through in Macedonia is based on bank-level data.

2.3.1 Studies that examine the factors that affect the size of the banks' retail rate adjustment (the pass-through multipliers)

This strand of empirical analyses can be classified into two subcategories, according to the estimation strategy used. The first subgroup of this kind of empirical studies is known as the two-stage model. The main characteristic of two-stage models is that in the first stage of the estimation process, using time-series econometric techniques, equation 2.4 is estimated in order to get estimates for the size and/or speed of the adjustment coefficients of banks' retail rates to changes in the 'cost of funds' rate (the β_2 coefficient in equations 2.4 and 2.8). In the second stage, the previously estimated pass-through coefficients (β_2) are regressed on a set of structural determinants (the vector $\overline{x}$ in equation 2.9), that, according to the various theories assessed in section 2.2, are hypothesised to affect the size and speed of adjustment of the interest rates. The two-stage estimation process can be presented with the following simplified equations:

Stage I: $i_t = \beta_1 + \beta_2 u_t + \varepsilon_t$ *(2.8)*

Stage II: $\beta_2 = C + \beta_3 \overline{x} + \varepsilon_1$ *(2.9)*

A summary table of studies that apply the two-stage estimation model, in the same order as they are discussed in the following paragraphs is presented in table 2.1. A summary of other empirical studies that are not discussed in detail, but employ the same estimators and a similar set of structural indicators is also presented in table in 2.1.

Table 2.1: Summary table of the studies that apply the two-stage method

Author(s)	Country	Time period	Frequency of the data	Type of the data	Number of cross-sectional units	Estimation method - stage I	Estimation method - stage II	Balanced / unbalanced panel	Retail rates considered	Multipliers examined	Structural Variables	Significant determinants
Cottarelli and Kourelis (1994)	31 economies around the world	1980(85)-1991(93)	Monthly	Aggregate	31	Partial adjustment	Cross section OLS	/	Loan	Short-run	GDP per capita, inflation, MMR vol., barriers to foreign competition, market concentration and public ownership in the banking sys.	Inflation, market concentration, barriers to entry, private ownership of the banking sys. and MMR vol.
Mojon (2000)	Set of 6 euro-zone economies	1979-1998	Monthly	Aggregate	55-87	ECM	Panel model	Unbalanced	Loan and deposit	Short-run	Inflation, MMR vol., the level of competition, operating and funding costs	Inflation, MMR vol., the level of competition and operating costs
Sander and Kleimer (2004a)	Set of 10 euro-zone economies	1993-2002	Monthly	Aggregate	>100	TAR	Panel	Unbalanced	Loan and deposit	Short-run and long-run	Banking effectiveness, MMR vol., inflation, GDP growth, credit-to-GDP	Banking effectiveness, MMR vol., inflation, GDP growth, credit-to-GDP
Sander and Kleimer (2004b)	Set of 8 CSEE economies	1993-2003	Monthly	Aggregate	>100	TAR	Panel	Unbalanced	Loan and deposit	Short-run and long-run	MMR vol., inflation, concentration, credit risk, foreign ownership	MMR vol., inflation, concentration, credit risk
Sorensen and Werner (2006)	Set of 10 euro-zone economies	1999-2004	Monthly	Aggregate	10	DSUR	Cross section OLS	/	Loan rates	Speed of adjustment (ECT)	20 financial indicators	GDP growth, portfolio diversification, interest risk and credit risk exposure, banking concentration, liquidity, capitalisation and the extent of portfolio diversification
de Graeve et al. (2004)	Belgium	1993-2002	Monthly	Bank level	268	Panel Cointegration by Swamy's estimator	Cross section FGLS	/	Loan and deposit	Short-run, long-run and speed of adjustment	Relationship lending, concentration, capitalisation, liquidity, portfolio diversification, interest risk and credit risk exposure	Concentration, capitalisation, liquidity, portfolio diversification, interest risk exposure
Lago-Gonzalez and Salas-Fumas (2005)	Spain	1988-2003	Monthly	Bank level	150	SUR	SUR	Unbalanced	Loan and deposit	Speed of adjustment	GDP, Inflation, concentration, asset size, credit risk exposure	GDP, Inflation, concentration, asset size, credit risk exposure
Cottarelli et al. (1995)	Italy	1986-1993	Monthly	Bank level	63	ECM	Cross section	/	Loan rates	Short-run	11 structural indicators	Size, maturity mismatch, undrawn credit lines, concentration and the private ownership in the banking sector

One of the pioneering two-stage model studies that empirically applies the Ho and Saunders (1981) mark-up pricing model in examining the determinants of interest rate pass-through, is by Cottarelli and Kourelis (1994). Based on aggregated data, the authors examine which factors affect the short-run pass-through multiplier by using a set of structural macro and microeconomic factors for a set of 31 economies around the world. The results from the second-stage regressions indicated that the most significant determinants of the short-run pass-through multipliers are inflation, market concentration, barriers to entry, private ownership of the banking system and the volatility of the money market rate; while GDP per capita did not have any significant impact. More precisely, according to the results, higher inflation, less entry barriers and a higher degree of private ownership in the banking sector, reduce the short-run rigidities in adjustment. In contrast, a higher concentration in the banking market, as well as higher money market volatility, increases the adjustment rigidity of banks' retail rates.

A disadvantage of this analysis is that in the first stage of the estimation process, Cottarelli and Kourelis (1994) estimate the pass-through multipliers by using a partial adjustment model (PAM), instead of more sophisticated cointegrating time series methods based on an error-correction model (ECM). Partial adjustment methods compared to error-correction models suffer from some conceptual weakness in that former are based on the assumption that markets are in long-run equilibrium, and that the short-run dynamics represents the partial short-run adjustment towards the long-run equilibrium (Sriram, 1999). Another weakness of PAM is that they do not properly deal with the problem of autocorrelation and they usually suffer from model misspecification because they may omit some significant lags in their structure. An additional possible weakness of this study is that the authors in estimating the pass-through multipliers, in the regression models do not control for the possible structural breaks arising from changes in monetary policy regimes among the economies considered that may affect the size and speed of adjustment.

Mojon (2000), also using aggregate level data for a set of six euro-zone economies, improves on Cottarelli and Kourelis (1994) work in estimating the pass-through coefficients (the first stage of the estimation process) by applying an ECM. Another value added of this study is that it takes into account the asymmetric adjustment of retail rates to upward/downward changes in the 'cost of funds' rate by splitting the sample period according to the economic cycles in the sample economies. In the second stage of the estimation process, by using a panel data model, the author explores the possible structural factors that may affect the size of the short-run adjustment of banks' retail rates, including inflation, money market rate volatility, the level of competition in the banking system, and operating and funding costs. The estimates regarding the loan interest rates indicate that all of the aforementioned factors, except funding costs, significantly affect the short-run pass-through multiplier with a sign consistent with the theory. Regarding the deposit rates, the only significant determinant with the expected sign is the proxy for banking competition, while the other structural indicators did not have any significant impact or had a sign contrary from what was expected.

The novelty of this study is that it extends the model by including the operating and funding costs and applies a more sophisticated econometric method in estimating the short-run relationship of the interest rate series by using an ECM where a sufficient condition for the validity of the model is the statistical significance of the error-correction coefficient. Nonetheless a possible shortcoming of this analysis is that the investigation of the asymmetric adjustment of banks' retail rates to upward/downward changes in the 'cost of funds' rate is done by splitting the sample according to the business cycle periods that are defined arbitrarily by the author, instead of using the more sophisticated methods such as threshold autoregressive (TAR) models, as carried out by Sander and Kleimeier (2004a, b).

The analyses of Sander and Kleimeier (2004a, b) are based on aggregate data and investigate the factors that affect the interest rate pass-through in 10 euro-zone economies and the eight new EU member states from CSEE, respectively. The major value added of these analyses is that in the first stage of the estimation process, when the pass-through coefficients are estimated, the authors use more sophisticated time series TAR models that are able to identify the structural breaks in the sample as well as to control for the asymmetric adjustment of banks' retail rates to upward/downward changes in the 'cost of funds' rate. In the second stage of the estimation process, using a panel data model, they regress the previously estimated short- and long-term pass-through multipliers on a set of 'standardised' structural variables in the empirical literature (see table 2.1). The results from the second stage regressions suggest that the impact of the variables depends on whether they affect the short or long-run pass-through multipliers of banks' retail rates. For example, in the case of the euro-zone economies, GDP growth and the measure for the effectiveness of the banking system positively affect the long-run pass-through multipliers of banks' retail rates, indicating that higher economic growth and/or higher effectiveness in the banking sector may lead to greater size of long-run adjustment. The rest of the structural variables, in the case of the euro-zone economies, significantly affect only the short-run pass-through multipliers of banks' retail rates. For instance, money market volatility and inflation are negatively related, whereas the level of financial intermediation is positively related to the short-run pass-through multipliers. The results for the CSEE economies indicated that the same structural factors affect differently the size and speed of adjustment of deposit and loan interest rates among banks in these countries. For example, the variables that significantly affect only the long-run pass-through multiplier of lending rates are inflation and money market volatility. As most influential characteristics of the banking sector that significantly affect both, the short- and long-run pass-through multipliers of lending rates are estimated to be the level of competitiveness and the credit risk exposure of the banking sector. In contrast, foreign ownership entered with a contrary sign from what was *a priori* expected for which no detailed explanation is offered. In respect of deposit rates, higher level of competitiveness, lower riskiness and higher foreign ownership in the banking sector may lead to a faster and more complete short- and long-run pass-through, while increased money market volatility and inflation significantly affect only the short-run adjustment.

The research of Sorensen and Werner (2006), based again on aggregate data, explores what factors may affect the speed of adjustment of interest rate pass-through for a set of 10 EMU economies. The major originality of this study is that it uses a different econometric method in the first stage of the estimation process, a dynamic seemingly unrelated regression (DSUR), based on time-series ECM. The major advantage of this method is that it controls for contemporaneous cross sectional correlation among the units, which is seem to be an important factor in estimating efficient estimates. Another innovation in this study is that it takes into consideration a broader range of structural indicators (up to 20 indicators[12]) in determining the speed of adjustment of banks' retail rates. According to the estimates, the fundamental factors that may affect the speed of adjustment of banks' retail rates are: GDP growth, portfolio diversification and credit risk exposure positively; and concentration, interest risk exposure, the level of liquidity, capitalisation and the extent of portfolio diversification in the banking sector negatively. However, the main shortcoming of this analysis is related to the estimation method used in the first stage of the estimation process. The authors apply the DSUR method which is still in the process of development and unit root tests for stationarity of the errors from the level equations are still not developed. Thus, Sorensen and Werner (2006), in examining whether the interest rate series are cointegrated apply the Pedroni panel cointegration test that is based on the assumption of no cross-sectional correlation among the units. They find a cointegrating relationship among the interest rate series and consequently the authors proceed with estimating the ECM (for details see section 3.3). Another weakness of this study is that it investigates the determinants only for the speed of adjustment coefficients (the ECT), while it does not examine the factors that affect the short-term pass-through multipliers.

[12] For details of these indicators see Sorensen and Werner (2006), p.41.

Based on individual (bank-level) data, de Graeve et al. (2004) explore the determinants of interest rate pass-through in Belgium. In the first stage of the estimation process in estimating the pass-through coefficients, they use panel cointegration method by employing Swamy's (1970) estimator. The results from the first stage of the estimation process, suggesting banks' heterogeneous size of adjustment in both short- and long-run, is in line with the findings of Mueller-Spahn (2008) for the case of Germany, but in contrast to the findings of Gambacorta (2008) for the case of Italy and Weth (2002) for the case of Germany (see the following paragraphs). In the second stage of the estimation process, de Graeve et al. examine which of the fundamental determinants such as, the existence of relationship lending between the bank and its customers, banking concentration, capitalisation, liquidity, portfolio diversification, interest risk and credit risk exposure of the Belgian banks, may significantly affect the pass-through coefficients. The results imply that one of the most influential factors that affects the short- and long-run pass-through multipliers of both lending and deposit rates is the capitalisation ratio. Liquidity also has an important role in determining the size and speed of adjustment of deposit rates, but for loan interest rates liquidity has more limited role because it significantly affects only the speed of adjustment coefficients. Portfolio diversification plays a significant role in determining the speed of adjustment coefficients of both lending and deposit rates. The interest rate risk exposure and the level of concentration in the banking system are estimated as significant factors in determining only the loan interest rates. The rest of the financial characteristics did not have any significant impact over the pass-through coefficients of either lending and deposit rates. However, the main pitfall of this analysis is related to the estimation method. In conducting the panel unit root tests for the stationarity of the residuals, the tests employed are based on the assumption of no cross-sectional correlation among the units. Moreover, not controlling for the cross-sectional dependence among the units may also provide inefficient estimates for the size of the pass-through (see section 3.3). Thus, a more appropriate method would seem to be a SUR model.

Lago-Gonzalez and Salas-Fumas (2005) explore the structural factors that determine the speed of adjustment of retail rates to changes in the 'cost of funds' rate among Spanish banks. In order to reduce the problems created by the cross-sectional dependence among the units, the authors apply a SUR method in the two-stages of the estimation process. Among the structural factors considered, the estimates suggest that the two commonly used macroeconomic factors, i.e. GDP and inflation, have (as expected) a positive impact over the adjustment speed of both lending and deposit rate. On the bank specific characteristics, the results indicated that higher credit risk exposure results in a faster speed of adjustment of banks' retail rates, while higher concentration in the banking sector and higher asset size leads to a lower speed of adjustment of banks' retail rates; a finding consistent with the study by Sorensen and Werner (2006).

The second group of empirical studies presented in this subsection directly investigate the structural factors that affect the size and speed of adjustment of banks' retail rates to changes in the 'cost of funds' rate in one-stage only. These studies use mainly dynamic panel data models by which they estimate the short and long-run pass-through coefficients. More specifically, some studies use the following model specification:

$$i_{kt} = \mu_k + \sum^{l} \beta_1 i_{kt-l} + \sum^{l} \beta_2 m_{t-l} + \sum^{l} \beta_3 X_{kt-l} + \sum^{l} \beta_4 X_{kt-1} m_{t-l} + \varepsilon_{kt} \qquad (2.10)$$

where: i is a bank retail rate (loan or deposit); μk is a bank specific constant; m is the 'cost of funds' rate; X represents the structural factors that may affect the retail rate setting; $X_{kt-1}m_{t-1}$ is the interaction term between the structural factor and the 'cost of funds' rate that enables to examine its impact over the size of the pass-through; k and t are cross-sectional and time specific subscripts, respectively; l indicates the number of lags.

The coefficient in front of the interaction term between the structural indicator and the 'cost of funds' rate (β_4) estimates the difference between banks in respect of their short- and long-run pass multipliers, conditional on their structural indicators.

A summary table of the assessed one-stage model studies, in the same order as they are discussed in the following paragraphs is presented in table 2.2.

Table 2.2: Summary of the one-stage estimation studies based on panel models

Author(s)	Country	Time period	Frequency of the data	Type of the data	Number of cross-sectional units	Estimation method	Balanced / unbalanced panel	Retail rates considered	Multipliers examined	Structural Variables	Significant determinants
Berstein and Fuentes (2003)	Chile	1996-2002	Monthly	Bank level	18-20	Dynamic panel, "difference" GMM	Unbalanced	Lending	Short and long-run	Size and credit risk exposure of banks	Size and credit risk exposure of banks
Berstein and Fuentes (2005)	Chile	1995-2002	Monthly	Bank level	20-21	Dynamic panel, "difference" GMM	Unbalanced	Deposit	Short and long-run	Concentration, liquidity, size and credit risk exposure of banks	Market concentration, liquidity, size and credit risk exposure of banks
Gambacorta (2008)	Italy	1993-2001	Quarterly	Bank level	73	Dynamic panel, "difference" GMM	Balanced	Deposit and lending	Short and long-run and the speed of adjustment	Liquidity, capitalisation, size, the level of non-deposit funding and the existence of relationship banking	Liquidity, capitalisation, the level of non-deposit funding and the existence of relationship banking. "Size"?
Weth (2002)	Germany	1993-2000	Monthly	Bank level	492	Panel ECM	/	Lending	Short and long-run and the speed of adjustment	Size, non-deposit funding, maturity miss-match and relationship banking	Size, non-deposit funding, maturity miss-match and relationship banking
Mueller-Spahn (2008)	Germany	2003-2006	Monthly	Bank level	197	Panel ECM	Balanced	Lending and deposit	Short and long-run	Size, liquidity and portfolio diversification	Size, liquidity and portfolio diversification
Chmielewski (2004)	Poland	1998-2003	Monthly	Bank level	11-14	Panel ECM	Unbalanced	Deposit and lending	Short and long-run and the speed of adjustment	Profitability, credit risk exposure and capitalisation	Profitability, credit risk exposure and capitalisation

Examples of studies who apply this approach are Berstein and Fuentes (2003 and 2005). The authors investigate the structural determinants that affect the pass-through multipliers of banks' retail rates in the Chilean banking system, using "difference" GMM dynamic panel data estimation. The results presented in Berstein and Fuentes (2003) suggest that the major determinants of short- and long-run pass-through multipliers of lending rates are the level of credit risk exposure and size of the banks. Larger bank size leads to more sluggish short- and long-run adjustment of lending rates to changes in the 'cost of funds' rate. Higher credit risk exposure leads to more rigid short-run adjustment, but more complete long-run adjustment of lending rates to changes in the 'cost of funds' rate; an inconsistent finding that lacks more detailed explanation. The estimates presented in Berstein and Fuentes (2005) indicate that the size of adjustment of deposit rates is determined not only from the size and credit risk exposure of banks, but also by liquidity and the degree of concentration in the banking sector. More precisely, concentration, liquidity and the credit risk exposure negatively affect the short- and long-run pass-through multipliers; whereas size is positively related to both short- and long-run multipliers. However, the estimated sign of credit risk exposure indicator is the opposite from what is expected. The authors explain this finding by arguing that this indicator serves as an *ex-post* risk measure, while the banks are actually interested in the *ex-ante* risk they face for which the authors could not find an appropriate proxy measure. A possible weakness of both studies of Berstein and Fuentes is that they only explore the factors that affect the pass-through multipliers without examining the factors that affect the speed of adjustment, as is done in other studies, i.e. Gambacorta (2008), de Graeve et al. (2004) and Sorensen and Werner (2006).

Gambacorta (2008) explores the structural determinants of banks' retail rate pass-through in Italy by using almost the same methodology as Berstein and Fuentes. The results indicate only to a short-run pass-through heterogeneity among banks in Italy, while in the long-run, pass-through heterogeneity was rejected, which is in line with the findings of Weth (2002) for the case of Germany but contrary to the findings of de Graeve et al. (2004) for the case of

Belgium and Mueller-Spahn (2008) for the case of Germany. This indicates that the retail rate setting strategy among banks in Italy differs only in the short-run, while in the long-run almost all banks react equally in adjusting their retail rates to changes in the ‘cost of funds’ rate. The most significant factors that negatively affect the speed of adjustment and short-run pass-through multipliers of both lending and deposit rates were estimated to be the liquidity and capitalisation of banks, the level of non-deposit funding and the existence of relationship banking. The size of Italian banks is positively associated with the speed of adjustment and short-run pass-through multipliers, indicating that larger banks adjust their retail rates quicker and more fully to changes in the ‘cost of funds’ rate. Nevertheless, the results in respect of the size of the banks should be taken with caution because their significance varies with different model specifications. However, as Gambacorta (2008) acknowledges, the sample may be biased because it over-represents large banks in Italy. The reason for this is because interest rate series for small banks (so-called mutual banks) is not available. Another weakness of the data set is related to the decision of the author to exclude foreign banks.

One possible general weakness of the afore-mentioned analyses of Berstein and Fuentes (2003 and 2005) and Gambacorta (2008), is related to their estimation method. These studies are based on dynamic panel model, estimated with “difference” GMM. However, having in mind that most of the variables included exhibit near unit root process and recent developments in dynamic panel estimators, a more appropriate estimator would be “system” GMM (for details see sections 4.5.3 and 5.4). Another possible weakness of the study by Gambacorta (2008) is that some regressions reported suffer from the possible problem of ‘too many instruments’ resulting in p-value of the Sargan test between 0.90 and 1, which indicates a low power of the test. In the studies by Berstein and Fuentes (2003 and 2005) the results of the Sargan test are not reported, which begs the issue of the validity of the instruments used.

Other empirical studies (Weth, 2002; Mueller-Spahn, 2008 and Chmielewski, 2004), investigate what factors affect the size and speed of adjustment of banks' retail rates, by again applying a panel data model, but estimated according to a different method. This type of empirical studies first order the banks according to each of their specific financial characteristics and divides them into various sub-groups. Then, by using an ECM, equation 2.4 is estimated for each group of banks. In this way, the researchers may compare the differences between the size and speed of adjustment coefficients among different groups of banks and may indirectly draw conclusions as to which financial characteristics may have an impact on the pass-through coefficients. However, the main requirement for conducting this methodology is a large cross-sectional sample with a relatively large heterogeneity among banks in respect to their financial characteristics. The main disadvantage of this methodology is that it can only be useful in disentangling which micro structural characteristics may affect the retail rate adjustment, but not the macroeconomic factors like GDP and inflation and the overall competitiveness in the banking system. The latter are also seen as significant factors for the heterogeneous retail rate setting decisions (Cottarelli and Kourelis, 1994; Sander and Kleimeier, 2004a).

Using this kind of methodology, Weth (2002) investigates which of the four financial characteristics (size, non-deposit funding, maturity miss-match between long-term loans and deposits and banks' involvement in relationship lending) affect the size and speed of adjustment of lending rates among banks in Germany. The results, similar to Gambacorta (2008) but in contrast to de Graeve et al. (2004) and Mueller-Spahn (2008), reject the long-run pass-through heterogeneity and indicate a substantial short-run pass-through heterogeneity in adjustment. This implies that different characteristics among German banks may affect their retail rate setting decisions only in the short-, but not in the long-run. According to the results, larger bank size, higher non-deposit funding and maturity miss-match between long-term loans and deposits lead to a faster and greater size of adjustment of lending rates to changes in the 'cost of funds' rate. In contrast, higher bank involvement in relationship lending (the "hausbank" phenomenon) leads to a more rigid short-run adjustment of lending rates (consistent with the relationship lending theory, see section 2.2.3). The results of

Mueller-Spahn (2008) indicated to both, a short- and long-run heterogeneity of adjustment of retail rates among German banks. As significant factors over the size of adjustment of banks' retail rates were estimated to be: bank size positively (consistent with Weth, 2002); and liquidity and portfolio diversification negatively.

In a similar manner, Chmielewski (2004) investigates what determines retail rate setting decisions among banks in Poland, by considering the following three different financial characteristics: profitability, credit risk exposure and capitalisation ratio. The results indicate that more profitable banks and/or banks with higher credit risk exposure adjust their retail rates faster and more fully to changes in the 'cost of funds' rate, while more capitalised banks exhibit higher adjustment rigidity. The main possible shortcoming of this study is related to the type of methodology applied to the relatively small cross-sectional sample that consists of only 11 to 14 banks. As mentioned in one of the previous paragraphs, a much larger sample is needed in order to group the banks into different categories if the aim is to compare the differences in the pass-through multipliers.

The main possible pitfall of the assessed studies by Weth (2002), Mueller-Spahn (2008) and Chmielewski (2004) is related to their estimation method. Namely, these authors use panel method with ECM, without testing first if the variables included are I(1) or I(0). Moreover, they do not test if the variables are cointegrated, but they just assume a long-run cointegrating relationship (see section 2.3.5). Moreover, the afore-mentioned authors, similar as de Graeve et al. (2004), apply panel ECM by assuming that the disturbances among the cross-sectional units are uncorrelated; as explained in section 3.3, this may provide inefficient estimates.

A general concern with the empirical studies assessed in this subsection is related to model specification and how they assess the size of short-run adjustment of banks' retail rates to changes in the 'cost of funds' rate. The main aim of the models is to investigate banks' reaction function to changes in the 'cost of funds' rate within the current or previous time period (the impact multiplier).

For that reason the time series models, the dynamic panel data models as well as the panel data models based on ECM, estimate the short-run pass through coefficients within the current or the previous month/quarter (the impact multiplier). However, in investigating the impact multiplier, those models implicitly assume that the current changes in the retail rates are mainly determined by changes in the 'cost of funds' rate that occurred within the current or the previous period. Accordingly, those models do not investigate the possibility of whether the adjustment of banks' retail rates in the current period may be a result of a delayed banks' response to changes in the 'cost of funds' rate that might have occurred some periods ago. Moreover, banks may also adjust their retail rates in the current period as a cumulative response to several changes in the 'cost of funds' rate that have occurred in the past. Such staggered adjustments may be, for instance, the outcome of 'menu costs' where the banks' view of the adjustment costs compared to the benefits of changing the retail rates change over time and the length of these lagged responses may vary with the development of monetary policy and other factors. Assessing whether banks' retail rate setting function indicates delayed adjustment to changes in the 'cost of funds' rate is not undertaken in the studies analysed in this subsection, given that it is difficult to specify an appropriate empirical model or select an appropriate estimation method.

In summary, the surveyed empirical studies in this subsection have attempted to investigate the determinants mainly of the size, and some of them, of the speed of adjustment of banks' retail rates to changes in the 'cost of funds' rate. The results have suggested that, among the various economies considered, as major determinants of the size and speed of the pass-through coefficients were estimated to be *a)* some macroeconomic factors such as, inflation and economic growth; *b)* some financial indicators like, money market rate volatility and the concentration in the banking sector and *c)* some bank specific characteristics like asset size, liquidity, capitalisation, credit risk and interest risk exposure of the banks, their involvement in relationship lending activities, portfolio diversification and operational efficiency. Although the assessed studies in this section have some weaknesses, in general their results are consistent with the theoretical predictions assessed in section 2.2.

2.3.2 Studies that examine the average level of retail rates setting

The studies in this group mainly differ by the data series used, i.e. whether they are based on aggregate or individual (bank-level) data. A summary table of the assessed studies which estimate the determinants of retail rate setting decisions based on a linear relationship, ordered in the same way as they are discussed in the text, is presented in table 2.3.

Table 2.3: Summary of the assessed studies which estimate the determinants of retail rate setting decisions based on a linear relationship

Author(s)	Country	Time period	Frequency of the data	Type of the data	Number of cross-sectional units	Estimation method	Structural Variables	Significant determinants
Wrobel and Pawlowska (2002)	Poland	1995-2001	Monthly	Aggregate	/	ECM	Banking concentration	Banking concentration
Betancourt et al. (2008)	Colombia	1999-2006	Monthly	Aggregate	/	ECM	Industrial production index	Industrial production index
Kauko (2005)	Finland	1993-2003	Quarterly	Aggregate	/	OLS	Credit risk exposure	GDP, credit risk exposure and liquidity of banks
Mishra et al. (2010)	109 low income economies	1960-2008	Monthly	Aggregate	<109	Panel data, FE	Concentration in the banking sector and "institutional quality" variable	Concentration in the banking sector and "institutional quality" variable
Berger and Hannan (1989)	USA	1983-1985	Quarterly	Bank level	470	Panel Data, OLS	Concentration, size, operating costs	Concentration
Cihak (2004)	Croatia	1999-2003	Monthly	Bank level	46	Panel Data, GLS, SUR	Size, liquidity, foreign ownership, NPL and capital ratios	Size, liquidity, foreign ownership, NPL and capital ratios
Vaskov et al. (2010)	Macedonia	2001Q4 - 2007Q2	Quarterly	Bank level	15	Panel Data: GLS and Fixed effects	Size, banks' market share, credit risk exposure, liquidity, capital, profitability, operating costs and foreign ownership	Size, banks' market share, credit risk exposure, capital, profitability, "liquidity" and "foreign ownership"

Most of the studies that are based on aggregated bank data apply time series methods in order to investigate the direct linear relationship between various structural indicators and the average level of banks' retail rates. For example, Wrobel and Pawlowska (2002), by employing an ECM, investigate how the level of concentration in the Polish banking sector affects banks' retail rate setting. The results are in line with the mark-up pricing theory suggesting that, on average, a higher level of concentration allows banks in the short-run to charge higher loan and offer lower deposit rates. Based on the same estimation method, Betancourt et al. (2008) explore how overall economic activity may affect retail rate setting in Columbia. Their results indicate that a higher level of economic activity negatively affects deposit rates in the short-run, implying that as economic activity intensifies banks on average provide lower deposit rates. This is explained by the argument that in periods of economic expansion banks have higher inflows of deposits for which they can offer lower deposit rates. In periods of economic downturns when banks are faced with deposit withdrawal and/or lower deposit supply, banks offer higher deposits rates in order to reduce the deposit withdrawal and/or to attract higher deposit supply. However, the economic activity variable did not have any significant impact on the lending rate setting, for which no explanation is given. Summary of the study by Kauko (2005) based on the OLS method and the study of Mishra et al. (2010) based on panel data fixed effects are presented in table 2.3.

The main weakness of the majority of the aforementioned analyses is that all of them assume a long-run equilibrium relationship among the interest rate series, i.e. the series are cointegrated. On that basis, Wrobel and Pawlowska (2002) and Betancourt et al. (2008) investigate the factors that affect only the short-run relationship by directly estimating the ECM. Moreover, Kauko (2005) directly estimates the long-run relationship by employing the OLS, again without investigating first if the series are cointegrated.

Based on bank-level data, one of the pioneering studies in this area is by Berger and Hannan (1989). The authors examine what factors affect the deposit rate setting among banks in the US economy using a panel data model. Among the factors considered, such as operating costs, the size of banks and the level of concentration in the banking sector, the authors provide statistical evidence that only the level of concentration negatively alters the deposit rate setting. This implies that banks in more concentrated markets set lower deposit rates. Operating costs are also significant in most of the regressions, but this does vary with different model specifications. Nonetheless, the main shortcoming of this analysis is that it only considers a few banks' specific financial characteristics and neglects the impact of some other potentially important financial characteristics such as interest risk and credit risk exposure, liquidity and capitalisation. These financial characteristics in other empirical studies (Sorensen and Werner, 2006 and Gambacorta, 2008) have been estimated as significant factors.

More comprehensive analyses, based on similar estimation methods, but with a greater variety of banks' financial characteristics as considered as determinants of lending rate setting behaviour for the Croatian and Macedonian banking systems respectively, were conducted by Cihak (2004) and Vaskov et al. (2010), respectively. The analysis by Cihak (2004) suggests that lending rate setting behaviour among banks in Croatia is negatively affected by their asset size, level of liquidity, capital ratio and the presence of foreign ownership, but positively by the NPL ratio. These results are broadly in line with the theoretical predictions.

Vaskov et al. (2010) suggest that banks' market share, size, credit risk exposure, capitalisation ratio and profitability of Macedonian banks have an important influence on the lending rate setting decisions and most of them have a sign consistent with theory. For example, banks' market share, credit risk exposure and profitability are positively related to the lending rates, indicating that the higher they are, then the higher will be loan interest rates charged by banks. Bank size and capital are negatively related to the lending rates, indicating that larger and/or more capitalised banks, on average, charge lower interest rates. The former is consistent with the "efficient-market" hypothesis, whereas the latter is in line with the bank lending channel theory (see sections 4.1 and 5.2). Foreign ownership variable is negative and marginally significant, suggesting that foreign owned banks on average charge lower lending rates. However, the liquidity variable is estimated with contrary sign to what was expected and is marginally significant, for which no comprehensive explanation is provided. One of the reasons for the contrary sign of liquidity indicator from what was expected may be the structural surplus liquidity of the Macedonian banking system (see section 1.4). The estimates of the liquidity variable are consistent with the results estimating the determinants of the stock of domestic currency loans in Macedonia, where this variable was also estimated with the contrary sign from what was expected, although insignificant (see section 5.5.3). The operating costs variable is estimated as statistically insignificant for which no explanation is offered. This is in line with the estimates discussed in section 2.3.3 of the interest rate spread and in section 3.5 for the size of lending rate adjustment in Macedonia. The main possible drawback of the study by Vaskov et al. (2010) is that the authors include banks' market share and profitability variables that, according to Structure-Conduct-Performance paradigm, may be endogenous to prices (lending rates). Regarding the former, firms may use their prices as an instrument to get higher market share. In the case of the banking sector, a bank may set lower lending rates in order to acquire a higher market share (Berger and Hannan, 1989). Regarding profitability, it may also be endogenous to prices (lending rates) because in the loan market where a bank has a market power, it may charge higher lending rates in order to increase its profitability. Associated with the model specification and the variables included, although the study by Vaskov et al. (2010) takes into account the impact of various bank balance sheet items (see table 2.3), it omits some other, possibly important, bank-level variables such as a relationship lending variable, maturity mismatch and the impact of portfolio diversification. Moreover, this study does not control for the possible impact of the macroeconomic factors.

In brief, the surveyed empirical studies in this subsection have investigated what are the major factors that affect the average level of interest rate charged by banks. All of them are based on the assumption of a linear relationship between banks' retail rates and the structural indicators examined. In general, it can be summarised that presented results are consistent with the various theoretical predictions assessed in section 2.2. These results imply that more or less, similar factors affect both the average level of retail rates charged and the size and speed of adjustment of banks' retail rates to changes in the 'cost of funds' rate, as explained in the previous subsection.

2.3.3 Studies that examine the determinants of interest margins between banks' retail rates and 'cost of funds' rate

There are several studies that explore the determinants of interest rate spread between banks' retail rates and the 'cost of funds' rate. They again differ according to the type of the data they use, i.e. aggregate or bank-level data and their estimation method. A summary table of the assessed studies, ordered in the same way as they are discussed in the text, is presented in table 2.4. A summary of other studies that use similar estimation methods and similar control variables as the ones to be discussed is also presented in table 2.4.

Table 2.4: Summary of the studies which estimate the determinants of interest rate spreads

Author(s)	Country	Time period	Frequency of the data	Type of the data	Number of cross-sectional units	Estimation method	Balanced / unbalanced panel	Spread calculated as a difference between:	Structural variables	Significant determinants
Corvoisier and Gropp (2002)	10 euro-zone economies	1993-1999	Annual	Aggregate	>10	Panel Data, Fixed and Random effects	/	Lending (deposit) and money market rate	Concentration in the banking sector, financial deepening of the economy and operating costs	Concentration in the banking sector, financial deepening of the economy
Angbazo (1997)	USA	1989-1993	Annual	Bank level	286	Panel Data, GLS	Balanced	Net interest margin	Credit risk and interest risk exposure, capitalisation and liquidity	Credit risk and interest risk exposure, capitalisation and liquidity
Demirguc-Kunt and Huizinga (1999)	set of 80 economies around the world	1988-1995	Annual	Bank level	>1000	Panel Data, Weighted Least Squares	Unbalanced	Net interest margin	GDP growth, inflation, level of financial deepening, capitalization, size of the banks, the level of concentration and the presence of foreign ownership in the banking sector and a set of legal variables	Inflation, level of financial deepening, capitalization, size of the banks, the level of concentration and the presence of foreign ownership in the banking sector
Sanders and Schumacher (2000)	5 EU economies plus USA	1988-1995	Annual	Bank level	614	Cross-section by OLS and Panel Data Groupwise regressions: 2 STEP GLS estimator	/	Net interest margin	Non-interest expenses, capital ratio, reserve requirements, interest rate volatility and institutional differences	Non-interest expenses, capital ratio, reserve requirements, interest rate volatility and institutional differences
More and Nagy (2003)	8 CSEE economies	1998-2001	Annual	Bank level	>80	Panel Data, Fixed and Random effects	/	Net interest margin	GDP growth, inflation, level of financial deepening, operating costs, credit risk exposure, banking concentration	Level of financial deepening, operating costs, credit risk exposure, banking concentration
Cihak (2004)	Croatia	1999-2003	Monthly	Bank level	46	Panel Data, GLS and SUR	Balanced	Loan and deposit rates	Size, liquidity, foreign ownership, NPL and capital ratios	Size, liquidity, foreign ownership, NPL and capital ratios

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Author(s)	Country	Time period	Frequency of the data	Type of the data	Number of cross-sectional units	Estimation method	Balanced / unbalanced panel	Spread calculated as a difference between:	Structural variables	Significant determinants
Vaskov et al. (2010)	Macedonia	2001Q4 - 2007Q2	Quarterly	Bank level	15	Panel Data, GLS, Fixed effects	Balanced	Loan and deposit rates	Size, banks' market share, credit risk exposure, liquidity, capital, profitability, operating costs and foreign ownership.	Size, banks' market share, credit risk exposure, profitability, foreign ownership and "liquidity".
Boutillier et al. (2006)	France	1992-2004	Quarterly	Aggregate by bank product	9-11	SUR	/	Loan and money market rates	GDP growth, unemployment, volatility of money market rate, credit risk exposure, debt burden	GDP growth, volatility of money market rate, credit risk exposure
Crowley (2007)	18 English-Speaking African Countries	1975-2004	Annual	Aggregate	18	Panel Data, Fixed effects	Unbalanced	Lending and deposit rate, adjusted for inflation	GDP growth, inflation, competition and public ownership in the banking sector, operating costs, credit risk exposure and capitalisation	Inflation, competition and public ownership in the banking sector
Maudos and de Guevara (2004)	5 EU economies	1993-2000	Annual	Bank level	1436-1796	Panel Data, Fixed effects with Within-group estimator	Unbalanced	Lending (deposit) and money market rate	Concentration in the banking sector, interest risk, credit risk exposure, operating costs and the management quality	Concentration in the banking sector, interest risk, credit risk exposure, operating costs and the management quality
Doliente (2005)	Philippines, Indonesia, Thailand and Malaysia	1994-2001	Annual	Bank level	/	Panel Data	/	Net interest margin	Capitalisation, operating costs, liquidity, non-interest earning assets and credit risk exposure	Capitalisation, operating costs, liquidity, non-interest earning assets and "credit risk exposure"
Afanasieff et al. (2002)	Brazil	1997-2000	Monthly	Bank level	142	Panel Data with Within-group estimator	Unbalanced	Loan and deposit rates	GDP growth, inflation and interest rate volatility, non-interest bearing deposits, operating costs, credit risk exposure and liquidity	Interest rate volatility, non-interest bearing deposits and the operating costs

Based on aggregated data, Corvoisier and Gropp (2002) examine the determinants of interest rate spreads for different loan products at the aggregate level for the 10 euro-zone economies. Their results suggest that interest rate spreads are positively determined by the level of concentration in the banking sector and the degree of financial deepening of the economy, while operating costs do not have any significant impact over the spreads. However, the estimated positive sign of the financial deepening variable (measured by the credit-to-GDP ratio), is not in line with standard *a priori* expectations that imply a reverse relationship. The authors suggest this is because when the financial deepening indicator is higher, then economic agents are more dependent on bank loans, the market power of banks increases, and thus they can set higher spreads.

Using bank-level data, Angbazo (1997) investigates how banks' financial characteristics influence spread setting decisions among banks in the US economy. The results of the panel data estimation imply, consistent with the theory, that higher credit risk and interest risk exposure, and capitalisation ratio are positively related to interest rate spreads while liquidity is negatively related. However, a possible weakness of this study is that it only investigates the impact of banks' financial characteristics on interest rate spreads without taking into account the influence of the macroeconomic factors like GDP growth, inflation and the level of financial deepening that according to Corvoisier and Gropp (2002) and Demirguc-Kunt and Huizinga (1999) are also found to be significant factors in spread determination.

Based on a similar estimation method, using bank-level data for up to 80 economies around the world, Demirguc-Kunt and Huizinga (1999) explore what macroeconomic and banks' financial factors determine interest rate spreads. Regarding the macroeconomic factors, the results indicate that interest rate spreads are significantly and positively determined by inflation and negatively by the level of financial deepening (a finding consistent with Corvoisier and Gropp discussed above, for which they offer a similar explanation); while GDP growth did not have any significant impact. Their estimates also suggest that interest rate spreads are positively determined by the capitalization ratio and banks' size, the level of concentration and the presence of foreign ownership in the banking sector. This research is conducted for a set of 80 economies around the world with different monetary policy regimes and financial structures which may significantly alter banks' spread-setting. Some of these factors are controlled for in the model by including country specific dummies and a set of legal variables proxing the country specific effects, however this may not fully capture the changing country specific effects in the banking systems of the sample economies.

Saunders and Schumacher (2000) explore what factors affect interest rate spreads among banks in the sample of five EU and the US economies. The results indicate that interest rate spreads are significantly determined by the ratio of non-interest expenses, capital ratio and the reserve requirements imposed by the monetary authorities. Regarding the country differences, interest rate spreads are significantly determined by differences in the interest rate volatility and the institutional differences among the sample economies. However, a possible drawback of this research, similar to Demirguc-Kunt and Huizinga above, is that in order to capture the impact of the various institutional settings among the sample economies the authors include country specific dummies, which may not fully capture the country specific changing effects in the banking systems of the sample economies.

Regarding the transition economies, More and Nagy (2003) investigate how some macroeconomic and banks' financial characteristics determine spread-setting among banks in the eight new EU member states from CSEE. Their results from a panel data model suggest that among the macroeconomic factors included, only the level of financial deepening plays a significant and negative role on the spread setting decisions, consistent with the findings of Corvoisier and Gropp (2002) and others discussed above. Regarding the banks' financial characteristics, the results are consistent with the theory, indicating a positive relationship between the operating costs, credit risk exposure and interest rate spreads. However, the results in respect to the banking concentration variable are estimated to be negative, which is contrary to the previously assessed studies (Demirguc-Kunt and Huizinga, 1999 and Corvoisier and Gropp, 2002). This finding is explained by the "efficient-market" hypothesis, i.e. more concentrated markets are dominated by larger banks that, due to the economies of scale, are more efficient and thus set lower spreads. A pitfall of this study is that during the sample period some economies, such as Czech Republic, underwent a monetary policy regime shift. This is not taken into account in the model, which is problematic as the monetary policy regime may directly affect the interest-rate channel of the monetary transmission and hence banks' interest-rate and spread setting decisions.

Regarding the case of Croatia and Macedonia, the analyses of Cihak (2004) and Vaskov et al. (2010) estimate how the same banks' financial characteristics as the ones already analysed for lending rates (considered in section 2.3.2) affect the interest rate spreads in both economies respectively. The estimates presented in Cihak indicate that interest rate spreads in Croatia are positively determined by the NPL and capital ratios, but negatively by their size, level of liquidity and the presence of foreign ownership.

The results of Vaskov et al. (2010) from various model specifications indicate a significant and positive impact on the interest rate spreads of banks' market share, profitability and liquidity; whereas asset size and foreign ownership variables are negatively related, consistent with the prior expectations. However, the credit risk exposure and bank liquidity had a significant impact but with contrary sign from what was expected, for which no detailed discussion is provided. The contrary impact of the liquidity variable is similar to the results reported in section 2.3.2. The operating costs variable is again statistically insignificant, for which no argument is provided. This is consistent with the previous results discussed in section 2.3.2 and the results in section 3.5. A possible weakness of this study is that the authors include profitability and banks' market share indicators that may again be endogenous to the interest rate margin setting, for the reasons already considered in section 2.3.2. Additionally, as already explained in section 2.3.2, this study in assessing the determinants of the interest rate spread among Macedonian banks omits some other ‘important’ bank specific characteristics and the impact of the macroeconomic environment.

In summary, the empirical studies assessed in this section investigating the determinants of banks’ interest rate margins, again point to similar indicators to the studies already surveyed in the previous two subsections. The presented results are largely in line with the theoretical predictions. The major macroeconomic determinants of interest rate margins were identified as inflation and economic growth. The major indicators for the financial system were estimated to be the money market rate volatility and the level of concentration in the banking sector. The most significant bank balance sheet items are indicated to be banks’ credit risk and interest rate risk exposure, liquidity and capital ratios, operating costs and the extent of their portfolio diversification.

2.3.4 Empirical studies that investigate the interest rate pass-through in Macedonia

Apart from the study by Vaskov et al. (2010) that investigates the determinants for the average level of lending rates charged and the determinants of interest rate margins among Macedonian banks (see sections 2.3.2 and 2.3.3), there is no existing study that explores the determinants of the size of adjustment of banks’ retail rates to changes in the ‘cost of funds’ rate. There are just a few studies that investigate only the size and speed of adjustment of lending rates in Macedonia whose details are presented in table 2.5.

Table 2.5: Summary of the studies that investigate the size and speed of interest rate pass-through in Macedonia

Author(s)	Time period	Frequency of the data	Type of the data	Estimation method
Jovanovski et al. (2005)	2002-2004	Monthly	Aggregate	ECM: VECM
Velickovski (2006)	1997-2006 / 2000-2006	Monthly	Aggregate	ECM: E-G
Velickovski (2010)	1997-2008 / 2003 - 2008	Monthly	Aggregate	ECM: E-G, VECM and VAR

Jovanovski et al. (2005) investigate the interest rate pass-through from the monetary policy rate as well as the money market rate to the banks' lending rate using the Vector Error Correction Model (VECM). Their results suggest a complete long-run pass-through from the policy rate to banks' lending rate and negative short-run pass-through between the key policy rate and lending rate. The latter is explained by the argument that the reference policy rate (the CB Bills rate) serves as an alternative rate of return for the banks and not as 'cost of funds' rate due to the fixed exchange rate regime and the way how the monetary policy is conducted (see sections 1.4 and 1.7). However, a possible pitfall of their analysis is that they employ a VECM on a time span of only 2 years, which may be inappropriate. Another possible weakness arises from multicollinearity, since in the model the authors include two separate regressors, the policy rate and money market rate, as proxy variables for the same thing, i.e. 'cost of funds' rate; which are highly correlated (see section 1.7).

Velickovski (2006 and 2010) investigates the size of the pass-through from CB Bills rate to the banks' retail rates. The results from Velickovski (2006), based on the Engle-Granger (E-G) method, indicate the non-existence of a cointegrating relationship between the two rates and he concludes that the interest rate channel is incomplete. However, this author does not proceed with the analysis by estimating the size of the pass-through with different methods, i.e. differenced variables or Vector Autoregression (VAR). In contrast, the findings of Velickovksi (2010) by using a VECM have indicated that, after restricting the time period from 2003 to 2008 (due to the lower variability of the key policy rate during this period); there is almost a complete long-run relationship between the key policy rate and banks' lending rate. Nonetheless, the results implied that the speed and size of the short-run adjustment between these two rates are quite sluggish and far from incomplete.

Additionally, Velickovski (2006 and 2010) investigates the size and speed of transmission from the referent policy rate to money market rate. The results have indicated that it is complete in both the short- and long-run.

The major weakness of the aforementioned studies is that they are conducted on aggregate data and may suffer from aggregation bias (see section 2.3.5). Furthermore, these studies conclude that the interest-rate pass-through from the 'cost of funds' rate to banks' lending rate is incomplete at least in the short-run, but do not identify what are the factors that impede the interest rate channel.

In brief, although the assessed empirical analyses for the size and speed of the adjustment of lending rates in the case of Macedonia have some weaknesses, they are the pioneering studies that quantitatively measure the size and speed of adjustment. Their major finding is that in the short-run, the adjustment of lending rates to changes in the reference rate is incomplete. For the long-run relationship, the evidence is mixed. The study by Jovanovski et al. (2005) indicates a cointegrating relationship between the reference rate and money market rate on one side and the lending rate on the other side. However, this statistical evidence should be treated with caution due to the short-time span. Similarly, the study by Velickovski (2010) points to complete long-run pass-through from key policy rate to lending rate. Another finding of the assessed studies is that the pass-through (short- and long-run) from the CB Bills rate to the money market rate is complete. Overall, although these studies have not directly explored the determinants for the incomplete short-run adjustment of lending rates in Macedonia, however they provide some useful indicators for future research.

2.3.5 A general criticism of the reviewed empirical studies

One of the main possible weaknesses of some of these reviewed studies is related to their data sets used. Many of the studies are based on aggregate level data (see tables 2.1, 2.3, 2.4 and 2.5), that are composed as a simple sum or as a weighted average of the bank-level data. However, aggregating the data of the micro units, according to Theil (1957) and Zellner (1962), may lead to aggregation bias. The theoretical basis of the aggregation bias is that the individual (micro) units from which the aggregated data is composed may be individuals with different (heterogeneous) behaviour. Consequently, by estimating the economic relations with aggregated data, the individual behaviour of each unit is suppressed and thus, it may be hidden in the disturbances of the model based on aggregated data that may result in biased estimates. The derivation of the aggregation bias based on simple (bivariate) time series regression, according to Theil (1957), Zellner (1962) and Lee et al. (1990) is as follows:

The general disaggregated model for each unit may be presented as:

$$Y_{it} = \beta_i X_{it} + u_i \; ; \; i = 1, 2, 3 \ldots\ldots n \qquad (2.11)$$

where: Y is the dependent variable; X is an independent variable; β is a coefficient to be estimated; u are white noise residuals; i and t are unit and time specific subscripts. The same equation derived for the aggregated data would be:

$$\sum_{i=1}^{n} Y_{it} = \sum_{i=1}^{n} \beta_i X_{it} + \sum_{i=1}^{n} u_i \qquad (2.12)$$

However, in the empirical research based on aggregated data, the economic relations are estimated as follows:

$$\sum_{i=1}^{n} Y_{it} = \beta \sum_{i=1}^{n} X_{it} + \mathrm{v}_i \qquad (2.13)$$

Equations 2.12 and 2.13 would be equal if the residuals of both equations are equal ($\sum_{i=1}^{n} u_i = \mathrm{v}_i$), for which the following condition (H_0) must be satisfied:

$$H_0\text{: } \sum_{i=1}^{n} \beta_i X_{it} - \beta \sum_{i=1}^{n} X_{it} = 0 \qquad (2.14)$$

or in a simplified form (Zellner, 1962):

$$H_0\text{: } \beta_1 = \beta_2 = \beta_3 = \cdots\cdots = \beta_i \qquad (2.15)$$

Condition (H_0) actually indicates that the parameters β from equation 2.12 must be equal between each individual unit, implying to homogeneous behaviour among the units from which the aggregated data are composed. Otherwise, if the condition (H_0) is not satisfied, then it implies that the units have heterogeneous behaviour that will be hidden in the error term of equation 2.13 and would result in biased estimates.

In the case of the banking sector, de Graeve et al. (2004) argues that estimating the pass-through multipliers with aggregate data may also lead to aggregation bias arising from the heterogeneous nature of the data. This argument is empirically supported by in their paper which presents estimates for Belgium where the pass-through estimates based on aggregate data were lower compared to the same estimates based on individual (bank-level) data.

Another possible drawback regarding the studies that use bank-level data and some of the studies that use aggregated data for the same group of economies (EMU and CSEE economies) may be related to the estimation method used. The studies based on time series methods like: ECM (Mojon, 2000 and Cottarelli et al., 1995); TAR (Sander and Kleimer, 2004a, b), Panel Cointegration (de Graeve et al., 2004) and panel ECM (Weth, 2002; Mueller-Spahn, 2008 and Chmielewski, 2004) may provide inefficient estimates because they do not control for the contemporaneous cross-sectional correlation among the units. This may be especially pronounced for the studies based on panel cointegration because the estimators employed in those studies are based on the assumption of no cross-sectional correlation among the units (see section 3.3). Moreover, majority of the studies based on static panel data models that use both aggregated data for similar group of economies and/or bank-level data, may again suffer from the cross-sectional correlation among the units, e.g. Mishra et al. (2010), Crowley (2007); Corvoisier and Gropp (2002), Maudos and de Guevara (2004), Angbazo (1997), Demiguc-Kunt and Huizinga (1999), More and Nagy (2003), Doliente (2005) and Afanseiff et al. (2002). However, some studies have tackled this issue by either using the SUR model (Sorensen and Werner, 2006; Lago-Gonzalez and Salas-Fumas, 2005 and Boutillier et al., 2006) that has been specifically developed for that purpose (see section 3.3); or have corrected the estimator employed by controlling for the cross-sectional correlation among the units (Berger and Hannan, 1989; Cihak, 2004 and Vaskov et al., 2010).

A general weakness of the studies based on ECM in estimating the size of the pass-through (Mojon, 2000; Cottarelli et al., 1995; Sander and Kleimeier, 2004a, b; Sorensen and Werner, 2006; de Greave et al., 2004; Weth, 2002; Mueller-Spahn, 2008; Chmielewski 2004; Wrobel and Pawlowska, 2002; Betancourt et al. 2008; Velickovski, 2006 and 2010 and Jovanovski et al., 2005); is that these *a priori* expect to find a cointegrating relationship between the 'cost of funds' rate and banks' retail rates. Consequently in estimating the ECM model, some of the studies (de Greave et al., 2004; Weth, 2002; Mueller-Spahn, 2008; Chmielewski 2004 and Wrobel and Pawlowska, 2002) do not test if the interest rate series employed are stationary or not. Furthermore, many of the studies such as Weth (2002), Mueller-Spahn (2008), Chmielewski (2004), Wrobel and Pawlowska (2002) and Betancourt et al. (2008) do not test for the existence of a cointegrating relationship among the interest rate series. They directly estimate an ECM based on the assumption that the interest rate series a cointegrated. This approach of estimating the size of the pass-through within an ECM may be inappropriate. The reason for this is that, as explained in section 2.2.5, the mark-up pricing model is not clear whether *a priori* we might expect a long-run equilibrium relationship among the 'cost of funds' rate and banks retail rates. Moreover, the rest of the theories assessed in section 2 are more inclined to suggest that *a priori* we might not expect a long-run equilibrium between the two interest rate series (see section 2.2.5). This maybe a reason why in the studies by Sander and Kleimeier (2004a, b), de Graeve et al. (2004), Egert and al. (2007) and

Velickovski (2006), the authors failed to find a cointegrating relationship for most of the interest rate series used. Thus, apart from Velickovski (2006), they proceed by estimating the size of the pass-through with model by using first differences of the variables or by employing a VAR model.

Another possible problem with the majority of the studies conducted for the developing and transition economies from CSEE (Cottarelli and Kourelis, 1994; Betancourt et al., 2008; Berstein and Fuentes, 2005; Crowley, 2007; Demirguc-Kunt and Huizinga, 1999; Sander and Kleimeier, 2004b; Chmielewski, 2004; Wrobel and Pawlowska, 2002; Mishra et al., 2010; Cihak, 2004 and Vaskov et al., 2010), arises from the interest rate series used. These authors use loan and/or deposit rates composed of a weighted average of all currency denominations, i.e. loans and/or deposits denominated in foreign as well as domestic currency, including the foreign currency indexed loans/deposits. In contrast, as the reference policy rate they use either the domestic policy interest rate and/or the domestic money market rate, both of which relate to transactions denominated only in domestic currency. Accordingly, the authors in attempting to investigate the determinants of interest rate pass-through between the bank retail rates and the 'cost of funds' rate, indirectly disregard the impact of the currency substitution phenomenon. This phenomenon is present in the afore-mentioned group of economies through the relatively high share of foreign currency loans/deposits and foreign currency indexed loans/deposits to total stock of loans/deposits. Not controlling for this phenomenon in the models may bias the results. Namely, the degree of pass-through may be under- or over-estimated because part of the aggregated retail interest rates does not only react to changes in domestic referent rate, but also to changes in the respective foreign reference rate(s). For example, according to the empirical studies of the bank lending channel conducted for the transition economies (see section 4.5.2), it is estimated that in many CSEE economies banks' total loans are more responsive to changes in foreign reference rate than domestic rate. This may be more pronounced where the currency substitution is larger.

2.4 Conclusions

The aims of this chapter were to critically assess various theories of how banks adjust their retail rates and the main factors that affect the size of adjustment of banks' retail rates to changes in the 'cost of funds' rate. Additionally, this chapter has critically surveyed various empirical studies that explore the structural factors that affect banks' retail rate setting decisions, classified according to the conceptual framework of what is investigated and how the underlying theoretical mark-up pricing model has been developed and modified through time. This analysis provides the foundation for the conduct of our empirical research in chapter 3, investigating what factors affect the size of adjustment of lending rate among banks in Macedonia.

Regarding the theoretical background to how banks' set their retail rates, the 'core' model is the mark-up pricing model designed for a non-perfect competitive pricing environment. This model implies that variations in banks' retail rates are determined by the variations in the 'cost of funds' rate plus the mark-up margin. The mark-up margin, according to Ho and Saunders (1981), is inversely related to the interest-rate risks that banks face, or as Allen (1988) and Angbazo (1997) argue, it is also determined by the cross-product diversification of loans and deposits in respect to their maturity and banks' credit risk exposure respectively.

The main focus of the later developed theories is in investigating the factors that affect the size of banks' retail rates adjustment, i.e. the proportion by which variations in the 'cost of funds' rate are transmitted in banks' retail rates. Those theories are: the theory for asymmetric information and lending rate stickiness by Stiglitz and Weiss (1981); switching cost and related to that, relationship lending theory and "menu costs" theory established by Hannan and Berger (1991). Although these theories have some weaknesses, they provide some explanations for the possible reasons for the incomplete (sluggish) adjustment of banks' retail rates to changes in the 'cost of funds' rate, i.e. retail rate adjustment rigidity.

Considering the empirical studies, although they have some weaknesses and there is substantial heterogeneity among them in respect of what they are estimating, how they are estimating and the type of the data they use; overall their findings are broadly consistent with the theoretical predictions. Namely, they point to common macroeconomic and banks' financial characteristics as significant determinants of banks' retail rate setting decisions. Among the macroeconomic factors considered, the most important ones appear to be economic growth and inflation. Considering the indicators for the development of the financial sector, the generally significant ones are estimated to be: money market volatility and the concentration in the banking sector. Regarding the banks' financial characteristics, the significant factors are: asset size, interest risk and credit risk exposure, liquidity, capitalisation, banks' involvement in relationship lending activities, operational efficiency and their portfolio diversification. However, none of the assessed empirical studies has examined the size of adjustment coefficients (pass-through multipliers) in the Macedonian banking sector using bank-level data and what are their major determinants, which is the main challenge of the next chapter.

CHAPTER 3: INVESTIGATION OF THE DETERMINANTS OF THE SIZE OF ADJUSTMENT OF LENDING RATES IN MACEDONIA – A SUR APPROACH

3.1 Introduction

After critically assessing the various theoretical and empirical approaches to how banks set their retail rates in the previous chapter, the aim of this chapter is to directly respond to the first and second research questions of the thesis. Hence, this chapter will empirically investigate the size of banks' lending rate adjustment to changes in the 'cost of funds' rate and whether this is heterogeneous among banks. In doing this, this chapter also aims to identify what factors affect the pass-through multipliers in Macedonia. The rationale for exploring these issues in more depth is to provide a fuller picture of the effectiveness of the monetary transmission through the interest rate channel. From the monetary policy-makers' perspective, this is seen as important issue, having in mind the significance of the interest rate channel in the monetary transmission mechanism. Additionally, this chapter will also eventually enable us to compare whether the same factors affect both the interest rate and bank lending channels (see chapter 5). Hence, this research may provide some policy implications regarding the effectiveness of the interest rate channel and identify the factors that impede 'smooth' transmission in Macedonia, which ultimately may help monetary policy makers to take more appropriate policy measures.

In order to conduct this research we primarily follow the mark-up pricing model of how banks' set their retail rates designed for a non-perfectly competitive environment, established by Rousseas (1985) and Ho and Saunders (1981), as well as the applications of this found in the empirical literature (see sections 2.2 and 2.3). The latter may give us an indication as to how the theoretical underpinnings can be investigated in our empirical work (see section 2.3). According to the existing theoretical and empirical literature, various macro and microeconomic factors are seen to affect banks' pricing policy such as the structure of the financial system, macroeconomic characteristics of the economy and banks' balance sheet items.

The empirical studies that investigate interest rate pass-through in the Macedonian banking sector suggest that it is incomplete in the short-run

(Jovanovski et al. 2005 and Velickovski 2010) or in both the short- and long-run (Velickovski, 2006), see section 2.3.4. However, we have argued that an important possible drawback in these studies is that they may suffer from aggregation bias (see section 2.3.5). Thus, the core aim of this chapter is to examine the size of lending rate adjustment, whether it is heterogeneous among banks as well as to explore how and what factors considered in the previous paragraph affect the size of lending rate adjustment among Macedonian banks to changes in the 'cost of funds' rate,

Accordingly, the value added of this chapter is as follows: *First*, it investigates the size of lending rate adjustment, whether it is heterogeneous among Macedonian banks and what factors may have a significant impact over it. Accordingly, this investigation is based on a disaggregated (bank-level) data set, which has not been previously used to study the size of the pass-through in Macedonia (see section 2.3.4). Indeed, the literature for other countries, especially for the CSEE, based on bank-level data is quite limited (see tables 2.1 and 2.2). This may be of importance since studies that use industry level data may suffer from aggregation bias (see section 2.3.5). *Second*, in order to investigate whether there is banks' heterogeneous size of lending rate adjustment to changes in the 'cost of funds' rate and what factors may have a significant impact over it by using bank-level data, this research employs the different and arguably more appropriate estimation method of Seemingly Unrelated Regression (SUR). This technique has not been previously used in the Macedonian research and is rarely used in the empirical studies even for the developed economies (see sections 2.3.1, 2.3.2 and 2.3.3 and 2.3.4). *Third*, this study focuses only on lending rates of loans denominated in domestic currency unlike the rest of the studies for Macedonia as well as CSEE that use aggregated data set including domestic and foreign currency denominated series. The rationale for this is explained in section (2.3.5).

This chapter is structured as follows: section 3.2 explains the model in detail. Section 3.3 provides the estimation method and strategy. Section 3.4

describes the data used. The estimation results are presented in section 3.5, while the final section concludes.

3.2 The model

The model aims to explore the heterogeneous size of short-run adjustment of banks' lending rates to changes in the 'cost of funds' rate and its major determinants. It is designed to take into account the impact of various banks' specific variables (8), macroeconomic control factors (2) and a banking concentration index that, according to the theoretical predictions and the empirical studies assessed in sections 2.2 and 2.3, may affect banks' retail rate reaction functions to changes in the 'cost of funds' rate.

In order to investigate the short-run relationship of the interest rate series, i.e. the size and the factors that affect the pass-through multiplier within one-month (1-month impact multiplier), the model is estimated in first differences. Here, like the rest of the empirical literature (see section 2.3.1), we do not model for the possible delayed and variable adjustment reaction of banks' retail rates to changes in the 'cost of funds' rate. Another reason for estimating the model in first differences is that the mark-up pricing theory (see section 2.2.1) as well as the various other theories assessed in section 2.2 are not explicit whether the interest rate series are expected to be in a long-run equilibrium relationship, although they tend to incline that they might not be (see section 2.2.5). Also the theory does not consider if the rest of the structural variables included as possible determinants of the size of the pass-through multipliers are in a long-run equilibrium relationship with the size of retail rate adjustment (see section 2.2.5). Considering the empirical evidence, the majority of studies assessed in sections 2.3.1 and 2.3.2 examine the short-run relationship of the size of the pass-through by using an ECM. However, although this approach is based on the assumption of the existence of a cointegrating relationship among the variables, the majority of these studies do not conduct a unit root test of the variables to investigate if they are I(1) or I(0) and do not test for the stationarity of the residuals from the long-run relationship equation (see section 2.3.5) in order to investigate if the variables are cointegrated. Additionally, the empirical analysis that investigates the possibility of cointegrating relationship between the 'cost of funds' rate and banks' retail rates for the case of three EMU economies and four CSEE economies suggests: "The most remarkable feature of the results is the absence of cointegration for a large number of interest rate series." Egert et al. (2007, p.215). Overall, the theoretical basis is unclear on the existence of a long-run equilibrium relationship among the lending rates and 'cost of funds' rate (see sections 2.2.1 and 2.2.5) and the empirical evidence does not support this.

There are several reasons why we are primarily interested in investigating the short-run variations in the interest rates to changes in the 'cost of funds' rate. *First,* from the monetary policy-makers' perspective examining the extent of the short-run adjustment of banks' retail rates to changes in the reference rate and the factors that impede the smooth transmission is seen as quite important. The monetary policy authorities, in order to fulfill their policy objectives, are primarily interested in the short-run effectiveness of the immediate stage of monetary transmission, i.e. short-run banks' reaction to changes in the policy stance and how predictable this is (assuming no shifts in the relationships). Additionally, for the central banks in setting their monetary policy it is also important to know whether the banks' lending rate adjustment is stable through time. However, having in mind the length of the data set (see section 3.4), the model employed (see equation 3.1) as well as the estimation method used (SUR model with FGLS estimator, discussed in section 3.3), it is difficult in this study to pursue statistical methods that test the stability of the model. In a limited fashion we can examine predictability assuming no shifts in the relationships for each bank individually by assessing the in-sample root mean squared error (RMSE) for each bank specific equation. This RMSE is calculated as the square root of the mean of the squared differences between the in-sample values estimated by the model and the actual observed values of the dependent variable. Since this calculation is 'in sample', the values of the independent variables are known and thus it needs to be recognised that these RMSEs underestimate the forecasting error that would be associated with central bank use of such relationships, even assuming no structural breaks. Additionally, when the size of lending rate adjustment is heterogeneous among banks and/or not stable through time, this will complicate the monetary policy setting framework, indicating that the interest rate channel may not be operational from the monetary policy point of view. *Second*, according to the mark-up pricing theory, in an imperfect competitive pricing environment, rigidity of lending rate adjustment to changes in the 'cost of funds' rate should be more pronounced in the short rather than long-run. More precisely, banks are faced with a downward sloping loan demand curve, which is usually more inelastic in the short-run. In the long-run, depending on the financial structure of the economy, the loan demand curve may become more elastic because the economic agents (households and especially firms) may find alternative sources of finance. Hence, this may ultimately force banks in the long-run to adjust their lending rates more fully to changes in the 'cost of funds' rate compared to the short-run (Cottarelli and Kourelis, 1994). Moreover, under the assumption of the absence of large entry barriers, due to a threat of new entrants into the market, banks' long-run price setting behaviour may favour the setting of more competitive prices in order to acquire a higher market share. This may ultimately make the long-run adjustment less rigid then that of the short-run, although it does not suggest that it may be complete. *Third*, according to the "menu costs" theory (see section 2.2.4), banks may decide to adjust their retail rates only if the marginal gain from changes in retail rates is higher than the costs incurred in changing their interest rates. However, the longer the lending rate is kept unadjusted to the changes in the 'cost of funds' rate, then the higher the potential costs of not changing the lending rate with forgone multi-period benefits, including the lost income from attracting new borrowers. This implies that banks are more likely to exhibit higher adjustment rigidity in the short- than in the long-run. *Fourth*, in order to explore whether there is a cross-sectional heterogeneity of banks' retail rate adjustment and, if there is, what are the possible factors causing it; then exploring the short-run pass-through behaviour among the units may be relevant. According to the empirical evidence presented by Gambacorta (2008) and Weth (2002), a homogeneous reaction among all banks' to changes in the 'cost of funds' rate is found in the long-run, but not in the short-run (see section 2.3.1). This indicates that in the short-run, banks with different financial characteristics react differently to changes in the 'cost of funds' rate. In contrast, the findings of de Graeve et al. (2004), Sorensen and Werner (2006) and Mueller-Spahn (2008) have suggested not only to a short-run pass through heterogeneity among banks, but also to differences in the long-run (see section 2.3.1). This indicates that the literature is not clear whether in the long-run we should expect a homogeneous banks' reaction function to changes in the 'cost of funds' rate. Moreover, the existing empirical evidence in the case of Macedonia, although based on aggregated data, suggests that the short-run adjustment rigidity of lending rates is more pronounced then the long-run (see section 2.3.4). On that basis, we argue that investigating the short-run pricing behaviour of banks is of relevance.

Some of the empirical studies assessed in section 2.3.1 investigate the long run relationship among the banks' lending rates and 'cost of funds' rate by employing an ECM. We explore whether a cointegrating relationship exists among the interest rate series and hence, whether it is appropriate to use an ECM given our data. The cointegration test results based on the Engle-Granger method with a small sample adjustment of the critical values of the t-statistics by MacKinnon (1991), indicate that the null hypothesis of no cointegration can be rejected for only three out of fifteen banks in the sample at 10% level (see appendix 3.1). Additionally, by assessing the statistical significance of the error correction term from the error correction model (see appendix 3.1), it is statistically significant at the 5% level for the same three banks for which the null hypothesis of no cointegration could not be rejected plus one more bank (bank 2) for which it was just significant at this level. However, for the latter the null hypothesis of no cointegration could not be rejected and thus the results together provide mixed evidence as to whether a cointegrating relationship among the interest rate series exists for this bank. Regarding the rest of the banks in the sample, in none of them is the error correction term estimated as statistically significant even at the 10% level. Overall, having in mind that those banks for which the results suggested the existence of a cointegration relationship are small and medium sized banks whose average loan market share during the whole sample period was less than 10%, we conclude that in general in our sample the interest rate series may not be in a long-run equilibrium relationship. This is consistent with the theoretical background presented in section 2.2 and various empirical studies such as: Egert et al. (2007), Velickovski (2006), Sander and Kleimer (2004a, b) and de Graeve et al. (2004) and hence, we proceed with estimating the short-run relationship among them.

In the model it is assumed that, in the short-run, banks are agents with heterogeneous behavioural functions. In the theoretical literature there are pro- and contra-arguments as to whether banks behave differently in the short-run, thus it is an empirical issue, and one which the literature has not yet resolved (see the previous paragraph and section 2.3.1). Consequently, in order to investigate if this assumption holds, we have selected an estimation method that allows us to test if the slope coefficients statistically differ between banks for the case of Macedonia (see section 3.3). In this sector there are some possible *a priori* theoretical arguments (explained in the following paragraph), as well as some *a priori* empirical indicators, based on simple eyeball analysis of the 1st differences of the loan interest rate series for each bank separately (see appendix 3.2). These suggest that the short-run lending rate setting behaviour is heterogeneous among the banks, indicating that the timing of interest rate changes has differed considerably between the banks. Whether this conclusion statistically holds or not and what are the possible factors causing it, is the subject of a more comprehensive econometric analysis later in this chapter (see section 3.5).

According to the theoretical literature, in the case of imperfect competition, there are arguments explaining why banks may have different price setting strategies and consequently, may have different sizes of short-run adjustment. One of the possible factors that may affect the optimal size of adjustment in banks, and thus affect the slope coefficients among them, is the different price elasticities of loan demand in the various loan market segments in which banks operate. For example, some banks may prefer granting more consumer loans while others favour real estate loans and some banks are more specialised in granting loans to the corporate sector while others concentrate on the household sector. Hence, loan demand elasticity may not be equal among various loans market segments which may directly affect the pass-through coefficients to differ between units (see sections 2.3.1 and 3.4). Bearing in mind that disaggregated interest rate series by sectoral structure and according to different types of loans by purpose are not available (see section 3.4), then unequal loan demand elasticity among different loan market segments may be a non-modelled factor leading to banks having heterogeneous slope coefficients. Another possible factor that may give heterogeneity in the short-run could be financial market imperfections and changes in regulatory requirements imposed by the monetary authorities by which banks are obligated to adjust their balance sheet items (Ho and Saunders, 1981; Angbazo, 1997 and Cottarelli and Kourelis, 1994). These may not affect all banks equally, and may make some banks better off and others not, depending upon their financial performances. Another non-modelled factor which may contribute for banks' short-run heterogeneous behaviour may be the existence of different degrees of switching costs among different loan market segments and different banks. For example, it is expected that short-run interest rate smoothing will be more pronounced for those borrowers that are faced with higher switching costs and vice versa (see section 2.2.3). The reason for not modelling for the impact of switching costs is mainly because the theories do not provide any indication of how they can be measured or by which variable(s) they may be proxied (see section 2.2.5). These costs are quite difficult to measure and in the empirical studies conducted so far no proxy measure for them has been included (see section 2.3). However, having in mind the theoretical basis of the switching costs and relationship lending activities of the banks (see section 2.2.3), their impact over the size of the banks' lending rate adjustment is partially captured by the relationship lending variable and the market concentration variable (see section 3.2).

The assessed empirical literature in section 2.3 implies that there is no straightforward and commonly accepted empirical model derived from the theory.

There is a large variation in the empirical models used, both in respect of the variables included and the estimation methods employed. Some authors have considered some theoretical aspects and omitted others. Other authors have attempted to deal with some issues from a statistical point of view by applying some specific estimation methods, but have disregarded others. Hence, having in mind the complexity of this whole area, in our model specification we attempt to deal with the following aspects. *First*, to investigate the determinants of the short-run lending rate adjustment to changes in the 'cost of funds' rate by considering a comprehensive set of bank balance sheet items as well as some macroeconomic control variables. *Second*, we attempt to explore if the slope coefficients differ among the units and consequently, to directly test if the assumption that banks are agents with heterogeneous behaviour, conditional on the controls, holds in the case of Macedonia. *Third*, we take into account the possible contemporaneous cross-sectional correlation among the units (see section 3.3). Overall, due to the complexity of the whole area, with the model specification below, as with other empirical studies in this field, we cannot encompass all possible complications. However, we use a model and econometric technique that is appropriate to investigate the above areas that we have argued are of importance.

The basic model specification that allows for different slope coefficients for each cross-sectional unit, based on a common equation structure is as follows:

$$\Delta i_{jt} = \beta_{0j} + \beta_{1j}\Delta m_{t-1} + (X_{jt-1}\Delta m_{t-1})'\beta_{2j} + (\Phi_{jt-1}\Delta m_{t-1})'\beta_{3j} + (\Pi_{jt-1}\Delta m_{t-1})'\beta_{4j} + \varepsilon_{jt}; \quad j = 1, \ldots, N \qquad (3.1)$$

Where:

- β_0 is the intercept term;
- i is bank's lending rate of domestic currency loans;
- m is the 'cost of funds' rate (MBKS rate);
- X is a matrix of bank specific characteristics (size, liquidity, capital, NPL ratio, maturity-mismatch, relationship lending, operational efficiency and portfolio diversification);
- Φ is a matrix of macroeconomic characteristics (inflation and economic growth);

- Π is a matrix of variables measuring the level of concentration in the banking sector (Hirschman-Herfindahl index: HHI and HHI^2);
- ε is the error term[13];
- j and t refer to the bank and time specific subscripts;
- Δ is a first difference operator;
- β_1 is a parameter to be estimated;
- β_{2j} is a vector of parameters to be estimated of the interaction terms between the change in the 'cost of funds' rate and each bank specific characteristic respectively;
- β_{3j} is a vector of parameters to be estimated of the interaction term between the change in the 'cost of funds' rate and macroeconomic variables (inflation and economic growth);
- B_{4j} is a vector of parameters to be estimated of the interaction term between the change in the 'cost of funds' rate and HHI indices.

The independent variables in the model 3.1 are included with one period (month) lag. The rationale for this, instead of including their contemporaneous values, is that there is likely to be some adjustment inertia of lending rates to changes in the 'cost of funds' rate. This inertia may be caused by the existence of some "menu costs" and the time-lag caused by the decision-making process. Using a one period time lag is also preferable for the balance sheet items and the macroeconomic control variables because it is seen to be a minimum adjustment period of banks' retail rates to changes in the structure of balance sheet items and macroeconomic environment to take a place. Moreover, bearing in mind that the bank's interest rate series reported are those for the end of each calendar month, and that the 'cost of funds' rate or changes in balance sheet items and/or macroeconomic variables may take place near the end of the calendar month, then using the current month reduces the possible reaction time considerably.

According to the mark-up pricing theory, all independent variables included in model 3.1 such as the 'cost of funds' rate, bank balance sheet items, macroeconomic indicators and market concentration variables are taken to be strictly exogenous. Even if for some of the bank balance sheet items this might be arguable; however their inclusion with one period time lag allows the

[13] The form of the error term depends on the econometric model employed that will be discussed in more detail in section 3.3.

contemporaneous exogeneity assumption to be satisfied (see section 3.3). As Gambacorta (2008) argues, "…..bank-specific characteristics should refer to the period before banks set their interest rates." p.798.

In the model specification 3.1, changes in banks' lending rate are dependent on changes in the 'cost of funds' rate, the interaction terms between changes in the 'cost of funds' rate and the bank specific variables, macroeconomic control variables, and variables measuring the level of concentration in the banking sector. In the model, we refrain from including the individual terms of bank balance sheet items, macroeconomic control variables and the HHI because, although we might expect these single terms to affect the level of interest rates, the single terms do not affect the size of adjustment which is the core aim of the research. According to equation 2.4, the theories presented in section 2 are concerned with modelling the factors that affect the β_2 coefficient that, as explained in section 2.2.1, is the size of adjustment of banks' lending rates to changes in the 'cost of funds' rate. For example, the theory of asymmetric information, relationship lending and menu costs theories (see sections 2.2.2, 2.2.3 and 2.2.4, respectively) investigate the factors that affect this coefficient and not the average level of lending rate setting, regardless of the change in the 'cost of funds' rate. In order to explore the impact on the size of adjustment of lending rates, as explained previously in this section, we have included interaction terms. Namely, as Gambacorta (2008) argues: "..... interaction terms between interest rates and the bank-specific characteristics .... capture heterogeneity in the monetary transmission mechanism." (p.801).

In model 3.1, the vector parameters β_{1j}, β_{2j}, β_{3j} and β_{4j} cannot be directly interpreted on a *ceteris paribus* basis by isolating the impact of the rest of the variables. This is because the equation contains interaction terms, which makes the interpretation of the results more complicated. Our main interest is to analyse their statistical significance and sign from which we may be able to draw a conclusion on whether there is any impact of the independent variables over the size of the pass-through and if there is, in what direction they affect it. To obtain the partial effect of the changes in the 'cost of funds' rate to the size of the pass-through multipliers of lending rates (*ceteris paribus*), we do a first order differentiation of equation 3.1 with respect of 'cost of funds' rate at a certain value of the rest of the variables that include the interaction terms such as their mean value. The first order differentiation in respect of the 'cost of funds' rate is shown with the following formula:

$$\frac{\Delta(\Delta i_{jt})}{\Delta(\Delta m_{t-1})} = \beta_1 + (X_{jt-1})'\beta_{2j} + (\Phi_{t-1})'\beta_{3j} + (\Pi_{t-1})'\beta_{4j} \qquad (3.2)$$

This equation indicates the size of the one month adjustment of banks' lending rates to changes in the 'cost of funds' rate, is conditional on specific value of the rest of the variables included in the model, e.g. their mean value. In other words, the estimated size of these coefficients implies what proportion of changes in the 'cost of funds' rate in the previous month has been transmitted to banks' lending rates in the current month, conditional on the value of the bank specific characteristics, macroeconomic variables and concentration in the banking sector. In order to investigate the impact of banks' specific variables, macroeconomic variables and the impact of the concentration in the banking sector over the size of adjustment, we again do a first order differentiation of the model. But the difference now is that the first order differentiation of the model is done in respect of the independent variable that is of our interest, conditional on a given value, such as the mean of the change in the money market rate over the sample period. All coefficients, as indicated by equation 3.1, are estimated for each cross-sectional unit separately and this enables us to test if they statistically differ among the units.

The economic argument for each regressor and the expected *a priori* sign of the parameters (table 3.1), is discussed in what follows.

The change in the 'cost of funds' rate is included to measure the size of the adjustment of banks' lending rates. The expected sign of β_1 coefficient is positive. In selecting the 'cost of funds' rate we aimed to select an interest rate of transactions denominated in denars in order to be consistent with the lending rate series (see section 3.4) which also refer to loans denominated in denars. In choosing between the key policy rate, i.e. the Central Bank (CB) Bills rate and the money market rate (MBKS), we have considered the theoretical underpinnings of the mark-up pricing theory suggesting that banks adjust their retail rates according to the 'cost of funds' rate because it represents the financing costs of their lending activities (see section 2.2.1). Thus, we aim to select the interest rate that represents more closely the 'cost of funds' rate in the case of Macedonian banking system. In considering the CB Bills rate, it should be taken into account that due to the fixed exchange rate regime and the structural excess liquidity of the banking system, the NBRM controls the liquidity of the banking system by conducting weekly auctions of CB Bills (see sections 1.4 and 1.7). Consequently, this interest rate acts more as the rate on an alternative investment for the banks rather than the 'cost of funds' because banks can only place their liquid assets in order to buy CB Bills and cannot borrow to finance their lending activities (see sections 1.4 and 1.7). Moreover, the secondary market for the CB Bills is not yet developed, so changes in the policy rate may affect only those banks who have decided to participate in the weekly auctions. In contrast, banks' short-term borrowing takes place at the money market rate where they may finance their lending activities. Hence, according to the mark-up pricing theory, we argue that in the case of Macedonia, the money market rate may represent more closely the 'cost of funds' rate than the CB Bills rate. Consequently, following the approach by Cottarelli and Kourelis (1994), Mojon (2000), Sander and Kleimeier (2004a, b), Sorensen and Werner (2006), de Graeve et al. (2004), Chmielewski (2004), Weth (2002), Gambacorta (2008) and Lago-Gonzalez and Salas-Fumas (2005), we have taken the weighted average monthly money market (MBKS) rate as the representative 'cost of funds' rate. An additional reason for selecting the money market rate as a representative 'cost of funds' rate is because it is determined via the market principles of supply and demand of funds, while the CB Bills rate over most of the sample time period has been administratively set by the NBRM (see table 1.7). This process gives a lower variability in the CB Bills rate compared to MBKS rate.

Bank size, measured by total assets, is included in order to estimate how the asset size affects the size of adjustment. The "menu costs" theory indicates that larger banks should exhibit lower interest rate adjustment rigidity because their "menu costs" of adjusting the retail rates, as well as some other fixed costs such as the transactions costs and costs of monitoring and screening the borrowers, represent a smaller proportion of their total costs. This may lead the larger banks to adjust their retail rates more flexibly to changes in the 'cost of funds' rate than smaller banks (Laudadio, 1987). Additionally, bigger banks, due to the economies of scale, may be more efficient and therefore may adjust their retail rates more fully to changes in the 'cost of funds' rate ("efficient-market" hypothesis). Another argument why it is expected larger banks to adjust their retail rates more flexibly than smaller banks is because large banks may engage in lending relations with large borrowers (firms) that usually have a relatively high loan demand elasticity (Laudadio, 1987; Niggle, 1987; Ho and Saunders, 1981 and Weth, 2002). This is because large borrowers can more easily raise external funds from other sources on the financial market since they are seen as less risky due to their size, as well as 'good reputation' on the market. This may force large banks to adjust their retail rates more closely to the market conditions in order to maintain and/or attract large borrowers. In contrast, the bank lending channel theory predicts a contrary impact of banks' size. More explicitly, in periods of monetary policy tightening, bigger banks have greater access to, and can more easily raise, non-deposit funds in order to offset the changes in the reference rate (see sections 4.2 and 5.2), which makes them less dependent on changes in the 'cost of funds' rate. Hence, according to the arguments presented, the expected sign of size variable is ambiguous.

The variables measuring the levels of bank liquidity and capitalisation serve as proxy variables for liquidity and the insolvency risk of banks (Angbazo, 1997). The rationale for their inclusion in the model, according to the bank lending channel theory (see sections 4.1 and 5.2), is that banks with more liquid assets and/or better capitalised banks are seen as less risky in the financial market and therefore they may more easily raise external funds in order to meet new loan demands or deposit withdrawals. Moreover, these banks may also use their already accumulated liquid assets or capital in order to meet new deposit withdrawals or new loan demand requirements, making them less dependent on money market borrowing and thus, less sensitive to changes in the 'cost of funds' rate. Consequently, the expected sign of these two variables is negative. However, in the case of liquidity variable, this theoretical rationale may not apply in Macedonia due to the structural surplus liquidity of the banking system (see sections 1.4 and 5.2). The empirical analysis for Macedonia in investigating the determinants of lending rate setting and interest rate spreads (Vaskov et al. 2010; see sections 2.3.2 and 2.3.3) have found a contrary sign from the prior expectations. Moreover, the results of the analysis conducted in chapter 5 were also unable to confirm the theoretically anticipated sign of liquidity variable on the supply function for the domestic currency loans (see section 5.5.3).

The non-performing loans (NPL) ratio is a proxy variable for the credit risk exposure of the banks and their risk averse behaviour (Angbazo, 1997). According to the mark-up pricing theory, those banks with higher credit risk exposure, in order to compensate for the lost income of borrowers' default, are expected to charge higher lending rates and to set-up higher interest margins compared to banks with lower credit risk exposure (Rousseas, 1985 and Ho and Saunders, 1981). Thus, those banks are expected to increase their lending rates proportionately more than the 'cost of funds' rate in order to compensate for the lost income with borrowers' default. This implies to a positive sign of the coefficient. However, according to the theory of asymmetric information and lending rate stickiness (see section 2.2.2), banks may instead decide to ration credit and adjust their lending rates less fully to changes in the 'cost of funds' rate. More precisely, when the 'cost of funds' rate increases, those banks with a higher NPL ratio are expected to increase their lending rates proportionately less than the 'cost of funds' rate and ration credit. This is due to their higher intolerance of incurring additional risks: if they increase their lending rates fully to changes in the 'cost of funds' rate, then they have higher probability of attracting even more riskier borrowers (see section 2.2.2). In the opposite case, when the 'cost of funds' rate decreases, those banks with higher NPL ratio are expected to reduce their lending rates proportionally less in order to maintain their higher interest rate margins. Consequently, the theory of asymmetric information and lending rate stickiness predicts a negative sign of the coefficient. Overall, according to the arguments presented the impact of this variable is also ambiguous.

The maturity-mismatch variable indicates the maturity gap between long-term loans and long-term deposits and is taken as a proxy variable for the interest rate risk that banks face and the stability of financing the long-term loans (Allen, 1988, Angbazo, 1997; Weth, 2002 and Sorensen and Werner, 2006). In other words, this variable seeks to measure what proportion of long-term loans is financed by long-term deposits and thus, the extent of interest rate risk exposure of banks on the money market (see section 2.2.1). When the maturity-mismatch ratio is low, it implies that a higher proportion of long-term loans is financed by long-term deposits, making banks less dependent on money market borrowing and hence, less sensitive to changes in the ‘cost of funds’ rate and vice versa (Allen 1988). Consequently, when the ‘cost of funds’ rate changes, those banks with a lower maturity-mismatch do not have to fully adjust their lending rates to changes in the ‘cost of funds’ rate because they do not have to additionally borrow on the money market in order to meet the new loan demand. The greater part of their financial resources is already secured by the long-term deposits. In the case of Macedonia, the stability of long-term loans is additionally secured by banks’ long-term borrowings from abroad in the form of long-term foreign currency borrowing and/or subordinated deposits (see section 1.5). Thus, in this study this variable is modified by including the long-term borrowings from abroad because these borrowings may act as long-term deposits, i.e. with a maturity longer than one year. The expected sign of this variable is positive.

The ratio of long-term loans over total loans, as suggested by Berger and Udell (1992), is an indicator of the relationship lending activities between the bank and its borrowers. The rationale for including this variable, according to the relationship lending theory (see section 2.2.3), is that when the bank is more engaged in relationship lending activities with its borrowers, then the higher will be the interest rate smoothing over the changes in the 'cost of funds' rate. Accordingly, when the proportion of long-term loans is higher relative to total loans, then it is considered that the bank has more long-term commitments with its borrowers and the reverse. In this way the bank can more closely monitor the borrowers and obtain more proprietary information and thus, smooth the interest rate adjustment to changes in the 'cost of funds' rate. Therefore, the sign of this variable is expected to be negative.

The ratio of operating costs to total costs is a used as a proxy measure for banks' operational efficiency. Operating costs such as staff costs and other administrative costs, according to mark-up pricing theory, are a relatively rigid part of banks' total costs that do not vary much with the level of lending activities (Rousseas, 1985). When the operating costs are lower, then it implies that the bank has higher operational efficiency. Hence, a lower value of this variable implies that a higher proportion of a bank's total costs is determined by the funding costs, which are flexible costs, leading the bank to more fully adjust its lending rates to the 'cost of funds' rate changes (Rousseas, 1985 and Mojon, 2000). Therefore, the sign of this variable is expected to be negative. However, in the case of Macedonia, similar to other CSEE economies, the 'inherited' policy of soft budget constraints and over-employment from the previous regime, may affect the impact of this variable. Moreover, this variable may differ among different groups of banks such as the formerly state owned banks that were privatised, foreign acquired banks and foreign greenfield banks (Poghosyan and Poghosyan, 2010). For example, the operational efficiency of the formerly state-owned banks may have varied over the transition period because these banks have undergone a transformation process during this period in order to increase the management efficiency and improve their financial performances. Namely, this type of banks may have decided to reduce the proportion of their fixed costs by reducing the number of employees, improving the management efficiency or reducing other unnecessary fixed costs in order to maximise their profit. Consequently, those banks had to employ more educated workers and make other workers redundant due to the inherited over-employment that was typical of the former regime. In contrast, the greenfield banks (especially the foreign owned) did not have to go through the same transformation process and have directly employed appropriately skilled workers in the numbers needed. Hence, the empirical evidence presented in Poghosyan and Poghosyan, (2010) for the case of CSEE economies indicates that "Foreign greenfield banks exhibit superior operational efficiency in comparison to domestic and foreign acquired banks." (p.592). The operational efficiency of foreign acquired banks "......deteriorates in the initial year of acquisition, slightly improving in the subsequent year." (Poghosyan and Poghosyan, 2010; p.592). Accordingly, this indicator for the operational efficiency between these types of banks may indicate different long-run adjustment processes in restructuring their operating costs and its impact over the size of the lending rate adjustment may differ between short- and long-run. In the short-run, the relationship between the operational efficiency variable and size of the lending rate adjustment may be changing due to the different long-run adjustment process in the operating costs of the banks that may affect the stability and the impact of the coefficient. On this basis we argue that on *a priori* grounds it is difficult to predict the impact and significance of this variable in the case of Macedonian banking system. Moreover, the previous empirical studies examining the determinants for the average level of lending rate and spread setting decisions among Macedonian banks have estimated an insignificant impact of this variable (Vaskov et al., 2010; see sections 2.3.2 and 2.3.3).

The ratio of non-interest income to gross income indicates the degree of portfolio diversification of the bank. Accordingly it indicates that banks that have a higher share of non-interest income to total income ".....do not only rely on traditional banking activities such as granting loans and taking deposits......" (Sorensen and Werner, 2006, p.27). Thus, those banks have more diversified portfolio structure and are engaged in other activities in the financial market, perhaps including: insurance, investment banking, and/or activities on the foreign and stock exchange markets. When the proportion of total income from these activities is higher, it implies that banks are less dependent on the money market borrowing, which may lead them to adjust their retail rates more sluggishly to changes in the 'cost of funds' rate (Sorensen and Werner, 2006 and de Graeve et al., 2004). Hence, this variable is expected to have a negative sign.

The rate of growth of industrial production index (IPI) and the level of inflation are included as macroeconomic control variables. Grunfeld and Griliches (1960) argue that the individual (micro-units) equations may be misspecified due to the omission of the macroeconomic factors that may affect the individual behaviour of the units. The rationale for inclusion of inflation in the model is to indicate the extent of nominal indexing of interest rates to changes in the price level (as interest rate series are in nominal terms), and how this indexing affects the size of adjustment. For example, in high inflationary environments it is expected banks to adjust their retail rates more frequently and thus, more 'easily' to pass-through the changes in the 'cost of funds' rate to their borrowers, compared to periods with stable and relatively low inflation (Cottarelli and Kourelis, 1994; Mojon, 2000 and Egert et al., 2007). Moreover, high inflation may indicate a higher perceived risk from the overall macroeconomic environment, which is likely to induce banks to adjust their retail rates faster and more fully to changes in 'cost of funds' rate and to fully pass on the inflationary costs to the borrowers. This variable is expected to enter with a positive sign. In the model we have included the annual rate of inflation because in that way, price fluctuations induced by seasonal factors, e.g. oil and unprocessed food prices are reduced.

The rate of growth of IPI is included as a control variable for the economic cycles and the level of loan demand in the economy. In periods of economic growth when the loan demand rises, it will be 'easier' for the banks to pass-through the changes in the 'cost of funds' rate to their lending rates due to the rising income of the borrowers (Egert et al., 2007). Moreover, this variable may also be an indicator of the level of overall risk faced by the banks. When the economy is expanding, then households' income and firms' profitability are likely to be increasing and hence, banks may perceive a better financial environment with a lower risk of borrowers' default. In this case the banks may more fully pass-through the 'cost of funds' rate changes into their lending rates because the cash flow of the households and firms will not be greatly affected due to their rising income and reverse. The expected sign of this variable is positive. However, in the case of Macedonia, economic growth and IPI as the proxy measure were severely affected by the transition process and this macroeconomic control variable may also be capturing other factors related to the process of transition. For example, loan demand may be affected by the political instability and financial instability in the country, especially in the initial period of transition which was characterised by banking failure, and there was another failure of saving houses in a later period (see sections 5.2 and 5.5.1). Therefore, the sign and size of this variable should be interpreted with caution. In the model we have included the annual growth rate of IPI because in that way seasonally induced fluctuations in the IPI are reduced.

The coefficients on inflation and IPI variables, although the variables are cross-sectional invariant, are expected to differ across the units. In the case of inflation, it may be that not all banks will equally 'pass-through' the changes in the 'cost of funds' rate to their lending rates when the price level changes due to their different forward looking expectations about the future price changes. In the case of IPI, the explanation is that various banks are specialised in granting loans in different loan market segments and thus, they might be faced with different loan demand elasticities as considered above. This may ultimately result in heterogeneous size of adjustment and hence, in different slope coefficients among the units.

The inclusion of the variables measuring the overall level of concentration in the banking sector is because banks' market power may affect the size of the pass-through multiplier. According to the mark-up pricing theory, banks operate in a non-perfect competitive environment with entry and exit barriers and thus, exhibit some degree of market power (Rousseas, 1985 and Ho and Saunders, 1981). Hence, when the loan market is more concentrated, all banks in the market may extract higher profits and charge non-competitive prices and thus, are expected to be less sensitive to changes in the money market conditions. Consequently, the banks are expected to adjust their retail rates more sluggishly to changes in the 'cost of funds' rate, indicating a negative sign of the coefficient. This theoretical prediction applies to all banks in the market regardless to their size and market share. For instance, the banks with higher market share may be price leaders and adjust their lending rates less fully to changes in the 'cost of funds' rate. The banks with a lower market share may be price followers and again are expected to charge non-competitive prices and adjust their lending rates less fully to in the 'cost of funds' rate. These theoretical predictions of the mark-up pricing theory, where market power of the banks is taken to be exogenous, are according to the "Structure-Conduct-Performance" paradigm. In contrast, the predictions of "efficient-market" hypothesis by Demsetz (1973) suggest an inverse relationship between market concentration and size of the pass-through. More specifically, this theory assumes that more concentrated markets are dominated by larger banks due to their greater efficiency which is taken as exogenous factor. Consequently, in more concentrated markets that are considered as more efficient, it is expected banks to set their lending rates more closely to the money market conditions and adjust them more fully to the changes in the 'cost of funds' rate. This implies to a positive sign of the coefficient. In this chapter we follow the mark-up pricing model (see section 2.2.1), and given that there are still relatively high entry and exit barriers in the market, we expect a negative sign of the interaction term containing the concentration index variable. In measuring the level of concentration in the banking sector, usually in the literature are taken CR3 or CR5 indices or the Hirschman-Herfindahl index (HHI). We have decided to use the HHI due to certain advantages over the CR3 or CR5 indices. Namely, CR3 or CR5 indices place "......equal emphasis on leading banks and ignore the rest; the Herfindhal index which, while placing greater emphasis on larger market players and allowing for each bank, adopts a calculation method that automatically excludes the competitive conduct of banks as a diminishing factor." (More and Nagy, 2003, p.12).

In the literature it is also argued that a non-linear relationship between market concentration and pricing may exist. Namely, firms in concentrated markets may charge higher monopoly prices, but after a certain threshold level of concentration, firms may exhibit more competitive conduct because there may be a threat of new entrants in the market. Additionally, after a certain threshold level of concentration, banks may start charging more competitive prices because the ‘second’ largest competitor may want to take over the position of the largest competitor on the market (Cottarelli and Kourelis, 1994 and Molyneux, 1993). In order to control for these possible non-linear effects of concentration, we have included squared value of the concentration index, whose coefficient is expected to be positive. Nonetheless, in the case of the Macedonian banking market, the impact and significance of this variable might not be *a priori* clear. The threat of probable entry of outside competitors is not considered as serious due to the existence of still relatively high entry barriers in this market, despite the change in the banking law in June 2007[14]. For example, new entrants into the banking sector have to fulfill strict regulatory requirements as well as to deposit relatively high funds at the Central Bank, which may partially reduce the possibility of the threat of outside competitors. Moreover, the argument that the ‘second’ largest competitor on the loan market would try to take over the largest bank in the loan market may not be of importance. Namely, in the Macedonian banking market operate 18 banks and hence, it may not be so much concentrated where the ‘second’ or the ‘third’ largest competitors would try to take over the whole market. Furthermore, some banks are *de facto* foreign owned (as defined in section 1.4) and if a competitors tries to take over their position, then they may ask for internal borrowing from their ‘parent’ company in order to enhance their financial performance and maintain their loan market position.

[14] For more details see Official Gazette of the Republic of Macedonia No. 67/2007.

Table 3. 1: Expected sign of each of the parameters of the model 3.1

Variable:	Expected Sign	Variable:	Expected Sign
'Cost of funds' rate (dmbks)	+	Operational efficiency * MBKS (dmbksoperef)	–
Bank size * MBKS (dmbkslassets)	+ / –	Portfolio diversification * MBKS (dmbksportdiv)	–
Liquidity * MBKS (dmbksliquidity)	–	Inflation * MBKS (dmbksinfl)	+
Capital * MBKS (dmbkscapital)	–	Economic growth * MBKS (dmbksipi)	+ / –
NPL ratio * MBKS (dmbksNPLratio)	+ / –	HHI * MBKS (dmbkslhhi)	– /+
Maturity-mismatch * MBKS (dmbksmatmisub)	+	$(HHI)^2$ * MBKS (dmbkshhi2)	+
Relationship lending * MBKS (dmbksrellending)	–		

Note: the abbreviations in the parentheses represent the names of the interaction terms of the variables used in the estimation output.

3.3 Estimation method

The estimation method is selected to fulfill the aims and objectives outlined in section 3.1 and to enable us to empirically test if the theoretical expectations derived in the previous section hold for the Macedonian banking sector. We have also taken into account the specific nature of the cross-sectional units and the data series used. Unit root tests have been conducted (Augmented Dickey-Fuller (ADF) on the data series used in model 3.1, utilising the Akaike (AIC) and Schwarz (SIC) lag length selection criteria, Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) presented in appendix 3.3. Regarding the interaction terms that we use in model 3.1 (see appendix 3.3.a), the ADF and PP unit root tests reject the null hypothesis of a unit root for all variables that enter in model 3.1 in nearly all cases at the 1% level. In all other cases but two, there is rejection at the 5% level. For the variables dmbksmatmisub3 and dmbksrellenging3 there is rejection at the only 10% level in the ADF tests, but rejection is at the 1% level in the PP test for these variables. The KPSS tests do not give sufficient evidence to reject the null hypothesis of no unit root at 10% level. Regarding the unit root tests for the first differences of the interest rate series, i.e. banks' lending rates and money market rate (see appendix 3.3b), we have also conducted the ADF, PP and KPSS tests. In selecting the lag length for the ADF test, we chose the number of lags by the information criteria (AIC and

SIC) that indicated less lags due to the relatively short time span of the data. In the majority of the cases we have selected the number of lags indicated by the AIC criteria because it pointed to less lags compared to the SIC criteria. For only two interest rate series (dlendrateden16 and dlendrateden27), do AIC and SIC suggest the same number of lags. Hence, the number of lags indicated by the information criteria ranges from four lags for the money market rate (dmbks) up to ten lags for the lending rate for bank 5 (dlendrateden5) from a total of ninety-five available observations for each interest rate series. The ADF test results suggest the rejection of the null hypothesis of a unit root at 5% for all interest rate series, whereas the PP test indicates to rejection of the null hypothesis of a unit root at 1% level. The KPSS test does not give sufficient evidence to reject the null hypothesis of no unit root at the 10% level for all interest rate series. These test results suggest that all variables used in model 3.1 can be treated as stationary. Moreover, given the requirement for the error term to be white noise in the ADF test for the first differences of the interest rate series, we additionally check the diagnostic statistics (see appendix 3.3.b), in particular that for serial correlation. Namely, we have checked the diagnostic tests of the ADF such as Breusch-Pagan-Godfrey test for autocorrelation, Ramsey RESET for the functional form and Koenker-Bassett test for heteroscedasticity of the first differences of the interest rate series (see appendix 3.3.b). The diagnostic tests conducted give non-rejection of the null hypotheses of no autocorrelation, correct functional form and homoskedasticity at the 10% level (see appendix 3.3.b). Thus it is reasonable to proceed on the basis that the errors are white noise. Consequently, given the aims and objectives of this chapter, we needed to select a method that is able to estimate the determinants of banks' short-run lending rate adjustment to changes in the 'cost of funds' rate. We also had to select a method that enables different slope coefficient estimates for each cross-sectional unit that will allow us to test if those coefficients statistically differ between the units. We aim to test for this since the existing literature does not currently provide a clear answer on this issue and because, as mentioned in section 3.2, we have some arguments on *a priori* basis why the slope coefficients might be statistically different among the units.

Regarding the specific nature of the data and the cross-sectional units (banks), we have considered the number of observations for each bank, the time span of the data as well as their interrelatedness that may cause contemporaneous cross-sectional dependence among the disturbances. Banks in Macedonia are interrelated because they borrow between each other in the same money market and the same macroeconomic and financial factors and the same regulatory requirements affect all of the banks. Although we include variables, such as inflation and the industrial production index to account for some of these factors, these are not expected to fully do so. In selecting the estimation method we were also bounded by the limitations of the data such as, with relatively small cross-sectional sample (only 18 banks), methodological changes in data collection giving a relatively short-time span of 8 years and the limited interest rate series available.

Various estimation techniques were critically assessed in section 2.3, such as the two-stage and one-stage estimation methods that estimate the determinants of size and speed of adjustment coefficients (see section 2.3.1), and the single equation approach based on static panel data models estimated with FE, RE and/or GLS (see sections 2.3.2 and 2.3.3).

Some weaknesses and limitations were identified in the two-stage estimation methods and thus this option is not pursued. More precisely, regarding the first stage of the estimation process, i.e. when the size and speed of pass-through coefficients are estimated with time series methods for each cross-sectional unit separately or by panel methods, we identified difficulties in applying these methods. For example, majority of the studies in the first stage of the estimation process attempt to estimate the size of the pass-through by employing an ECM, but do not conduct unit root test(s) for the stationarity of the variables employed and the residuals from the long-run relationship in order to investigate if the variables are cointegrated. They only assume that there may exist a cointegrating relationship (see sections 2.3.1 and 2.3.5), although the theory is not clear on this (see section 2.2.5). Moreover, the majority of the empirical studies that have conducted a unit root tests for the stationarity of the residuals from the long-run relationship failed to find a cointegrating relationship. Hence, they proceed to estimate the pass-through coefficients by using first differences of the variables (Sander and Kleimer, 2004a, b; de Graeve et al., 2004 and Egert et al., 2007). Nonetheless, regardless whether the pass-through coefficients are estimated with or without an ECM for each cross-sectional unit separately, the results in majority of those studies may be inefficient because of the contemporaneous cross-sectional correlation between the units, which is expected in this case, and is not controlled for. Moreover, regarding our model specification, another technical reason that may complicate the possibility of employing an ECM is that we have interaction terms composed of two continuous variables. The time-series cointegration methods are not designed for inclusion of interaction terms of two continuous variables due to statistical reasons. More precisely by multiplying two I(1) variables, I(1) and I(0) or I(2) and I(1) or I(0); what will be the order of integration of the newly constructed interaction term is unclear. Due to the all of the afore-mentioned reasons in this paragraph we preclude the possibility of using cointegration and ECM methods.

Regarding the second stage of the estimation process, things may become even more ‘complicated’. Usually in the empirical literature (as considered in section 2.3.1), the procedure is to regress the estimated pass-through coefficients on a set of structural variables in a cross-sectional regression (Cottarelli and Kourelis, 1994; Sander and Kleimeier, 2004a, b; Sorensen and Werner, 2006 and de Graeve et al., 2004) or in a panel data model by dividing the sample into separate time-periods, i.e. sub-periods of 3 to 5 years (Mojon, 2000). In order to conduct the second stage of the estimation process with both, cross-sectional regression and panel data models, the authors use the average values of the independent structural variables over the years. By averaging the values of the variables over the whole or part of the time span, the fluctuations in the variables are reduced and hence, the time dimension of the data is omitted. In this way the changes that may have occurred during the analysed period may be disregarded. This method may be more appropriate for the developed economies that many of which have had, until recently, a more stable macroeconomic and financial environment over the last 10 years than transition economies, and thus we argue that this method may be inappropriate for our investigation. Moreover, even if this method is deemed suitable, it is still not applicable in our case because we have a small cross-sectional sample of only 18 units. Some authors such as Sorensen and Werner (2006) have attempted to solve this problem by applying "….. a wild-bootstrap method for the computation of p-values…." (p.26), but applying this method on a cross-sectional sample of only 18 observations would seem problematic.

One stage estimation methods based on dynamic panel data models that use either "difference" GMM estimator or panel ECM method are also problematic to use here. Dynamic panel data models that use the "difference" and/or "system" GMM estimator are ruled out in our case, given data limitations. Namely, as explained in section 5.4, they are designed for "large N and small T" samples. This assumption is not satisfied with our data because T is substantially greater than N (see section 3.4), and if we had proceeded with this estimation method, we expect to have the problem of the creation of 'too many' instruments and therefore, a low power of the diagnostic tests (see sections 5.4 and 5.5). Carrying out the same procedure as in chapter 5, i.e. using annual data in order to reduce the number of T observations, would mean in this case that the time variation in the data could not be investigated appropriately. Namely, the main area of interest here is to model the time variations in interest rate series and not the adjustment in stocks, as is the case with the model in chapter 5. Regarding the use of a panel ECM method, we also reject it because it requires an even larger cross-sectional sample than the GMM estimator. The authors that use these methods (see section 2.3.1) first group the banks according to their specific characteristics and then, for each group of banks, they estimate the pass-through coefficients and thus, compare the differences between the estimates. With a cross-sectional sample of 18 banks we argue that this option is not feasible. Another reason for precluding the possibility of using panel ECM and panel cointegration methods is that they do not control for the cross-sectional correlation among the units. Namely, panel cointegration tests "…..are based on the assumption that there is no correlation and no cointegration between the sections." (Sorensen and Werner, 2006, p.18). Moreover, in using panel cointegration method, as discussed previously, we have interaction terms composed of two continuous variables that may additionally complicate the whole estimation process.

Regarding the single equation approach based on static panel data models estimated with FE, RE and/or GLS, we argue that there are problems in using these estimators because they provide average estimates for the level of interest rates set by banks and their size of adjustment to changes in the 'cost of funds' rate. Additionally, these models assume equal slope coefficients for each cross-sectional unit on *a priori* grounds and do not allow for the possibility of testing if the slope coefficients statistically differ among the units, which we have argued should be examined with our model. Moreover, FE and RE estimators by *de-fault*, do not control for the possible cross-sectional contemporaneous correlation among the disturbances, unless you additionally do take care of it.

Thus, given to the assessment of the applicability of the various estimation methods, the specific nature of the data series and the possible phenomenon of contemporaneous correlation among the banks, we have selected Zellner's (1962 and 1963) Seemingly Unrelated Regression (SUR) model. The rationale for selecting this model is based upon several reasons. *Firstly*, in the case when there is contemporaneous correlation among the disturbances that are by nature heteroskedastic, then the SUR model based on a Feasible Generalised Least Squares (FGLS) estimator provides more efficient estimates compared to OLS, by using the information of the variance-covariance matrix of the error terms. Thus, when the correlation among the error terms of each cross-sectional unit is higher, then FGLS estimator is able to use more information from the variance-covariance matrix of the error terms and hence, the efficiency gain by employing the SUR model will be higher (Baum 2006, Greene 2008 and Vogelvang 2005). *Secondly*, it is designed for samples with large time dimension (T) and small or finite cross sectional dimension (N) where one of the major requirements is T to be substantially greater than N, which is the case with our data (T=96; N=15).

Thirdly, it may estimate different slope coefficients for each cross-sectional unit that allows testing for their cross-sectional equality. This then enables us to investigate whether there is a heterogeneous size of adjustment among banks in Macedonia and what the major determinants are. This option will actually enable us to test if the slope coefficients statistically differ among the cross-sectional units. *Fourthly*, as another advantage of employing the SUR model is that in the case when the repeated iterations in calculating the coefficients and their variances for each cross-sectional unit converge, then the FGLS estimator becomes equal to the Maximum Likelihood Estimator (MLE). This may provide some additional efficiency gains, under the condition that the normality assumption about error terms is fulfilled (Greene, 2008 and Moon and Perron, 2006). However, as discussed in Greene (2008), whether MLE provides some efficiency gains in small samples is uncertain.

The general form of the SUR model can be presented with the following system of equations:

$$Y_{1t} = \beta'_1 x_{1t} + u_{1t}$$

$$Y_{2t} = \beta'_2 x_{2t} + u_{2t}$$

$$\vdots$$

$$Y_{nt} = \beta'_n x_{nt} + u_{nt} \qquad (3.3)$$

Where: Y is the dependent variable, β' is a vector of coefficients; X is a matrix of independent variables, u are the error terms and n and t are cross-sectional and time specific subscripts.

The above equations can be stacked as a system and can be presented more compactly as follows:

$$Y_t = X_t'\beta + u_t \qquad (3.4)$$

Where: Y_t is $TN \times 1$ matrix of dependent variables; x' is a $TN \times K$ matrix of independent variables; β is a $K \times 1$ matrix of coefficients; u is $TN \times 1$ matrix of error terms; T and N are the number of time and cross-sectional observations, respectively and K is the number of independent variables.

Nonetheless, the SUR model has some limitations and requires certain assumptions to be fulfilled. The main assumptions are the exogeneity of the regressors and a normal distribution of the residuals; the latter assumption is mainly for MLE but not for FGLS. As Zellner (1963) argues: "….even when normality is not present, the estimation procedure is applicable and will yield consistent coefficient estimators which are asymptotically normally distributed." (p.988). In respect of the exogeneity assumption, the strongest form is the strict exogeneity assumption where all regressors from each equation are uncorrelated with the respective equation's error terms for all time periods:

$$E = (u_t \mid x_1, x_2, x_3, \ldots\ldots, x_t) = 0 \tag{3.5}$$

However, Wooldridge (2002) argues that this assumption may be relaxed by assuming a contemporaneous exogeneity, i.e. no correlation between the regressors and the error terms in the same time period, presented below:

$$E = (u_t \mid x_t) = 0 \tag{3.6}$$

The major limitation of the SUR model is that it does not properly deal with non-stationary variables because cointegration methods are not developed within the framework, while dynamic specifications are still in the process of development. Another limitation is that if any of the system equations is miss-specified, then all coefficients in each equation will be inconsistently estimated. Therefore, for a consistency check, it is argued that the results should be compared with the ones estimated with the OLS conducted on equation-by-equation basis (Moon and Perron 2006).

Regarding the issue whether the SUR model provides an appropriate estimator for dynamic models, we have considered if the recent work in the field of dynamic SUR is applicable in our case. More precisely, we have assessed the estimation method applied in Sorensen and Werner (2006) who employ Dynamic SUR (DSUR) for estimating the long-run relationship among the variables and the ECM for SUR (SURECM) for estimating the short-run dynamics. The recently developed DSUR method by Mark et al. (2005) and Moon and Perron (2005) is based on the dynamic ordinary least squares (DOLS) method by Stock and Watson (1993) that controls for the possible endogeneity of the regressors. Namely, "System DOLS is distinguished from ordinary DOLS in that endogeneity in equation *i* is corrected by introducing leads and lags of the first difference not only of the regressors of equation *i* but also of the regressors from all other equations in the system." (Mark et al., 2005, p.798). However, one of the weaknesses of the DSUR method is that it is designed for samples that have substantially larger T than N, or as it is discussed in Mark et al. (2005) it is works well for data series with T larger than 100 and N smaller than 8. Estimating DSUR on a system with greater N than 8 will absorb too many degrees of freedom due to the large number of leads and lags that have to be included in each equation, which suggests that this method is not applicable given our data set. Another weakness of this method is that it does not test for a co-integrating relationship among the variables, but cointegration is assumed according to the empirically tested theory. For instance, Moon and Perron (2005) empirically test the purchasing power parity (PPP) theory, by assuming that the PPP theory in the long-run holds and thus, assume that the residuals from the DSUR model are stationary and variables cointegrated. Regarding the interest rate pass-through, the assumption that banks' lending rate and 'cost of funds' rate are in a long-run equilibrium relationship (cointegrated), cannot be justified on *a priori* ground (see section 2.2.5). There are various theoretical reasons for expecting why the interest rate series may not be in a long-run equilibrium (section 2.2).

Regarding the SURECM method for estimating the short-run dynamics, we argue that it also has some severe weaknesses and therefore, is not appropriate in our case. This method is based on the Eagle-Granger error correction model, but again does not test for the stationarity of the residuals from the long-run relationship equation. The authors that employ this method (Thomson et al., 2002; Kim, 2004 and Sorensen and Werner, 2006), make a simple assumption that the residuals from the long-run relationship equation are stationary and thus, the variables are cointegrated as suggested by the economic theory, and proceed by estimating the short-run dynamics of the model. However, as considered above we think that the stationarity assumption is dubious for the theories that explain the determinants of interest rate pass-through, so we preclude the application of the SURECM method.

3.4 Data issues

The data period ranges from 2001:M1 to 2008:M12 and we have 96 available observations per bank. The reason for restricting the time period is because before 2001 the interest rate series for each bank were not available while at the beginning of 2009 a new accounting methodology was applied which distorts comparisons with the rest of the data series used in this analysis. Throughout the sample period we work with a balanced panel comprising 15 banks that have been operating continuously over the sample period. The SUR model is conducted on balanced panel data; although there are some recent developments in SUR methods for unbalanced data, these are still in the process of development.

The sample has been adjusted for mergers and acquisitions. The adjustment of banks' balance sheet items has been done by backward aggregation of the data series before the merger or acquisition occurred (for more details see section 5.3). Although this is the most commonly used approach in the literature (Ehrmann et al., 2003; Worms, 2003; Farinha and Marques, 2003; de Haan, 2003; Gambacorta, 2005; Havrylchyk and Jurzyk, 2005; Prutenau-Podpiera, 2007; Juks, 2004 and Benkovskis, 2008) and no other approach appears preferable, we have to be aware that this may give errors in the data because changes in the management of the merged bank and any gained know-how are not controlled for. In the case of merger we aggregate the data backwards as a weighted average of the value of the stock of loans and the respective interest rate of both entities. In doing this we have assumed, in the case of merger, that the management of both entities has also been merged and no single entity's retail rate setting strategy is taken as a dominant one. This may be problematic in that after the merger the new entity may apply a completely different price setting strategy. Nevertheless, due to the relatively small cross-sectional sample and the need to work with balanced panel data, we think that this is the 'second' best solution. In the case of acquisition, we have kept the lending rates of the acquiring bank before the acquisition has occurred, instead of backward aggregating the series as in the case of mergers. We argue that after the acquisition has occurred, the acquiring bank is likely to have maintained its previous retail rate setting strategy and has not changed or adopted the strategy of the acquired bank.

All variables in the model are expressed in nominal terms, except for the industrial production index which is in real terms. The balance sheet items such as total loans, long-term loans and long-term deposits are those of the non-financial private sector. Some of the balance sheet items[15] such as total assets, total loans, long-term loans, gross deposits and liquidity have been seasonally adjusted by using the census X-12 additive method, which is the most commonly used seasonal adjustment method in the literature. The other available option was to include monthly dummies in each equation in order to control for the seasonality in the data. However, this method will reduce the degrees of freedom substantially and thus, we refrained from using this method.

In examining the determinants of banks' lending rate rigidity, we use the interest rate series on banks' outstanding loans for each bank separately. Interest rates on newly issued loans are likely to be much more responsive to changes in the 'cost of funds' rate, but those data series are unavailable. However, in examining the effect of monetary policy changes, the retail rates of banks' outstanding loans are arguably preferable because they provide a more comprehensive picture about the cash flows of firms and households. If we had worked only with the interest rates of newly issued loans, then the pass-through coefficient would have been overestimated.

[15] We have seasonally adjusted some but not all of the balance sheet items because *a priori* we do not expect a seasonal pattern in all balance sheet items such as: capital, NPL ratio etc. Additionally, we have checked whether there is a seasonal pattern in these balance sheet items where we might not expect seasonality and we did not find any.

Regarding the currency structure, we use an interest rate series of loans denominated in denars for the reasons explained in section 2.3.5. An additional reason for selecting the lending rates of loans denominated in domestic currency is because their reaction to changes in the domestic reference rate is the main focus of the monetary policy makers. Nevertheless, the interest rate series in denars also include the interest rates of foreign currency indexed loans and due to data unavailability we were unable to disaggregate them. Nonetheless, as can be seen on figure 1.22, these two interest rate series on aggregate level (the ones in domestic currency and the ones indexed to a foreign currency) have almost the same dynamics, except that latter have on average a lower level.

Concerning the frequency of the data, the interest rate series were available in both quarterly and monthly frequencies. However, due to the estimation method used (see section 3.3), as well as from the monetary policy makers perspective (see section 3.2), using higher frequency data is preferable. Therefore, we use monthly frequency data.

Regarding the construction of the interest rate series, the loan interest rates in denars from 2001 to 2003 include short-term loans with maturity up to 1 year for the corporate sector only, while for 2004 they include short-term loans with maturity up to 1 year of both corporate and household sector of all loan types by purpose. From 2005 to 2008, loan rates are constructed as weighted average of all maturities (short- and long-term) of both sectors (household and corporate). This methodological change in constructing the data series that occurred in 2005 is a limitation with the interest rate series. The chosen interest rate series includes the interest rates of loans on both a fixed and variable basis.

Investigating the interest rate adjustment separately for the household and corporate sectors, as well as the adjustment of different types of loans by purpose may be more appropriate because, according to the empirical literature presented in section 2.3, not all loan interest rates adjust equally to changes in the 'cost of funds' rate (Sander and Kleimeier, 2004a, b; Lago-Gonzalez and Salas-Fumas, 2005; Egert et al., 2007; Sorensen and Werner, 2006). For example, loan rates on household sector are typically found to adjust more sluggishly then the ones in the corporate sector, while interest rates on mortgage loans are found to adjust more sluggishly to changes in the referent rate compared to interest rates on consumer loans. Nonetheless, such disaggregated interest rate series are not available.

Apart from the interest rate series, there are also some limitations of the rest of the data series, i.e. banks' balance sheet items in terms of their reliability, methodological consistence and the way they have been collected and backward revised (see section 5.3). However, these are perceived as minor and unlikely to significantly affect the results.

A detailed description of each data series is presented in table 3.2.

Table 3.2: Data description

Variable:	Description:	Value:	Source:
Lending rate	Weighted average monthly loan rates for each bank separately	%, annualised	NBRM
'Cost of funds' rate	Weighted average MBKS rate	%, annualised	NBRM
Bank size	Log of total assets	Nominal	NBRM
Liquidity	Ratio of liquid over total assets. Liquid assets include: cash in vault at the NBRM + short term deposits in accounts in banks abroad + CB Bills and treasury bills with maturity up to 1 year + cash in vaults in domestic banks + short term restricted deposits in accounts in domestic banks + short term loans granted to domestic financial institutions (banks and saving houses).	Nominal	NBRM
Capital	Ratio of equity plus reserves to total assets.	Nominal	NBRM
Credit risk exposure	Ratio of NPL to total loans.	Nominal	NBRM
Maturity-mismatch	Ratio of long-term loans to long-term deposits and long-term borrowings from abroad.	Nominal	NBRM
Relationship lending	Ratio of long-term loans to total loans.	Nominal	NBRM
Operational efficiency	Ratio of administrative costs to total costs.	Nominal	NBRM
Portfolio diversification	Ratio of non-interest income to gross income.	Nominal	NBRM
Price changes	Annual rate of inflation, measured by CPI.	%	SSO
Economic growth	Annual rate of growth of IPI.	%	SSO
Market concentration	Log of HHI and $(HHI)^2$	Index	Author's own calculations upon the data from NBRM

Source: NBRM and SSO.

The summary statistics of each variable as described in table 3.2 is presented in table below.

Table 3.3: Summary statistics

Variable:	Mean	Median	Minimum	Maximum	Standard Dev.	Observations
Lending rate	0.15	0.14	0.06	0.30	0.04	1440
MBKS	0.08	0.07	0.03	0.19	0.04	96
CB Bills rate 28 days	0.09	0.08	0.05	0.20	0.04	96
Assets	8423912	7438828	463137	7.E+07	3505318	1440
Liquidity	0.36	0.34	0.03	0.95	0.11	1440
Capital	0.33	0.33	0.06	1.11	0.09	1440
NPLratio	0.17	0.15	2E-06	0.91	0.09	1440
Maturiy mismatch	3.64	3.25	2E-05	58.89	2.28	1440
Relationship lending	0.44	0.46	3E-06	0.99	0.14	1440
Operational efficiency	0.31	0.32	0.01	0.78	0.08	1440
Portfolio diversification	0.63	0.62	-2.48	14.23	0.18	1440
Inflation	0.03	0.02	-0.02	0.10	0.03	96
Industrial prod. Index	0.01	0.01	-0.23	0.34	0.10	96
HHI	1640	1651	1394	1813	118	96

Source: Author's own calculations performed in EViews 6.

3.5 Results

The estimation strategy goes from a general (unrestricted) model as presented with equation 3.1, to a more specific version in order to select the most parsimonious model. In order to select the most parsimonious model we have performed a number of preliminary regressions. Starting from the most general model, given the theoretical arguments previously discussed as well their possible practical implications for the case of the Macedonian banking sector, we have obtained the following results.

Having in mind the ambiguous economic arguments presented in section 3.2 for the inclusion of the squared concentration index variable over the size of lending rate adjustment, we decided to assess its statistical significance in the model. An F-test for the joint significance of this variable in all bank specific equations indicated that it is jointly insignificant at 5% level of significance[16]. It was also statistically insignificant in the majority (12 out of 15 at the 5% level of significance) of the individual bank specific regressions. One of the three banks

[16] The results are available from the author upon request.

where this variable was statistically significant was a large bank, but the other two were small banks, for which the economic arguments presented in section 3.2 would not seem to apply.

Given the theoretical arguments for inclusion of this variable (explained in section 3.2), and the fact that the average loan market share of the three largest banks during the sample period was around 65%; we decided to include it only for the three largest banks in the sample. This is because those banks may be price leaders. Thus, in order to maintain their market power due to the possible threat of entry of outside competitors, these banks may start setting their lending rates on a more competitive basis. However, this variable was again individually insignificant for the two out of the three largest banks and jointly insignificant for all the three of them at the 5% level of significance[17]. Consequently, the results imply that this variable may not have significant explanatory power over the size of lending rate adjustment behaviour, even of the three largest banks and consequently, we excluded it from the model. These results are consistent with the findings of Berger and Hannan (1989).

Another variable with a questionable theoretical rationale for inclusion in the model, given the specific nature of the Macedonian banking system, is the operational efficiency variable (see section 3.2). From the statistical point of view, the results indicate that the operational efficiency variable is individually statistically insignificant for 13 out of 15 banks at 5% level. The F-test for the joint significance of this variable implies that it is insignificant at the 5% level[18]. We used another narrower indicator for operational efficiency by substituting the administrative costs with gross wages of the employees, which constitute substantial part of banks' administrative costs, as this has been employed in the empirical literature (Mojon, 2000). This variable again was jointly insignificant at 5% level of significance[19]. These results are in line with the findings of Vaskov et al. (2010) for the average level of lending rate setting and the interest rate spread

[17] The results are available from the author upon request.
[18] The results are available from the author upon request.
[19] The results are available from the author upon request.

among Macedonian banks (see sections 2.3.2 and 2.3.3), Gambacorta (2008) for the case of Italy, but contrary to the results of Mojon (2000) for the case of EMU (see section 2.3.1). Thus, we decided to exclude this variable from the model and proceed with a more parsimonious specification. This decision was based on two arguments. Firstly, the economic rationale presented in section 3.2, which suggest this variable may represent different transformation processes among various types of banks which may complicate the relationship. Secondly, the joint insignificance of this variable.

The results from the final model specification (presented in table 3.4 and in appendix 3.4) indicate that the model can significantly explain the variations in the pass-through multipliers in lending rates for almost all 15 banks in the sample. The results for the overall significance of the bank-specific equations, apart from the equations for banks 7 and 10, indicate that they are statistically significant at least at the 10% level of significance and in the case of ten banks are significant at the 1% level (see table 3.4 and appendix 3.4). Moreover, to check the joint statistical significance over all the banks of the remaining variables in the model, we have performed an F-test for their joint significance. The F-test results indicated that all regressors in the model are jointly significant at 5% level of significance (see table 3.6 and appendix 3.4).

Table 3.4: Estimation results of the final model specification for the adjustment of lending rates

VARIABLE:	Bank 1	Bank 2	Bank 3	Bank 5	Bank 6	Bank 7	Bank 8	Bank 9	Bank 10	Bank 11	Bank 12	Bank 13	Bank 14	Bank 16	Bank 27
L.dmbks	92.34*	91.40*	-52.48***	456.8***	-10.23	41.42*	34.21	-93.84**	8.096	-18.68	-55.96	-5.162	652.7***	-71.39**	-9.91
	(49.77)	(50.75)	(20.01)	(68.98)	(19.33)	(23.98)	(104.8)	(41.64)	(16.95)	(20.97)	(34.01)	(25.39)	(147.5)	(34.82)	(38.93)
L.dmbkslassets	-10.06***	-2.95	1.02*	-26.13***	-0.96	-2.05*	-5.48	5.03***	0.53	0.64	2.63	0.86	-32.39***	6.17*	-0.59
	(2.83)	(2.92)	(0.57)	(4.07)	(0.84)	(1.23)	(7.29)	(1.52)	(0.95)	(1.17)	(2.44)	(1.64)	(7.72)	(-3.28)	(-2.07)
L.dmbksliquidity	33.73***	-3.82	0.03	-14.65***	-2.56*	-0.41	17.19***	0.15	-2.57	-2.09	-4.06	-0.72	1.11	2.36	-2.17
	(5.71)	(3.24)	(1.34)	(4.46)	(1.41)	(1.57)	(6.34)	(2.63)	(1.81)	(1.77)	(2.79)	(1.55)	(1.73)	(2.34)	(2.33)
L.dmbkscapital	27.59	-36.34**	0.92	-139.7***	3.19	-5.59*	9.50	22.37***	-2.9	2.44	4.62	7.17	-2.35	9.43	1.02
	(24.23)	(17.37)	(1.98)	(21.78)	(3.13)	(3.37)	(9.93)	(4.67)	(6.27)	(9.63)	(11.17)	(5.25)	(2.98)	(6.24)	(4.12)
L.dmbksNPLratio	-26.20***	1.00	-1.90*	43.20***	-5.12*	0.92	-1.51	-9.2***	-5.89	-6.64	5.28	-4.29**	-9.18***	-3.34	2.19
	(5.05)	(2.67)	(1.04)	(8.54)	(2.62)	(2.19)	(2.41)	(2.20)	(8.44)	(8.81)	(4.99)	(2.05)	(2.74)	(5.61)	(2.39)
L.dmbksmatmisub	-0.12	-0.38	-0.22	5.88***	-1.96***	-0.003	-0.3	-0.01	-0.36	-0.05	0.17	-2.83***	-0.73	0.19	-0.51**
	(0.16)	(0.29)	(0.95)	(1.30)	(0.46)	(0.01)	(0.26)	(0.03)	(0.27)	(0.57)	(1.08)	(1.02)	(0.55)	(1.17)	(0.20)
L.dmbksrellending	-11.43**	15.80***	-8.63	3.62	1.17	1.86	6.29	-4.71*	-2.88	-3.56**	-6.14	3.69	-4.06	1.59	4.22
	(5.05)	(5.15)	(9.86)	(2.77)	(1.31)	(1.67)	(5.26)	(2.70)	(3.33)	(1.8)	(3.83)	(2.47)	(3.09)	(1.64)	(2.92)
L.dmbksportdiv	-9.66***	3.60	2.02	2.48	1.66	-0.13	2.01	1.82	-0.34	0.46	-0.04	0.004	14.35**	-2.27	-0.41
	(3.3)	(2.39)	(1.36)	(3.6)	(1.46)	(3.65)	(1.79)	(1.78)	(2.38)	(2.06)	(2.16)	(0.02)	(5.87)	(2.92)	(0.56)
L.dmbksinfl	48.03***	6.64	13.60	13.14	-4.14	4.13	-13.23	5.66	-4.71	7.35	5.09	1.62	-49.04***	9.87	5.19
	(10.47)	(6.35)	(11.49)	(11.75)	(3.98)	(6.03)	(8.72)	(9.36)	(5.04)	(5.27)	(4.81)	(6.03)	(17.75)	(7.75)	(6.47)
L.dmbksipi	2.59*	1.91***	0.38	5.99***	0.06	0.09	1.33	0.39	-0.4	0.29	-1.85***	-2.01**	-1.67	-0.99	-0.62
	(1.35)	(0.72)	(1.49)	(1.75)	(0.67)	(0.83)	(1.23)	(1.84)	(0.68)	(0.74)	(0.71)	(0.99)	(2.1)	(1.36)	(0.97)
L.dmbkslhhi	12.07**	-5.70***	5.18**	-6.07	3.61**	-1.28	4.06	1.87	-1.64	1.43	2.24	-1.00	-30.66***	-3.22	2.47
	(4.72)	(1.91)	(2.34)	(4.61)	(1.77)	(2.74)	(3.53)	(5.02)	(2.46)	(1.92)	(1.85)	(1.85)	(7.28)	(4.39)	(2.94)
Const	-0.002**	-0.0009*	0.0003	-0.002*	0.0001	-0.001*	-0.002*	-0.002	-0.001*	-0.001	-0.001	-0.001	-0.001	-0.0003	-0.001
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
R-squared	0.51	0.21	0.11	0.51	0.23	0.05	0.29	0.13	0.05	0.08	0.27	0.09	0.15	0.20	0.19
RMSE	0.0098	0.0052	0.0099	0.0122	0.0045	0.0060	0.0092	0.0127	0.0048	0.0055	0.0052	0.0074	0.0135	0.0095	0.0071
F-stat for joint significance of the bank specific eqution	9.84***	3.32***	1.59*	10.45***	3.53***	0.64	3.75***	2.86***	0.62	1.63*	2.86***	1.58*	2.29***	2.41***	2.33***
Breusch-Pagan test for the contemporaneous covariance independence between the error terms chi2 (105) = 305.253; p-value = 0.000															

Standard Errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's own calculations performed in STATA 10.

In order to examine if there is some efficiency gain from employing the SUR method, we performed the Breusch-Pagan test that tests the contemporaneous covariance independence between the error terms. At 1% level of significance we can reject the null hypothesis of zero contemporaneous covariance dependence between the errors from each equation (see table 3.4 and appendix 3.4). Thus there is evidence in support of contemporaneous cross-sectional correlation among the error terms and hence some efficiency gain from employing the SUR method.

3.5.1 Interpretation of the results

To assess the size of the adjustment of lending rates to changes in the money market rate we have carried out first order differentiation in respect of the change in the money market rate as in equation 3.2, and evaluated at the mean value of the rest of the variables over the sample period. As presented in table 3.5, there are large differences in the estimated size of adjustment of lending rates to changes in the money market rate between banks.

Table 3.5: Size of the adjustment of lending rates estimated for each bank separately.

	DMBKS
Bank 1	0.02***
Bank 2	0.10***
Bank 3	0.11*
Bank 5	0.33***
Bank 6	0.13***
Bank 7	-0.15
Bank 8	0.19***
Bank 9	0.39***
Bank 10	0.03
Bank 11	0.07*
Bank 12	0.17***
Bank 13	0.09*
Bank 14	-0.35***
Bank 16	0.20***
Bank 27	0.09***

***/**/* denotes joint significance by the overall F-test in the bank specific regression at 1%, 5% and 10% level of significance, respectively.
Source: Author’s own calculations.

As expected, except for banks 7 and 14, the pass-through coefficient is positive and below 1. The pass-through coefficient is negative but statistically insignificant for bank 7, implying that the current model specification cannot explain the lending rate adjustment of this bank. For bank 14, the pass-through coefficient is negative but statistically significant, which may be partially explained by the specific history of this bank. Its main activity was related to the national payment card through which it administered the wages of the employees in the public administration and not the lending activities in the loan market. For the rest of the banks, the size of the pass-through coefficient ranges from 0.02 (bank 1) to 0.39 (bank 9). The pass-through coefficient can be interpreted as a one percentage point increase in the money market rate in the previous month, leads on average from 2 up to 39 basis points increase in the lending rates in the current month on a *ceteris paribus* basis, given the mean value of the rest of the variables. Additionally, as argued in section 3.2, for the monetary policy makers it is important whether the size of the lending rate adjustment is predictable over time and whether that predictability varies among banks. Thus, if we assess the in-sample root mean squared error (RMSE, explained in section 3.2, while acknowledging the limitations in its usefulness discussed on page 116) for each bank specific equation separately where the measurement units are the same as those of the dependent variable; we can observe that these differ considerably among banks. For example, it ranges from 45 basis points (bank 6) up to 1.35 percentage points (bank 14) (see table 3.5 and appendix 3.4).

Comparing the estimated size of the lending rate adjustment among banks, some similarities in the pass-through coefficients can be noticed between banks that are in some respects alike. For instance, they are the lowest for banks 1 and 10 (0.02 and 0.03, respectively). These two banks have some similarities in their assets size, market share and type of the ownership, in that these two banks are among the three largest banks in the country and both of them are *de facto* foreign owned, as explained in sections 1.4 and 5.2. The pass-through coefficients for banks 2, 3, 6, 11, 13 and 27 are within a range of 0.07 (bank 11) to 0.13 (bank 6).

The major similarity among these banks is that most of them during the sample period were *de facto* domestically owned during the whole period, with the other two domestically owned for most of the period. Those two, banks 11 and 6, were domestically owned until the middle of 2007 and the third quarter of 2008 respectively, when they were taken over by foreign banks and became *de facto* foreign owned. In the middle range, according to the size of the pass-through coefficient, are banks 8, 12 and 16, whose coefficients are estimated between 0.17 and 0.20. The main similarity between banks 8 and 12 is that during most the sample period they were domestically owned (bank 8 was taken over by a foreign bank in the beginning of 2008). However, this is not the case with bank 16, that was established as a greenfield foreign-owned bank. The highest pass-through coefficients of 0.33 and 0.39 were estimated for banks 5 and 9 respectively. The major similarity between these two banks is that from 2006 their market share on the loan market has increased and since 2006 both of them, according to the classification of the NBRM, became medium-sized banks (see table 1.4).

Box 1: explaining the calculation of the results presented in tables 3.5 and 3.6.

This text box provides an example of how the results in tables 3.5 and 3.6 have been calculated. The model 3.1 contains interaction terms between the change in the money market rate and banks' balance sheet items, macroeconomic control variable and banking concentration index variable. As explained in section 3.2, in order to calculate the impact of the change in the 'cost of funds' rate on the banks' lending rate, we undertake a first order differentiation of model 3.1 in respect of the 'cost of funds' rate, conditional on the mean value of the rest of the independent variables in the model that enter into the interaction term.

For example, for bank 1 a first order differentiation of model 3.1 in respect of the 'cost of funds' rate, as presented with equation 3.2, provides the following result:

$$\frac{\Delta(\Delta i_{jt})}{\Delta(\Delta m_{t-1})} = \beta_1 + (X_{jt-1})'\beta_{2j} + (\Phi_{t-1})'\beta_{3j} + (\Pi_{t-1})'\beta_{4j}\ ; \qquad (3.7)$$

If we substitute the estimated coefficients (β_1, β_2, β_3 *and* β_4) for bank 1 (see table 3.4), we get the following expression:

$\frac{\Delta(\Delta i_{jt})}{\Delta(\Delta m_{t-1})}$ *= 92.34 - 10.06*(mean value of asset size) + 33.73*(mean value of liquidity) + 27.59*(mean value of capital) - 26.20*(mean value of NPL ratio) - 0.12*(mean value of maturity mismatch variable) - 11.43*(mean value of relationship lending variable) - 9.67*(mean value of portfolio diversification variable) + 48.03*(mean value of inflation) + 2.59*(mean value of industrial production variable) + 12.07*(mean value of banking concentration index variable);* *(3.8)*

If we substitute the mean values of the variables in parenthesis in expression 3.8 above, we get the following expression:

$\frac{\Delta(\Delta i_{jt})}{\Delta(\Delta m_{t-1})}$ *= 92.34 - 10.06*(17.32) + 33.73*(0.28) + 27.59*(0.11) - 26.20*(0.34) - 0.12*(4.50) - 11.43*(0.40) - 9.67*(0.75) + 48.03*(0.03) + 2.59*(0.001) + 12.07*(7.4);*

(3.9)

By multiplying the estimated coefficients in expression 3.9 with the mean values of the variables that are in the parenthesis, we get the size of adjustment coefficient of lending rate of bank 1 to change in the 'cost of funds' that equals 0.02 (see Table 3.5).

The same calculations in estimating the size of adjustment coefficient of lending rates to changes in the 'cost of funds' apply for all the other banks in the sample.

In order to calculate the impact of the rest of the independent variables that enter in model 3.1, conditional on the mean value of the change in the 'cost of funds' rate, we undertake a first order differentiation of model 3.1 in respect of the independent variable that is of our interest. For example, in order to calculate the impact of asset size on the size of adjustment of lending rate of bank 1, conditional on the mean value of the change in the money market rate, we do a first order differentiation of model 3.1 in respect of asset size as follows:

$$\frac{\Delta(\Delta i_{jt})}{\Delta(asset\_size)} = \beta_2 * (\textit{mean value of change in the money market rate}); \qquad (3.10)$$

If we substitute the estimated coefficient of β_2 for bank 1 (see table 3.4), we get the following expression:

$$\frac{\Delta(\Delta i_{jt})}{\Delta(asset\_size)} = -10.06 * (\textit{ mean value of change in the money market rate}) \qquad (3.11)$$

By multiplying the estimated coefficient in expression 3.11 with the mean value of the change in the money market rate (the variable in the parenthesis, which is -0.002), we get the impact of asset size on the size of adjustment of lending rate for bank 1 conditional on the mean value of change in the ‘cost of funds’ rate. In the case of bank 1 we get positive value of the impact of asset size (see Table 3.6).

The same calculations apply for the rest of the independent variables in model 3.1 for all the banks in the sample.

Regarding the rest of the variables included, i.e. the balance sheet items, macroeconomic control variables and the banking concentration index variable, as already discussed in section 3.2, we can only additionally interpret their sign and statistical significance, given that these are interaction terms (the effect on the pass-through at the mean of these variables already being included in the above discussion). From tables 3.4 and 3.6, it can be noticed that there is a huge variation of the significance and sign and of the same variables among the banks. This implies that the same variables do not have equal importance or even the same direction of impact on the size of the pass-through multipliers of the lending rates among banks. In other words, these results support our hypothesis of aggregation bias in the literature (see section 2.3.5), which has mainly used aggregated data (see section 2.3.1 and 2.3.5).

Table 3.6: Estimated signs of the rest of the independent variables in the model presented for each bank separately and the F-test for their joint significance

VARIABLE:	Assets	Liquidity	Capital	NPLratio	Mat-mismatch	Rel. lending	Portdiv.	Inflation	IPI	HHI
Bank 1	+ ***	– ***	–	+ ***	+	+ **	+ ***	– ***	– *	– **
Bank 2	+	+	+ **	–	+	– ***	–	–	– ***	+ ***
Bank 3	– *	–	–	+ *	+	+	–	–	–	– **
Bank 5	+ ***	+ ***	+ ***	– ***	– ***	–	–	–	– ***	+
Bank 6	+	+ *	–	+ *	+ ***	–	–	+	–	– **
Bank 7	+ *	+	+ *	–	+	–	+	–	–	+
Bank 8	+	– ***	–	+	+	–	–	+	–	–
Bank 9	– ***	–	– ***	+ ***	+	+ *	–	–	–	–
Bank 10	–	+	+	+	+	+	+	+	+	+
Bank 11	–	+	–	+	+	+ **	–	–	–	–
Bank 12	–	+	–	–	–	+	+	–	+ ***	–
Bank 13	–	+	–	+ **	+ ***	–	–	–	+ **	+
Bank 14	+ ***	–	+	+ ***	+	+	– **	+ ***	+	+ ***
Bank 16	– *	–	–	+	–	–	+	–	+	+
Bank 27	+	+	–	–	+ **	–	+	–	+	–
F-stat for joint signiicance of the variable in all bank specific regressions.	6.46***	4.69***	5.05***	6.11***	4.19***	2.85***	1.75**	3.76***	2.61***	3.55***

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's own calculations.

The results in table 3.5 imply to a lack of synchronisation of the pass-through behaviour among banks in the Macedonian economy. The results in table 3.6 indicate that the relationship between the pass-through behaviour and the rest of the coefficients in the model differs considerably to the extent that their sign in the bank specific regressions (considering where the variable is statistically significant); is not consistent among the cross-sectional units. Consequently, results presented in tables 3.5 and 3.6 suggest that the hypothesis of parameter equality across the units presented with equations 2.14 and 2.15 is rejected and thus, banks in Macedonia exhibit heterogeneous behaviour[20]. This suggests there may be a problem with the results of most of the literature that explores the determinants of the size of pass-through multipliers in various economies around the world by using aggregated data set (see section 2.3.1). This includes the studies that explore the size and speed of adjustment of lending rates in Macedonia (see section 2.3.4) that are again based on aggregate data and may

[20] Here we are interested in the combined effect of the money market rate conditional on the mean value of the rest of the variables in the model. However, if we test the individual coefficients, in each case the hypothesis of parameter equality is rejected at 5% level of significance.

suffer from aggregation bias by not taking into account banks' heterogeneous behaviour. These above results, indicating aggregation bias, are in line with the results of de Graeve et al. (2004) for the case of Belgium (see section 2.3.1).

One of the possible reasons for banks' heterogeneous pass-through behaviour in the case of Macedonia may be due to the transition process not affecting all banks equally. The bank balance sheet structure of various banks may have undergone a long-run adjustment process in order to reach some optimum level and/or structure in order to maximise their utility. For instance, those banks that were formerly state owned and were privatised, had different starting grounds compared to greenfield banks both domestically and foreign owned (Poghosyan and Poghosyan, 2010). The state owned banks may have been overcapitalised, had relatively high NPL ratio and/or had insufficient liquid assets due to the policy of soft budget constraints. Hence, with the process of privatisation, those banks may have had to adjust their balance sheet items in order to maximise their rate of return. Another possible explanation for their heterogeneous behaviour, as mentioned in section 3.2, is that their balance sheet structures may have been affected differently by changes in the regulatory requirements.

This heterogeneity among banks' behaviour can be examined in more detail if we analyse the significance and the sign of each variable where it enters significantly in the bank specific equations (see table 3.6). For example, asset size is estimated as statistically significant at 7 out of 15 banks and where significant, it has a positive impact on the size of the pass-through multiplier at 4 banks, consistent with the "menu costs" theory and the "efficient-market" hypothesis (see section 3.2) as well as the findings of Vaskov et al. (2010) for the average level of lending rate setting and interest rate spread (see sections 2.3.2 and 2.3.3). In contrast, for the other three banks where the asset size variable enters significantly, it has a negative sign which is in line the bank lending channel theory and the results for the foreign currency loans for the case of Macedonia (see section 5.5.3).

A similar difference in estimated significance and sign between banks applies to the the rest of the balance sheet items. For example, the NPL ratio is estimated as statistically significant at 7 out of 15 banks and where significant, it has a positive impact on the size of the pass-through coefficient in 6 banks in the sample, which is consistent with the mark-up pricing theory. These banks may have attempted to compensate for the lost income due to the borrowers' default by adjusting their lending rates more closely to the 'cost of funds' rate. However, for the other bank where the NPL ratio is statistically significant, it has a negative impact on the size of adjustment (bank 5), which is line with the theory of asymmetric information and lending rate stickiness.

The maturity-mismatch variable, indicating the interest rate risk that banks face, is estimated as statistically significant for 4 banks and affects positively the size of the pass-through coefficient at 3 banks, which supports the theoretical expectations. More precisely, those banks that have lower coverage of their long-term loans with long-term deposits, are forced to borrow more frequently on the money market and thus, to adjust their lending rates more fully to changes in the 'cost of funds' rate. However, for bank 5 it is estimated with a negative sign.

Similar conclusions for the banks' heterogeneous behaviour can be drawn if we assess the impact of the two macroeconomic control variables and the concentration index variable. The inflation is estimated as statistically significant for 2 banks but the coefficient has a different sign. The concentration index variable (HHI), is estimated as statistically significant in 5 bank specific equations and in these cases it has a negative impact on the size of the pass-through adjustment for 2 banks, which is consistent with the predictions of the mark-up pricing model for the non-perfect competitive pricing environment. Namely, these banks use their market power and hence, by not adjusting fully their lending rates to changes in the money market rate they extract higher monopoly profits. However, for the rest of these banks it has the opposite sign, which may imply that those banks are adjusting their lending rates more fully to changes in the money market rate in order to get higher market share. These results for the different impact of banking concentration over various banks are in line with the findings of (Poghosyan and Poghosyan, 2010) in estimating the determinants of banking efficiency among CSEE economies.

3.5.2 Robustness check

A robustness check of the existing model has been undertaken in the following two ways. *First*, as mentioned in section 3.3, when after a sufficient number of iterations in estimating the coefficients and their variances for each cross-sectional unit converge; then the FGLS estimator equals the MLE. Hence, in this way we compare if the estimates already reported in section 3.5 estimated by FGLS estimator are in line with the ones calculated by MLE. However, as mentioned in section 3.3, whether the MLE provides additional efficiency gain over the FGLS and which estimator has better asymptotic properties is an open issue. *Second*, we have estimated the same model with OLS equation-by-equation in order to compare the size of the coefficients between the two methods that according to Moon and Perron (2006), are expected to be quite similar (see section 3.3). Additionally, in order to empirically support our arguments presented in section 3.2 that representative 'cost of funds' rate in the case of Macedonian banking sector may be the money market (MBKS) rate instead of the key policy (CB Bills) rate; we compare the estimates from the model by substituting for the money market rate with the reference policy rate. *A priori*, as mentioned in section 3.2, we do not expect the CB Bills rate to significantly explain the variations in lending rates. Although it has been estimated that CB Bills rate has direct impact on the money market interest rate (see section 2.3.4), nonetheless this interest rate serves more as an alternative investment for the banks and not as a cost of financing their lending activities (see sections 1.4, 1.7 and 3.2).

For the first type of robustness check, i.e. estimating the model with MLE (see appendix 3.5), the estimates are comparable to the ones obtained by FGLS estimator. The overall significance of the bank specific equations and the joint significance of each regressor in all bank specific equations in the SUR model estimated by MLE estimator are the same as the ones estimated by FGLS estimator, as discussed in sections 3.5 and 3.5.1. The estimated size of the pass-through coefficients (see appendix 3.5.b) are very similar to the ones reported in table 3.5, apart from some variations to the second decimal place for some banks. The main difference appears with the equation for bank 9 where the size of the pass-through multiplier is now estimated to be higher, i.e. 0.48 compared to 0.39 using the FGLS estimator. Regarding the significance of the coefficients in the bank specific equations in the SUR model estimated with MLE (see appendix 3.5.c), the major difference is that now the asset size variable is estimated as statistically significant for banks 2 and 13 as well as capital for banks 13 and 16, unlike before when these variables were estimated as statistically insignificant for these banks. Moreover, the liquidity variable is now estimated as statistically significant for banks 2 and 10 as well as the NPL ratio for banks 10, 16 and 27. Regarding the signs of the rest of the significant coefficients of the SUR model estimated with MLE, they are in line with the estimates obtained by FGLS estimator

According to the second type of robustness check, i.e. OLS equation-by-equation (see appendix 3.6) the results have indicated that the standard errors estimated by OLS equation-by-equation (see appendix 3.6.a and 3.6.d) are quite higher as expected, than the ones estimated by the SUR model (see table 3.4 and appendix 3.4). This directly affects the significance of the variables as well as the overall significance of the regressions for each cross-sectional unit. In the estimates obtained by SUR model, the overall regressions were statistically insignificant only for 2 out of 15 banks, whereas in employing OLS equation-by-equation the regressions for 7 out of 15 banks are overall statistically insignificant. This may suggest that there is indeed some efficiency gain by employing the SUR model. Regarding the estimated size of the pass-through coefficients for each bank individually (see appendix 3.6.b), they are similar to the ones obtained by SUR model with FGLS estimator (see table 3.5) with some variations to the second decimal place. The only exceptions are the estimates for banks 3 and 9 where the size of the pass-through coefficients (although insignificant) are estimated to be at 0.24 and 0.29, compared to 0.11 and 0.39 estimated with the SUR model estimated with the FGLS estimator. Regarding the estimated sign and size of the rest of the coefficients of the structural variables (see appendix 3.6.c), they in line with the ones previously discussed in section 3.5.1.

Finally, comparing the results of the model in which we have substituted the money market rate (mbks) with the reference policy rate (CB Bills rate), there are substantial differences in the results (see appendix 3.7). Considering the overall statistical significance of the regressions for each individual bank, the overall regressions for 7 out of 15 banks are now statistically insignificant. The root mean squared error has also increased in 11 out of 15 bank specific equations (see appendix 3.7.a), compared to the the estimates discussed in section 3.5.1. Moreover, by assessing the joint significance of each independent variable in the model, the industrial production index (IPI; see appendix 3.7.c and 3.7.d), is jointly insignificant at even the 10% level of significance. Regarding the pass-through coefficients, where significant, they are now estimated to be negative in 4 banks, unlike before where they were estimated to be negative and statistically significant in only 1 bank. Analysing the estimated sign of the rest of the coefficients (see appendix 3.7.c), there is a substantial variation between the two models in their significance and sign. Similar results with a negative short-run association between the lending rates and CB Bills rate, at the aggregate level, was also estimated in the study by Jovanovski et al. (2005), see section 2.3.4. The discussed results of the general insignificant and negative impact of the CB Bills rate on the size of the short-run pass-through coefficients of lending rates are in line with the argument presented in section 3.2 that the CB Bills rate may actually serves as an alternative investment rate for the banks in Macedonia and not as their ‘cost of funds’ rate. Overall, the presented arguments indicate that CB Bills rate cannot significantly explain the short-run variations in lending rates.

3.6 Conclusions

The critically assessed theories that define how banks set their retail rates and what determines the pass-through behaviour, as well as the assessment of the various models and estimation methods used in the empirical studies, as discussed in the previous chapter; provided the background to the conduct of the empirical analysis in this chapter. Accordingly, the main aims of this chapter were to explore the short-run variations in the size of adjustment of the lending rates to changes in the 'cost of funds' rate among banks in Macedonia as well as to investigate what factors affect their different pass-through behaviour. For this purpose, we have used a set of up to eight bank balance sheet items, two macroeconomic control factors and a banking concentration index variable.

We endeavored to improve on some of the weaknesses found in the existing empirical literature for Macedonia as well as part of the literature for the developed economies and CSEE. In particular, all of the studies conducted for the Macedonian banking system (see section 2.3.4) as well as part of the studies for CSEE and developed economies (see section 2.3.1) are based on aggregate data and the estimates may suffer from aggregation bias. Another drawback in the empirical literature is that majority of the studies conducted for both, for the CSEE and developed economies that do use bank-level data (see section 2.3.1), do not control for contemporaneous cross-sectional correlation among the disturbances. An additional weakness of the studies for the case of Macedonia as well as CSEE (see section 2.3.5), is that they use an interest rate series composed of loans or deposit rates denominated in both domestic and foreign currency. Consequently, we argue that this may result in biased estimates of the size of the pass-through coefficient for the reasons explained in section 2.3.5.

Accordingly, in this chapter we attempted to deal with the problem of aggregation bias by using disaggregated (bank-level) data set. In order to consider the contemporaneous cross-sectional correlation among the disturbances we have applied the SUR model. Furthermore, we have used disaggregated bank-level lending rates denominated in domestic currency only.

The main findings of this chapter are that in the short-run, various banks adjust their lending rates differently to changes in the 'cost of funds' rate. This can be concluded from the estimated size of the pass-through coefficients that vary considerably between the banks. Another finding of this chapter is that various factors including bank-specific characteristics, macroeconomic control variables and the banking concentration index variable, affect the size of lending rate adjustment behaviour of banks differently. Both of these findings support the hypothesis of aggregation bias in the literature (see section 2.3.5). The robustness of these results has been checked by using different estimation methods: SUR estimated with MLE and simple OLS equation-by-equation.

The results of this chapter also indicate that CB Bills rate does not significantly determine banks' short-run pass-through behaviour. This may be due to Central Bank's role in controlling the liquidity of the banking system in order to maintain the fixed exchange rate regime. In this case, the reference policy rate may be acting more as a rate of alternative return for the banks that have available liquid assets to place them on the CB Bills auctions, a finding which is line with Jovanovski et al. (2005).

Overall, the presented empirical findings in this chapter indicate that the size of the short-run adjustment of lending rates to changes in the 'cost of funds' rate is incomplete and heterogeneous among the Macedonian banks. Additionally, it is estimated that various factors may affect differently banks' lending rate pass-through decisions. These findings indicate that the short-run pass-through behaviour among banks in Macedonia lacks synchronisation. This may imply that the interest rate pass-through as a part of the monetary transmission may not be as effective and may not play as important role because of its difficulty to predict banks' reaction to changes in the 'cost of funds' rate; as it is the case in other CSEE economies that have an inflation targeting regime, i.e. the Czech Republic, Hungary and Poland. Thus, in order to fulfill the overall aims of the thesis, another area of interest is to explore whether the interest rate pass-through is complemented by the bank lending channel and whether the same determinants, i.e. macroeconomic and bank balance sheet factors, affect both the interest rate and the bank lending channel. This can be inferred from the analysis of the role of the bank lending channel in Macedonia, which is a subject of detailed investigation in the next two chapters.

CHAPTER 4: CRITICAL ASSESSMENT OF THE THEORY AND EMPIRICAL STUDIES OF THE BANK LENDING CHANNEL

4.1 Introduction

This chapter is related to the third and fourth research questions: whether the bank lending channel is operational in the Macedonian banking system and what are the major determinants of the variations in the stock of loans. Accordingly, the major research aims of this chapter are to analyse and critically assess the theoretical basis of the bank lending channel and to examine the empirical evidence of its existence in different economies, predominantly the USA, EU and transition economies of CSEE.

The main underlying theoretical model that describes the bank lending channel is that of Bernanke and Blinder (1988a, b). This was one of the first formal models to modify the ‘traditional’ IS-LM model by analysing not only the role of money in the monetary transmission mechanism and income determination, but also the role of loans in the economy. Thus, this chapter critically assesses some of the weaknesses of this model and reviews some additional explanations and modifications found in the literature.

In relation to the empirical analyses, this chapter examines the applied model put forward by Ehrmann et al. (2001 and 2003), which is a simplified and modified version of Bernanke and Blinder (1988a, b) model. This is the most frequently used model in empirical studies and it is also used as a basis in the next chapter of the thesis, which provides an empirical investigation of the bank lending channel in Macedonia. Additionally, a comprehensive critical appraisal of empirical studies that examine the bank lending channel in different economies is provided. This is accompanied by assessment of various econometric methods employed in the empirical analyses and how the basic empirical specification of Ehrmann et al. has been modified. This will inform our own empirical investigation in the next chapter.

This chapter is structured as follows: section 4.2 explains Bernanke and Blinder (1988a, b) model. Section 4.3 provides a critical appraisal and examines some amendments made to that model. Section 4.4 describes and criticises the applied model designed by Ehrmann et al. (2001 and 2003). Section 4.5 surveys various empirical studies and methods employed that investigate the bank lending channel. The conclusions of this chapter are presented in the final section.

4.2 The theoretical basis of the bank lending channel

The theoretical background of the bank lending channel was initially developed by Bernanke and Blinder (1988a, b)[21]. They modify the traditional IS-LM model by relaxing some of its basic assumptions. Their starting argument is that although the traditional IS-LM model can explain the money and interest rate channel of monetary transmission quite well, one of its main pitfalls is that it analyses the influence of various shocks in the economy only through the money function, giving a negligible role to the other financial instruments, i.e. loans. More precisely, the IS-LM model treats asymmetrically banks' assets and liabilities, by assigning a special role to money as a bank liability in determining aggregate demand. On the other hand, it treats loans and bonds as perfect substitutes for each other, where both markets are suppressed by Walras's Law and assumes that financial markets clear only by price changes.

The main innovation of the Bernanke and Blinder model is the abandonment of the assumption of perfect substitutability of loans and bonds. Bernanke and Blinder argue that loans should have a different treatment in the economy from other financial instruments because they are provided by intermediary institutions, which are specialised in screening and monitoring the borrowers in the presence of asymmetric information. These institutions can have an important impact on the monetary transmission mechanism in the economy where market clearance can be achieved not only by changes in the interest rates,

[21] There are previous attempts in the literature that tackle the issue of existence of bank lending channel, but the first formal model that depicts the lending channel is that of Bernanke and Blinder (1988a, b).

but also by the quantity of loans supplied. Another argument why loans should have a different treatment from the other financial assets is associated with the periods of financial deregulation and integration of financial systems that induce higher capital mobility. Both of these factors, accompanied by financial innovations that can create similar instruments to money, may destabilise the money demand function.

Bernanke and Blinder (1988a, b) amend the IS-LM model by augmenting the IS curve with the so-called credit-commodity curve (CC)[22]. The model is based on three basic equations. The first one is the LM curve, representing equilibrium in the money market. The second one is the so-called credit market curve (CM), representing equilibrium in the credit market and the third one is the IS curve, representing equilibrium in the goods market. The model is based on the assumption that the monetary authority controls the monetary base (banks' reserves). Hence, banks cannot create their own reserves. The monetary policy instruments are changes the monetary base or changes in the reserve requirement ratio. The derivation of the model, under the assumption of given prices, inflation and constant expected inflation, and given information asymmetry, is presented below. In doing this we follow the practice in this literature and include the theoretically expected signs directly in the equations.

A simplified bank balance sheet that ignores net worth is presented below:

$$R + B + L = D \qquad (4.1)$$

where banks' total assets are composed of reserves (R), bonds (B) and loans (L), whereas banks' total liabilities, for simplicity, are assumed to consist only of deposits (D). Total banks' reserves are composed of required reserves which are a given proportion of deposits (τD) plus excess reserves (E), where τ is the reserve requirement coefficient. Based on the assumption that R is exogenous for the banks and fixed (as considered in the previous paragraph), then change in the

[22] Henceforth, we will also refer to the Bernanke and Blinder (1988a, b) model as the CC-LM model.

reserve requirement coefficient does not change total banks' reserves - *R*. Thus, banks' adding up constraint is:

$$E + B + L = D(1\text{-}\tau) \qquad (4.2)$$

Cash is ignored in the model and it is assumed that the loan interest rate does not have any impact on the excess reserves function. Banks excess reserves are, given equation 4.2, a fraction of $D(1\text{-}\tau)$ that is assumed to depend negatively on the bond rate *(i)*, due to the opportunity costs of holding excess reserves, and thus they are modelled with the following function:

$$E = f\,(i)\,D(1\text{-}\tau) \qquad (4.3)$$

where $(1\text{-}\tau)$ is a positive fraction and $f(i)$ is also a positive fraction, though variable with *i*.

The money multiplier, $m(i)$, is by definition D/R, where *R* are banks' reserves (required reserves (τD) plus excess reserves E given by equation 4.3). Substituting these into the money multiplier formula gives:

$m(i) = D\,/\,[\,\tau D + f\,(i)\,D(1\text{-}\tau)]$; and cancelling out D gives:

$$m(i) = [f\,(i)(1\text{-}\tau) + \tau]^{-1} \qquad (4.4)$$

That is the money multiplier that is expressed as the reciprocal of the proportion of banks' reserves kept from deposits, including both the required reserves and excess reserves of the banks. If, for instance, the reserve ratio τ increases, the total effect is to decrease the money multiplier. This is because in 4.4 the second term in the square brackets increases and although the first term decreases (as it is $-\tau$ in the brackets) it does so by less than the second term, since the $-\tau$ is multiplied by $f(i)$ which is itself constrained to be greater than or equal to 0, but less than 1 (indeed since we would expect a banks' holdings of excess reserves to be a small relative to loans and bond holdings, this fraction is expected to take a small positive value).

In the model, the money market equation (the LM curve) is derived as follows:

The deposit supply function (D^s) equals bank reserves times the money multiplier ($m(i)$):

$$D^s = R\, m(i) \qquad (4.5)$$

Henceforth, by following the approach of Kierzenkowski (2005 and 2007) all variables in the model are expressed in natural logarithms. Hence, the sign in front of each parameter in the following equations equals the expected sign of the parameter. A summary table of each parameter used in the following equations together with their expected sign is presented in Table 4.1.

Table 4.1: Summary of the names of the parameters used in the equations of Bernanke and Blinder model and their expected sign

Parameter:	Name of the parameter:	Equations in which the parameter enters (the numeration in parenthesis refers to the number of the equation in the text)	Expected sign*:
β_b	Bond interest rate elasticity of deposit demand	Deposit demand equation *(4.7)*	–
β_y	Income elasticity of deposit demand	Deposit demand equation *(4.7)*	+
γ_b	Bond interest rate elasticity of loan supply	Loan supply equation *(4.9)*	–
γ_l	Loan interest rate elasticity of loan supply	Loan supply equation *(4.9)*	+
λ_b	Bond interest rate elasticity of loan demand	Loan demand equation *(4.10)*	+
λ_l	Loan interest rate elasticity of loan demand	Loan demand equation *(4.10)*	–
λ_y	Income elasticity of loan demand	Loan demand equation *(4.10)*	+
θ_l	Loan interest rate elasticity of output demand	IS curve *(4.12)*	–
θ_b	Bond interest rate elasticity of output demand	IS curve *(4.12)*	–

* In presenting the model in the text of this thesis the expected sign of each parameter is included directly in each equation in front of the parameter.

Consequently, equation 4.4 expressed in natural logarithms, can be rewritten as:

$$D^s = R + m(i) \tag{4.6}$$

The deposit demand function (D^d) is negatively related to the interest rate on bonds (i), due to the opportunity costs of holding money and positively related to income (y) that represents the transactions motive and the total wealth:

$$D^d = -\beta_b i + \beta_y y \tag{4.7}$$

where coefficients β_b and β_y represent the bond interest rate and income elasticities of deposit demand, respectively. However, in Bernanke and Blinder's model, total wealth is assumed to be constant and therefore it is suppressed throughout the model. However this assumption may be too strong and may not apply in the medium and long run given the likely significant fluctuations in net wealth. Following equations 4.7 and 4.6, the equilibrium on the money market, representing the LM curve, is shown below:

$$-\beta_b i + \beta_y y = m(i) + R \tag{4.8}$$

In the model, the CM curve is derived on the following basis: assuming that the desired portfolio structure of banks is determined by the interest rates on loans and bonds, banks' loan supply function (L^s) is modelled as follows:

$$L^s = -\gamma_b i + \gamma_l \rho + D \tag{4.9}$$

Hence, the loan supply is negatively related to interest rates on bonds (i) as an alternative rate of return and positively to interest rates on loans (ρ) and the amount of deposits. Namely, the higher the amount of deposits, then the greater will be the quantity of loan supply. Coefficients γ_l and γ_b refer to the loan and bond interest rate elasticities of loan supply, respectively.

The loan demand function of the private sector (L^d):

$$L^d = \lambda_b i + \lambda_y y - \lambda_l \rho \tag{4.10}$$

is determined positively by the interest rate on bonds (i), income (y) that captures the transactions demand for loans, which according to Bernanke and Blinder may arise from working capital or liquidity considerations, and negatively by the interest rate on loans (ρ). The coefficients λ_l and λ_b indicate the bond and loan interest rate elasticities of loan demand respectively, while λ_y refers to income elasticity of loan demand. Accordingly, from equations 4.10 and 4.9, the equilibrium in the loan market (the CM curve), is presented as follows:

$$\lambda_b i + \lambda_y y - \lambda_l \rho = -\gamma_b i + \gamma_l \rho + D \qquad (4.11)$$

The IS curve, indicating equilibrium in the goods market, is a negative function of both bond (θ_b) and loan (θ_l) interest rate elasticities of output demand, which is shown below:

$$y = -\theta_l \rho - \theta_b i \qquad (4.12)$$

Regarding the equations presented so far, the 'traditional' IS-LM model can be expressed with the following two equations, referring to the IS and LM curves respectively:

$$\text{(IS curve):} \quad y = -\theta_l \rho - \theta_b i$$
$$\text{(LM curve):} \quad -\beta_b i + \beta_y y = m(i) + R \qquad (4.13)$$

The major contribution of Bernanke and Blinder's model is that it amends the IS-LM model by adding another equation that represents the credit market (CM curve), which is presented below:

$$\text{(IS curve):} \quad y = -\theta_l \rho - \theta_b i$$
$$\text{(LM curve):} \quad -\beta_b i + \beta_y y = m(i) + R$$
$$\text{(CM curve):} \quad \lambda_b i + \lambda_y y - \lambda_l \rho = -\gamma_b i + \gamma_l \rho + D \qquad (4.14)$$

By substituting the deposit (D) variable, as it defined by equation 4.6, in the CM equation 4.14; we derive the following CM curve:

$$\lambda_b i + \lambda_y y - \lambda_l \rho = -\gamma_b i + \gamma_l \rho + m(i) + R \qquad (4.15)$$

Solving the equation 4.15 for interest rate on loans (*ρ*), expressed as a function of interest rate of bonds, income and bank reserves (*i*, *y*, *R*, respectively); we get the following equation:

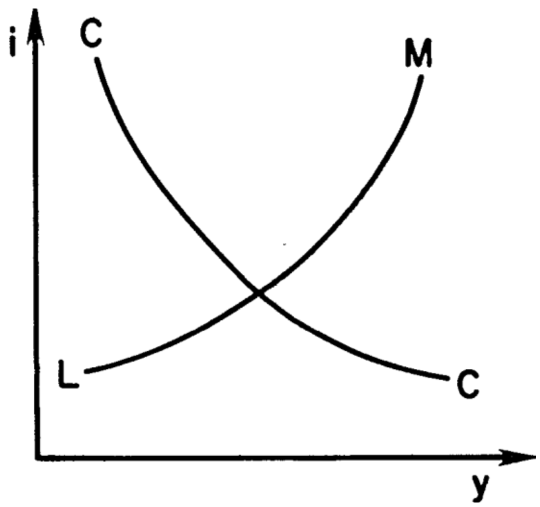
$$\rho = \frac{\lambda_b i + \lambda_y y + \gamma_b i - m(i) - R}{\lambda_l + \gamma_l} \qquad (4.16)$$

By substituting the loan interest rate (*ρ*), as defined by equation 4.16, in the IS curve (equation 4.12) we get the following equilibrium relationship:

$$y = \frac{-i[\theta_l(\lambda_b + \gamma_b) + \theta_l(\lambda_l + \gamma_l)] + \theta_l m(i) + \theta_l R}{\lambda_l + \gamma_l + \lambda_y \theta_l} \qquad (4.17)$$

Equation 4.17 refers to, as termed by Bernanke and Blinder, the credit commodity curve (CC) that shows simultaneous equilibrium in both credit and commodities markets. The CC curve is downward sloped, since the signs of all the terms in the square brackets in 4.17 are positive; the relationship between income (y) and the interest rate on bonds (*i*) is determined by the negative sign outside the brackets. It is positive function of money multiplier (*m(i)*) and banks' reserves (*R*) given their respective signs in 4.17. A graphical representation of the model is shown in figure 4.1:

Figure 4.1: The CC-LM model

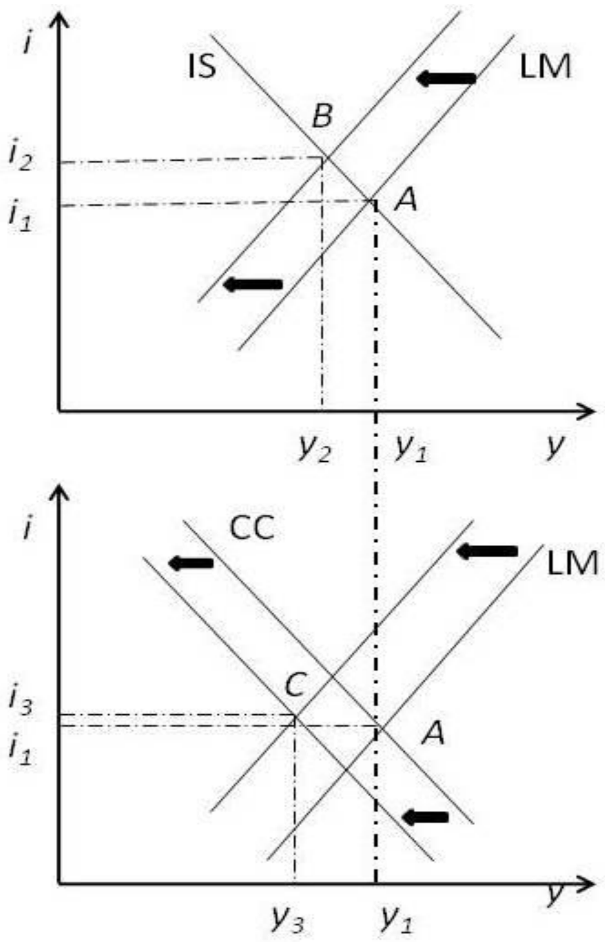


Source: Bernanke and Blinder (1988a, b).

As can be seen in figure 4.1, the CC-LM model is similar to the IS-LM model (see the upper part from figure 4.2), with the CC curve being negatively sloped as is the IS curve. The CC-LM model will become equivalent to the IS-LM model if *I)* loans and bonds are perceived as perfect substitutes either by lenders or borrowers, i.e. when the interest rate elasticities of loan supply or demand converge to plus and minus infinity respectively, ($\gamma_l \rightarrow \sim$; *or* $\lambda_l \rightarrow - \sim$); and *II)* when the income elasticity of loan demand equals zero ($\lambda_y = 0$). The point where both curves intersect indicates equilibrium in the money, credit and commodity markets.

The main difference from the IS-LM model is that now changes in the monetary policy stance do not only affect the LM curve, but also the CC curve through the banks' reserves and money multiplier (equation 4.17), which ultimately makes monetary policy more effective. A comparison between the IS-LM and CC-LM model in the case of monetary policy tightening is provided in figure 4.2.

Figure 4.2: Comparison between IS-LM model (upper figure) and the CC-LM model (lower figure) in the case of monetary policy tightening



We start with an initial condition where both models are in equilibrium (point A in both figures on figure 4.2). In the case of monetary policy tightening (increase of the reserve requirement coefficient), in the IS-LM model this will affect the LM curve by a reduction of the quantity of deposit (money) supply by the banks through the lower value of the money multiplier *m(i)* (see equation 4.4 for the money multiplier and the accompanying discussion above). In equation 4.6, *R* is constant, but *m(i)* (which enters with a positive sign) is reduced, giving a fall in D^s. In equation 4.13 representing the LM curve, the right hand side is reduced in value since *m(i)* enters with a positive sign. This will shift the LM curve to the left, whereas the IS curve will stay unchanged (as in upper figure in figure 4.2). The new equilibrium point will be *B* and the result will be a higher bond interest rate (i_2) and lower level of income (y_2). In the case of the CC-LM model, the same level of monetary policy tightening will also shift the LM curve to the left through the same mechanism as it was the case with the IS-LM model. However, the major difference between the IS-LM and CC-LM models is that in the latter, monetary policy has a direct impact on the income through the money multiplier (see equation 4.17). In this case, the money multiplier, $m(i)$ which enters with a positive sign, is reduced and hence, monetary tightening will simultaneously shift the CC curve to the left (see the lower figure in figure 4.2). In contrast, in the IS-LM model the IS curve will stay unchanged because, as the IS curve is modelled (see equation 4.12) the change in the monetary policy does not have a direct impact on income through any of the right-hand side variables in the equation.

The underlying mechanism through which monetary policy will shift the CC curve through the left is by the change in the money multiplier that will decrease, which is also part of the CC curve (see equation 4.17). More precisely, a reduction of money multiplier will result in reduction of the quantity of loans that will limit the possibility of external financing of the private sector through banks' loans. Hence, personal consumption and investment may decline that may cause a decline in the overall income. Consequently, the new equilibrium will be achieved at point *C* (see the lower figure on figure 4.2), where the bond interest rate may increase slightly to point (i_3), depending on the extent of the shift in the CC curve, and the level of income will decline to point (y_3). By comparing the new equilibrium values in both models (points *B* and *C*, respectively), the same level of monetary policy tightening makes the monetary policy more effective in the case of the CC-LM model because the same increase of the reserve requirement coefficient results in greater reduction of income and at the same time to a lower increase of the bond interest rate, compared to the case of the IS-LM model. A similar effect to the above is the case when the authorities directly reduce the level of reserves in the system *R* (i.e. adjust the monetary base for example through open market operations), rather than increasing the reserve requirement as in the example above. The same conclusion, that the monetary policy is more effective in the CC-LM model, also holds in the case of monetary policy easing.

An additional difference between IS-LM and CC-LM models is that in the latter changes in banks' reserves through open market operations will have greater impact over the loan interest rate than the bond interest rate. Consequently, changes in the monetary policy stance will also have an impact on the size of the interest rate spread between the public bonds and loans. For example, monetary policy tightening should increase the interest rate spread between loan and bond interest rates and vice versa. However, the derivation of the interest rate spread between the bond and loan interest rates is quite complex and is not pursued here because it is not of primary concern to the aims and objectives of the thesis and the development of the empirical part of this research. A detailed explanation and calculus of how this works in terms of Bernanke and Blinder model can be found in Kierzenkowski (2007), pp. 9-12.

One other noteworthy difference between the CC-LM and IS-LM models is that shocks to credit supply or demand may affect the CC curve, which is not the case with the IS curve. These shocks affect the CC curve through the money multiplier (see equation 4.17). However, in practice it is difficult to identify the demand side shocks because it is complicated to disentangle whether the loan demand is affected by purely demand side shocks or by other macroeconomic and/or financial factors. Therefore, usually in the empirical literature, the functioning of the bank lending channel is examined mainly through the loan supply side factors. For example, a perceived lower riskiness of loans by the intermediary institutions may increase the loan supply through for example, lower loan loss provisions. This will in turn shift the CC curve to the right, given that reserves have a positive effect in equation 4.17. The aforementioned factors that may induce shifts in the CC curve constitute the bank lending channel that, according to Bernanke and Blinder, enhances the effectiveness of the monetary policy.

These predictions of the Bernanke and Blinder model on the bank lending channel are supported by empirical evidence in their work. For instance, estimations of the correlation between the growth rates of Gross National Product

(GNP) and money and credit aggregates in the USA for the period 1953-1985, have indicated a higher correlation between the growth of GNP and credit after 1980 than the correlation between the growth of GNP and money[23]. Furthermore, the estimates of money and credit demand functions have suggested a higher parameter stability of the credit demand function from the 1980s, implying that the latter may be a better predictor of the movements of GNP[24]. Another empirical finding is that the lending channel can significantly affect the size of the interest rate spread between bond and loan interest rates. This argument of Bernanke and Blinder is based on the results from the credit demand function where credit aggregates are regressed on GNP, bonds and loans interest rates and the GNP deflator. According to the results, in periods of monetary policy tightening when bank reserves are reduced; the size of the interest rate spread between loans and bonds increases and vice versa. However, the aforementioned results should be taken with caution because the significance level of the correlation coefficients are not provided, while the regression results may be unreliable due to the relatively short time span of the data. Furthermore, the authors do not discuss the stability of the model or provide diagnostic tests. Additionally, considering their use of time series data, current practice would suggest the need to consider the stationarity of the data and the application of cointegration methods.

Bernanke and Blinder (1992) argue that if the bank lending channel exists, then bank balance sheet items should exhibit systematic movements after a monetary policy shock. More precisely, monetary policy tightening is expected to affect both banks’ assets and liabilities in such a way that the reduction of deposits should be offset by a reduction in loan supply. In the context of the Bernanke and Blinder model this can be seen through loan supply equation 4.9 where the quantity of loan supply depends positively of the quantity of deposits. In the CC curve (equation 4.17) this works through the money multiplier and banks’ reserves;. as can be seen from equation 4.6, deposits are expressed as a function of

[23] Even though the Bernanke and Blinder model is based on real terms, the correlation coefficients are estimated in both real and nominal terms and provide consistent findings.
[24] The GNP is in real terms, while the rest of the regressors are in nominal terms. However, the price level is controlled for in the regression model by the inclusion of the GDP deflator.

the money multiplier and banks' reserves. Accordingly, results from an impulse response analysis conducted for the US economy for the period 1959-1978 using aggregate data, indicated that a monetary policy tightening (an increase in Federal Funds Rate[25]) led to an immediate decline in bank deposits. Bank securities decline in the first six months after the shock and afterwards they start to rise. In contrast, bank loans remain unaffected immediately after the shock and begin to decline with a delay of 6 to 8 months. Consequently, the authors argue that these changes in bank portfolio structure show systematic movements because banks, in order to maintain their level of loan supply after the policy shock, offset the decline of deposits by the sale of securities. Later on, banks do not continue to offset the decline in deposits by selling securities and therefore they start to reduce the level of loan supply by lowering the quantity of new loans and/or by terminating old ones and begin to rebuild their level of securities. According to the authors this is a further indication of the existence of the bank lending channel.

Nevertheless, this interpretation of this empirical finding, based on aggregate data, should be taken with caution as there may be an identification problem. More specifically, the decline in loans may not only arise from supply side factors (reduced loan supply, resulting from decline in deposits), but also from demand side factors because an increase in the interest rate may lead to lower investment and consumption by firms and households that may result in a reduced loan demand (Kashyap and Stein, 1995). Furthermore, confidence intervals from the impulse response analysis are not provided and thus the significance of the findings is unclear.

Overall, the main contribution of the Bernanke and Blinder model is that it indicates that banks' loans can have an important role in monetary transmission in an economy. By abandoning the assumption of perfect substitutability between loans and bonds of the 'traditional' IS-LM model, they argue that loans as a

[25] In this example, a tightening of monetary policy refers to sale of bills by the Federal Reserve System (FED) that drains banks' reserves and increases the Federal Funds Rate.

financial instrument should have a different treatment in the economy to that of bonds. Accordingly, the authors argue that changes in monetary policy do not affect only the money market but also the credit and commodity markets, ultimately making monetary policy more effective.

4.3 Critical assessment and further modifications of the model

Bernanke and Blinder's model has been criticised in the literature mainly in relation to weaknesses arising from its basic assumptions. As a consequence, this model has undergone through several refinements that attempt to alleviate some of its problems. The criticisms of the model and its main amendments are examined in this section.

One of the major shortcomings of the original Bernanke and Blinder model is that it lacks clear microeconomic foundations. Kashyap and Stein (1993) provide microfoundations for the two basic assumptions of the CC-LM model: *I)* imperfect substitutability between loans and bonds and *II)* changes in bank reserves affect the quantity of loans supplied by the banks. Their microeconomic rationale for the first assumption is that loans provided by intermediary institutions have a special role in the economy because they are specialised in screening and monitoring borrowers which reduces the asymmetric information in financial markets between lenders and borrowers[26]. This is not the case in the bond market because here lenders are not so specialised in monitoring borrowers. Accordingly, borrowers in the bond market may exhibit moral hazard and may cause high deadweight costs for lenders, which is one of the major differences between these two financial instruments. An additional argument explaining why bank loans are different from bonds is that the costs of raising a loan (the loan interest rates) are associated with the reference rate (mark-up pricing theory, see

[26] Traditionally it has been assumed that banks are generally effective in assessing the risks associated with financial intermediation, nonetheless the current economic crisis may question the appropriateness of this assumption.

section 2.2.1) and are usually lower compared to the costs (interest rate set) on bonds issuance. Furthermore, repeated transactions between the borrowers and lenders may result in the so-called “locked-in” effect, implying that after establishing a relationship between the borrowers and lenders, it may become ‘costly’ for the borrowers to change lenders or the financial instrument (see relationship lending theory, section 2.2.3) .

Related to the second assumption of the Bernanke and Blinder model, Kashyap and Stein (1993) argue that only in the case when banks dominate the loan market can, then the central bank can affect the quantity of loans by controlling the level of bank reserves. This may not always be the case, especially in those economies with a developed financial system. An additional rationale for the second assumption of the CC-LM model, according to Kashyap and Stein (1993), is that banks are not indifferent to their portfolio structure. When their reserves are reduced, they respond by cutting the loan supply instead of selling some of their security holdings or issuing new certificate of deposits (CDs). The argument as to why banks do not fully compensate for the withdrawal of deposits by selling their security holdings is that securities are seen as liquid assets in the banks’ portfolio structure that act as a shield in case of any unexpected withdrawal of deposits. Similarly, banks do not fully compensate for the reduction in their reserves by issuing CDs as a tradable instrument because the marginal costs of additional issuance may rise substantially. More precisely, due to asymmetric information, investors in CDs may suspect the quality of a bank that issues a high amount of CDs, particularly if it is a small bank, and may therefore require a high rate of return. Ultimately, this reduces the spread between the interest rates on loans and CDs and subsequently loan profitability. This argument was developed for the US economy where CDs are a tradable financial instrument, whereas in other economies, especially with still relatively underdeveloped financial systems (transition economies), time deposits, as an alternative instrument to CDs, may not be tradable at all. This may make the bank lending channel even more pronounced.

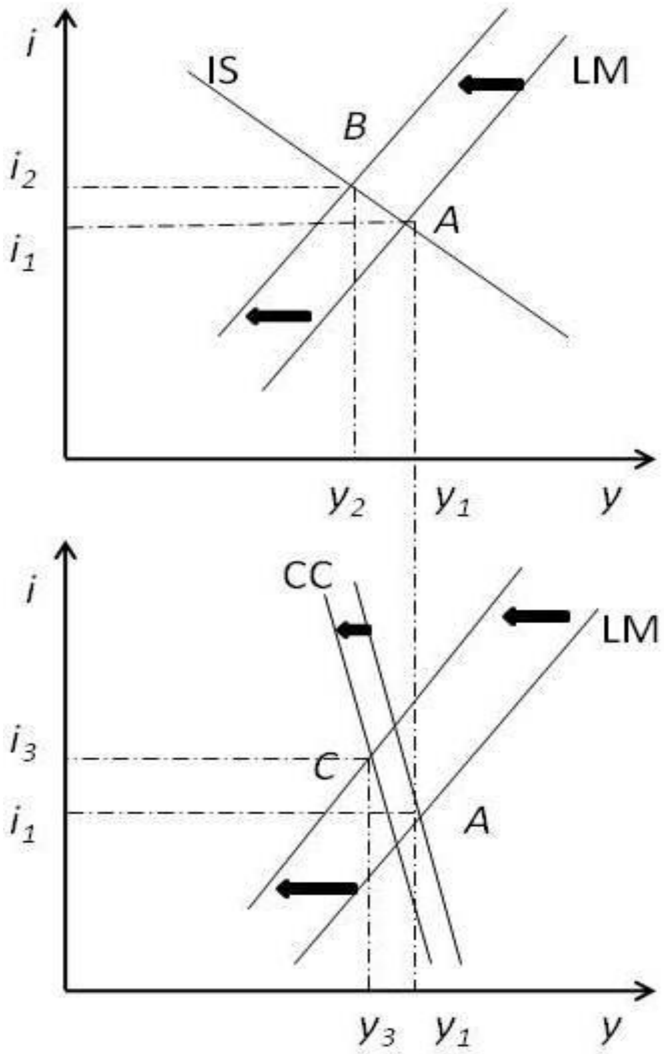
Further microeconomic foundations for the bank lending channel are provided by Bernanke and Gertler (1995), where the functioning of the lending channel is related to changes in the external finance premium that borrowers face. The external finance premium is defined as the spread between the costs of external funds that have to be raised for financing their investment activities (loans or issuing equity) and the opportunity costs of their internal funds for financing (retained earnings). The authors argue that during a monetary policy tightening, asymmetric information in the credit market worsens. Therefore, the costs of intermediary loan supply institutions rise because banks have to do more intensive screening, evaluation and monitoring of borrowers, as well as additional activities related to contract enforcement and repayment of loans. Consequently, these activities result in an increase in costs (interest rates) of loans that lead to an increase in the external finance premium for the borrowers, which eventually may reduce the level of their borrowing. Another explanation is that in a period of restrictive monetary policy, when bank reserves decline and subsequently banks reduce the quantity of loans, borrowers may be forced to find another lender (bank), which incurs additional costs, i.e. switching costs (see section 2.2.3); that will also affect their external finance premium.

Bernanke and Gertler (1995) do not make a clear distinction between the functioning of the bank lending channel and the balance sheet channel, which are related and may both affect the external finance premium. More precisely, the balance sheet channel represents the effects of changes in the net worth of borrowers, defined as the value of assets minus liabilities, which are induced by the changes in monetary policy. For example, these authors explain that an increase in interest rates induced by monetary policy tightening may worsen the financial position of borrowers. Namely, an increase in interest rates will increase the interest expenses of borrowers and therefore, will reduce their cash flow. Moreover, an increase in interest rates may also affect the value of borrowers' collateral provided because an increase in interest rates is usually associated with a decline in asset prices. Consequently, due to the worsening of the financial position of borrowers, banks may perceive greater possibility of borrowers' default and thus, may increase the rates on loans in order to compensate for potential default or cut back their loan supply. However, according to the theory of asymmetric information and lending rate stickiness, in periods of monetary tightening; banks may not fully increase their lending rates due to the worsening of the asymmetric information in the loan market and thus, may ration credit (see section 2.2.2). Overall, both cases suggest that monetary policy tightening may affect the external finance premium of borrowers, either through the reduced cash flow of borrowers caused by the increase in the lending rates and/or by reduction of their collateral value, which may result in a reduced quantity of loan supply by the banks.

Kierzenkowski (2007) further amends the CC-LM model by assessing the possibility that the bank lending channel may not always enhance the effectiveness of monetary policy. Kierzenkowski argues that the bank lending channel may in some circumstances even reduce it. This depends on the factors that determine the slope and the scale of shifts of the CC curve. For example, the slope of the CC curve is mainly determined by the loan and bond interest rate elasticities of loan supply (γ_l and γ_b respectively, see equation 4.9) as well as the loan, bond and income elasticities of loan demand (λ_l, λ_b and λ_y respectively, see equation 4.10). Consequently, when the loan supply is more responsive to changes in loan interest rates than bond rates ($\gamma_l > \gamma_b$) and/or when loan demand is more responsive to changes in loan rates than bond rates ($\lambda_l > \lambda_b$) and when income elasticity of loan demand is relatively high (λ_y); then the loan interest rate adjustment to changes in monetary policy will be lower compared to the bond interest rate adjustment. In this case, the slope of the CC curve is steeper than the IS curve, implying that the bank lending channel may reduce the strength of the interest rate channel, which ultimately may weaken the strength of monetary policy.

These possibilities are illustrated in Figure 4.3, we start at point *A* by considering the effects of monetary policy tightening. When the CC curve is steeper than the IS curve, which implies that the absolute slope of the CC curve is greater (the lower figure of 4.3, i.e. CC) than that of the IS curve (the upper figure), then in a case of monetary policy tightening, the bank lending channel may reduce the strength of monetary policy. However, this depends on the scale of shift of the CC curve. For example, if the scale of shift of the CC curve is up to the point *C* on the lower figure of 4.3, then the bank lending channel will reduce the strength of the monetary policy. This implies a lower or the same decline of output between IS-LM and CC-LM models, but in the case of the CC-LM model this is achieved by a greater increase in the bond interest rate (i_3), the lower figure on figure 4.3) compared to the IS-LM model (i_2, the upper figure on figure 4.3), which is contrary to Bernanke and Blinder's interpretation assessed in section 4.2 and figure 4.2. In the other case, when the scale of shift of CC is greater than point *C*, then even though the CC curve has a steeper slope than IS curve, the bank lending channel will enhance the effectiveness of monetary policy.

Figure 4.3: Comparison of IS-LM and CC-LM models



Source: Kierzenkowski (2007), p. 8.

The argument of Kierzenkowski (2007) that the bank lending channel may weaken the effectiveness of monetary policy, which depends not only on the slope of the CC curve compared to the IS curve, but also on the scale of the shift of the CC curve; is the major value added of the author. Nevertheless, the factors that affect the slope and scale of shift the CC curve have not been specified in more detail. Additionally, the possibilities that bank lending channel may reduce the effectiveness of monetary policy are assessed through loan and bond interest rate elasticities of loan supply as well as the loan, bond and income elasticities of loan demand. Hence, Kierzenkowski refers to equations 4.9 and 4.10 and not to equation 4.17 that actually represents the CC curve and thus, his arguments should be treated with caution.

The possibility that the bank lending channel may in some circumstances reduce the effectiveness of the interest rate channel is also discussed by Milne and Wood (2009). Their model is built upon changes in the quantities of inflows and outflows of funds (received deposits and granted loans, respectively) in periods of monetary policy tightening. One hypothesis of their model is that if in the periods of monetary policy tightening, the reduction in the inflow of funds (received deposits) is greater than the fall in the outflow of funds (granted loans); then the bank lending channel may increase the effectiveness of the interest rate channel. Namely, when banks are faced with a net outflow of funds, imposing funding constraints, then they will react by reducing the quantity loan supply, which is in line with the predictions of Bernanke and Blinder’s model. The alternative hypothesis of Milne and Wood is that if in periods of monetary policy tightening, the reduction in the quantity of deposit inflow is lower than the reduction in the outflow of funds (granted loans); then the ultimate result is a net inflow of funds to the banks. In this case, the banks will still be able to meet the loan demand and this will reduce the effectiveness of the interest rate channel. The outcome of these two hypotheses of Milne and Wood might be analysed through the changes in the interest rate spreads between the money market rate and lending and deposit rates. In the first case, when banks are faced with a higher reduction in the inflow of funds than the reduction of the outflow, then the interest rate spread between the lending rates and money market rate will increase, which is consistent with the CC-LM model of Bernanke and Blinder. More precisely, banks will tend to increase their lending rates proportionately more than the increases in the money market rates in order to reduce the loan demand. However, in the opposite case, when the reduction in the inflow of funds is lower than the reduction in the outflow of funds; then banks have a net inflow of funds. Thus, banks in order to place those funds in the loan market will increase their lending rates proportionally less than the money market rate, which will result in the narrowing of the spread between the two rates. This finding is in contrast to Bernanke and

Blinder predictions, but consistent with the arguments of Kierzenkowski (2007). Based on a VAR model and impulse response analyses, Milne and Wood (2009) investigate responses in banks' deposits and loans to changes in the money market rate for the G8 economies. According to the presented results, no clear conclusion could be drawn on whether the bank lending channel amplifies or attenuates the interest rate channel: "The overall picture is mixed....." (Milne and Wood 2009, p.35). The main shortcoming of Milne and Wood's model is that the effectiveness of the bank lending channel is based on the analysis of interest rate spreads between money market rate and banks' retail rates. Nonetheless, the variations in the interest rate spreads may not only be a result of the changes in the net inflows and outflow of funds but also to changes in the interest rates risks that banks face on the financial market (Ho and Saunders, 1981; see section 2.2.1).

Kashyap and Stein (1993) also argue that in some cases, the bank lending channel may reduce the strength of monetary policy. This may occur during an expansionary monetary policy when some banks cannot further extend the quantity of loan supply due to a binding capital constraint of the legal capital requirement provisions regulating the banking sector.

A further amendment of the Bernanke and Blinder model is proposed by Kierzenkowski (2005). He amends the CC-LM model by substituting the main monetary policy instrument of the model, i.e. control over the bank reserves through open market operations; with control over the key central bank interest rate. The same conditions for amplification and attenuation regime of the bank lending channel apply as in Kierzenkowski (2007), except that now the direction of interest rate spread is analysed between the loan rate and key policy rate. This model modification is empirically tested for the case of Poland. The results pointed to an attenuation effect of the lending channel under the fixed exchange rate regime during the period 1996-1998. After 1998 when the exchange rate has become flexible, the results suggest a neutral effect of the bank lending channel over the monetary transmission. The main shortcoming of this analysis is that it lacks a more comprehensive investigation of the monetary transmission channels in Poland, i.e. the reasons why the functioning of the bank lending channel has changed over time are not explained in detail. It is only stressed that it coincides with the switch in the exchange rate regime from a fixed to flexible one, without examining the inter-connection between the bank lending channel and exchange rate channel.

Disyatat (2010) attempts to 'reformulate' the factors that drive the bank lending channel by designing a model under the assumption of developed financial markets where banks are to a great extent dependent on non-deposit funding from the financial market. Disyatat argues that when monetary policy tightens, then (unlike the explanation of Bernanke and Blinder), changes in the quantity of loan supply by the banks are not actually driven by the changes in their deposit base. The alternative explanation is they are mainly driven by the anticipated changes in banks' balance sheet strength and thus, changes in their external finance premium. The logic behind this explanation is that in the case when banks are dependent on non-deposit funding, an increase of the reference interest rate may lead to increased external finance premium for banks' non-deposit funding. Namely, the financial institutions that provide non-deposit funds to the banks may perceive that banks are faced with a higher risk of borrowers' default when the reference rate increases, which may ultimately deteriorate banks' balance sheet strength. Thus, the financial institutions that provide non-deposit funds will react by increasing their external finance premium. Consequently, banks' reaction to the increased external finance premium will be to pass on these costs to their borrowers by increasing their lending rates. This in turn is seen to discourage some of the borrowers from taking new loans, resulting in lower quantity of newly issued loans. Overall, although the model provided by Disyatat (2010) offers an alternative way of interpreting the bank lending channel, it has some weaknesses. For example, his model is based on the assumption of developed financial markets and financial institutions that may not be relevant for majority of the transition and developing economies where banks still heavily rely on deposit funding. Moreover, the model is based on the assumption that "Banks are risk neutral and operate in a competitive market." (p.11). This assumption may not hold even in the case of developed economies because according to mark-up pricing theory, banks operate in a non-perfect competitive loan market (see section 2.2.1). Additionally, the Disyatat's model is not empirically tested.

Another criticism of the Bernanke and Blinder model is that it does not take into account the impact of foreign ownership of firms, foreign direct investment (FDI) and foreign bank ownership, which may reduce the strength of the lending channel. For instance, in the case of monetary tightening it may become 'cheaper' for the foreign-owned firms to use trade credit from their 'parent' company as a source of finance and that may reduce firms' dependency on domestic banks' loans (Corricelli et al., 2006 and Juks, 2004). This may be especially important in some transition economies with large FDI inflows and a large presence of foreign-owned firms. Regarding foreign-owned banks, there is empirical evidence indicating that they may respond less strongly to changes in the domestic reference interest rate than domestically owned banks (Schmitz, 2004 and Arena et al., 2007, see section 4.5.2). Furthermore, the study by de Haas and Lelyveld (2006) conducted for a sample of CSEE economies indicated that foreign-owned banks, especially greenfield banks, reduce the quantity of loans less during crisis periods. One of the reasons for such a response by foreign-owned banks is that they may use internal capital markets in order to get financial resources from their 'parent' bank (de Haas and Naaborg 2005).

An additional factor that may also reduce the strength of the bank lending channel, which is not considered in the model, may be close interbank relationships. For instance, depending on the structure of the banking system, some small banks may use their interbank relationship in order to get funds (interbank deposits) from some larger banks in periods of monetary tightening, as is the case in Germany and Italy (Worms, 2003 and Gambacorta, 2005). Another factor that may reduce the effectiveness of the bank lending channel in periods of monetary tightening may be the presence of relationship lending between the bank and some of its borrowers (see section 2.2.3). Moreover, government involvement in the banking sector through ownership and the policy of soft budget constraints and/or state loan guarantees may additionally reduce the strength of the lending channel (Ehrmann et al., 2003 and Corricelli et al., 2006). However, this may not be the case in Macedonia because a dominant proportion (over 87% of total banking capital since 1999) is privately owned (see table 1.6).

In conclusion, the main criticisms of Bernanke and Blinder's (1988a, b) model are the following: *first,* it lacks microeconomic foundations. *Second*, the claim that bank lending channel makes the monetary policy more effective neglects some factors that may work in the reverse direction. *Third*, the postulation that the main monetary policy of the central bank is control over the base money; and *fourth,* it does not take into account banks' financial characteristics as loan supply side factors . Consequently, the main modifications of Bernanke and Blinder's model are: related to the first criticism, Kashyap and Stein (1993) provide microeconomic foundations. Regarding the second weakness, Kierzenkowski (2007), Milne and Wood (2009) and Kashyap and Stein (1993) argue that the bank lending channel in some circumstances may reduce the strength of the monetary policy. Related to the third shortcoming, Kierzenkowski (2005) amends the model by substituting the policy instrument – control over the base money; with instrument – control over the key policy interest rate. Finally, in response to the fourth criticism Ehrmann et al. (2001 and 2003) amend the model by including bank specific characteristics as loan supply side factors. The latter is the subject of a more detailed analysis in the next section.

4.4 Examination of the 'conventional' model used in empirical work

The model that is most frequently used for examining the bank lending channel in empirical studies is that of Ehrmann et al. (2001 and 2003). This model attempts to correct a weakness of the Bernanke and Blinder model, which does not include banks' financial characteristics as additional factors from the supply side of the loan market. Ehrmann et al.'s model is based on simplified version of Bernanke and Blinder model.

Its derivation expressed with the variables in natural logarithms is as follows. As before in doing this we follow the practice in the literature and include the expected signs directly in the equations.

Table 4.2: Summary of the names of the parameters used in the equations of Ehrmann et al. (2001 and 2003) model and their expected sign

Parameter:	Name of the parameter:	Equations in which the parameter enters (the numeration in parenthesis refers to the number of the equation in the text)	Expected sign*:
ψ	Elasticity of banks' deposits to reference interest rate	Deposit market equation *(4.18)*	–
β	Constant	Deposit market equation *(4.18)*	/
φ_1	Income elasticity of loan demand	Loan demand equation *(4.19)*	+
φ_2	Price level elasticity of loan demand	Loan demand equation *(4.19)*	+
φ_3	Loan interest rate elasticity of loan demand	Loan demand equation *(4.19)*	-
μ	Elasticity of loan supply to variations in banks' deposits	Loan supply equation *(4.20)*	+
φ_4	Loan interest rate elasticity of loan supply	Loan demand equation *(4.20)*	+
φ_5	Elasticity of loan supply to reference interest rate	Loan demand equation *(4.20)*	–
μ_0	Constant in equation 4.21 for the impact of banks' specific characteristics	Equation *(4.21)*	/
μ_1	Elasticity of banks' deposits to banks' specific characteristics (size, liquidity or capital)	Equation *(4.21)*	-

* In presenting the model in the text of this thesis the expected sign of each parameter is included directly in each equation in front of the parameter.

In a simplified framework for the deposit market it is assumed that deposits (*D*) equal money (*M*), which is negatively determined by the reference interest rate (*r*) plus a constant (β), presented below:

$$M = D = -\psi r + \beta \qquad (4.18)$$

The loan demand function expressed in nominal terms (shown below), depends negatively on the loan interest rate (ρ) and positively on real income (y) and the price level (P).

$$L^d = \varphi_1 y + \varphi_2 P - \varphi_3 \rho \qquad (4.19)$$

The loan supply function, expression 4.20, is positively associated with the amount of deposits (D) that banks have as a source for financing their lending activities and the interest rate on loans (ρ), while negatively with the reference interest rate (r). The rationale why loan supply is a negative function of the reference interest rate is because the latter refers to banks' costs of financing their lending activities when they borrow in the money market (consistent with the mark-up pricing theory, section 2.2.1).

$$L^s = \mu D + \varphi_4 \rho - \varphi_5 r \qquad (4.20)$$

The main contribution of the Ehrmann et al. model is that it introduces banks' specific characteristics as determinants of loan supply function. More precisely, the model takes account of the possibility that not all banks are equally dependent on the amount of deposits for financing their lending activities. Namely, bigger, more liquid or more capitalised banks are perceived as less risky in the financial market and hence, those banks may more easily raise external non-deposit funding and/or pay a lower finance premium for it, regardless of the changes in the reference rate. Consequently, variations in the level of banks' deposits will be negatively related to the banks' financial characteristics such as either asset size, level of liquidity or capital because the greater they are the lower will be banks' dependence on deposit funding. Moreover, bigger, more liquid or more capitalised banks are seen to be less dependent on deposits because they may use some of their balance sheet items as a substitute for deposits in order to finance their lending activities. Thus, the model indicates that each of one these three banks' specific characteristics may serve as a proxy for the same thing, i.e.

banks' standing in financial market[27]. As presented with equation 4.21, only one at a time of these three characteristics is included in the model. The impact of the banks' specific characteristics is incorporated in the model through the following equation:

$$\mu = \mu_0 - \mu_1 x \qquad (4.21)$$

where, (μ) refers to variations in deposits by banks (see equation 4.20) and (x) represents one of the aforementioned bank specific characteristics as a proxy for the bank's ability to raise funding in the financial markets.

By substituting for equations 4.18 and 4.21 in equation 4.20, the clearing of the loan market, calculated as a reduced form of the model, is as follows:

$$L = \frac{\mu_0\varphi_3\beta + \varphi_1\varphi_4 y + \varphi_2\varphi_4 P - (\varphi_5 + \mu_0\psi)\varphi_3 r + \mu_1\varphi_3\beta x + \mu_1\psi\varphi_3 rx}{\varphi_3 + \varphi_4} \qquad (4.22)$$

where the expected signs of the relationships to the respective right hand side variables are given in the equation, i.e. positive for y, P, x and rx, and negative for r. If we substitute the coefficients in equation 4.22 as follows:

$\frac{\mu_0\varphi_3\beta}{\varphi_3 + \varphi_4} = \beta_0$ (the constant);

$\frac{\varphi_1\varphi_4}{\varphi_3 + \varphi_4} = \beta_1$ (the coefficient in front of the output)

$\frac{\varphi_2\varphi_4}{\varphi_3 + \varphi_4} = \beta_2$ (the coefficient in front of the price level)

$\frac{(\varphi_5 + \mu_0\psi)\varphi_3}{\varphi_3 + \varphi_4} = \beta_3$ (the coefficient in front of the money market rate)

[27] As an alternative phrases that will be used throughout this thesis will be banks' possibility to raise non-deposit funding or banks' access to non-deposit funding or banks' dependence on deposit funding.

$\frac{\mu_1 \varphi_3 \beta}{\varphi_3 + \varphi_4} = \beta_4$ (the coefficient in front of the single term of the banks' specific characteristic such as asset size, liquidity or capital)

$\frac{\mu_1 \psi \varphi_3}{\varphi_3 + \varphi_4} = \beta_5$ (the coefficient in front of the interaction term between the money market rate and the banks' specific characteristics such as asset size, liquidity or capital);

equation 4.22 can be presented in simplified version:

$$L = \beta_0 + \beta_1 y + \beta_2 P - \beta_3 r + \beta_4 x + \beta_5 rx; \qquad (4.23)$$

The coefficient β_3 indicates the extent to which banks react to changes in the reference rate in adjusting the quantity of loans. This determines the effectiveness of the bank lending channel. Namely, the greater the size of β_3, the more effective will be the bank lending channel. The coefficient β_4 indicates the impact of different bank characteristics on the quantity of loans, as supply side factors affect the loan market outcomes, regardless of the impact of the reference rate. More precisely, bigger, more liquid or more capitalised banks are expected to make a greater quantity of loans than smaller, less liquid or less capitalised banks. The coefficient β_5 is the coefficient of the interaction term between the reference interest rate and banks' specific characteristics. This coefficient indicates whether different banks with different financial characteristics react differently in adjusting the quantity of loans when the reference interest rate changes. As explained previously, larger, more liquid or more capitalised banks are less dependent on deposits as a source of financing their lending activities and thus, when the reference rate increases these banks are expected to reduce the quantity of loans proportionately less than smaller, less liquid or less capitalised banks. Hence, the coefficients β_4 and β_5 are expected to be positive.

However, a possible weakness of Ehrmann et al. model arises from its assumption of equal interest rate elasticity of loan demand among the borrowers in the loan demand equation 4.19 (Worms, 2003 and Hernando and Martinez-

Pegas, 2003). According to Worms and Hernando and Martinez-Pegas this assumption might not always hold in practice because various borrowers may respond differently to changes in the interest rate on loans. Additionally, this assumption excludes the impact of the switching costs and relationship lending activities that might alter the elasticity of loan demand of borrowers (see section 2.2.3). Thus, the empirical studies of Worms and Hernando and Martinez-Pegas attempt to control for the different loan demand elasticities among borrowers by including proxy variables for the borrowers' specific characteristics. Nonetheless the estimated results were in line as with the assumption of homogenous loan demand function among borrowers.

The econometric specification of the Ehrmann et al. model, based on equation 4.23, is as follows:

$$log(L_{it}) = \beta_0 + \sum_{j=1}^{l} \beta_1 log(L_{it-j}) + \sum_{j=0}^{l} \beta_2 r_{t-j} + \sum_{j=0}^{l} \beta_3 log(GDP_{t-j}) + \sum_{j=0}^{l} \beta_4 P_{t-j} + \sum_{j=0}^{l} \beta_5 X_{it-j} + \sum_{j=0}^{l} \beta_6 X_{it-j} r_{t-j} + \varepsilon_{it} \qquad (4.24)$$

where: β_0 is the intercept term; L is the quantity of outstanding loans supplied by banks to non-financial private sector; r is the reference interest rate; GDP is the Gross Domestic Product; P is the price level; X represents the bank specific financial characteristics; Xr is the interaction term between the bank specific characteristic and the reference rate; i and t are cross section and time specific subscripts, respectively; l indicates the number of lags.

The empirical model, which is a stock adjustment model, is designed as a dynamic panel data model where the quantity of loans depends on its past value(s), the macroeconomic control variables (GDP and price level), changes in the reference rate, banks specific characteristic(s) as a proxy for the banks' standing in the financial markets and their interaction term with the reference rate. Hence, parameter β_2 from the above equation corresponds to parameter β_3 from equation 4.23 and as previously explained, its statistical significance and negative sign indicate the existence of a bank lending channel. The parameter β_6 in equation 4.24 corresponds to parameter β_5 in equation 4.23 and its statistical significance implies that different banks with different characteristics react differently in adjusting the quantity of loans to changes in the reference rate.

Overall, the main originality of the model by Ehrmann et al. is that it incorporates bank specific characteristics as an influential factor in determining banks' loan supply reaction function to changes in reference rate. Consequently, investigating how banks' specific characteristics may affect the loan supply function may provide useful information of how different banks react in adjusting their quantity of loans when the reference rate changes.

4.5 Critical assessment of the empirical research

This section critically surveys the empirical studies that examine the existence of a bank lending channel and which banks' specific characteristics, as supply side factors, affect the quantity of loans. Consequently, this section critically surveys studies that investigate the functioning of the bank landing channel in: *I)* developed economies mainly: USA, Euro-area (EMU) and individual economies from the EU and *II)* the transition economies from CSEE.

The common characteristic of all surveyed studies in the next two subsections is that they are based on microeconomic (bank-level) data. The rationale for the use of bank-level data is that, as explained in section 4.2, the factors that affect the loan supply side can be identified more clearly. Otherwise, if aggregated data are used, then the model will have an identification problem because changes in the quantity of loans could arise not only from supply side factors, but also from the demand side factors (Kashyap and Stein, 1995). An additional reason for the use of bank-level data is because of the aggregation bias problem explained in section 2.3.5,

The empirical evidence on the existence of the bank lending channel is now assessed. The main criterion for selecting empirical studies to be critically assessed in more detail was according to the 'originality' of the studies and the importance of their influence on the other empirical studies. We have assessed in more depth the studies conducted for the transition economies because their macroeconomic and financial environment is more similar to one in the Republic of Macedonia. Regarding empirical studies for the developed economies, we have considered mainly the 'original' research articles conducted on the US economy, the Euro-zone economy.

4.5.1 Assessment of the empirical evidence for the developed economies

This subsection critically surveys the empirical studies for the developed economies, primarily the USA and EU. Table 4.3 provides a summary of the empirical studies analysed in this subsection ordered in the same way as they are discussed below. It also provides a summary of the other studies conducted on the individual country level from the EU that use similar estimation method(s) and provide similar findings as the ones that will be discussed in this section.

Table 4.3: Summary of the empirical studies for the developed economies (USA, EMU and EU)

Country / Area:	Study by:	Time period:	Frequency of the data:	Data source:	Method of estimation:	Size of N and T:	Balanced / unbalanced panel:	Macroeconomic control variables used:	Evidence of the existence of bank lending channel:	Significant determinants of bank lending channel:
USA	Kashyap and Stein (1995)	1976 Q1 - 1992 Q2	Quarterly	Call Reports, FED	Static Panel data, OLS and IV	N=14280; T=1976-1992	Unbalanced	Nominal GDP and CPI	YES	Size
	Kashyap and Stein (2000)	1976 Q1 - 1993 Q2	Quarterly	Call Reports, FED	Panel data, Two Step and One Step regression approach	N=13736; N=1976Q1-1993Q2	Unbalanced	Real GDP, time trend	YES	Size, liquidity
	Kishan and Opiela (2000)	1980 Q1 - 1995 Q4	Quarterly	Call Reports, FED	Panel data, Two Stage Regression Process	N=13042; T=1980-1995	/	Real GDP	YES	Size, capital
	Kishan and Opiela (2006)	1980 Q1 - 1999 Q4	Quarterly	Call Reports, FED	Panel data, Two Stage Regression Process	N=N/A; T=1980-1999	/	Real GDP, time trend	YES	Size, capital
	Peek and Rosengren (1995)	1976Q2 - 1994Q4	Quarterly	Call Reports, FED	Panel Data, Two-stage least squares	N=N/A; T=1976-1994	/	CPI, unemployment	"YES"	"Capital"
	Ashcraft (2006)	1986-1999	Annual	Call Reports, FED	Panel Data with generalised difference in difference strategy	N=N/A; T=1986-1999	/	/	YES	Size, capital, liquidity
	Chowdhury (2010)	1992-2007	Annual	Call Reports, FED	Dynamic Panel data by "system" GMM estimator	N=5820; T=1992-2007	Balanced	GDP, CPI	YES	Size, liquidity
	Brissimis and Deli (2010)	1994-2007	Annual	BankScope	Panel data by LGMM estimator	N=5873; T=1994-2007	Unbalanced	Real GDP and stock-market capitalisation to GDP ratio	YES	Size, capital and liquidity
EMU	Ehrmann et al. (2003)	1993 - 1999	Annual	BankScope	Dynamic Panel data by "difference" GMM estimator	N=4425; T=1992-1999	/	Real GDP, CPI	YES	Size
	Altunbas et al. (2002)	1991 - 1999	Annual	BankScope	Dynamic Panel data, RE	N=N/A; T=1991-1999	/	GDP	YES	Capital
	Brissimis and Deli (2010)	1994-2007	Annual	BankScope	Panel data by LGMM estimator	N=6133; T=1994-2007	Unbalanced	Real GDP and stock-market capitalisation to GDP ratio	YES	Size, capital and liquidity
Germany	Ehrmann et al. (2003)	1994 Q1 - 1998 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=3281; T=1993-1998	/	Real GDP, CPI	YES	Liquidity
	Worms (2003)	1992 Q1 - 1998 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=3207; T=1992-1998	/	Real sector output, interbank deposits	YES	Liquidity, capitalisation and "size"
	Altunbas et al. (2002)	1991 - 1999	Annual	BankScope	Dynamic Panel data, RE	N=N/A; T=1991-1999	/	GDP	NO	NONE
	Merkl and Stolz (2006)	1999Q1 - 2004Q4	Quarterly	Central bank	Dynamic Panel data by "system" GMM estimator	N=N/A; T=1999-2004	Unbalanced	GDP	NO	"Capital"

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Country / Area:	Study by:	Time period:	Frequency of the data:	Data source:	Method of estimation:	Size of N and T:	Balanced / unbalanced panel:	Macroeconomic control variables used:	Evidence of the existence of bank lending channel:	Significant determinants of bank lending channel:
Italy	Ehrmann et al. (2003)	1988 Q1 - 1998 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=785; T=1986Q4-1998Q4	/	Real GDP, CPI	YES	Liquidity
	Gambacorta (2005)	1986 Q1 - 2001 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=759; T=1986-2001	/	Real GDP, CPI	YES	Liquidity, capitalisation
Spain	Ehrmann et al. (2003)	1991 Q1 - 1998 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=264; T=1991-1998	/	Real GDP, CPI	YES	Liquidity
	Hernando and Martinez-Pegas (2003)	1991 Q1 - 1998 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=299; T=1991-1998	Unbalanced	Real GDP, CPI	Weak evidence	Liquidity
	Altunbas et al. (2002)	1991 - 1999	Annual	BankScope	Dynamic Panel data, RE	N=N/A; T=1991-1999	/	GDP	YES	Capitalisation
Netherlands	De Haan (2003)	1990 Q4 -1997 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=99; T=1990Q4-1997Q4	/	Real GDP, CPI	YES	Size, liquidity, capitalisation
France	Ehrmann et al. (2003)	1994 Q3 - 2000 Q3	Quarterly	National Bank supervisory reports	Dynamic Panel data by "difference" GMM estimator	N=496; T=1993Q1-2000Q3	/	Real GDP, CPI	YES	Liquidity
	Loupias et al. (2003)	1993 Q1 - 2000 Q4	Quarterly	/	Panel data by "difference" GMM estimator	N=312; T=1993-2000	Unbalanced	Real GDP, CPI	YES	Liquidity
	Altunbas et al. (2002)	1991 - 1999	Annual	BankScope	Dynamic Panel data, RE	N=N/A; T=1991-1999	/	GDP	NO	NONE
Austria	Kaufmann (2003)	1990Q1 - 1998Q2	Quarterly	Central bank	Markov chain Monte Carlo simulation	N=665; T=1990-1998	Balanced	GDP, CPI	NO	"Liquidity"
	Engler et al. (2005)	1997Q1 - 2003Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=760; T=1997-2003	Unbalanced	GDP, REER	NO	"Capital"
Portugal	Farinha and Marques (2003)	1990 Q1 - 1998 Q4	Quarterly	Central bank	Panel cointegration with PFMOLS estimators	N=18; T=1990-1998	Balanced	Real GDP, CPI	YES	Capitalisation
Finland	Topi and Vilmunen (2003)	1995 Q1 - 2000 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=343; T=1995Q1-200Q4	Unbalanced	Real GDP, CPI	Weak evidence (ambiguous)	None
Greece	Brissimis et al. (2003)	1995 M1 - 1999 M12	Monthly	Central bank	Panel data with SUR (for the first model) and SUR for panel cointegration (the second model)	N=12; T=1995-1999, p.12	/	Real GDP, CPI	YES	Size, liquidity
Sweden	Westerlund (2003)	1998 M1 - 2003 M6	Monthly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=12; T=1998M1-2003M6	/	Real GDP, CPI	YES	Size, liquidity

The first empirical study based on US bank-level data that explored the existence of the bank lending channel was conducted by Kashyap and Stein (1995). These authors examine how different asset sizes among banks affect the loans. Their results indicated a significant impact of the reference rate on the quantity of loans, implying the existence of a bank lending channel. Regarding the asset size of the banks, their results suggested that smaller banks are more sensitive in adjusting the quantity of loans to changes in reference interest rate compared to bigger banks. This finding is explained by the argument that bigger banks are perceived as less risky banks in the financial markets. Thus, they may find it easier to offset a decline in deposits by raising non-deposit funds, such as commercial papers. Additionally, Kashyap and Stein (2000) examine other alternative financial characteristics. Their estimates implied that an alternative significant determinant of the quantity of loans from the supply side is the level of liquidity. For instance, banks with less liquid assets reduce the quantity of loans proportionally more than more liquid banks. This finding is explained by the argument that more liquid banks are perceived as less risky in the financial markets and may more easily raise non-deposit funding. Moreover, more liquid banks may also use their liquid assets as a buffer in the face of deposit reduction when the monetary policy tightens, limiting their reduction in the quantity of loans.

Kishan and Opiela (2000 and 2006) also test for the existence of a bank lending channel in the US economy by considering another alternative bank financial characteristic: capitalisation ratio. Their results indicated that the bank lending channel exists, which is consistent with the findings of previous studies. Additionally, their results implied that not only the size of the banks may play a significant role over banks' lending decisions, but also the level of capitalisation. The results have indicated that less capitalised banks reduce their quantity of loans proportionately more than more capitalised banks. The authors' explanation for this finding is that more capitalised banks have greater access to non-deposit funding and therefore, can more easily compensate for deposit reduction when the reference rate tightens. In contrast, although the results of Peek and Rosengren (1995) provide statistical evidence that the bank lending channel is 'working' in the US (New England), their results in respect of the bank capital were mixed.

The findings of Ashcraft (2006) also suggest that the bank lending channel is functional in the US economy. In this study, the significant bank specific characteristics on the loan function are estimated to be banks' asset size, capital and liquidity. These findings are consistent with some of the previous studies (Kashyap and Stein, 1995 and 2000 and Kishan and Opiela, 2000 and 2006). A more recent analysis conducted by Chowdhury (2010) again suggests that the bank lending channel exists in the US economy, with size and liquidity but not capital being significant determinants on the loan function.

Several studies that analyse the functioning of the bank lending channel in the Euro zone have been conducted. For example, the researches undertaken by Ehrmann et al. (2003) and Altunbas et al. (2002) pointed to the existence of a bank lending channel. Regarding banks' financial characteristics (size, liquidity or capital) as determinants of different (heterogeneous) loan functions among EMU banks, the findings of Ehrmann et al. (2003) indicate that only the size of the banks is a significant factor. More specifically, the estimates based on model specification 4.24 suggest that smaller banks react more strongly in adjusting the quantity of loans when the reference rate changes than bigger banks do, which is similar to the results of the US studies conducted. However, the interaction term of the liquidity variable is estimated with a sign contrary to the theoretical prediction for which no detailed discussion is provided. Regarding the capitalisation of the banks, the results suggested that it does not have any significant impact over the loan function, which is contrary to the US results. Somewhat different findings are presented in Altunbas et al. (2002). The estimated results with a different model specification imply that only the level of capitalisation has a significant influence over the banks' lending decisions in the EMU, while size does not.

A more recent study that investigates the functioning of the bank lending channel in both the US and Euro-zone economies is by Brissimis and Delis (2010). By employing the "Local Generalised Method of Moments" (LGMM) estimator, the results suggest that the bank lending channel works in both economies, which is consistent with the findings of the previously assessed studies. Moreover, the results implied that banks in the Euro-zone react more strongly in adjusting the quantity of loans to changes in the reference rate compared to the US economy. This is explained by the higher dependence of the private sector on loans as a source of external financing in the Euro-zone than the US economy, although it is not supported by any additional empirical evidence. Additionally, the results indicate that the bank lending channel in both economies weakens through time. According to Brissimis and Delis, this might be due to the overall development of the financial system in both economies that makes the private sector less dependent on banks' loans as a source of external financing. Again this explanation is not supported by any additional empirical examination. Regarding the bank specific characteristics, the results suggest that either size, capital or liquidity may play a significant role in determining the loan function in both economies, which is in line with some of the previous findings for these economies.

Summarising the findings for EU counties, the majority of the analyses are based on model specification 4.24 and provide empirical evidence for the existence of a bank lending channel (see table 4.3). The only exceptions are the two studies for Austria and one for Finland where the results of Topi and Vilmunen (2003) for the existence of the bank lending channel are not robust. Regarding the bank-specific characteristics as possible determinants of the loan function, various studies provide different findings even for the same economy. One reason why this may be the case, apart from the different data series used and different time samples, may be differences in model specification (discussed in section 4.5.3).

In brief, according to the empirical studies reviewed above, there is evidence suggesting that the bank lending channel is functional in the US, the Euro-zone economies as well as the majority of the EU economies. Furthermore, some studies have found that bank-specific characteristics, i.e. size, liquidity or capital, may be significant determinant(s) of a loan function, although findings differ from study to study for the same economy. Even though the majority of the assessed studies in this subsection may suffer from some weaknesses to be discussed in section 4.5.3, overall they provide findings consistent with the bank lending channel theory.

4.5.2 Assessment of the empirical evidence for transition economies

This subsection critically assesses the empirical studies that investigate the functioning of the bank lending channel in transition economies, focusing on the CSEE countries. There are various studies that examine the bank lending channel at aggregate level for the eight (ten) new EU member states from CSEE[28] as well as various studies conducted at the individual country level. The criteria for selecting studies to be discussed in more depth was already mentioned in section 4.5, though we will also assess in more depth those studies of the Baltic States due to their monetary policy regime being similar to that in Macedonia, i.e. the exchange rate peg.

Most of the studies of transition economies augment model specification 4.24 with some specific variables that are of special interest to these economies. More precisely, some studies (Schmitz, 2004; Havrylchyk and Jurzyk, 2005; Chmielewski, 2006; Golodniuk, 2006; de Souza, 2006), include in the model the real effective exchange rate (REER) as an important macroeconomic control variable. The rationale for inclusion of the REER variable, according to Schmitz (2004), is to capture the effect of changes in the price competitiveness of the

[28] The economies considered under the eight (ten) new EU member states are: Czech Republic, Hungary, Poland, Slovakia, Slovenia and the three Baltic states (Estonia, Latvia and Lithuania). The additional two new EU member states are Bulgaria and Romania.

CSEE economies on banks' assets and their lending potential. More precisely, a change in price competitiveness may affect the trade balance and the inflow and outflow of funds through the capital account. The latter may in turn directly affect banks' assets and increase/decrease their lending potential.

Other studies (Schmitz, 2004; Kohler et al., 2006; Horvath et al., 2006; Juks, 2004 and Benkovskis, 2008) investigate the effect of changes not only in the domestic reference rate but also of the foreign one, e.g. the 3-month EURIBOR rate. Moreover, the majority of the studies additionally augment the model with a foreign ownership dummy variable and its interaction term with the reference rate (Schmitz, 2004; Matousek and Sarantis, 2009; Jimborean, 2009; Kohler et al., 2006; Havrylchyk and Jurzyk, 2005; Chmielewski, 2006; Pruteanu-Podpiera, 2007; Horvath et al., 2006; Benkovskis, 2008; Juurikkala et al., 2009; Brooks, 2007 and Arena et al., 2007). The reason for including the EURIBOR rate as a reference rate is explained by the relatively high proportion of foreign currency loans and foreign currency indexed loans relative to total loans. An additional reason for using the foreign reference rate (the EURIBOR rate) is the relatively high dependence on foreign financing of the banks in transition economies that may borrow funds in the international financial markets, mainly the Euro-zone from where the majority of the foreign owned banks originate. Consequently, due to these reasons it is expected the banks in the transition economies react more strongly to changes in the EURIBOR rate than to changes in the domestic reference rate. The rationale for controlling for the foreign ownership in the model is that foreign-owned banks are perceived to react differently to changes in domestic reference rate compared to domestically owned banks because of their use of their internal capital market and access to funds from their 'parent' institution (see section 4.3).

Another variable that is added in the model specification 4.24 is the ratio of non-performing loans to total loans (the NPL ratio) and its interaction term with the reference rate (Chmielewski, 2006 and Pruteanu-Podpiera, 2007). The rationale for including this variable is that a higher level of NPL incurs additional costs for banks, alters their risk preferences and worsens their asset portfolio structure (for details see section 5.2) which may affect banks' lending preferences.

A summary table of the studies selected on the criteria mentioned in section 4.5, ordered in the same way as they are discussed in the text is presented in table 4.4. A summary of other empirical studies conducted for transition economies, as well as studies conducted for other non-transition emerging economies such Turkey and economies from Latin America and Asia, are presented in table 4.4.

Table 4.4: Summary of the empirical studies for the transition economies from SCEE and some other emerging economies

Country / Area:	Study by:	Time period:	Frequency of the data:	Data source:	Method of estimation:	Size of N and T:	Balanced / unbalanced panel:	Macroeconomic control variables used:	Evidence of the existence of bank lending channel:	Significant determinants of bank lending channel:
Eight/ten new EU member states	Schmitz (2004)	1990 - 2001	Annual	BankScope	Static Panel data with fixed effects	N=261; T=1990-2001	Unbalanced	Real GDP, CPI, REER, foreign ownership	"YES", through EURIBOR	Ownership, size weakly
	Matousek and Sarantis (2009)	1994 - 2003	Annual	BankScope	Dynamic Panel data by "difference" GMM estimator	N depends from the economy; T=1994-2003	/	Real GDP, CPI	Weak evidence, only for Slovenia and Poland	Size, liquidity
	Jimborean (2009)	1998-2006	Annual	BankScope	Dynamic Panel data by "system" GMM estimator	N=68-203; T=1998-2006	/	Real GDP, CPI	Ambigious	Size, Liquidity
Baltic States	Kohler et al. (2006)	1997 - 2004	Annual	BankScope	Static Panel data by OLS	N=36; T=1997-2004	Unbalanced	Nominal GDP	"YES", through EURIBOR	Liquidity, capitalisation, ownership
Poland	Wrobel and Pawlowska (2002)	1997 Q1 - 2001 Q4	Quarterly	Central bank	Dynamic Panel data with fixed effects, estimated with GLS method	N=648; T=1997Q1-2001Q4	/	Real GDP, CPI	YES	Size, liquidity and capital
	Havrylchyk and Jurzyk (2005)	1995 Q1 - 2002 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=67; T=1995-2004	Unbalanced	Real GDP, CPI, REER, foreign ownership	YES, weak evidence	Liquidity and foreign ownership
	Chmielewski (2006)	1997 Q1 - 2004 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=N/A; T=1997-2004	/	Real GDP, CPI, REER, foreign ownership	YES	Liquidity, foreign ownership and NPL ratio
Czech Republic	Prutenau-Podpiera (2007)	1996 Q1 - 1998 Q4; 1999 Q1 - 2001 Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=33; T=1996-2001	/	Real GDP, CPI, foreign ownership	YES	Capitalisation, liquidity

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Country / Area:	Study by:	Time period:	Frequency of the data:	Data source:	Method of estimation:	Size of N and T:	Balanced / unbalanced panel:	Macroeconomic control variables used:	Evidence of the existence of bank lending channel:	Significant determinants of bank lending channel:
Estonia	Juks (2004)	1996 Q4 - 2004 Q1	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=5; T=1997-2004	/	Real GDP, CPI	NO	"Liquidity", "capitalisation"
Latvia	Benkovskis (2008)	1995 Q2 - 2006Q4	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=23; T=1995-2006	Unbalanced	Real GDP, CPI	NO	"Capitalisation"
Russia	de Souza (2006)	1995-2003	Annual	BankScope	Dynamic Panel data by "difference" GMM estimator	N=232; T=1995-2003	/	GDP, CPI, REER	NO	"Size", "capital"
	Juurikkala et al. (2009)	1999Q1 - 2007Q1	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=1475; T=1999-2007	Unbalanced	GDP, CPI	"YES" through monetary aggregates only	Capitalisation
Hungary	Horvath et al. (2006)	1995 Q1 - 2004 Q3	Quarterly	Central bank	Dynamic Panel data by "difference" GMM estimator	N=25; 1995-2004	/	GDP, CPI, nominal exchange rate, foreign ownership	YES	Size, capitalisation, foreign ownership
Ukraine	Golodniuk (2006)	1998 - 2003	Annual	Central bank	Dynamic Panel data by "difference" GMM estimator	N=149; T=1998-2003	/	Real GDP, CPI, REER	YES	Capitalisation
Turkey	Brooks (2007)	June 2006 - March 2007	Quarterly	Bank Association of Turkey	Static Panel data model with "difference to difference" approach by using least absolute deviations method	N=33; T=2006Q2-2007Q1	/	/	YES	Liquidity
Emerging economies from Latin America and Asia	Arena et al. (2007)	1989 - 2001	Annual	BankScope	Static Panel data with fixed effects, estimated with GLS method	N=1565; T=1989-2001	Unbalanced	Foreign ownership	YES	Liquidity, capitalisation, foreign ownership

One of the first studies exploring the functioning of the bank lending channel jointly for the eight new EU member states from CSEE was by Schmitz (2004). The results based on augmented model specification 4.24 for the REER, foreign ownership and EURIBOR rate variables; indicate that the bank lending channel is not functional through the domestic reference rate. However, the results imply that banks' loans significantly react to changes in the EURIBOR rate. This indicates that the lending channel works through the foreign reference rate which is outside of the control of the domestic monetary policy makers. Related to the banks' specific characteristics (size, liquidity, capitalisation and ownership structure), the ownership structure turns out to be the most significant determinant of the loan function. More precisely, foreign-owned banks are more sensitive in adjusting the quantity of loans to changes in the EURIBOR rate than domestically-owned banks. Regarding the rest of the bank specific characteristics, none of them turned out to have a significant influence on the bank lending channel. There is 'weak' evidence that the size of the banks may have an impact on the quantity of loans, but the results are sensitive to different model specifications and different sample periods. The main shortcoming of this research is that during the sample period some of these economies have undergone a change in their monetary policy regime, i.e. from fixed exchange rate to inflation targeting (Czech Republic), but this was not controlled for in the regressions.

In a similar vein, Matousek and Sarantis (2009) explore the bank lending channel for the same group of transition economies, but on an individual basis. The results based on the augmented model specification 4.24 for the ownership structure indicated that, apart from Slovenia and partially in Poland, changes in domestic reference rates do not have any significant impact on the quantity of loans . This is consistent with Schmitz's (2004) findings, indicating that in a majority of the CSEE economies the 'domestic' lending channel does not exist. The main pitfall of this analysis is that it does not take into account the influence of the foreign reference rate, which according to Schmitz is the key variable in determining the bank lending channel. Another drawback of Matousek and

Sarantis's study is that the model again does not control for changes in monetary policy regime.

Similarly, Jimborean (2009) explores the functioning of the bank lending channel jointly for the ten new EU member states. The major value added of this study is that banks in the sample are divided into three subcategories according to their loans-to-deposit ratio, a proxy measure for banks' dependency on external funding. The results from various model specifications indicate that the respective domestic reference rate is either statistically insignificant or it is statistically significant, but with a contrary (positive) sign from what was expected. This is interpreted that that bank lending channel is not functional at this group of economies, which is in line with Matousek and Sarantis (2009) findings. Regarding the bank specific characteristics (size, liquidity, capital and foreign ownership), only the interaction terms in respect of the size and liquidity variables turned out to have a significant impact on the quantity of loans, but only for the second (middle) group of banks according to the loans-to-deposit ratio. Accordingly, the author argues that the bank lending channel works mainly through those banks. However, considering that the impact of the reference rate is insignificant and/or where significant it has a contrary sign than the predictions of the Bernanke and Blinder model, it cannot be argued that the bank lending channel is functional in this group of economies. Moreover, the liquidity variable enters with contrary sign from what was expected. According to Jimborean (2009), this is explained by the excess liquidity of the banking systems in these economies, though no detailed explanation is provided. An additional weakness of this study is that the author only tests the sensitivity of loans to changes in domestic reference rates and, unlike Schmitz (2004), does not investigate the impact of the changes in the foreign reference rate.

Kohler et al. (2006) investigate the bank lending channel jointly for the three Baltic States. The rationale for this is similarities in the monetary policy regimes and the financial structure among these economies. Accordingly, by amending the model specification 4.24 for the EURIBOR rate as a reference rate and with a foreign ownership variable, the estimated results suggested again that 'domestic' lending channel through domestic reference rate does not exist. Hence, consistent with Schmitz's (2004) findings, the results have indicated that the lending channel 'works' through the changes in the EURIBOR rate. Hence this channel cannot be 'utilised' by domestic monetary policy makers. Regarding the banks' characteristics, significant determinants of the loan function are estimated to be capitalisation, foreign-ownership and liquidity. However, the coefficient on the liquidity variable has the contrary (negative) sign from the theoretical predictions, which is again explained by the excess liquidity of the banks in these countries (for more details see section 5.2).

Analysing the bank lending channel at individual country level, several studies provide some evidence for Poland. For example, the results of Wrobel and Pawlowska (2002), Havrylchyk and Jurzyk (2005) and Chmielewski (2006) based on model specification 4.24 imply that the bank lending channel operates in Poland through changes in domestic reference rate, which is in contrast to the findings of Schmitz (2004). Regarding the bank specific characteristics, all three studies provide evidence that liquidity has a significant impact on the bank lending channel, but with the opposite sign from what is predicted by economic theory. This is explained by the structural excess liquidity of the Polish banking system that may bias the results (for more details see section 5.2). Related to the other bank specific characteristics, the results of Wrobel and Pawlowska (2002) suggest that banks' loans are affected by the asset size and capitalisation ratio. The estimates of Havrylchyk and Jurzyk (2005) and Chmielewski (2006) indicate that an additional significant bank specific characteristic affecting banks' loans in Poland is foreign ownership. Furthermore, the results of Chmielewski (2006) based on augmented model specification 4.24, implied that the NPL ratio is also another significant determinant of banks' loans. Nonetheless, the main shortcoming of these analyses is that they do not test for the sensitivity of loans to changes in the foreign reference rate, which may be an important determinant of the lending channel in Poland.

In the Czech Republic, Pruteanu-Podpiera (2007) investigates the bank lending channel for the two subperiods 1996-1998 and 1999-2001[29]. The results point to a significant loans supply adjustment by banks to changes in domestic reference rate in the two subperiods, being stronger for the second subperiod. These results are contrary to the findings of Schmitz (2004), Matousek and Sarantis (2009) and Jimborean (2009). Analysing the role of banks' specific characteristics, liquidity and capitalisation were seen to be the major determinants of the banks' loans in the first subperiod, but not in the second. Size and foreign ownership variables also had a significant impact over the banks' loans, but with contrary signs from what is expected from economic theory, for which no detailed explanation is provided. The interaction term in respect of the NPL ratio entered with a contrary (positive) sign from the prior expectations in the two subperiods. The reason for this, according to the author, may be due to the domestically-owned banks granting loans to risky borrowers because of their 'close relations' with those borrowers. This was especially the case in the initial period of transition when state ownership of banks was present to greater extent. However, this is not supported by any additional explanation or empirical evidence. In summary, this analysis provides some evidence for the existence of the bank lending channel in Czech Republic. Nevertheless, the main limitation of this study is that the foreign reference rate and the REER variables are not included in the model.

Juks (2004) investigates the impact of the EURIBOR rate, taken as the reference rate due to the currency board regime, over Estonian banks' loans . The estimates indicate that banks' loans do not react significantly to changes in the EURIBOR rate, which is contrary to Kohler et al.'s (2006) findings. The reasons for this, according to the author, are related to many non-modelled non-monetary and non-economic factors associated with the transition process, though no specific factors are identified and no detailed explanation is provided. The main

[29] The reason for dividing the sample into two subperiods is the rapid changes in monetary policy during the second subperiod, characterised by a continual reduction in the monetary policy rate and reserve requirement.

weakness of this analysis is that it does not take into account other factors that may have an impact over the lending channel in Estonia such as, the REER and foreign ownership variable, as it is done by other studies.

The investigation by Benkovskis (2008) provides mixed evidence for the existence of a bank lending channel in Latvia. By using the quantity of total loans as well as their sectoral and currency disaggregation, the author investigates whether the bank lending channel is functional in respect of domestic and foreign reference interest rates. The results indicate that banks' loans (total loans as well as their currency and sectoral disaggregation) are unresponsive to changes in both the domestic and foreign reference interest rates. This suggests that the bank lending channel is not operational in Latvia, a finding contrary to that of Kohler et al. (2006).

In brief, the results of these empirical studies suggest that a bank lending channel exists in some European transition economies and in some other non-transition emerging economies. However, the bank lending channel in many of the transition economies does not 'work' through the domestic reference rate. It 'works' through changes in the foreign reference rate, which is outside the control of domestic monetary policy makers. This may be due to banks' dependence on foreign financing, the relatively high level of currency substitution and the relatively high level of foreign ownership in the banking sector. Regarding the impact of the bank-specific characteristics as supply side determinants, the evidence is mixed. Namely, various studies point to different characteristics in different economies having a significant impact. Possible reasons for the lack of consistent findings, together with a consideration of some generics weaknesses in such analyses, are considered in the following subsection.

4.5.3 General criticism of previous empirical studies

A common weakness of the empirical analyses assessed in sections 4.5.1 and 4.5.2 is that they investigate the existence of a bank lending channel by assessing the impact of the domestic reference rate on the quantity of loans, without directly considering whether it is operational and to what extent. Investigating the latter is of great importance for the monetary policy makers in choosing their policy instruments to achieve their objectives. In considering whether the bank lending channel is operational, the orthodox theory typically predicts that there is sizeable, homogeneous and predictable reaction of banks to changes in the domestic reference rate. Both, sizeable and predictable response of loans to a change in the reference rate is required for the bank lending channel to be 'operational'. However, where there are differences between banks' responsiveness, then if these are stable over time, then the bank lending channel may still be used as a basis for monetary policy; although the implementation of the monetary policy will be more difficult.

Another general shortcoming of most empirical studies is related to their model specification. More precisely, there is inconsistency with the 'basic' empirical model specification 4.24 designed by Ehrmann et al. (2001 and 2003), regarding the use of the three commonly used bank-specific characteristics (asset size, liquidity and capital). The theoretical basis and the applied model specification by Ehrmann et al. suggest that these three bank specific characteristics serve as a proxy for the same thing, i.e. a banks' dependence on deposit funding in financing its lending activities (see section 4.4). Consequently, Ehrmann et al. suggest including only one single and one interaction term of one of these three bank balance sheet items at a time. Nonetheless, many of the empirical studies such as: Chowdhury (2010), Ehrmann et al. (2003), Loupias et al. (2003), Gambacorta (2005), Matousek and Sarantis (2009), Jimborean (2009), Havrylchyk and Jurzyk (2005), Horvath et al. (2006), Benkovskis (2008), Golodniuk (2006), de Souza (2006), Juurikkala et al. (2009); include more than one of these bank specific characteristic and their interaction terms. Some of the empirical studies like Ehrmann et al. (2003), Matousek and Sarantis (2009), Horvath et al. (2006); include even a double interaction terms composed of two bank specific characteristics times the reference rate or one of the macroeconomic control variables (CPI or GDP), for which no detailed explanation is given. These empirical studies are not explicitly clear whether they include these variables as a proxy for the same thing (banks' ability to raise non-deposit funding in financial markets), or to capture slightly different aspect of the banks' reputation. This confusion may be one of the reasons for the different results among the studies that are conducted even for the same economy or same group of economies.

An additional weakness of these studies again relates to the model specification, especially those conducted on individual EMU economies. Apart from Engler et al. (2005), they do not include a REER variable; as many empirical analyses conducted for other transition economies do. This may be an important determinant of the lending channel in the EMU economies, having in mind the importance of the exchange rate during the pre-accession period in the Euro-zone and the fluctuation margins defined by the Exchange Rate Mechanism (ERM) II.

Another possible problem associated with model specification is whether the model should be estimated in real or nominal terms. The theoretical model by Bernanke and Blinder assumes constant inflation and inflation expectations are suppressed throughout the model. However, the empirical model of Ehrmann et al. (2001 and 2003) is specified in nominal terms, apart from GDP which is in real terms. In the empirical studies analysed in the previous two subsections there is inconsistency on this issue and no clear cut preferred specification is evident. For example, Westerlund (2003) and Schmitz (2004) estimate the model with some variables in real terms (loans, deposits and GDP) and some variables in nominal terms (reference interest rate and bank financial characteristics). Altunbas et al. (2002) and Kohler et al. (2006) estimate the model in nominal terms without considering the effect of inflation. Other studies, Matousek and Sarantis (2009), Chmielewski (2006) and Horvath et al. (2006), estimate the model in nominal terms, controlling for the effect of inflation, but nevertheless fail to state if GDP is in real or nominal terms. Kashyap and Stein (1995) and Golodniuk (2006) estimate the model both in nominal terms (where the former study includes inflation as a variable but not the latter study) and in real terms, though they find no significant difference in the results.

A further issue related to model specification is whether the macroeconomic variables (GDP and CPI) and the reference rate should be treated as exogenous, predetermined or endogenous. In some studies this issue is not discussed (Chowdhury, 2010; Brissimis and Delis, 2010; Merkl and Stolz, 2006; Engler et al., 2005; de Haan, 2003; Jimborean, 2009; Horvath et al., 2006; Golodniuk, 2006; Pruteanu-Podpiera, 2007; Matousek and Sarantis, 2009, de Souza, 2006 and Juurikkala et al., 2009). Other studies such as, Juks (2004) and Topi and Vilmunen (2003) treat them as endogenous. In contrast, Ehrmann et al. (2003), Hernando and Martinez-Pages (2003), Havrylchyk and Jurzyk (2005), Chmielewski (2006) and Gambacorta (2005) and Benkovskis (2008) treat them as strictly exogenous, whereas Loupias et al. (2003) assume that CPI and GDP are strictly exogenous, while the reference interest rate is taken as predetermined. However, all of these studies lack an explanation as to why they made their particular decisions.

A further weakness of some of these studies arises from the estimation method applied, given the endogenous nature of the model. Some studies, such as Schmitz (2004) and Kohler et al. (2006) estimated a static panel data model with fixed effects or random effects. However, they have used a technique that does not account for endogeneity of some of the independent variables such as banks' specific characteristics. Moreover, the studies by Wrobel and Pawlowska (2002) and Altunbas et al. (2002) are specified as dynamic panel data models estimated with fixed effects, GLS or ML estimators. The employed estimation methods in this case may be inconsistent and biased. Namely, the lagged dependent variable is correlated with the error term and this gives rise to an endogeneity problem. Moreover, these two studies as well as the ones by Schmitz (2004) and Kohler et al. (2006) have other potentially endogenous independent variables, like bank specific characteristics. Consequently, due to the dynamic nature of the model and the endogeneity issue, dynamic panel estimation by GMM estimator is a method that appropriately deals with these problems and this is the most frequently used method in majority of the assessed studies (see tables 4.1 and 4.2).

There has been a rapid development of understanding and techniques in dynamic panel analysis in recent years (Arellano and Bover, 1995; Blundell and Bond, 1998 and Roodman, 2009a). Given these developments, the use of “difference” GMM by the majority of these studies does not now seem to be the most appropriate estimator. “System” GMM may be more appropriate in the presence of a near unit root process. Better properties when estimating with such data series is a major advantage of using “system” GMM over “difference” GMM. This would seem to be applicable to the estimations of models of loans because the data series are seen to exhibit a high persistence, i.e. data that contain near unit root process; which is going to be discussed in more detail in section 5.4.

GMM estimators are designed for samples with short time series data (small T) and large cross sectional units (large N). However, some studies like Westerlund (2003), Horvath et al. (2006), Benkovskis (2008) and especially Juks (2004) have a much greater T than N (see tables 4.1 and 4.2). This creates the problem of ‘too many’ instruments for predetermined and/or endogenous variables and as the literature on dynamic panel analysis has developed, it has become clear that this that may weaken the power of the Sargan and/or Hansen test for validity of the instruments (see section 5.4). In particular it may lead to a value of one or close to one and lead inappropriately to the non-rejection of the null that all the instruments are valid. Regarding the p-value of Sargan/Hansen test, many of the studies, Worms (2003), Merkl and Stolz (2006), de Haan (2003), Matousek and Sarantis (2009), Havrylchyk and Jurzyk (2005), Chmielewski (2006), Juks (2004) and Benkovskis (2008), report a p-value of Sargan/Hansen test in majority of the regressions that equals 1 or is close to 1. What is surprising is that in some studies, the p-value of Sargan/Hansen test equals 1 or close to 1 even though they are conducted for a sample with much greater N than T. For instance, the sample for Netherlands comprises 99 banks (de Haan, 2003), more than 2200 banks in Germany (Ehrmann et al., 2003 and Worms, 2003), more than 200 banks in Spain (Hernando and Martinez-Pages, 2003) and 67 banks in Poland (Havrylchyk and Jurzyk, 2005) and the p-value of Sargan/Hansen test in these studies is close to 1. In other studies, Westerlund (2003), Golodniuk (2006) and de Souza (2006), the results of Sargan/Hansen test are not reported. In Chowdhury (2010) and in Pruteanu-Podpiera (2007) the p-value of Hansen/Sargan test in some of the regressions reported is less than 0.10, leading to rejection of the null hypothesis of the validity of all the instruments at 10% level.

Another possible pitfall in the majority of the studies conducted for the transition economies from CSEE like: Matousek and Sarantis (2009), Jimborean (2009), Wrobel and Pawlowska (2002), Havrylchyk and Jurzyk (2005), Prutenau-Podpiera (2007), Golodniuk (2006) and de Souza (2006); arises from the data series used for outstanding loans. These studies use an outstanding loan series composed as a sum of all currency denominations. Namely, they use loans denominated in foreign as well as domestic currency, including the foreign currency indexed loans. However, as the reference rate they use either the domestic official policy interest rate and/or the domestic money market rate. This may be inappropriate having in mind the relatively high level of currency substitution in these CSEE economies as indicated by the relatively high presence of foreign currency and foreign currency indexed loans (see figure 1.15) and the relatively high dependence of the banking sector on foreign financing. More precisely, by estimating the loan function using the currency-aggregated stock of loans, it is not clear what proportion of the total loans is adjusted to changes in the domestic reference interest rate and what proportion to the foreign reference interest rate. For instance, banks may adjust their foreign currency loans to changes in foreign reference interest rates rather than domestic rates due to their foreign currency borrowings from aboard. In contrast, the loan adjustment of the domestic currency loans may be more sensitive to changes in the domestic reference rate. Accordingly, investigating the loan function in the transition economies from CSEE according to the currency disaggregated loans may be much more relevant and may provide more pertinent results for policy.

In respect of the reported results, there is large variation in the estimated coefficients in respect to their signs and magnitude in different model specifications, even within individual papers. This is especially the case with studies conducted for CSEE economies. For instance, in Pruteanu-Podpiera (2007) there is variation in the sign of the estimates for CPI and considerable variation in magnitude of the estimates for GDP. In Chmielewski (2006) and Matousek and Sarantis (2009), there is variation in both sign and magnitude of the estimates for inflation, GDP and the reference rate. However, in many of the studies reviewed in sections 4.5.1 and 4.5.2 there is no discussion of the robustness of the models and their sensitivity to different sample periods, variables included and to different estimation methods.

Overall, these assessed studies in the previous two subsections provide interesting investigations of the existence of bank lending channel and its determinants. However, their major weakness is related to the use of “difference” GMM instead of “system” GMM estimator. It should be borne in mind that at the time when these studies were conducted, the tools and econometric software for applying “system” GMM estimator in practise were not as developed as today. This may be one of the reasons for not using this method in the empirical investigation.

4.6 Conclusions

The aim of this chapter was to explain in detail and to critically assess the underlying theoretical model of the bank lending channel formally designed by Bernanke and Blinder (1988a, b). Furthermore, this chapter has investigated the main modifications of the model found in the literature and has explained the simplified empirical model that is commonly used in the empirical studies. Additionally, this chapter has critically surveyed the empirical studies that explore the major determinants of the bank lending channel in developed economies and transition economies.

The main innovation of Bernanke and Blinder model is that it abandoned the assumption of perfect substitutability between loans and bonds of the IS-LM model. Accordingly, changes in monetary policy rate have an impact not only on the money market but also on the credit and commodities markets, making monetary policy more effective. However, this chapter has discussed several weaknesses of the model. Related to the empirical model, the most commonly used specification in empirical studies is a simplified version of the Bernanke and Blinder model developed by Ehrmann et al. (2001 and 2003).

Regarding the empirical evidence that examines the existence of the bank lending channel, the studies find evidence that the bank lending channel is functional in the US and Euro-zone economies, many economies from the EU and some of the transition economies from CSEE. Even though some of the surveyed empirical studies have some shortcomings related to the estimation method used and model specification, overall they provide results consistent with the bank lending channel theory. An important gap in the empirical research is that there is no study that investigates the bank lending channel in Macedonia, which is the core aim of the next chapter.

CHAPTER 5: AN EMPIRICAL INVESTIGATION OF THE BANK LENDING CHANNEL IN MACEDONIA

5.1 Introduction

This chapter directly tackles the third and fourth research questions of the thesis. The main research aims of this chapter are to empirically examine to what extent is the bank lending channel operational in the Macedonian banking system and what bank-specific characteristics affect the loan market.. The majority of empirical studies conducted for the transition economies on this issue do not use currency disaggregated data, which we argue may bias their estimates (see section 4.5.3). Below we investigate two different loan functions by disaggregating loans by their currency. The rationale for examining separately two loan functions is due to the relatively high share of foreign currency loans in the total loans of the Macedonian banking sector (see section 1.5), which is typical of many transition economies, and the belief that these may respond to different influences from those affecting loans in domestic currency. For example, as already discussed in section 4.5.2, in some transition economies, especially those with fixed exchange and/or currency boards as in the Baltic States, it is commonly found that the quantity of loans is affected by the changes in the foreign reference interest rate instead of the domestic one (Kohler et al., 2006). There may be a similar situation in the Republic of Macedonia, where the *de facto* fixed exchange regime is pegged to the Euro. Moreover, Macedonian banks' dependence on foreign financing by borrowing financial resources from abroad (see section 1.5) may weaken the impact of the domestic reference rate on the stock of loans. Namely, banks may borrow funds from abroad at a relatively 'cheaper' price and place those funds in the domestic loan market and get a relatively high return. This can be seen by the interest rate movements between foreign money market rate and domestic rates where the 3-month EURIBOR rate has been substantially below the domestic money market rate and banks' lending rate (see section 1.7 and figure 1.26). Consequently, by exploring two different loan functions we attempt to investigate if the regime of *de facto* fixed exchange rate and the possibility that banks may get involved in 'arbitrage' give a weak impact of the domestic reference rate on the overall quantity of loans. In that way we can draw a conclusion regarding whether changes in the domestic reference rate really matter for banks in Macedonia and significantly affect the quantity of loans or whether changes in the foreign reference rate are more important.

The main theoretical model on which this empirical research is based is that of Bernanke and Blinder (1988a, b) presented in chapter 4, section 4.2. The reason for this choice is that these authors assign a special role to loans in the monetary transmission mechanism. Following from this, the underlying applied model specification that is used in this chapter is the one designed by Ehrmann et al. (2001 and 2003), see section 4.4 and model 4.24 for details. This is a panel data model designed as a simplified reduced form version of the Bernanke and Blinder model. It is the most commonly used model in empirical work (see section 4.5). The empirical examination of the bank lending channel and its determinants in Macedonia is based mainly on bank-level data. The reasons for this are explained in section 4.5.

According to the empirical literature that explores the determinants of the bank lending channel in transition economies, the most influential financial characteristics, used as proxies for the banks' standing in financial markets, are: asset size, liquidity, capitalisation ratio (see sections 4.4 and 4.5). Additionally, the model is augmented by two other bank specific characteristics: the ratio of non-performing loans (NPL) to total loans as a proxy for banks' risk preferences and a variable for the foreign ownership, given the possible existence of internal capital markets for the foreign-owned banks (see section 4.5.2).

The value added of this chapter to the existing empirical literature is: *first*, it is the first analysis that investigates the bank lending channel in Macedonia. *Second*, it uses a different estimation method, "system" GMM, which may have some advantages, compared to other empirical studies that commonly used "difference" GMM (see tables 4.1 and 4.2). *Third*, unlike the majority of studies conducted for the transition economies (see section 4.5.3), it uses a loan series disaggregated by currency. *Fourth*, unlike most studies for both developed and transition economies (see sections 4.5.1 and 4.5.2), it augments the model by adding an additional bank specific characteristic to the model, the NPL ratio.

This chapter is organised as follows: section 5.2 explains the model in detail. Section 5.3 describes the data used. Section 5.4 discusses the estimation method and strategy. Section 5.5 presents the results. The final section concludes.

5.2 The model

In examining the bank lending channel, variations in banks' outstanding loans to changes in the reference interest rate will be investigated. The rationale for this, according to the Bernanke and Blinder model, is that a restrictive monetary policy (an increase of the reference rate) will reduce banks' deposit base and will make money market borrowing more costly. Consequently, this will affect banks' loan supply because they cannot completely offset the reduction in deposits with other sources of finance, either because it may be too costly for them to raise uninsured funds of finance or they have restricted access to non-deposit funding (for details see sections 4.2 and 4.3).

Throughout this chapter, a dynamic panel model will be used. This is because the Bernanke and Blinder model is designed as a stock adjustment model, with the stock of loans as the dependent variable. Therefore, it is expected that the stock of loans is dependent on its own past value(s) due to the inertia in the adjustment process caused largely by the presence of long-term loans. More precisely, the stock of loans consists of short-term loans (with maturity up to 1 year) and long-term loans (with maturity more than 1 year). Thus, in the short run when the monetary policy changes, banks will react mainly by adjusting the stock of short-term loans that is affected by both, the repayment of already granted short-term loans and the banks' decision on their additional reduction or expansion. Although the stock of short-term loans is more flexible than the stock of long-term loans, some short-term loans may normally be expected to be rolled-over, thus also causing inertia in the adjustment process.

The equations in the Bernanke and Blinder model are expressed as a non-linear relationship. In order to estimate the linear relationships between the variables, the empirical model for bank lending channel is typically estimated in natural logarithms (see sections 4.2 and 4.4). This enables us to investigate the proportional changes in the dependent variable (the stock of loans). Another reason for transforming the variables into natural logarithms is to bring them to a comparable scale (in %) because they are in different measurement units (see table 5.2), which eases the interpretation of the results.

The basic model used in this chapter is based on an augmented model specification 4.24 (see sections 4.4). The stock of loans is regressed on its own lagged value(s), the reference interest rate, real GDP, CPI, REER, normalised values of each of the bank specific characteristics (explained in section 5.3) and their interaction terms with the reference interest rate. The bank specific characteristics are one of the following three proxies for banks' dependence on deposit funding (liquidity, size, and capitalisation ratio), a foreign ownership dummy variable and the ratio of non-performing loans to total loans.

The general (unrestricted) model that has the following specification:

$$log(Loans_{it}) = \beta_0 + \beta_1 log(Loans_{it-1}) + \beta_2 MPI_t + \beta_3 log(GDP_t) + \beta_4 logCPI_t + \beta_5 logREER_t + \beta_6 X_{it} + \beta_7 X_{it} MPI_t + \beta_8 ForOwnDum_{it} + \beta_9 MPI_t ForOwnDum_{it} + \beta_{10} NPL_{it}/L_{it} + \beta_{11} MPI_t (NPL_{it}/L_{it}) + \varepsilon_{it} \quad (5.1)$$

Where:

- β_0 is the intercept term;
- *Loans* is a bank's outstanding loans, in domestic currency or foreign currency, respectively;
- *MPI* is the reference interest rate (domestic or the foreign one, depending on the currency denomination of the loans);

- *GDP* is the real Gross Domestic Product;
- *CPI* is the consumer price index;
- *REER* is real effective exchange rate of Macedonian denar;
- *X* refers to each bank-specific characteristic such as: liquidity, size and capitalisation ratio;
- $X_{it}MPI_t$ is the interaction term between each of the aforementioned bank-specific characteristic and the reference rate;
- $ForOwnDum_{it}$ and $MPI_tForOwnDum_{it}$ are foreign ownership dummy variable and its interaction term with the reference rate, respectively.
- NPL_{it}/L_{it} and $MPI_t(NPL_{it}/L_{it})$ are the non-performing loans ratio and its interaction term between with the reference rate, respectively;
- ε_{it} is the error term, the specification of which depends on the econometric model which will be discussed in section 5.4;
- *i* and *t* refer to bank and time specific subscripts;
- $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}$ and β_{11} are the parameters to be estimated.

The parameters of greatest interest are $\beta_2, \beta_7, \beta_9$ and β_{11}. Their statistical significance provides evidence in support of the bank lending channel and whether the bank reaction function differs among banks to changes in the reference rate. More specifically, parameter β_2 indicates whether and to what extent bank loans are responsive to changes in the reference rate, while parameters β_7, β_9 and β_{11} indicate whether the size of the adjustment of the quantity of loans differs among banks, conditional on their specific characteristics.

The Bernanke and Blinder model assumes that inflation and inflationary expectations are constant. However, in the empirical studies this assumption cannot be made and several approaches have been taken, though none with a clear theoretical base (see section 4.5.3). In our model we include all variables, except *GDP* and *REER*, in nominal terms. The argument for including the GDP in real terms is that we are interested in examining how aggregate demand (GDP) affects credit growth. Accordingly, if we include the nominal GDP we cannot establish if changes in loan growth are caused by the real output changes or inflation. Moreover, the empirical model put forward by Ehrmann et al. (see section 4.4) utilises this approach.

The economic argument for each regressor and the expected *a priori* sign of the parameters (see table 5.1) is discussed in what follows. We also make a reference to the previous empirical work in this area to support the inclusion of some variables, as well as in discussing their expected sign. Whether the variable is considered to be endogenous or exogenous is also considered as this is important in the econometric specification.

Table 5.1: Expected sign of each of the parameters of the model 5.1

Parameter:	Expected sign:	Parameter:	Expected sign:
β_1	+	β_7	+
β_2	−	β_8	+ (+/−?)
β_3	+ (+/−?)	β_9	+ (+/−?)
β_4	+ (+/−?)	β_{10}	− (+/−?)
β_5	+ (+/−?)	β_{11}	− (+/−?)
β_6	+		

The reason for the lagged dependent variable in the model has been discussed earlier in this section. Its coefficient is expected to be positive. The reference interest rate is included to indicate if there is response of loans to changes in the reference rate. The expected sign is negative. In choosing the domestic rate, we considered the Central Bank (CB) Bills rate, that is the official policy rate by the NBRM, and the weighted average money market rate (MBKS). As already discussed in section 3.2, the CB Bills rate serves more as a rate of alternative investment for the banks whereas the money market rate represents more closely the ‘cost of funds’ rate because short-term bank financing goes mainly through the money market. Thus, following the approach of Worms (2003), Ehrmann et al. (2003), Topi and Vilmunen (2003), and Havrylchyk and Jurzyk (2005) and assuming that changes in the CB Bills rate are directly transmitted to the money market rate, for which there is some empirical support in the case of the Republic of Macedonia (see section 2.3.4); we have selected the MBKS rate. Additional reasons for selecting the MBKS rate instead of CB Bills rate were identified in section 3.2.

In selecting the representative foreign rate, we chose the 3-month EURIBOR rate as in other studies for CSEE (see section 4.5.2). The argument for using this rate is that: *first*, a substantial proportion of foreign currency loans are denominated in Euros and *second*, domestic banks borrow funds in foreign markets mainly in Euros. Accordingly, the interest rate on what they borrow is determined by the 3-month EURIBOR rate plus a mark-up. An additional reason for this selection is that the majority of foreign-owned banks in Macedonia are from EMU economies whose internal borrowing is largely denominated in Euros. However, a few of them are from countries outside the EMU, i.e. Turkey and Iceland, but their internal borrowing is also mainly denominated in Euros.

Regarding the issue of endogeneity, there is no consensus as whether the domestic money market rate should be treated as exogenous or endogenous. Some studies assume that it is strictly exogenous whereas in other studies it is argued to be endogenous (Bernanke and Mihov 1998 and see section 4.5.3). In the latter case, the argument is that a relatively high credit expansion may force the policy-makers into a more restrictive monetary policy by raising the policy rate and vice versa. Therefore, having in mind the monetary policy regime in Macedonia and how monetary policy is conducted (see section 1.2), in our model we treat the domestic money market rate as endogenous. The EURIBOR rate is treated as exogenous because the monetary policy and the credit growth in Macedonia do not have any impact on the determination of euro interest rates.

GDP and *CPI* serve as macroeconomic control variables that capture the demand side effects and the business cycle in the economy. A higher price level and GDP are expected to positively influence loans (see sections 4.2 and 4.4). However, from the current literature it is again not clear whether they should be taken as exogenous or endogenous in the model (see section 4.5.3). We assume that they are endogenous because in the Bernanke and Blinder model changes in loans may affect the overall economic activity. For instance, a higher level of loans may result in higher aggregate demand through higher investment and personal consumption that may induce higher output and the reverse. This may also create a demand pressure that may affect the price level. The estimated sign and size of these two variables should be treated with caution, though these are not a main concern in this study. CPI and GDP are macroeconomic control variables for loan demand, under the assumption of homogenous elasticity of loan demand among the borrowers[30]. However, in the case of the transition economies, they may be capturing something else that is not included in the model but is related to the process of transition. For example, it may be expected that loan elasticity is highly related to changes in CPI and GDP, reflecting a catching-up process of loan demand, which usually in the transition economies from CSEE is estimated to be below the equilibrium level during the initial period of transition (Egert et al., 2006; Boissay et al., 2006 and Cottarelli et al., 2005). This expected high elasticity may be based upon the higher confidence of economic agents in the macroeconomic environment, since in the last 10 years the inflation in Macedonia has been relatively low and stable compared to the initial period of transition (see table 1.1). Additionally, GDP and CPI may also capture some other non-economic factors that may influence the loan demand. In the case of Macedonia, the loan demand may also be affected by the banking failures in the initial period of transition, with another failure of saving houses in a later period. The loan demand may also have been affected by the political instability in the region i.e. NATO intervention in Serbia and Kosovo in 1998 and the armed conflict in Macedonia in 2001. Although only relating to the bivariate relationship, the descriptive statistics on GDP and loans do not suggest a straightforward relationship. In Macedonia in 2001 real GDP fell by 4.5%, whereas in the subsequent years it had moderate growth reaching the level of the year 2000 in 2004 (see table 1.1). In contrast, the aggregate level of total loans has been growing continually since 2000 (see section 1.6), suggesting a negative association between the two in this period.

[30] Some studies (Worms, 2003 and Hernando and Martinez-Pages, 2003) have attempted to modify the model by including borrowers' specific variables. Nonetheless, the results were in line with the assumption of homogeneous demand among the borrowers (see section 4.4).

The rationale for adding the *REER* as a macroeconomic control variable (see section 4.5.2) is that a measure of the price competitiveness of domestic products is important, given the openness of the Macedonian economy (see table 1.1). As discussed in section 4.5.2, this variable is expected to capture the effect of changes in the price competitiveness of the Macedonian economy on banks' assets and their lending potential by the inflow and outflow of funds through the capital account. Nevertheless, this argument should be taken with caution because the capital account in Macedonia is not fully liberalised and may not directly affect banks' assets as in most other CSEE economies. Moreover, trade balance deterioration caused by appreciation of the REER is not fully covered by capital inflows that may affect banks' assets. It is partially covered by other sources, such as private transfers that in 2007 and 2008 accounted around 17% and 14% of the nominal GDP respectively. Therefore, it is expected that this variable may not have as large impact as in other CSEE economies that have fully liberalised capital account. The REER is taken as endogenous because it is directly affected by the CPI. The sign of the parameter is expected to be negative.

Each of the three bank specific characteristics (size, liquidity and capitalisation) and their interaction terms with the money market rate serve as proxy variables for banks' standing in financial markets. Unlike some of the empirical studies, we do not include all the three of them in the same model (see section 4.5.3). We include only one at a time in order to be consistent with the empirical model derived by Ehrmann et al. (2001 and 2003) (see section 4.4). The rationale for this is due to the following arguments: *first*, an economic argument that all these three aforementioned bank specific characteristics serve as proxy variables for the same thing, i.e. a banks' possibility to raise non-deposit funding in the financial markets. *Second*, a statistical reason: a small cross-sectional sample and the danger of creating too many instruments (see section 5.4).

The single terms of the bank specific variables indicate the impact of banks' characteristics on the quantity of banks' loans, independent of the money market rate. The interaction terms of the bank specific variables with the money market rate indicate whether the loan function differs between banks (see section 4.4), which is one of the core variables of interest. The rationale for inclusion of the interaction terms in respect of these three variables is that more liquid, bigger or more capitalised banks can issue time deposits or they can more easily borrow from other financial institutions because they are seen as less risky for investors in periods when the reference rate changes (Kashyap and Stein, 1995 and Kishan and Opiela, 2000). Therefore, the sign of the single and the interaction terms of these variables are expected to be positive. In our model we follow the conventional empirical approach in treating these three variables (liquidity, size and capitalisation) as endogenous.

However, the sign of liquidity variable for Macedonia, given that banks have structural excess liquidity (see section 1.4), does not have an *a priori* expectation, perhaps because the liquidity variable may not be good proxy any more for banks' possibility to get non-deposit funding in this type of banking system. In previous studies for the ten new EU member states from CSEE (Jimborean, 2009), in the Baltic States (Kohler et al., 2006) and in Poland (Wrobel and Pawlowska, 2002; Havrylchyk and Jurzyk, 2005, Chmielewski, 2006), whose banking systems also have structural excess liquidity, the sign of liquidity variable and/or its interaction term has been estimated as negative (see section 4.5.2). A possible explanation for this, according to Jimborean (2009) and Kohler et al. (2006), is that banks have accumulated more liquid assets in order to serve as a buffer against the existence of relatively high level of asymmetric information in the loan market caused by the transition process. Kohler et al. (2006) argue that the estimated negative sign of liquidity reflects the previously large accumulation of non-performing loans in some banks. Consequently, those banks have intentionally built-up a higher buffer of liquid assets in order to hedge against borrowers' default in a case of deposit withdrawal. For these reasons, those banks are more vigilant about their lending activities and they actually cut the quantity of loans proportionately more when the reference rate increases.

Another explanation for the estimated negative impact of the liquidity variable (Wrobel and Pawlowska, 2002), is that in Poland liquidity may not be a good proxy for a banks' possibility of raising non-deposit funding. According to the authors, when the banking system is characterised by surplus liquidity, it is difficult to distinguish the different loan functions between the banks that have below the average level and those banks that have above the average level of liquid assets. The reason for this is because, in the case of persistent liquidity, almost all banks keep a higher level of liquid assets from what is needed. A different explanation is suggested by Chmielewski (2006) who argues that banks that have accumulated a large amount of securities holdings (liquid assets) and have not hedged against the interest rate risk; they thus find that their opportunity costs increase when reference rate increases. Therefore, those banks reduce the quantity of loans proportionately more than less liquid ones. However, all of these authors do not empirically investigate these possible explanations.

The single term of the NPL ratio may indicate the *ex-post* quality of the loan portfolio of a bank. Banks with a higher NPL ratio may currently have a poorer loan quality portfolio and are expected to have lower proportion of quantity of loans, *ceteris paribus*, due to the higher risk of bank default. The interaction term with the money market rate is included to indicate banks' different risk-taking attitudes. Namely, when a bank has a certain proportion of NPL in its asset portfolio, it usually compensates for the risk of borrowers' default with a higher mark-up margin between the yield of the risk-free portfolio (risk-free rate) and the current lending rate (Chmielewski, 2006). However, in periods of monetary policy tightening (an increase of the reference rate), the mark-up margin may even decrease as the risk-free rate increases because some of the loan contracts have fixed lending rates and thus, the bank may not fully increase its lending rate. Another reason why the bank may not fully raise its lending rates is because, according to the theory of asymmetric information and lending rate stickiness (see section 2.2.2), in periods of monetary tightening asymmetric information on the loan market worsen. Consequently, if banks raise the lending rates in the same proportion as the reference rate, they may attract even more risky borrowers due to adverse selection and moral hazard problems. Thus, all of the aforementioned factors may indicate to a reduction of the current mark-up margin that ultimately will increase the risk of a bank failure.

In these circumstances, the management and/or shareholders of the bank, in order to restore the previous level of risk present in the asset structure (the asset risk), under the assumption that their risk preferences are constant, have three alternatives: *First*, re-allocation of the bank's own funds, i.e. the reserve fund, in order to compensate for the potential default of borrowers. *Second*, to get additional non-deposit funding and/or to raise additional capital. *Third*, to change the asset structure by reducing the newly issued loans. The first option does not give much space for manoeuvre because of the binding legal capital requirements (see section 4.3). Banks usually keep the level of capital (own funds) equal or slightly above the regulatory capital requirements in order to maximise the rate of return. The second option is not desirable for the bank management because in such conditions, bank's costs will be higher for the bank as the presence of the NPL that puts additional pressure on the risk premium. Moreover, the alternative of raising additional capital may also not be feasible in the short-run because, as argued by Bolton and Freixas (2006), it takes time for the legal procedures to be carried out; which seems to be relevant for the case of Macedonia. Accordingly, banks in order to restore the previous level of risk, may in general choose the third option (changing their asset structure) mainly by reducing the quantity of loans particularly in the short run. According to the theory, which is reflected in the empirical model specified in this chapter, there is symmetrical response to changes in the policy rate. However, in the case of Macedonia, the response may not be symmetrical. For instance, when the reference rate loosens, banks with higher NPL ratio may not expand the quantity of loans proportionately more due to already high level of accumulated reserves that serve as a buffer in a case of borrowers' default. However, this possible asymmetric response is not incorporated into the model due to problems in identifying the business cycles in the Macedonian economy and lack of data.

The NPL variable provides an additional dimension to the common empirical approach to examining the determinants of the stock of loans, in that it may be an indicator of the healthiness of the banking sector by measuring the level of risk present in banks' asset structure. Hence, the impact of the single and the interaction term of the NPL variable is expected to be negative and this balance sheet item is taken as endogenous in the model. However, the quality of the loan portfolio measured by the NPL ratio can be significantly influenced by factors that are beyond the banks' control. For instance, a loan that was considered relatively safe two years ago might have turned into a non-performing loan due to adverse economic conditions. In that direction, the recent strand of literature (Altunbas et al., 2010; Angeloni et al., 2010 and Borio and Zhu, 2008) argue that the so-called banks' "risk-taking channel" may be determined by various factors outside the banks' control. The above authors suggest that banks' risk taking preferences may not only be determined by the NPL ratio, but also by the monetary policy stance and the overall economic activity of a certain economy. Moreover, Altunbas et al. (2010) indicate that banks' risk preferences may additionally be determined by the volatility of asset prices, whereas Angeloni et al. (2010) argue that changes in the fiscal policy stance may also play an important role. Consequently, the NPL ratio may not be a significant determinant.

A foreign ownership dummy variable and its interaction term with the reference rate are incorporated in the model for the reasons already discussed in section 4.5.2. The signs of both parameters are expected to be positive. However, as argued in section 1.4, there may be a divergence between the legal definition of foreign-owned banks (*de jure*) and the one in practice (*de facto*) for the reasons explained in section 1.4. In the case of Macedonia, thus it is not clear that the foreign-ownership variable will have a significant impact on the bank lending channel.

5.3 Data issues

We use bank balance sheet data obtained from the NBRM. We work with an annual data set, although monthly and quarterly frequencies of the data are available. The rationale for using an annual data is because lower frequency data provide greater variability of the balance sheet items compared to higher frequency data.

The data is available from 2000 to 2008, but due to the lagged dependent variable in the model (see equation 5.1), the sample period is from 2001 to 2008, giving a maximum number of observations for each bank of 8. The sample is restricted to this time span as data before 2000 are not available, while at the beginning of 2009 a new accounting methodology was applied which distorts comparisons with the rest of the data. The number of banks[31] at the beginning of the sample period was 22 while at the end of the sample period was 17 (for details see section 1.4). The sample was adjusted for mergers and acquisitions among banks by backward aggregation of the balance sheet items. Although this is the most commonly used approach in the literature (Ehrmann et al., 2003; Worms, 2003; Gambacorta, 2005; Farinha and Marques, 2003; de Haan, 2003; Havrylchyk and Jurzyk, 2005; Prutenau-Podpiera, 2007; Juks, 2004 and Benkovskis, 2008) and no other approach appears preferable, we have to be aware that this may bias the data because changes in the management of the merged bank and the gained know-how from the staff are not controlled for.

Over the whole sample period, for the domestic currency loans we work with a set of 20 banks, whereas for the foreign currency loans the cross-sectional sample consists of only 16 banks. The reason for the lower number of banks in the latter case is because some of the banks had a licence to perform only domestic payment operations which includes granting loans only in domestic currency and were not licensed to perform international payment operations and to extend

[31] We do not consider the state-owned bank "Macedonian Bank for Development Promotion" a.d. Skopje for the reasons explained in section 1.4.

foreign currency loans (NBRM, 2002b-2009b). According to Roodman (2009a), the size of these cross-sectional samples may be problematic, especially in the case of foreign currency loans because the General Method of Moments (GMM) estimator for dynamic panel data models is designed for large N and small T (see section 5.4). However, for this analysis the sample cannot be extended because covers all banks in Macedonia. A possible solution would be to include in the sample banks from the neighbouring economies or some other transitional economies but this it is problematic because of data unavailability and different monetary policy regimes.

Detailed description of each data series is presented in table 5.2:

Table 5.2: Data description

Variable:	Description:	Value	Source:
LoansDen	Outstanding loans to non-financial private sector in domestic currency (Denars).	Nominal	NBRM
LoansFX	Outstanding loans to non-financial private sector in foreign currency.	Nominal	NBRM
MBKS	Average weighted interbank interest rate.	% annualised	NBRM
EUR	3-month EURIBOR rate	% annualised	EUROSTAT
GDPr	Real Gross Domestic Product.	In denars from 1997	SSO and NBRM staff calculations
CPI1	Consumer price index.	Index, base year 2000=100	SSO and NBRM staff calculations
REER	Real effective exchange rate, 2003=100.	Index, base year 2003=100	NBRM
Size	Log of total assets. Normalised according to equation 5.2.	Nominal	NBRM
Liquid2	Ratio of liquid over total assets. It includes: cash in vault at the NBRM + short term deposits in accounts in banks abroad + CB bills and treasury bills with maturity up to 1 year + cheques and overdrafts + short term restricted deposits in accounts in banks abroad + short term security holdings issued by banks and saving houses + short term bonds issued by the state + short term credits granted to banks abroad. Normalised according to equation 5.3.	Nominal	NBRM
Capital	Ratio of equity plus reserves over total assets. Normalised according to equation 5.4.	Nominal	NBRM
NPLTratio	Ratio of NPL over total outstanding loans. Normalised according to equation 5.5.	Ratio	NBRM
ForOwn	Foreign ownership dummy variable.1 if foreign owned (50% of the total issued shares are owned by non-residents), 0 otherwise.	Dummy	NBRM

Source: NBRM and SSO.

The bank specific characteristics have been normalised according to their averages across all banks in the sample and they sum up to zero over all observations (Ehrmann et al., 2003). In other words, they are expressed as deviations from their cross sectional means. The size variable has been additionally normalised to each period mean in order to remove the general trend from this variable (Ehrmann et al., 2003). This procedure of normalisation of these three variables is usual in most of the empirical studies and is according to the equations below:

$$Size_{it} = logA_{it} - \frac{1}{N_t}\sum_i logA_{it} \quad (5.2)$$

$$Liq_{it} = \frac{L_{it}}{A_{it}} - \frac{1}{T}\sum_t \left(\frac{1}{N_t}\sum_i \frac{L_{it}}{A_{it}}\right) \quad (5.3)$$

$$Cap_{it} = \frac{C_{it}}{A_{it}} - \frac{1}{T}\sum_t \left(\frac{1}{N_t}\sum_i \frac{C_{it}}{A_{it}}\right) \quad (5.4)$$

$$NPLratio_{it} = \frac{NPL_{it}}{LoansT_{it}} - \frac{1}{T}\sum_t \left(\frac{1}{N_t}\sum_i \frac{NPL_{it}}{LoansT_{it}}\right) \quad (5.5)$$

Where:

- *A*, *L*, *C* and *NPL* represent bank assets, liquidity, size and non-performing loans respectively;
- *N* and *T* indicate the size and the time length of the sample respectively;
- *i* and *t* are bank and time specific subscripts.

The main reason for this normalisation is that the average value of the bank specific variables equals zero. Hence, if we want to assess the impact of the reference interest rate over the stock of loans, we need to do a first order differentiation of the model 5.1 in respect of the reference rate (see section 3.2 for details). Hence, by normalising the bank specific variables, the interaction terms $X_{it}MPI_t$ and $MPI_t(NPL_{it}/L_{it})$ from the equation 5.1 on average are equal to zero, and the coefficient β_2 is interpreted as a direct impact of the reference rate on the stock of loans on average (Ehrmann et al., 2003 and Gambacorta, 2005). An additional reason for the normalisation is that in this way any disturbances caused by minor methodological changes in the balance sheet data can be reduced (Chmielewski, 2006).

There are some limitations of the data in terms of their reliability, methodological consistency and the way they have been collected and revised. Some of the data series have had minor methodological changes and have not been revised backwards i.e. balance sheet data for the banks and GDP. However, these limitations are perceived as minor and unlikely to affect the results significantly.

The summary statistics of each variable is presented in table 5.3, while the estimation strategy and method are presented in the next section.

Table 5.3: Summary statistics

Variable:	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
LoansDen	2906879	952248.5	36311387	21117	5245215	164
LoansFX	925946.1	167303.5	16892128	0	2240230	164
MBKS	8.156111	8.518964	12.00115	3.598527	3.055624	180
EUR	3.398889	3.32	4.63	2.11	0.968146	180
lCPI1	4.563905	4.554903	4.684727	4.4702	0.055731	180
GDPr	222455.5	216163	259838.2	200284	19744.69	180
REER	97.26046	96.8561	113.0669	88.444	7.706822	180
Size	7798137	2668321	59590494	464779	12400347	164
Liquid2	2712777	1016651	21570496	26367	4384432	164
Capital	1170754	785602	4885904	94041	997178.3	164
NPL	530602.7	120896.5	5285288	0	1080437	164
ForOwnDum	0.455696	0	1	0	0.499617	158

Source: author's own calculations done in Eviews 6.

As can be seen from table 5.3, the number of observations for the foreign ownership variable is lower compared to the other bank specific variables due to missing data for some banks at the beginning of the sample period.

5.4 Estimation strategy and method

The estimation strategy goes from a general (unrestricted) to a more specific model in order to select the most parsimonious model. We use a panel data model in order to exploit the cross sectional and time variations among banks in exploring what are the major determinants of the stock of loans. It also controls for all unobservable factors that may also have an influence over banks' loans, which are captured by banks' specific characteristics; assuming that they are stable over the whole sample period. This is the major advantage of panel data models over the cross section and time series models.

In selecting the most appropriate model and estimation method, we have firstly considered pooled OLS, Within Groups Estimator (WGE), fixed (FE) and random effects (RE) models, respectively. Due to the autoregressive nature of our model, none of these methods may be appropriate because of endogeneity arising from the correlation between the lagged dependent variable and the error term, which means that these provide inconsistent and biased estimators. For example, the OLS provides upward biased estimates, while FE provides downward biased estimates (Roodman 2009a). Therefore, the most suitable approach is to use a dynamic panel model by employing the Generalised Method of Moments (GMM) estimator developed by Arellano and Bond (1991) and augmented by Arellano and Bover (1995) and Blundell and Bond (1998). The reason for choosing this method is because it provides the most appropriate model specification in both economic and statistical senses. For instance, the regression is better specified than the other methods because it deals with the problem of endogeneity by using 'internal' instruments (lagged and differenced lagged values of the endogenous regressors). Another advantage of this method is that it is able to disentangle between short-run and long-run relationships, which is considered important here. As we noted in the previous chapter, dynamic GMM is used in majority of the empirical studies in this area, although not without some problems (see section 4.5.3). With this model the endogeneity of the lagged dependent variable is treated along with the possible endogenous nature of the other explanatory variables in the model discussed in section 5.2.

However, a weakness of these models is that they are based on the assumption of no cross-sectional correlation among the units, which we will empirically examine in section 5.5.3. In order to alleviate this problem time dummies are normally included. These would serve in this case to capture the effect of the overall expansion of the financial sector that otherwise may be included in the residuals of the model. In this way the correlation among individual banks may be reduced (Roodman 2009a). However, since the macroeconomic control variables (*CPI* and *GDP*) are included in the model (and given the estimation covers only one country these are constant over all banks for each year), time dummies are not included because of collinearity. Overall, due to the complexity of the whole area, as with other empirical studies in this field, we cannot predict and control for all possible complications. However, we use a method that is seen to deal most appropriately with the autoregressive nature of the model as well as the endogeneity of some of the other regressors which we argue is of importance.

There are two types of GMM estimators. The first one is the "difference" GMM that estimates the equation in first differences of the variables and uses the past level values of the endogenous regressors as instruments. However, this method in our case may perform poorly because most of the variables may have a unit root[32]. According to Bover (1995), Blundell and Bond (1998), Levine et al. (2000) and Roodman (2009a), the estimates from this method may be biased when the variables have near unit root process as here, since the lagged levels of the variables used as instruments may reveal little information on the differenced endogenous regressors.

The second one is the Arellano and Bover (1995) and Blundell and Bond (1998) "system" GMM estimator. It is more efficient than the "difference" GMM as it creates additional moment conditions and is argued to be preferable in these

[32] We have performed several tests for panel unit root like: Fisher ADF; Fisher PP; Im, Pesaran and Shin and Hadri tests, with constant and constant and trend by using Schwartz and Akaike lag length selection criteria, respectively. The results indicated that the outstanding loans in both domestic and foreign currency are not stationary. Regarding GDP, monetary policy rate and CPI, we have performed the Augmented Dickey Fuller and Phillips Perron tests with both, Akaike and Schwartz lag length selection criteria. The test results suggested that these variables are not stationary as well. Performing the same tests on the first differences of these variables, the test results implied that they are stationary. This may imply that these variables are I(1).

circumstances. Namely, this method simultaneously for each period, estimates system of equations in levels by using instruments in 1st differences and equations in 1st differences by using instruments in levels of the variables, as in the equations below:

$$Y_{it} = \sum_{l=1}^{n} \beta_1 Y_{it-1} + X_{it}\beta_2 + (u_i + \varepsilon_{it}) \tag{5.6}$$

$$Y_{it} - Y_{it-1} = \beta_1(Y_{it-1} - Y_{it-2}) + \beta_2 (X_{it} - X_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \tag{5.7}$$

where: y_{it} is the dependent variable; y_{it-j} is the lagged dependent variable; x_{it} is a vector of exogenous, predetermined and/or endogenous variables, u_i is a bank-specific error term and ε_{it} is the usual i.i.d. error term; i and t are bank and time specific subscripts, respectively; l indicates the number of lags.

Nevertheless, the main problem with this method is that it is efficient for large N and small T, but for small N and relatively large T it gives a biased estimator. More specifically, as Roodman (2009b) argues, when T is large then there is a problem of overidentification because 'too many' instruments are created. Consequently, this may weaken the results of Sargan/Hansen tests in a direction of under-rejection of the null hypothesis of joint validity of the instruments[33], leading to a p-value of 1 or close to 1. According to the literature on "difference" and "system" GMM, the number of instruments (I) should be at least less than or equal to N (Roodman, 2009a). In many earlier studies in this area, estimated with "difference" GMM, the p-value of Sargan test was 1 or 0.99, even when these studies were conducted on samples with substantially greater N than here (see tables 4.1 and 4.2 and section 4.5.3). However, there are also other empirical studies in this area conducted on similar or even smaller cross-sectional size than the one used in this thesis.

With relatively small N and large T, Alvarez and Arellano (2003) argue for the use of Limited Information Maximum Likelihood (LIML) in panels. However, as the authors explain, both of the above mentioned methods perform well for models with stationary variables but not for variables that have near unit root process. In our sample we have a small N and T is not large.

[33] The problem of 'too many' instruments is relevant for "difference" GMM as well.

In order to counteract the problem of creation of 'too many' instruments relative to N, the number of instruments per period can be restricted using only certain lags. An associated procedure presented in Roodman (2009b) is "collapsing" the instruments by combining them into smaller sets. A third way suggested is a combination of these two methods. In the estimations reported in this chapter we have approached the problem of too many instruments by restricting and collapsing the instrument set(s). Consequently, the total number of instruments created was reduced considerably and ranges from 16 (regression 2, table 5.4) to 29 (regression 2, tables 5.5). Even by applying this method in our investigation (restricting and collapsing the instrument set), we do not satisfy the condition $I \leq N$, "..... as a minimally arbitrary rule of thumb...." (Roodman, 2009a, p. 99) in all cases. We are aware of the problems that may be caused by having "too many" instruments and this means that our results have to be treated with caution.

In "system" GMM dynamic panel estimation, the two-step estimator is more efficient than the one-step estimator, but nevertheless it is argued that two-step standard errors estimates may be biased downwards in small (finite) samples (Roodman 2009a). Windmeijer (2005) develops a small sample correction of two-step standard errors. The results using two-step estimators with Windmeijer (2005) corrected standard errors by restricting and collapsing the instrument set with the command xtabond2 are reported in tables 5.4 and 5.5. For a robustness check, the results of one-step estimators with robust standard errors are discussed in section 5.5.4.

In estimating each equation, a set of diagnostic tests are undertaken, and special attention is paid to the Hansen test for the validity of the instruments and the Arellano-Bond test for second order serial correlation in the error terms. The Hansen test is preferred over the Sargan test because it is robust in a presence of heteroskedasticity and/or autocorrelation, although the latter may not be so directly weakened by 'too many' instruments (Roodman, 2009a).

The results of the most restricted (parsimonious model) will be reported given the small N of only 20 for the domestic currency loans and 16 for the foreign currency loans and consequently, the relatively small number of observations. Having more variables in the model, leads to the creation of more instruments that may give rise to the previously mentioned problem of ‘too many’ instruments. Moreover, estimating a model with more variables absorbs additional degrees of freedom that may bias the results of the GMM estimator for the reasons discussed previously in this section.

5.5 Estimation results

This section discusses the estimation results of various model specifications going from the most general, equation 5.1, to the most parsimonious model. The same model specifications were estimated for both domestic and foreign currency loans. This section is divided into separate subsections in which we provide general discussion about the interpretation of the results, the process of selection of the most parsimonious model and finally, we interpret the results of the most restricted model selected. A robustness check is presented in subsection 5.5.4.

5.5.1 General discussion about the interpretation of the results

In interpreting the results, the main emphasis will be on the short-run estimates. The reason for this focus is that exploring banks’ short-run reaction to changes in the money market rate is of more interest to monetary policy-makers. More precisely, monetary policy authorities in order to achieve their policy goals may use that information as an input in their decision-making process when attempting to smooth the short-run fluctuations of the economy.

Regarding the long-run estimates, the 3-year long-run cumulative effect will be briefly discussed. The rationale for choosing this period is that in the process of economic transition, other non-economic factors, such as legal reforms, are likely to affect the impact of the right hand side variables over a longer time period. The 3-year cumulative effect, the overall long-run effect[34] and the respective multipliers of the final model specification are provided in appendix 5.1.

Where possible, a comparison of the results will be made with the empirical studies conducted for the CSEE economies, given that their financial structures are more like those of Macedonia. Nevertheless when comparing these results with those of other studies, some differences may appear that, as discussed in section 4.5.3, those might be due to the differences in the model specifications and the estimator employed, i.e. majority of the empirical studies use "difference" GMM (see table 4.3). Moreover, in comparing the results with the previous empirical studies, we need to be aware of the high variation of the reported estimates in respect of the coefficient size and magnitudes (see section 4.5.3).

In selecting the most parsimonious model, firstly we will assess the diagnostic tests such as, Arellano-Bond test for the second order serial correlation and Sargan and Hansen tests for the joint validity of the instrument sets. Additionally, we have performed the difference-in-Hansen test that may be used to test if "system" GMM is 'more appropriate' than the "difference" GMM. As suggested by Sarafidis et al. (2006), this test may also be used as a proxy indicator for the presence of cross-sectional dependence.

We decided to include the contemporary values of the independent regressors and only one lag of the dependent variable. This was done for two

[34] The overall long-run effect is calculated with the following formula: $\sum_t \beta_t \,/\, (1 - \sum_{l=1} y_{t-l})$, where β is the coefficient(s) of the independent variable, y is the coefficient(s) of the lagged dependent variable, t is the time subscript and l indicates the number of lags. In STATA 10 we use the nlcom command for calculating the long-run coefficients and their statistical significance (Papke and Wooldridge, 2005).

reasons: *first,* because we work with an annual data set and therefore, including more time lags does not seem appropriate from an economic viewpoint as adjustment in the financial sector is considered to be relatively quick. *Second,* to generate a better model specification, in a statistical sense, when selecting the most parsimonious model.

The final model specifications are variants on the general form presented in equation 5.1. The initial investigation started from this as reflecting the underlying theory and variables found to be important elsewhere in the transition environment. However, in our specification search we were aware of the need to specify as restricted a model as possible, given the need to keep the number of instruments relatively low.

5.5.2 Estimation strategy for selecting the most parsimonious model

Starting from the most general model presented in equation 5.1, the estimated results for both domestic and foreign currency loans indicate that the model suffers from the problem of 'too many' instruments. The most general model specification contains 'too many' variables relative to the cross-sectional dimension of the sample. Even by restricting and collapsing the instrument set there remained a problem of 'too many' instruments, implied by the value of Hansen test equal close to 1. In order to get a more restricted model selection we have assessed the economic rationale for the inclusion of some variables in the model and the arguments for their possible ambiguous implication in the case of Macedonia (as discussed in section 5.2). We have also considered their statistical significance (while acknowledging that such estimates of significance are the result of problematic estimation). In restricting the model we choose not to exclude the basic variables that are included in the original model of Bernanke and Blinder (see section 4.2).

We started first by assessing the impact and the statistical significance of the *REER* variable. The results from both models for domestic and foreign currency loans indicated that this variable is statistically insignificant at the 10% level of significance. Thus, given the economic arguments that in the case of Macedonia this variable may *a priori* have an ambiguous impact (see section 5.2), we decided to exclude it from the model.

In the more restricted model there was again a problem of 'too many' instruments, implied by the p-value of Hansen test that was equal to 1. We next assessed the statistical significance of the foreign ownership variable and its interaction term with the money market rate. The results indicated that the interaction term of the foreign ownership variable is individually statistically insignificant at the 10% level of significance and in all model specifications, whereas both terms (single and the interaction terms) are jointly insignificant at 10% level of significance as well. Moreover, even using some insider information from the bank supervision department from the NBRM in order to clearly distinguish which banks are *de facto* foreign-owned and which only *de jure* (as it was discussed in section 5.2) in defining the dummy variable; the foreign ownership was again statistically insignificant. This may be due to the impact of long-term borrowings from abroad (see sections 1.5 and 5.2). Consequently, we decided to exclude it from the models.

The more parsimonious model for the domestic and foreign currency loans thus was reduced to the following form:

$$log(Loans_{it}) = \beta_0 + \beta_1 log(Loans_{it-1}) + \beta_2 MPI_t + \beta_3 log(GDP_t) + \beta_4 logCPI_t + \beta_5 X_{it} + \beta_6 X_{it} MPI_t + \beta_7 NPL_{it}/L_{it} + \beta_8 MPI_t(NPL_{it}/L_{it}) + (u_i + \varepsilon_{it}) \quad (5.8)$$

However, this model specification again had the problem of too many instruments. The p-value of the Hansen test in the majority of the regressions was around 1. We decided to assess the statistical impact of the NPL ratio and its interaction term, given the discussion in section 5.2. In most of the cases they had a contrary sign from what was expected and were jointly insignificant at 10% level of significance. Accordingly, we decided to exclude this variable from the model and proceed with the final, most restricted model below:

$$log(Loans_{it}) = \beta_0 + \beta_1 log(Loans_{it-1}) + \beta_2 MPI_t + \beta_3 log(GDP_t) + \beta_4 logCPI_t + \beta_5 X_{it} + \beta_6 X_{it} MPI_t + (u_i + \varepsilon_{it}) \quad (5.9)$$

The estimates for the remaining variables changed a little with the deletions and are discussed in the following subsection.

5.5.3 Interpretation of the results of the most parsimonious models

The two-step results with Windmeijer (2005) corrected standard errors for the currency disaggregated loans are presented in tables 5.4 and 5.5, respectively. The regressions are classified according to the interaction term of each bank specific characteristic (size, liquidity and capitalisation). The STATA printouts are given in appendices 5.2 and 5.3.

Table 5.4: Estimates of outstanding loans in domestic currency

Dependent variable: log of the stock of loans in domestic currency.

VARIABLES:	Regression 1	Regression 2	Regression 3
	Controlling for Size	Controlling for Liquidity2	Controlling for Capital
L.lLoansDen	**0.823******	**0.851******	**0.823******
	(0.274)	(0.275)	(0.171)
MBKS	**-0.047***	**-0.083****	**-0.042****
	(0.0247)	(0.0350)	(0.0198)
lCPI1	**3.797****	**2.935***	**3.113****
	(1.756)	(1.649)	(1.380)
lGDPr	-2.054	-2.802	-2.079
	(2.212)	(1.915)	(1.327)
SizeNorm	0.365		
	(0.228)		
SizenormMBKS	-0.014		
	(0.019)		
Liquid2Norm		0.630	
		(1.574)	
Liquid2normMBKS		-0.210	
		(0.182)	
CapitalNorm			**-2.175****
			(0.797)
CapitalnormMBKS			**0.210******
			-0.046
Constant	10.92	23.99	14.31
Number of observations:	144	144	144
Number of banks	20	20	20
Number of instruments	17	16	25
F-test for the significance of the whole regression (p-value)	F(6, 19) = 170.10 (0.00)	F(6, 19) = 38.6 (0.00)	F(6, 19) = 425.53 (0.00)
F-test for the joint significance of the bank specific char. and the interaction term (p-value)	F(2, 19) = 1.45 (0.26)	F(2, 19) = 1.84 (0.19)	F(2, 19) = 10.53 (0.00)
AR(1)/(p-value)	-1.59 (0.11)	-1.67 (0.10)	-1.64 (0.10)
AR(2)/(p-value)	-1.04 (0.30)	0.37 (0.71)	-1.29 (0.20)
Sargan (p-value)	0.08	0.09	0.19
Hansen (p-value)	0.35	0.40	0.74
Diff. in Hansen for "system" over "difference" GMM (p-value)	0.43	0.29	1.0
Diff. in Hansen for the instruments for the lagged dependent variable (p-value)	0.36	0.70	0.81
Estimates of L.lLoansDen with FE	0.51	0.37	0.58
Estimates of L.lLoansDen with OLS	0.84	0.96	0.91

Notes: estimated by two-step "system" GMM estimator with Windmeijer (2005) corrected standard errors, by restricting and collapsing the instrument set with the command xtabond2.
***/**/* denotes significance at 1%, 5% and 10% level of significance respectively.
Windmeijer (2005) corrected standard errors in parenthesis.
Computations have been done in STATA 10.

Table 5.5: Estimates of outstanding loans in foreign currency

Dependent variable: log of the stock of loans in foreign currency

VARIABLES:	Regression 1 Controlling for Size	Regression 2 Controlling for Liquidity2	Regression 3 Controlling for Capital
L.lLoansFX	**0.314****	**0.456****	**0.583****
	(0.135)	(0.179)	(0.231)
EUR	**-0.270***	**-0.259****	**-0.197****
	(0.142)	(0.102)	(0.0877)
lCPI1	2.665	5.572	1.262
	(4.678)	(7.670)	(3.591)
lGDPr	0.415	0.0959	0.468
	(3.094)	(4.144)	(1.904)
SizeNorm	0.433		
	(0.462)		
SizenormEUR	**0.170*****		
	(0.0561)		
Liquid2Norm		-0.336	
		(11.86)	
Liquid2normEUR		0.384	
		(3.122)	
CapitalNorm			-2.749
			(2.211)
CapitalnormEUR			0.112
			(0.431)
Constant	-7.974	-18.83	-5.531
	(27.390)	(36.359)	(16.134)
Number of observations:	105	105	105
Number of banks	16	16	16
Number of instruments	18	29	21
F-test for the significance of the whole regression (p-value)	F(6, 15) = 19.89 (0.00)	F(6, 15) = 8.42 (0.00)	F(6, 15) = 19.89 (0.00)
F-test for the joint significance of the bank specific char. and the interaction term (p-value)	F(2, 15) = 23.10 (0.00)	F(2, 15) = 0.11 (0.90)	F(2, 15) = 0.95 (0.41)
AR(1)/(p-value)	-0.98 (0.33)	-0.98 (0.33)	-0.98 (0.33)
AR(2)/(p-value)	-0.94 (0.35)	-0.95 (0.34)	-0.94 (0.35)
Sargan (p-value)	0.92	0.00	0.92
Hansen (p-value)	0.85	0.93	0.85
Diff. in Hansen for "system" over "difference" GMM (p-value)	1.0	0.98	1.0
Diff. in Hansen for the instruments for the lagged dependent variable (p-value)	0.90	0.46	1.0
Estimates of L.lLoansFX with FE	0.15	0.10	0.17
Estimates of L.lLoansFX with OLS	0.57	0.79	0.86

Notes: estimated by two-step "system" GMM estimator with Windmeijer (2005) corrected standard errors, by restricting and collapsing the instrument set with the command xtabond2.
***/**/* denotes significance at 1%, 5% and 10% level of significance respectively. Windmeijer (2005) corrected standard errors in parenthesis.
Computations have been done in STATA 10.

All model specifications reported satisfy the criteria of no second order serial correlation in the residuals. The null hypothesis of the Arellano-Bond test cannot be rejected at 10% level of significance. Regarding the validity of the instruments, the results of Hansen test point to non rejection of the null hypothesis of validity of the over-identifying restrictions at the 10% level of significance. By restricting and collapsing the instrument sets we managed to substantially reduce the number of instruments. Unlike the case of the more general models discussed in the previous subsection, we managed to reduce the p-value of Hansen test below 1. It now ranges from 0.35 (regression 1, table 5.4) to 0.93 (regression 2, table 5.5). These p-values of the Hansen test are greater than the rule of thumb of 0.25 that is suggested by Roodman (2009b). However, the value of 0.93 might still be close enough to 1 to be worrisome. The results of Sargan test, apart from regression 2, table 5.5, give the non rejection of the null hypothesis of validity of the over-identifying restrictions at the 5% level of significance. However, the results of Sargan test should be taken with caution because as mentioned in section 5.4, they are not robust to heteroskedasticity and serial correlation.

As additional specification test we have conducted the difference-in-Hansen test for the joint validity of the differenced instruments used for the level equation. The results indicated that at 10% level of significance we cannot reject the null hypothesis of their joint validity, supporting the choice of “system” over “difference” GMM (see appendices 5.2 and 5.3). Moreover, as a ‘rough’ test for the presence of cross-sectional dependence in the model we also used the difference-in-Hansen test for the validity of the instruments for the lagged value of the dependent variable (Sarafidis et al., 2006 and Pugh et al., 2010). Accordingly, the test results indicated that at 25% level of significance we cannot reject the null hypothesis for the joint validity of the instruments for the lagged value of the dependent variable in each regression (see tables 5.4 and 5.5 and appendices 5.2 and 5.3, respectively). This implies that there is not sufficient evidence to reject the null hypothesis of homogeneous error cross section dependence. Overall, although the diagnostics appear to be satisfactory, though it should be born in mind that due to the relatively small N, the interpretation of the results should be taken with caution, particularly for the foreign currency loans estimations.

Related to the identification of the loan supply function of domestic currency loans, from the results presented in Table 5.4 in all three regressions, it can be noticed that the loan supply function is identified, since one of the variables that is unique to the loan demand function, such as CPI (see equation 4.19), is statistically significant in all three regressions. However, regarding the loan supply function of foreign currency loans, from the results presented in Table 5.5 in all three regressions none of the variables that are unique to the loan demand function, such as GDP and CPI, are statistically significant. This suggests that the loan supply function of foreign currency loans is not identified.

We proceed by comparing and contrasting the interpretation of the results in respect of domestic and foreign currency loans. The lagged coefficient of the log of outstanding loans for both domestic and foreign currency loans is, as expected, highly significant and has a positive sign. Regarding the domestic currency loans, the short-run coefficient is around 0.82 in all three specifications. In respect of foreign currency loans, the magnitude of this coefficient is lower and varies more between the specifications, ranging from 0.31 to 0.58. These results imply relatively high inertia in the adjustment process of the stock of both domestic and foreign currency loans. This indicates that a relatively high proportion of the current value is determined by its own past value. Compared to estimates for other economies, these coefficients are much higher. In the Czech Republic estimates range from -0.11 to 0.08 (Pruteanu-Podpiera, 2007) estimated on quarterly data. In Ukraine the estimate is 0.12 (Golodnuik, 2006) while in Slovenia, Poland and Hungary the highest estimates are 0.2, 0.3 and 0.3, respectively (Matousek and Sarantis, 2009). Both of latter studies utilise annual data sets. Some of the possible reasons for the differences among the coefficients are already discussed in section 5.5.1.

For domestic currency loans, the domestic money market rate (*MBKS*) has a negative estimated coefficient as expected and is significant in all regressions in both the short-run and 3-year cumulative effect. The size of the short-run estimates ranges from -4% (regression 3, table 5.4) to -8% (regression 2, table 5.4), for a one percentage point increase in MBKS. This suggests that domestic currency loans react significantly to changes in the domestic money market rate, implying the existence of a bank lending channel. Compared to the other studies conducted for various transition economies, a similar adjustment size of around 8% is estimated in Ukraine (Golodniuk, 2006). However, a lower impact of the domestic reference rate on the quantity of loans is estimated in Poland (Havrylchyk and Jurzyk 2005), ranging from 1.3% to 2.2%. The 3-year long-run cumulative effect and the multiplier of MBKS rate are again significant in all three model specifications. The three year cumulative effect ranges from -14% to -28% (see appendix 5.1).

The results for foreign currency loans imply that they react significantly and more strongly to changes in the foreign money market rate in both the short-run and in 3-year cumulative period than do domestic currency loans to the domestic interest rate. The size of the short-run estimates ranges from 20% up to 27%. This suggests that foreign currency loans are much more sensitive to changes in the relevant money market rate compared to the loans in domestic currency. This finding is in line with the results of Schmitz (2004) for the eight CSEE economies and Kohler et al. (2006) for the Baltic States (both of them based on aggregated stock of loans), where in the latter study the coefficient ranges from 12% to 20%. The 3-year long-run multipliers and the cumulative effect of foreign reference rate are again always significant. The three year cumulative effect ranges from -47% to -55% (see appendix 5.1).

The price level (*CPI*) enters positively as expected and is statistically significant in all three regressions in the supply function for domestic currency loans in the estimates for both, short- and 3-year cumulative period. However, in the regressions for foreign currency loans, the price level is insignificant in all model specifications. This may be because banks in granting foreign currency loans believe that are partially hedged from the possible risks of an unstable macroeconomic environment and higher inflation, as these risks are largely transmitted to the borrowers. Consistent results, where the price level has a significant impact for the loans denominated in domestic currency but not for loans denominated in foreign currency are presented in Benkovskis (2008) for the case of Latvia.

In the regressions for domestic currency loans, the size of the short-run estimates of price level coefficient are of a similar magnitude, ranging from 3 to 3.8, implying a relatively high elasticity of the stock of domestic currency loans to changes in the price level. This estimated loan elasticity to variations in price level in Macedonia is considerably higher than estimates for Hungary where the price elasticity is estimated from 0.1 to 0.3 (Horvath et al., 2006). In Poland estimates of the price elasticity are more spread and range from 2 up to 10 depending from the model specification (Chmielewski, 2006). In Latvia, this coefficient ranges from 2 up to 4.5 (Benkovskis, 2008). Some of the possible reasons for the relatively high sensitivity of loans to price variations in Macedonia were discussed in section 5.2. The 3-year long-run cumulative effect of the price level is much stronger; the coefficients range from 10 to 13 (see appendix 5.1).

The other macroeconomic control variable (*GDP*) is statistically insignificant in both short- and long-run estimates in the two sets of domestic and foreign currency loans functions. In the regressions for the domestic currency loans, GDP enters with a negative sign, which is contrary to what is normally expected. Some possible reasons are considered in section 5.2. GDP has also been estimated to have a negative effect in other studies. For example, it has a negative sign in most of the estimates for Poland (Chmielewski, 2006), Slovenia and Hungary (Matousek and Sarantis, 2009) and in some of the estimates for Netherlands (de Haan, 2003), as well as in France and Spain (Ehrmann et al., 2003). Regarding the foreign currency loans, the GDP coefficient has, as expected, a positive sign but is again statistically insignificant.

Regarding the single and interaction terms of the bank specific characteristics, the results for the domestic currency loans suggest that capital, as a proxy for banks' standing in the financial market, has a statistically significant impact in both the short- and 3-year cumulative period estimates. However, the single term of capital is estimated with a contrary sign to the theoretical predictions. The interaction term of the capital variable with the domestic money market rate is also significant and enters with the expected (positive) sign. The estimate suggests that more capitalised banks reduce the quantity of loans proportionately less when the domestic money market rate increases compared to the less capitalised banks. However, in order to investigate whether the positive effect is greater than the negative, we did a first order differentiation of the model in respect of the capital variable, as explained in section 3.2, conditional on the weighted mean value of the domestic reference rate. The estimates indicated that the overall effect in respect of the capital variable is positive (but quite small). The two other single and interaction terms of the banks' specific characteristics (size and liquidity) are insignificant. We have performed a joint F-test of the single and the interaction terms of the bank specific characteristics for the short-run estimates. The results (see table 5.4 and appendix 5.2) indicate that the single and interaction term of capital are jointly significant at 1% level of significance. However, the F-test for the other two bank specific characteristics gives jointly insignificance at the 10% level. The long-run estimates for the single and interaction terms of bank specific variables and their joint significance are given in appendix 5.1. The results are in line with the short-run estimates, suggesting that the variables containing capital (the single and interaction term), are individually and jointly significant, whereas the other two variables and their interaction terms (size and liquidity) are jointly insignificant.

With the foreign currency loans, none of the single terms of the bank specific characteristics has a statistically significant impact on the stock of loans in the short-run estimates. Regarding the interaction terms the results imply that only the asset size is significant and is of the expected sign. The estimate suggests that larger banks reduce the quantity of loans by proportionately less when the foreign money market rate tightens compared to the smaller banks. The other two interaction terms with the bank specific characteristics do not have a statistically significant impact. We have again performed the F-test to investigate the joint significance of the single and the interaction terms of the bank specific variable. The results imply that asset size is jointly significant at 1% level of significance, whereas the other two bank specific characteristics are jointly insignificant at 10% level of significance. The long-run estimates (the 3-year cumulative effects) for the individual and the interaction terms of bank specific variables and their joint significance are given in appendix 5.1. The estimates for the long-run and the 3-year cumulative effect suggest that the single terms of size and capital are statistically significant, but the latter is estimated with contrary sign from the prior expectations. Regarding the interaction terms of the bank specific variables and the foreign reference rate, the results are in line with the short-run estimates, with the interaction term of size being statistically significant with the expected positive sign. Assessing the joint significance of the single and interaction terms of the bank specific variable, the estimates indicated that only the terms containing the asset size are jointly significant (see appendix 5.1), which is again consistent with the short-run estimates.

Overall, the short-run and 3-year long-run estimates suggest that the domestic currency loans significantly react to changes in the domestic reference rate, implying that the bank lending channel exists in the Macedonian banking system. However, the loan adjustment of foreign currency loans with respect of foreign reference rate is stronger, which is beyond the control of domestic monetary policy makers. These results may suggest that the fixed exchange rate regime, the possibility for banks to borrow financial resources from abroad and the continual increase of the share of the foreign currency loans in the total loans (see section 1.6 and figure 1.14) may weaken the impact of the domestic money market rate on the overall loans.

5.5.4 Robustness check

The robustness of the results has been checked by using different GMM estimators. We have re-estimated the same model specifications with a one-step "system" GMM estimator with robust standard errors by restricting and collapsing the number of instrument sets, using the xtabond2 command (see appendix 5.4). When re-estimating the same regressions by one-step "system" GMM with robust standard errors and reducing and collapsing the instrument sets (see appendix 5.4), the results indicate that all model specifications again satisfy all diagnostic criteria. Regarding the significance of the coefficients, the major difference for domestic currency loans is that the price level is now statistically insignificant for the regression containing the liquidity variable. The significance of the rest of the variables for both the domestic and foreign currency loans is in line with the previously discussed results in section 5.5.3. Regarding the sign and size of the significant coefficients, the results in general are consistent with the ones discussed previously.

As additional informal robustness check of the estimates, suggested by Roodman (2009a) and Bond (2002), is to verify if the estimates of the lagged dependent variable lie between the estimates using FE and OLS (see tables 5.4 and 5.5). The first method tends to bias the estimates downwards, while the second method tends to bias the estimates upwards. The results indicate that the reported estimates in the previous subsection appear to be acceptable. More precisely, the estimates of the lagged dependent variables (the stock of loans) in all model specifications lie between the estimates obtained by FE and OLS (see the last two columns in tables 5.4 and 5.5).

5.5.5 Comparison of the results with "difference" GMM

This subsection compares the results discussed in section 5.5.3 with the results estimated by employing the "difference" GMM estimator, as this method is employed by the majority of the empirical studies for the CSEE (see table 4.3). On *a priori* grounds we expect the results to be different because, as it is argued in section 5.4, the "difference" GMM estimator does not deal adequately with instrumenting variables that have near unit root.

We report the results estimated by one-step "difference" GMM estimator with robust standard errors (see appendix 5.5). The one-step, instead of two-step estimator, is reported because in "difference" GMM a two-step estimator biases the standard errors downwards (de Haan, 2003 and Roodman, 2009a).

Considering the diagnostic tests (see appendix 5.5), they are quite different from the ones discussed in section 5.5.3. The major difference is that now, in two out of three regressions for the domestic currency loans, the null hypothesis of no second order serial correlation cannot be rejected at 10% level of significance. Another noticeable difference is the Sargan test for the foreign currency loans. In all three model specifications the test results indicate that the null hypothesis for joint validity of the instruments can be rejected at 5% level of significance. The significance of the parameters are also quite different. For example, the reference rate in the regressions with liquidity is now insignificant for both domestic and foreign currency loans. Moreover, the lagged value of the dependent variable is insignificant in all three regressions for the foreign currency loans. In the regressions for the domestic currency loans, now the single and interaction terms in respect of liquidity variable are jointly significant, but with a contrary (negative) sign from the prior expectations. Regarding the foreign currency loans, unlike before, all the three bank specific characteristics are estimated as jointly significant at the 1% level of significance.

Overall, in section 4.5.3 we noted the variation in the results found in the existing literature and the differences between these results and our own (section 5.5.3). The estimates presented in this subsection suggest that these differences may not just reflect between country differences, but may also reflect the estimation method used.

5.6 Conclusions

The aim of this chapter was to empirically investigate the bank lending channel and its determinants in Macedonia. Due to the specific structure of the banking system, the monetary policy regime and the high trade openness of the economy, we investigated two loan functions according to the currency of the loans. Given recent developments in econometric techniques, we use a different estimation method from majority of the empirical studies in this area that is arguably preferable given the likely non-stationarity of our data. The factors that were considered to proxy banks' standing on the financial markets were asset size, liquidity, capitalisation ratio, and we also considered the impact of the foreign ownership and the NPL ratio as possible important factors affecting the stock of loans from the supply side in Macedonia.

The discussed short-run and 3-year long-run estimates provide evidence in favour of the existence of a lending channel. Changes in the money market rates do have a significant influence on the stock of of both domestic and foreign currency loans. The major difference is that the foreign currency loans react more strongly to changes in the foreign money market rate, than the domestic currency loans to the domestic rate. These findings are robust to different model specifications and different estimation methods. This suggests that the specific currency structure of the outstanding loans such as the relatively high proportion of the foreign currency loans (see section 1.6), the fixed exchange rate regime and the possibility of banks to borrow funds from abroad may weaken the impact of domestic money market rate on the overall loan function. More precisely, banks may borrow at a cheaper price from foreign financial markets and place those funds in the domestic loan market where they can get relatively a high rate of return.

Of the bank specific factors that proxy a banks' access to non-deposit funding, the results indicated that only bank capital has a significant role determining banks' supply of domestic currency loans. Regarding the foreign currency loans, there is statistical evidence that only the asset size is a significant determinant of the different loan reaction functions among banks. These findings are robust to the number of instruments selected and estimation methods. However, the caveat considered earlier on the number of instruments relative to the cross-sectional sample, means that these results have to be treated with caution, particularly for the foreign currency estimations.

Overall, this analysis has presented empirical evidence indicating that banks in Macedonia react to changes in domestic and foreign money market rates by adjusting the quantity of loans supplied. However, banks’ reaction function to changes in domestic money market rate is weaker than their reaction to foreign money market rates. This is similar with the findings for the other transition economies that have either fixed exchange rate regime or a currency board, such as the Baltic States. The presented findings in this chapter may imply that the specific structure of the banking system, the regime of *de facto* fixed exchange rate and the relatively high share of the foreign currency loans in the total outstanding loans (section 1.6) may limit the independent impact of the domestic monetary policy on banks’ lending decisions.

CHAPTER 6: CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Introduction

The main motivation for starting this research four years ago was to assess whether the current monetary policy regime in the Republic of Macedonian, as well as in the rest of the CSEE economies that have a *de facto* fixed exchange rate or currency board regime, was appropriate for achieving the price stability goal. In addition, this research programme questions whether an alternative monetary policy regime would be more effective. One alternative for example might be an inflation targeting regime, which is now operative in some CSEE economies (Czech Republic, Poland and Hungary). Hence, an aim of this thesis was to assess whether some of the main preconditions for adopting this latter regime are met in Macedonia (see section 1.1). This thesis therefore provides evidence of relevance to monetary policy makers about their preparedness and readiness to maintain the current peg of the national currency to the Euro during the forthcoming period of EMU accession together with full capital account liberalisation. Accordingly, the findings of this thesis have some relevance for the transition economies that have similar economic and financial structure and monetary policy regime like the Baltic States, Croatia and Bulgaria.

In order to fulfill these aims and to provide policy implications, this research has focused on investigating the effectiveness of two major channels of monetary transmission: the interest rate and bank lending channels. The reason for focusing on these two channels is that according to Carrere et al. (2002) and Batini et al. (2006), their effectiveness in transmitting changes in the monetary policy stance is one of the main preconditions for implementation of an inflation targeting regime, although as we discuss in section 6.3, they may be to some extent endogenous to the monetary policy regime. However, in the case of the transition economies that have a fixed exchange rate, a high level of currency substitution and where banks' are dependent on foreign financing with a relatively high level of foreign ownership in the banking sector, these factors may weaken the impact of the domestic monetary policy instruments. Thus, this may make the domestic monetary policy ‘ineffective’. Hence, the main research questions of this thesis were:

1) What is the size of the short-run lending rate adjustment to changes in the domestic ‘cost of funds’ rate in Macedonia and is it homogeneous among banks?
2) What factors affect the size of the short-run lending rate adjustment in Macedonia?
3) Does a bank lending channel exist in an economy with a fixed exchange rate like Macedonia and what is the size of the adjustment of banks’ loans to changes in the reference rate?
4) Is the loan adjustment heterogenous across banks and,if so, what are the major determinants for this heterogenous adjustment?
5) Do the interest rate and bank lending channels work in the same direction (complement each other) or in the opposite direction (conflict with each other) and are they operational from the monetary policy point of view?

This chapter is structured as follows: section 6.2 summarises the main findings of each of the previous five chapters and discusses how those findings relate to the five main research questions. The policy implications of these findings are examined in section 6.3. In sections 6.4 and 6.5 the limitations of the research and areas for further research will be assessed. In the final section of this chapter the main contributions to knowledge of this research programme are summarised.

6.2 Main findings of the research

In order to address the major research questions of this thesis presented in the previous section, chapter 1 provides a general discussion of the monetary policy and the banking system in the Republic of Macedonia. This assessment of these areas was undertaken to identify the specific characteristics of the Macedonian banking system, the way monetary policy is conducted and their relevance for the empirical investigations conducted in chapters 3 and 5. The major findings of chapter 1 are that the Macedonian banking sector is among the most concentrated in CSEE and according to the EBRD's index for banking sector reforms and interest rate liberalisation, it lacks additional banking sector reforms associated with reducing further the entry costs into the banking market (see section 1.4). An additional finding of chapter 1 is that banks are to a great extent dependent on foreign financing (see section 1.5), and the presence of foreign ownership in the banking sector and the level of currency substitution is amongst the highest in CSEE (see sections 1.4 and 1.6).

Related to the first and the second research questions, chapter 2 critically assesses the theory and empirical studies related to the issue of how banks' set their retail rates and what determines their retail rate-setting decisions. This enabled us to identify what factors we should take into account in our empirical model in chapter 3 as possible determinants of banks' retail rate setting. Furthermore, by the critical analysis of empirical studies we were able to identify the main gaps and weaknesses in the empirical literature, which helped us in selecting the estimation strategy and method to be adopted in the empirical analysis reported in chapter 3. It was argued that the main weaknesses of previous studies were related to their data series and estimation method(s) used (see section 2.3.5). Regarding the former, the majority of the empirical studies examined the size of the interest rate pass-through with aggregated data set(s) that, as discussed in section 2.3.5, may lead to aggregation bias. Moreover, in empirical studies related to the transition economies, the majority of them have used an aggregated interest rate series that include loans in all currency denominations. Accordingly, the results in those studies do not clearly indicate to what extent banks' adjust their lending rates to changes in the domestic and foreign 'cost of funds' rates, respectively. This may lead to 'inappropriate' policy implications being drawn regarding whether the interest rate channel is operational. Related to the estimation methods applied, the majority of these studies do not control for cross-sectional correlation among the units (banks), which given that they face a similar economic environment, at any point in time may be expected.

By critically assessing the theoretical background of how banks set their retail rates and identifying the major weaknesses and gaps in previous empirical studies, the empirical investigation conducted in chapter 3 enables the first and the second research questions to be addressed. Regarding the first research question, one of the main findings of the analysis presented in chapter 3 is that the size of the short-run lending rate adjustment to changes in the 'cost of funds' rate was incomplete (much below 1) and differed across individual banks in Macedonia (see section 3.5.1). Additionally, the results implied that the stability of the size of the lending rate adjustment also differs among banks (see section 3.5.1). These findings imply that the short-run pass-through process is unsynchronised across the banks in the Macedonian economy. Moreover, the results indicated that the key policy rate (CB Bills) does not significantly affect banks' short-run adjustment of the lending rates (see section 3.5.2). A possible explanation for this, as argued in section 3.2, may be that the key policy rate may serve more as an alternative investment for the banks, instead of the cost of financing their lending activities. This might be due to the *de facto* fixed exchange rate regime and the way monetary policy is currently conducted in the Republic of Macedonia (see sections 1.4 and 1.7).

With respect to the second research question, the empirical findings in chapter 3 indicate that various bank specific characteristics play different roles in determining the size of the lending rate adjustment. One of the major findings of the thesis is that the relationship between the size of the pass-through multiplier and the effect of banks' specific characteristics, the two macroeconomic control variables and the banking concentration index variable differ considerably among the banks (see section 3.5.1). More precisely, the significance and sign of the estimated coefficients of these variables are not consistent across the cross-sectional units. These findings question the appropriateness of most previous research that has explored the determinants of the interest rate pass-through using aggregated data sets (see section 2.3.1). These studies assumed that the impact of these variables on banks' retail rate setting decisions was homogeneous.

Overall, the findings of chapter 3 suggest that the short-run lending rate adjustment to changes in the 'cost of funds' rate is heterogeneous among the banks. Given this, using aggregated data set(s) that are constructed by averaging bank-level series before the estimation process will suppress banks' heterogeneous behaviour and will give rise to aggregation bias as discussed in section 2.3.5. In our case, this can be inferred by heterogeneity in the estimated size of the lending rate adjustment to changes in the 'cost of funds' rate and the heterogeneous impact of the control variables on the size of the pass-through among the Macedonian banks.

In respect of the third and fourth research question, chapter 4 provided an assessment of the theoretical foundations and empirical studies of the bank lending channel. This chapter presented a critical appraisal of the theory related to the bank lending channel and investigated the main modifications to the Bernanke and Blinder (1988a, b) model. Additionally, by surveying the empirical studies for developed and the transition economies from CSEE, we were able to identify the main gaps and weaknesses of the estimation method(s) used in previous empirical studies and hence, to select the most appropriate method for our empirical analysis presented in chapter 5. More precisely, the majority of the empirical studies estimate the loan function with "difference" GMM that in the case when variables contain near unit root process may provide biased and less efficient estimates compared to "system" GMM (see section 5.4). An additional weakness of these empirical studies, arising from the estimation method applied, was related to the problem of creating 'too many' instruments (see section 4.5.3). A further possible weakness of the empirical studies conducted for the transition economies was associated with the data series used: the majority of these studies use aggregated stock of loans series that include all currency denominations. We argue that this may bias the results because the impact of changes in the domestic and the foreign reference rates on banks' loans cannot be clearly disentangled. In assessing the empirical studies for transition economies we considered some additional variables specific to the case of these economies. Those variables were: the REER, the foreign reference rate, foreign ownership of the banking sector and additionally, unlike majority of the empirical studies, we have considered the NPL ratio as a proxy indicator for banks' risk preferences. The analysis presented in chapter 5 responds directly to the third and fourth research questions by empirically examining the functioning of the bank lending channel and what determines variations in the stock of loans. Accordingly, it investigates two loan functions according to the currency denomination of the loans. This enables us to draw conclusions on the effect of the domestic reference rate on domestic currency loans and the foreign reference rate (that is outside the control of domestic policy makers) on foreign currency loans.

Related to the third research question, the investigation in chapter 5 provided some evidence that the bank lending channel exists in the Republic of Macedonia in both the short- and long-run. Nonetheless, the results indicated that there is a significant reaction of foreign currency loans to changes in the foreign reference rate, whose share in banks' total loans is relatively high, with an increasing trend over time (see section 1.6) that may limit the impact of the domestic reference rate on overall loans. This is consistent with the findings of many of the empirical studies conducted for the transition economies of CSEE. This finding may be due to the specific characteristics of the banking system that are common to many transition economies, especially those with fixed exchange rates or currency board regimes, including the Macedonian economy. Namely, as in some other CSEE economies (the Baltic States, Croatia and Bulgaria), the *de facto* fixed exchange rate regime, the relatively high level of currency substitution and foreign ownership in the banking sector, and banks' dependence on foreign financing may make domestic monetary policy 'ineffective'.

With regards to the fourth research question, the results presented in chapter 5 indicate that various banks in Macedonia react differently in adjusting their quantity of loans to changes in reference rate. Among the control variables considered as proxy variables for banks' dependence on deposit funding (asset size liquidity or capital), the results implied that for the domestic currency loans, bank capital has a statistically significant impact in the short- and long-run. The estimates imply that more capitalised banks reduce their quantity of domestic currency loans proportionally less when the domestic referent interest rate increases compared to the less capitalised banks. Regarding the foreign currency loans, the results implied that asset size has a statistically significant influence over banks' loans. These estimates suggest that larger banks reduce the quantity of foreign currency loans proportionally less when the foreign reference rate increase than the smaller banks. The results in respect of the rest of the bank-specific variables considered in the empirical model (liquidity, foreign ownership and the NPL ratio) suggest that they do not have a significant influence on banks' lending decisions. Their lack of impact may be related to the specific structure of the Macedonian banking system as discussed in section 5.2. The last research question of the thesis is addressed in the following section.

6.3 Policy implications

As discussed in sections 3.2 and 4.5.3, an important issue for the central bank in designing its monetary policy is to have information on whether the interest rate and bank lending channels of monetary transmission mechanism are effective and operational. If they are, then the central bank may pursue its objectives by taking the appropriate monetary policy measures that will be passed-through to prices and economic activity via these two channels. Hence, in order to address these issues we need to summarise and link the findings of chapters 3 and 5.

As argued in the previous section, the findings of both chapters suggest that banks in the Republic of Macedonia react significantly to changes in the domestic reference rate by adjusting their lending rates and the quantity of loans.

Moreover, the adjustment of both, the lending rates (the interest rate channel) and the quantity of domestic currency loans (the bank lending channel), is in the same direction. This implies that both channels of the monetary transmission supplement each other. However, as argued in the previous section, this research has also provided evidence that banks' adjustment of the lending rates and the quantity of domestic currency loans to changes in domestic reference rate is incomplete and heterogeneous among banks (see sections 3.5.1 and 5.5.3, respectively). Furthermore, the lending rate adjustment significantly differs among banks (see section 3.5.1). Regarding the bank lending channel, this analysis has examined if the impact of the domestic reference rate is additionally limited by the presence of foreign currency loans. The latter significantly reacts to changes in the foreign reference rate (see section 5.5.3) that is beyond the influence of domestic monetary policy makers. Moreover, the share of foreign currency loans in the total loans in Macedonia has been increasing gradually through time and if this trend continues, it may limit the impact of the domestic reference rate on the overall stock of loans even more in future (see section 1.6).

The afore-mentioned findings may suggest that it is difficult to design and implement an independent monetary policy in Macedonia that will operate efficiently through the interest rate and bank lending channels. Moreover, the implementation of the monetary policy through utilisation of these two channels may be additionally complicated by the complexity of the whole forecasting process of banks' reaction to changes in the domestic reference rate. For example, complications might arise from predicting (forecasting) the values of the variables used in the model and further complications may also arise from the measurement errors in the variables such as the GDP that is prone to substantial revisions from one period to another. Furthermore, the heterogeneity in banks' reaction to changes in domestic reference rate may impose additional forecasting difficulties and errors because there are more variables that need forecasting. All of these problems may lead to significant forecasting errors. An additional problem is related to the possible changing relationship among the variables over time, especially after the beginning of economic recession in 2009. Further on, an open issue for the monetary policy makers is to know to what extent are these two channels of monetary transmission endogenous to the monetary policy regime, which is one of the limitations of our research (see section 6.3). For example some authors argue that as the monetary policy changes towards inflation targeting, their effectiveness may ‘improve’ (Mishkin and Schmidt-Hebbel, 2006). Nonetheless, a sudden switch towards an inflation targeting regime may incur risks of losing the credibility of the central bank in the short- and medium-term (Brito and Bystedt, 2010), which is seen as an important factor affecting the expectations of the economic agents (Cukierman and Liviatan, 1992).

All of these arguments in this and the previous sections imply that at this stage of financial and economic development of the Macedonian economy, it may be difficult for the policy makers to use effectively the interest rate and bank lending channels. This may indicate that, as discussed in sections 1.1 and 6.1, the main requirements for a switch to inflation targeting are not fully satisfied at this moment. Namely, due to banks’ sluggish and heterogeneous response to changes in the domestic reference rate, the Central Bank cannot predict their reactions in adjusting their lending rates and quantity of loans with any accuracy when the domestic reference rate changes.

As outlined in chapter 1, there are some additional factors in Macedonia that may affect the interest rate and bank lending channels of monetary transmission, which may make them less effective, or indeed ineffective. Some of those factors may be: *a)* a relatively high level of foreign currency substitution; *b)* banks’ dependence on foreign financing and *c)* a strong presence of foreign capital in the banking system. This suggests that the current monetary policy regime of a *de facto* fixed exchange rate regime may be appropriate at this stage of development of the overall financial system in achieving the price stability goal. Anchoring the inflationary expectations of the economic agents through a stable nominal exchange rate when the domestic final consumption and the production processes are highly import dependent may be the most efficient way of maintaining price stability.

A future challenge for monetary policy-makers in Macedonia is the issue of maintaining the nominal exchange rate fixed after full capital account liberalisation. Currently the relatively high differential between domestic and foreign interest rates may cause, following full liberalization, large capital movements that may threaten the stability of the nominal exchange rate. Moreover, the interest rate differential between the domestic and foreign reference rates increased substantially during 2009, due largely to the different reactions of monetary policy authorities at home and abroad (see section 1.7). For example, the European Central Bank, as well as the economies from CSEE that conduct an explicit or implicit inflation targeting regime, have been reducing their key policy rate continually through 2009. In contrast, the Macedonian monetary policy authorities in order to maintain the stability of the nominal exchange rate and to stabilise pressures on the foreign exchange market have substantially increased their key policy rate. This was done in order to reduce the liquidity of the banks by making CB Bills more attractive investment for the banks (see section 1.7).

These arguments would suggest that the forthcoming full capital account liberalisation in Macedonia should be postponed until both the domestic economy and international economic environment recover and cause a decline in the interest rate differential. In the Euro-zone, the economic recovery should lead to a revitalisation of domestic demand (private consumption and investment) and an increase in their reference rates. Moreover, the economic recovery in the Euro-zone is expected to result in a recovery in exports from the Macedonian economy. This may lead to stabilisation of the pressures in the foreign exchange market that should ultimately result in a reduction of the key policy rate. The recovery in the Macedonian exports may also increase the pace of the economic recovery of the Macedonian economy and thus the recent increase in the country risk premium in 2009 (see figure 1.27), should decline. Consequently, within the fixed exchange rate setting, the reduction of the differential between the domestic and foreign reference rates may ultimately affect banks' behaviour towards relying more on borrowing in domestic than foreign financial markets, which should also increase the effectiveness of the domestic reference rate over the bank lending channel.

6.4 Limitations of the research

The main limitations of this research arise from the following: *I)* limitations in the theoretical analysis related to the absence of a more explicit exposition of what effective and operational interest rate and bank lending channels are and how these can be empirically assessed; *II)* wider limitations related to the applied model specifications for the interest rate and bank lending channels and the estimation methods used; *III)* the relatively small cross-sectional sample (which is determined by the small number of banks in Macedonia); *IV)* data unavailability and *V)* the methodological changes in some of the data series from 2009. Related to the first limitation, the theoretical literature of the interest rate and bank lending channels does not provide any specific indication as to how the effective and operational interest rate and bank lending channels from the monetary policy makers' point of view should be defined and how this may be empirically explored. Additionally, there is a limitation related to the issue regarding to what extent are these two channels endogenous to the monetary policy regime and how this endogeneity can be assessed. These limitations have restricted our analysis from providing more explicit policy recommendations as to whether the monetary policy can be efficiently utilised through the interest rate and bank lending channels and how these two channels may be affected by any change in the monetary policy regime.

The second limitation of our research is related to the derivation of the applied model for assessing banks' lending rate setting behaviour. Theory is unclear about some issues such as what macroeconomic control variables should be considered, leading to inclusion of some *ad hoc* variables in the applied research (see sections 2.2.5 and 2.3). Moreover, the switching costs theory indicates the importance of such costs in affecting the size of lending rate adjustments, but fails to specify how these costs can be empirically measured or proxied (see section 2.2.5 and 3.2). Related to the bank lending channel theory, there is also a limitation in specifying the applied model arising from some of the assumptions made in the Bernanke and Blinder model. For instance, this model is based on the assumption of constant expected inflation and the adaptation of it to environments where such an assumption would appear unreasonable, has led to some inconsistencies among the empirical studies that assess the bank lending channel (see section 4.5.3). There are also some wider limitations related to the estimation methods used in chapters 3 and 5 that cannot encompass all possible complications. For example, a limitation of the estimation method applied in chapter 3 is that the SUR model has not been developed for unbalanced panels. This precludes us from exploiting a greater cross-sectional dimension of the data by necessitating the exclusion of those banks that have not operated continually during the whole sample period (see section 3.4). Regarding the estimator applied in chapter 5 (the "system" GMM), its major limitation is that it is based on the assumption that there is no cross-sectional correlation among the units, although there are some indications (Roodman 2009a) how this problem may be alleviated and there is a statistical test by which this can be examined (see section 5.4 and 5.5.3). In our estimates, the statistical test conducted indicated that there is a lack of evidence of cross-sectional correlation (see section 5.5.3).

Regarding the small cross sectional sample, the research reported above included all banks that operated in Macedonia during the sample period. However, this small sample limited the analysis that could be undertaken. A possible solution to this problem might have been a use of larger sample by including banks from other transition economies with similar banking systems and policy regimes (the Baltic States, Croatia and Bulgaria). However, loan data disaggregated by the currency of the loan are not available for those economies, even if we use the BankScope[35] data set. Even if this was possible, there are also differences in the monetary and economic policies among these economies which would make the modelling more difficult.

The absence of disaggregated loan rate series by sector, maturity and the type of loans by purpose has precluded us from further investigation of the causes of the differences among Macedonian banks in their size of the lending rate

[35] This data base is provided by Bureau van Dijks and FITCH IBCA.

adjustment. An additional limitation was the unavailability of a lending rate series of loans denominated in foreign currency that precluded analysing the impact of changes in the foreign 'cost of funds' rate.

Methodological changes to the treatment of bank balance sheet items restricted our sample period to the end of 2008. At the beginning of 2009, a new reporting accounting methodology was imposed by the NBRM that made the banks' balance sheet items not directly comparable with the previous period. This restricted us from employing a longer time series of data.

6.5 Further research

This research was focused on investigating the effectiveness of the 'first round' effects of the interest rate and bank lending channels. It has investigated the effectiveness of the monetary transmission from changes in the 'cost of funds' rate to banks' lending rates and the adjustment of their stock of loans. Further research should be in the direction of investigating the so-called 'second round' effects of the effectiveness of these two channels of the monetary transmission. For instance, investigating the impact of changes in the lending rates and the adjustment of the stock of loans on private consumption and investments and how these in turn may affect overall aggregate demand in the Macedonian economy. Broadening this research in this way would provide a more comprehensive picture about the overall effectiveness of domestic monetary policy.

The analysis can also be extended by incorporating the spillover effects of the worlds' financial crisis by extending the sample period and augmenting the models used. For example, during 2009 Macedonian banks were faced with reduced sources of financing from abroad and substantial deterioration in the quality of their loan portfolio as measured by the NPL ratio. These banks, apart from increasing their lending rates, additionally tightened their lending conditions by imposing, for example, a higher collateral coverage. Investigating the impact of these changes caused by the world's financial crisis may provide additional useful insights for the Macedonian monetary policy makers.

An additional area recommended for further research is the examination of the existence of the housing price channel of the monetary transmission mechanism. This channel is seen to be a separate channel of the monetary transmission mechanism that is considered to be quite important in many developed economies. Moreover, this channel of the monetary transmission has been argued to gain greater importance in the more advanced transition economies, such as Czech Republic, Poland and the Baltic States (Coricelli et al., 2006). Regarding the case of Macedonia, there is an indication of gradual increase in housing prices during the period 2000-2007 (Davidovska-Stojanova et al., 2008). Hence, investigating what have caused this gradual increase of the housing prices and how, if this is related to the monetary transmission mechanism; may provide some relevant information for the monetary policy makers.

6.6 Contributions to knowledge

After the earlier summary of the main findings of the thesis in relation to the main research questions, this subsection summarises the main contributions to knowledge of the thesis. The major contributions to knowledge can be grouped in the following three areas: theoretical, application of method and empirical. The majority of these contributions to knowledge do not just refer to the analysis of the Macedonian economy, but can be utilised in the analysis of other transition economies, especially those with a fixed exchange rate or currency board regime. Moreover, some of the theoretical and methodological contributions are also relevant for developed and/or developing economies as well.

A theoretical contribution to knowledge of this research is that it provides pioneering analyses of the issue concerning the meaning of 'effective' and 'operational' interest rate and bank lending channels from the monetary policy point of view. The theory of both the interest rate and bank lending channels does not provide any explicit indications about this issue that, as discussed in sections 3.2 and 4.5.3, it is an important limitation when designing and implementing the monetary policy. Hence, this thesis has argued that for the interest rate and bank lending channels to be effective and operational, then there should be a sizeable, stable and homogeneous reaction among banks in adjusting their lending rates and quantity of loans to changes in the domestic reference rate (see sections 3.2 and 4.5.3, respectively).

The application of method contributions can be summarised as follows. *First*, in chapter 3 we have used an estimation method that controls for the contemporaneous cross-sectional correlation among the units, i.e. Zellner's (1962 and 1963) SUR model. This was done because, as argued in section 3.3, we expect that banks' activities are interrelated. The empirics presented in sections 3.5.1 and 3.5.2, indicate that controlling for this provides efficiency gains. Furthermore, an additional reason for employing the SUR model was because it provided the possibility of estimating banks' individual slope coefficients and exploring whether they statistically differ, which allows us to examine banks' individual lending rate setting behaviour. From the central bankers' perspective, modelling the individual bank lending rate adjustment provides quite important information as to whether the individual banks respond equally in adjusting their lending rates when the domestic 'cost of funds' rate changes. Hence, the use of the SUR method contributes not only to the literature related to the transition economies, but also to the wider literature by providing evidence that controlling for the cross-sectional correlation among the units and modelling for banks' individual lending rate setting behaviour is important.

Second, unlike the majority of the studies for the developed and transition economies, an 'originality' of our study is that in chapter 5 in examining the bank lending channel, we employ an econometric method for dynamic panel data models that has been recently developed, that is the "system" GMM. Thus, as argued in sections 4.5.3 and 5.4, this econometric technique is seen to be more appropriate when some of the variables exhibit random walk. Consequently, the results presented in section 5.5.5 suggest that in the latter case using the “system” instead of “difference” GMM considerably alters the results. Additionally, using the “system” GMM estimator enables us to restrict and collapse the instrument sets which alleviates the problem of creating ‘too many’ instruments relative to the number of cross-sectional units that may violate the validity of Hansen test. This problem was found in most existing studies (see section 4.5.3). The estimates assessed in section 5.5.3 indicate that applying this procedure may be important in reducing the number of instruments created with the p-value of the Hansen test in the majority of the regressions being reduced below 1.

The major empirical contributions to knowledge are in the following areas. F*irst*, this is the pioneering analysis for the Macedonian literature and among the few in the context of the transition, developed and developing economies that investigates bank-level differences in the size of short-run lending rate adjustment to changes in the ‘cost of funds’ rate. According to the findings presented in section 3.5.1, this research has concluded that the extent to which various banks adjust their lending rates to changes in the ‘cost of funds’ rate differs considerably. This implies that banks are agents with heterogeneous lending rate adjustment behavior, suggesting that empirical investigations using aggregate data suffer from aggregation bias (see section 2.3.5).

Second, this is the first Macedonian analysis that examines factors that affect the size of the short-term lending rate adjustment by considering a set of bank-balance sheet items, two macroeconomic control variables and a banking concentration index variable. According to the empirical results discussed in section 3.5.1, this research has concluded that the afore-mentioned factors have different impact on the size of the short-run pass-through multipliers in different banks. This empirical finding contributes to the wider literature because it provides some empirical support for the predictions of various theories assessed in section 2.2 concerning the factors that may affect banks’ lending rate setting decisions.

Third, this study is one of the unique analyses among the empirical literature for the transition economies in that it examines the functioning of the bank lending channel by exploring two loan reaction functions among banks according to their currency denomination. According to the results discussed in section 5.5.3, this study has concluded that there is a difference in how banks adjust their foreign currency loans to changes in the foreign reference rate, compared to the domestic currency loans to changes in domestic reference rate. These findings may be generalised to other transition economies with currency pegs, suggesting that the impact of the domestic reference rate over the domestic currency loans may be limited due to the relatively high presence of foreign currency loans, whose share in the total loans is not negligible and is gradually increasing through time.

REFERENCES:

Afanasieff, T., S., Lhacer, P., M., V. and Nakane, M., I. (2002), "The Determinants of Bank Interest Spread in Brazil", *Banco Central Do Brazil Working Paper Series,* No. 46.

Allen, L. (1988), "The Determinants of Bank Interest Margins: A Note", *Journal of Financial and Quantitative Analysis*, Vol. 23, No. 2, pp. 231 – 235.

Altunbas, Y., Fazylov, O. and Molyneux, P. (2002), "Evidence on the Bank Lending Channel in Europe", *Journal of Banking and Finance,* Vol. 26, No. 11, pp. 2093 – 2110.

Altunbas, Y., Gambacorta, L. and Marques–Ibanez, D. (2010): "Does Monetary Policy Affect Bank Risk Taking?", *Bank for International Settlements Working Paper,* No. 298.

Alvarez, J. and Arellano, M. (2003), "The Time Series and Cross–Section Asymptotics of Dynamic Panel Data Estimators", *Econometrica*, Vol. 71, No. 4, pp. 1121 – 1159.

Amaya, C., A., G. (2005), "Interest Rate Setting and the Colombian Monetary Transmission Mechanism", *Banco de la Republica Colombia Working Paper,* No. 313.

Anderson, T., W. and Hsiao, C. (1982), "Formulation and Estimation of Dynamic Models Using Panel Data", *Journal of Econometrics,* Vol. 18, No. 1, pp. 47 – 82.

Angbazo, L. (1997), "Commercial Bank Net Interest Margins, Default Risk, Interest–rate Risk, and Off–balance Sheet Banking", *Journal of Banking and Finance,* Vol. 21, Issue 1, pp. 55 – 87.

Angeloni, I., Faia, E. and lo Duca, M. (2010), "Monetary Policy and Risk Taking", *Bruegel Working Paper,* No. 2010/00.

Arak, M., Englander, A., S. and Tang, E., M., P. (1983), "Credit Cycles and the Pricing of the Prime Rate", *Federal Reserve Bank of New York,* Quarterly Review/Summer 1983, pp. 12 – 18.

Arellano, M. (2003), "*Panel Data Econometrics*", Oxford University Press, Oxford.

Arellano, M. and Bond, S. (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies,* Vol. 58, No. 194, pp. 277 – 297.

Arellano, M. and Bover, O. (1995), "Another Look at the Instrumental Variable Estimation of Error–components Models", *Journal of Econometrics*, Vol. 68, No. 1, pp. 29 – 51.

Arena, M., Reinhart, C. and Vazquez, F. (2007), "The Lending Channel in Emerging Economies: Are Foreign Banks Different?", *International Monetary Fund Working Paper*, No. 07/48.

Ashcraft, A., B. (2006), "New Evidence on the Bank Lending Channel," *Journal of Money, Credit, and Banking*, Vol. 38, No. 3, pp. 751 – 776.

Batini, N., Breuer, P., Kochhar, K. and Roger, S. (2006), "Inflation Targeting and the IMF", Paper published by the International Monetary Fund, Prepared by Monetary and Financial Systems Department, Policy and Development Review Department, and Research Department. Available online:
http://imf.org/external/np/pp/eng/2006/031606.pdf (last accessed 23/05/2008).

Baum, C., F. (2006), "*An introduction to Modern Econometrics Using Stata*", Stata Press, College Station.

Benkovskis, K. (2008), "Is There a Bank Lending Channel of Monetary Policy in Latvia? Evidence from Bank Level Data", *Latvijas Banka Working Paper*, No. 1/2008.

Berger, A., N. and Hannan, T., H. (1989), "The Price–Concentration Relationship in Banking", *Review of Economics and Statistics*, Vol. 71, No. 2, pp. 291 – 299.

Berger, A., N. and Udell, G., F. (1992), "Some Evidence on the Empirical Significance of Credit Rationing", *Journal of Political Economy*, Vol. 100, No. 5, pp. 1047 – 1077.

Bernanke, B. (1993), "Credit in the Macroeconomy", *Federal Reserve Bank of New York Quarterly Review*, Vol. 18, No. 1, pp. 50 – 70.

Bernanke, B. and Blinder, A. (1988 a), "Credit, Money, and Aggregate Demand", *American Economic Review*, Vol. 78, No. 2, pp. 435 – 439.

Bernanke, B. and Blinder, A. (1988 b), "Credit, Money, and Aggregate Demand", *National Bureau of Economic Research Working Paper*, No. 2534.

Bernanke, B. and Blinder, A. (1992), "The Federal Funds Rate and the Channels of Monetary Transmission", *American Economic Review*, Vol. 82, No. 4, pp. 901 – 921.

Bernanke, B. and Gertler, M. (1995), "Inside the Black Box: the Credit Channel of Monetary Policy Transmission", *National Bureau of Economic Research Working Paper*, No. 5146.

Bernanke, B. and Mihov, I. (1998), “Measuring Monetary Policy”, *Quarterly Journal of Economics*, Vol. 113, No. 3, pp. 869 – 902.

Berstein, S. and Fuentes, R. (2003), “Is There Lending Rate Stickiness in the Chilean Banking Industry?”, *Central Bank of Chile Working Papers*, No. 218.

Berstein, S. and Fuentes, R. (2005), “Concentration and Price Rigidity: Evidence for the Deposit Market in Chile”, *Central Bank of Chile Working Papers*, No. 311.

Betancourt, R., Vargas, H. and Rodriguez, N. (2008), “Interest Rate Pass–Through in Colombia: a Micro–Banking Perspective”, *Cuadernos de Economia*, Vol. 45, No. 1, pp. 29 – 58.

Black, L. K. and Rosen, R. J. (2007), “How the Credit Channel Works: Differentiating the Bank Lending Channel and the Balance Sheet Channel”, *Federal Reserve Bank of Chicago Working Paper*, No. 2007–13.

Blundell, R. and Bond, S. (1998), “Initial Conditions and Moment Restrictions in Dynamic Panel Data Models”, *Journal of Econometrics*, Vol. 87, No. 1, pp. 115 – 143.

Boissay, F., Calvo–Gonzalez, O. and Kozluk, T. (2006), “Is Lending in Central and Eastern Europe Developing too Fast?”, Paper presented at the conference: “Finance and Consumption Workshop: Consumption and Credit in Countries with Developing Credit Markets”, Florence, 16 – 17 June 2006. Available online: http://www.eu–financial–system.org/fileadmin/content/Dokumente_Events/second_conference/Boissay_Calvo–Gonzales_Kozluk.pdf (last accessed 28/03/2010).

Bolton, P. and Freixas, X. (2006), “Corporate Finance and the Monetary Transmission Mechanism”, *The Review of Financial Studies*, Vol. 19, No. 3, pp. 829 – 70.

Bond, S. (2002), “Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice”, *Institute for Fiscal Studies London Working Paper*, No. 09/02.

Boot, A., W., A. (2000), “Relationship Banking: What Do We Know?”, *Journal of Financial Intermediation*, Vol. 9, No. 1, pp. 7 – 25.

Borio, C. and Zhu, H. (2008), “Capital Regulation, Risk–taking and Monetary Policy: A Missing Link in the Transmission Mechanism?”, *Bank for International Settlements Working Paper*, No. 268.

Boutillier, M., Kierzenkowski, R. and Rousseaux, P. (2006), “Loan interest rates: a Spread Analysis Using French Data from 1993 to 2004”, paper presented at a 21st EEA Annual Congress, Vienna (Austria), August 24th – 28th, 2006.

Brissimis, S., N. and Delis, M., D. (2010), “Bank Heterogeneity and Monetary Policy Transmission”, *European Central Bank Working Paper,* No. 1233.

Brissimis, S., N., Kamberoglou, N., C. and Simigiannis, G., T. (2003), “Is There a Bank Lending Channel of Monetary Policy in Greece? Evidence from Bank Level Data”. In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), “*Monetary Policy in the Euro Area*”, Cambridge University Press, Cambridge, 2003, pp. 309 – 322.

Brito, D., R. and Bystedt, B. (2010), “*Inflation Targeting in Emerging Economies: Panel Evidence*”, Journal of Development Economics, Vol. 91, Issue 2, pp. 198 – 210.

Brooks, P. K. (2007), “Does the Bank Lending Channel of Monetary Transmission Work in Turkey?”, *International Monetary Fund Working Paper*, No. 07/272.

Carere, A., Schaechter, A., Stone, M. and Zelmer, M. (2002), “Establishing Initial Conditions in Support of Inflation Targeting”, *International Monetary Fund Working Paper*, No. 02/102.

Chmielewski, T. (2004), “Interest Rate Pass–through in the Polish Banking Sector and Bank–specific Financial Disturbances”, Munich Personal RePEc Archive Paper, No. 5133. Available online:
http://mpra.ub.uni–muenchen.de/5133/ (last accessed 23/06/2009).

Chmielewski, T. (2006), “Bank Risks, Risk Preferences and Lending”, Munich Personal RePEc Archive, Paper No. 5131, posted 07. November 2007 / 04:27. Available online:
http://mpra.ub.uni–muenchen.de/5131 (last accessed 21/02/2010).

Chowdhury, R., A. (2010), “An Empirical Study of the Bank Lending Channel in the United States”, Paper presented at the conference “*PhD Conference in Monetary and Financial Economics*”, Bristol Business School, University of West of England, Bristol 20/09/2010.

Cihak, M. (2004), “The Determinants of Lending Rates and Domestic Spreads in Croatia”, *International Monetary Fund Country Report*, No. 04/251.

Coricelli, F., Egert, B. and MacDonald, R. (2006), “Monetary Transmission Mechanism in Central and Eastern Europe: Gliding on a Wind of Change”, *William Davidson Institute Working Paper*, No. 850.

Corvoisier, S. and Gropp, R. (2002), “Bank Concentration and Retail Interest Rates”, *Journal of Banking and Finance,* Vol. 26, No. 11, pp. 2155 – 2189.

Cottarelli, C. and Kourelis, A. (1994), “Financial Structure, Bank Lending Rates, and the Transmission Mechanism of Monetary Policy”, *International Monetary Fund Working Paper*, No. 94/39.

Cottarelli, C., Dell'Ariccia, G. and Vladkova–Hollar, I. (2005), "Early Birds, Late Risers, and Sleeping Beauties: Bank Credit Growth to the Private Sector in Central and Eastern Europe and in the Balkans", *Journal of Banking and Finance,* Vol. 29, No. 1, pp. 83 – 104.

Cottarelli, C., Ferri, G. and Generale, A. (1995), "Bank Lending Rates and Financial Structure in Italy: A Case Study", *International Monetary Fund Working Paper*, No. 95/38.

Crowley, J. (2007), "Interest Rate Spreads in English–Speaking African Countries", *International Monetary Fund Working Paper,* No. 07/101.

Cukierman, A. and Liviatan, N. (1992), "The Dynamics of Optimal Gradual Stabilizations", *The World Bank Economic Review,* Vol. 6, No. 3, pp. 439 – 458.

Davidovska-Stojanova, B., Jovanovic, B., Kadievska-Vojnovic, M. and Ramadani, G. (2008), "Housing Prices in the Republic of Macedonia", *National Bank of the Republic of Macedonia Working Paper,* August 2008.

de Bondt, G. (2005), "Interest Rate Pass–Through: Empirical Results for the Euro Area", *German Economic Review,* Vol. 6, No. 1, pp. 37 – 78.

de Graeve, F., de Jonghe, O. and Vennet, R., V. (2004), "The Determinants of Pass–Through of Market Conditions to Bank Retail Interest Rates in Belgium", *National Bank of Belgium Working Papers – Research Series,* No. 47.

de Haan, L. (2003), "The Impact of Monetary Policy on Bank Lending in the Netherlands". In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 335 – 346.

de Haas, R., T., A. and Naaborg, I., J. (2005), "Internal Capital Markets in Multinational Banks: Implications for European Transition Countries", *De Nederlandsche Bank Working Paper,* No. 51.

de Haas, R., T., A. and Van Lelyveld, I. (2006), "Foreign Banks and Credit Stability in Central and Eastern Europe. A Panel Data Analysis", *Journal of Banking and Finance,* Vol. 30, No. 7, pp. 1927 – 1952.

de Souza, L., V. (2006), "Estimating the Existence of the Bank Lending Channel in the Russian Federation", *Bank I Kredyt,* wrzesien 2006, Central Bank of Poland.

Demirguc–Kunt, A. and Huizinga, H. (1999), "Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence", *The World Bank Economic Review,* Vol. 13, No. 2, pp. 379 – 408.

Demsetz, H. (1973), "Industry Structure, Market Rivalry, and Public Policy", *Journal of Law and Economics,* Vol. 16, No.1, pp. 1 – 9.

Disyatat, P. (2010), "The Bank Lending Channel Revisited", *Bank for International Settlements Working Paper*, No. 297.

Djankov, S., McLeish, C. and Shleifer, A. (2005), "Private Credit in 129 Countries", *National Bureau of Economic Research, Working Paper*, No. 11078.

Doliente, J., S. (2005), "Determinants of Bank Net Interest Margins in Southeast Asia", *Applied Financial Economics Letters*, Vol. 1, Issue 1, pp. 53 – 57.

Egert, B., Backe, P. and Zumer, T. (2006), "Credit Growth in Central and Eastern Europe, New (Over) Shooting Stars", *European Central Bank Working Paper Series*, No. 687.

Egert, B., Crespo–Cuaresma, J., and Reininger T. (2007), "Interest Rate Pass–Through in Central and Eastern Europe: Reborn from Ashes Merely to Pass Away?", *Journal of Policy Modeling*, Vol. 29, Issue 2, pp. 209 – 225.

Ehrmann, M., Gambacorta, L., Martinez–Pages, J., Sevesrte, P. and Worms, A. (2001), "Financial System and the Role of Banks in Monetary Policy Transmission in the Euro Area", *European Central Bank Working Paper Series*, No. 105.

Ehrmann, M., Gambacorta, L., Martinez–Pages, J., Sevestre, P. and Worms, A. (2003), "Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area". In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 235–269.

Engler, P., Jokipii, T., Merkl, C., Kaltwasser, P., R. and de Souza, L., V. (2005), "The Effect of Capital Requirement Regulation on the Transmission of Monetary Policy: Evidence from Austria", *Oesterreichische Nationalbank Working Paper*, No. 99.

European Bank for Reconstruction and Development (EBRD 2006), "*Transition Report: Finance in Transition*", October 2006 European Bank for Reconstruction and Development, London UK.

European Bank for Reconstruction and Development (EBRD 2009), "*Transition Report: Transition in Crises*", November 2009 European Bank for Reconstruction and Development, London UK.

European Central Bank (ECB 2009), "*Financial Stability Review December 2009*", December 2009 European Central Bank, Frankfurt am Main Germany.

European Central Bank (ECB 2010), "*Structural Indicators for the EU banking Sector*", January 2010 European Central Bank, Frankfurt am Main Germany.

Farinha, L. and Marques, C., R. (2003), "The Bank Lending Channel of Monetary Policy: Identification and Estimation Using Portuguese Micro Bank Data". In:

Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 359 – 371.

Flannery, M., J. (1982), "Retail Bank Deposits as Quasi–Fixed Factors of Production", *The American Economic Review*, Vol. 72, No. 3, pp. 527 – 536.

Gambacorta, L. (2005), "Inside the Bank Lending Channel", *European Economic Review*, Vol. 49, No. 7, p. 1737 – 1759.

Gambacorta, L. (2008), "How Do Banks Set Interest Rates?", *European Economic Review*, Vol. 52, No. 5, pp. 792 – 819.

Golodniuk, I. (2006), "Evidence on the Bank–lending Channel in Ukraine", *Research in International Business and Finance*, Vol. 20, No. 2, pp. 180 – 199.

Greene, W., H. (2008), "*Econometric Analysis*", 6th edition, Prentice Hall, New Jersey.

Grunfeld, Y. and Griliches, Zn. (1960), "Is Aggregation Necessarily Bad?", *The Review of Economics and Statistics*, Vol. 42, No. 1, pp. 1 – 13.

Hahn, J. and Kuersteiner, G. (2002), "Asymptotically Unbiased Inference for a Dynamic Panel Model with Fixed Effects When Both N and T are Large", *Econometrica*, Vol. 70, No. 4, pp. 1639 – 1657.

Hahn, J., Kuersteiner, G. and Cho, M., H. (2004), "Asymptotic Distribution of Misspecified Random Effects Estimator for a Dynamic Panel Model with Fixed Effects When Both N and T are Large", *Economic Letters*, Vol. 84, No. 1, pp. 117 – 125.

Hannan, T., H. and Berger, A., N. (1991), "The Rigidity of Prices: Evidence from the Banking Industry", *American Economic Review*, Vol. 81, No. 4, pp. 938 – 945.

Havrylchyk, O. and Jurzyk, E. (2005), "Does the Bank Lending Channel Work in a Transition Economy? A Case of Poland", *European University Viadrina*, mimeo.

Hernando, I. and Martinez–Pages, J. (2003), "Is There a Bank Lending Channel of Monetary Policy in Spain?". In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 284 – 296.

Ho, T., S., Y. and Saunders, A. (1981), "The Determinants of Bank Interest Margins: Theory and Empirical Evidence", *Journal of Financial Intermediation and Quantitative Analysis*, Vol. 16, No. 4, pp. 581 – 600.

Horvath, C., Kreko, J. and Naszodi, A. (2006), "Is There a Bank Lending Channel in Hungary? Evidence from Bank Panel Data", *Magyar Nemzeti Bank Working Paper,* No. 2006/7.

Jimborean, R. (2009), "The Role of Banks in the Monetary Policy Transmission in the new EU Member States", *Economic Systems,* Vol. 33, No. 4, pp. 360 – 375.

Jovanovski, Z., Krstevska, A., Mitreska, A. and Bojceva–Terzijan, S. (2005), "Monetary Transmission Through the Interest Rates in the Republic of Macedonia", *National Bank of the Republic of Macedonia Working Paper*, No. 13.

Juks, R. (2004), "The Importance of the Bank–Lending Channel in Estonia: Evidence from Micro–Economic Data", *Working Papers of Eesti Pank,* No. 6.

Juurikkala, T., Karas, A. and Solanko, L. (2009), "The Role of Banks in Monetary Policy Transmission: Empirical Evidence from Russia", *Bank of Finland Discussion Papers,* No. 8/2009.

Kadievska–Vojnovic, M. and Georgievska, Lj. (2006), "Analysis of Interest Rates and Interest Rate Spread of the Banking System in Republic of Macedonia – Statistical and Methodological Aspects", *National Bank of the Republic of Macedonia Working Paper*, No. 15.

Kashyap, A. K. and Stein, J. C. (1995), "The Impact of Monetary Policy on Bank Balance Sheets", *Carnegie–Rochester Conference Series on Public Policy,* No. 42, pp. 151 – 195.

Kashyap, A. K. and Stein, J. C. (2000), "What do a Million Observations on Banks Say About the Transmission of Monetary Policy?", *American Economic Review,* Vol. 90, No. 3, pp. 407 – 428.

Kashyap, A. K. and Stein, J. S. (1993), "Monetary Policy and Bank Lending", *National Bureau of Economic Research Working Paper,* No. 4317.

Kaufmann, S. (2003), "The Cross–sectional and the Time Dimension of the Bank Lending Channel: the Austrian Case". In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 347 – 358.

Kauko, K. (2005), "Bank Interest Rates in a Small European Economy: Some Exploratory Macro Level Analyses Using Finnish Data", *Bank of Finland Research Discussion Papers,* No. 9/2005.

Kierzenkowski, R. (2005), "The Multi–Regime Bank Lending Channel and the Effectiveness of the Polish Monetary Transmission During Transition", *Journal of Comparative Economics,* Vol. 33, No. 1, pp. 1 – 24.

Kierzenkowski, R. (2007), "Another View of the Bank Lending Channel Theory: The Bernanke and Blinder (1988) Model Revisited", Banque de France, Mimeo, available online:
http://phare.univ–paris1.fr/pdf/Kierzenkowski_Phare.pdf (last accessed 05/20/2008).

Kim, J. (2004), "Short Run Real Exchange Rate Dynamics: a SUR Approach", *Applied Economics Letters*, Vol. 11, No. 14, pp. 909 – 913.

Kishan, R. and Opiela, T. (2000), "Bank Size, Bank Capital, and the Bank Lending Channel", *Journal of Money, Credit and Banking*, Vol. 32, No. 1, pp. 121 – 140.

Kishan, R. and Opiela, T. (2006), "Bank Capital and Loan Asymmetry in the Transmission of Monetary Policy", *Journal of Banking and Finance*, Vol. 30, No. 1, pp. 259 – 285.

Klemperer, P. (1987), "Markets with Consumer Switching Costs", *Quarterly Journal of Economics*, Vol. 102, Issue 2, pp. 375 – 394.

Kohler, M., Hommel, J. and Grote, M. (2006), "The Role of Banks in the Transmission of Monetary Policy in the Baltics", *Zentrum fur Europaische Wirtschaftsforschung Discussion Paper*, No 10.

Lago–Gonzalez, R. and Salas–Fumas, V. (2005), "Market Power and Bank Interest Rate Adjustments", *Bank of Spain Working Paper*, No. 0539.

Laudadio, L. (1987), "Commercial Banks: Market Structure and Short–term Interest Rates", *Journal of Post Keynesian Economics*, Vol. 9, No. 4, pp. 632 – 641.

Lee, K., C., Pesaran, M., H. and Pierse, R., G. (1990), "Testing for Aggregation Bias in Linear Models", *Economic Journal*, Vol. 100, No. 1, pp. 137 – 150.

Levine, R., Loayza, N. and Beck, T. (2000), "Financial Intermediation and Growth: Causality and Causes", *Journal of Monetary Economics*, Vol. 46, No. 1, pp. 31 – 77.

Loupias, F., Savignac, F. and Sevestre, P. (2003), "Is there a Bank–lending Channel in France? Evidence from Bank Panel Data". In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 297 – 308.

Lowe, P. and Rohling, T. (1992), "Loan Rate Stickiness: Theory and Evidence", *Reserve Bank of Australia Research Discussion Paper*, No. 9206.

MacKinnon, J. (1991), "Critical Values in Co-integration Tests", in Engle, R., F. and Granger, C., W., J. (eds), *Long-run Economic Relationships*, Oxford University Press, Oxford, pp. 267 – 276.

Mark, N., Ogaki, M. and Sul, D. (2005), “Dynamic Seemingly Unrelated Cointegration Regression”, *The Review of Economic Studies*, Vol. 72, No. 252, pp. 797 – 820.

Matousek, R., and Sarantis, N. (2009), “The Bank Lending Channel and Monetary Transmission in Central and Eastern European Countries”, *Journal of Comparative Economics*, Vol. 37, No. 2, pp. 321 – 334.

Maudos, J. and de Guevara, J., F. (2004), “Factors Explaining the Interest Margin in the Banking Sectors of the European Union”, *Journal of Banking and Finance*, Vol. 28, No. 9, pp. 2259 – 2281.

Merkl, C. and Stolz, S. (2006), “Bank's Regulatory Buffers, Liquidity Networks and Monetary Policy Transmission”, *Kiel Institute for the World Economy Working Paper*, No. 1303.

Milne, A. and Wood, G. (2009), “The Bank Lending Channel Reconsidered”, *Bank of Finland Research Discussion Papers*, No. 2/2009.

Mishkin, F., S. and Schmidt-Hebbel, K. (2006), “*Does Inflation Targeting Make a Difference?*”, Czech National Bank Working Paper Series, No. 13/2006.

Mishra, P., Montiel, P., J. and Spilimbergo, A. (2010), “Monetary Transmission in Low Income Countries”, *International Monetary Fund Working Paper Series*, No. 10/223.

Mojon, B. (2000), “Financial Structure and the Interest Rate Channel of European Central Bank Monetary Policy”, *European Central Bank Working Paper Series*, No. 40.

Molyneux, P. (1993), “Cooperation and Rivalry in European Banking”, *Institute of European Finance Research Papers in Banking and Finance*, No. 93/14, pp. 1 – 21.

Moon, H., R. and Perron, B. (2005), “Efficient Estimation of the SUR Cointegration Regression Model and Testing for Purchasing Power Parity”, *Econometrics Review*, Vol. 23, No. 4, pp. 293 – 323.

Moon, H., R. and Perron, B. (2006), “Seemingly Unrelated Regressions”, mimeo. Available online: http://mapageweb.umontreal.ca/perrob/palgrave.pdf (last accessed 13/10/2009).

More, C. and Nagy, M. (2003), “Relationship between Market Structure and Bank Performance: Empirical Evidence for Central and Eastern Europe”, *Magyar Nemzeti Bank Working Paper*, No. 2003/12.

Muller–Spahn, S. (2008), “The Pass–Through From Market Interest Rates to Retail Bank Rates in Germany”, *Centre for Finance and Credit Markets Working Paper*, No. 08/05.

National Bank of the Republic of Macedonia (1997), "*Annual Report 1997*", June 1997 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (1998), "*Annual Report 1998*", June 1998 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (1999 a), "*Annual Report 1999*", June 1999 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (1999,b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 1999*", June 1997 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2000 a), "*Annual Report 2000*", June 2000 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2000 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2000*", June 2000 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2001 a), "*Annual Report 2001*", June 2001 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2001 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2001*", June 2001 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2001 c), "*Quarterly Bulletin – IV/2001*", National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2002 a), "*Annual Report 2002*", June 2002 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2002 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2002*", June 2002 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2003 a), "*Annual Report 2003*", June 2003 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2003 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2003*", June 2003 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2004 a), "*Annual Report 2004*", June 2004 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2004 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2004*", June 2004 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2005 a), "*Annual Report 2005*", June 2005 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2005 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2005*", June 2005 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2006 a), "*Annual Report 2006*", June 2006 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2006 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2006*", June 2006 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2006 c), "*Bulletin 2006/4*", National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2006 d), "*Quarterly Bulletin – IV/2006*", National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2007 a), "*Annual Report 2007*", Skopje June 2007 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2007 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2007*", June 2007 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2007 c), "*Financial Stability Report for the Republic of Macedonia in 2007*", June 2007 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2008 a), "*Annual Report 2008*", Skopje June 2008 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2008 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2008*", June 2008 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2008 c), "*Financial Stability Report for the Republic of Macedonia in 2008*", June 2008 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2009 a), "*Annual Report 2009*", Skopje June 2009 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2009 b), "*Annual Report on Banking System and Banking Supervision of the Republic of Macedonia 2009*", June 2009 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2009 c), "*Financial Stability Report for the Republic of Macedonia in 2009*", June 2009 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2009 d), "*Credit Activity Survey April 2009*", April 2009 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2009 e), "*Credit Activity Survey July 2009*", July 2009 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2009 f), "*Credit Activity Survey October 2009*", October 2009 National Bank of the Republic of Macedonia, Skopje Macedonia.

National Bank of the Republic of Macedonia (2010), "*Credit Activity Survey January 2010*", January 2010 National Bank of the Republic of Macedonia, Skopje Macedonia.

Niggle, C., J. (1987), "A Comment on the Mark–up Theory of Bank Loan Rates", *Journal of Post Keynesian Economics*, Vol. 9, No. 4, pp. 629 – 631.

Official Gazette of the Republic of Macedonia No. 67/2007.

Papke, L., E. And Wooldridge, J., M. (2005), "A Computational Trick for Delta–method Standard Errors", *Economic Letters*, Vol. 86, Issue 3, pp. 413 – 417.

Peek, J. and Rosengren, E., S. (1995), "Bank Lending and the Transmission of Monetary Policy". In: "*Is Bank Lending Important for the Transmission of Monetary Policy? An Overview*", Conference series Federal Reserve Bank of Boston No. 39.

Petersen, M., A. and Rajan, R., G. (1994), "The Benefits of Lending Relationships: Evidence from Small Business Data", *The Journal of Finance*, Vol.49, No.1, pp. 3 – 37.

Phillips, P., C., B. and Sul, D. (2007), "Bias in Dynamic Panel Estimation with Fixed Effects, Incidental Trends and Cross Section Dependence", *Journal of Econometrics*, Vol. 137, No. 1, pp. 162 – 188.

Poghosyan, T. and Poghosyan, A. (2010), "Foreign Bank Entry, Bank Efficiency and Market Power in Central and Eastern European Countries", *Economics of Transition*, Vol. 18, No. 3, pp. 571 – 598.

Pruteanu–Podpiera, A. M. (2007), "The Role of Banks in the Czech Monetary Policy Transmission Mechanism", *Economics of Transition*, Vol. 15, No. 2, p. 393 – 428.

Pugh, G., Mangan, J. and Gray, J. (2010), "Do Increased Resources Increase Educational Attainment During a Period of Rising Expenditure? Evidence from English secondary schools using a dynamic panel analysis", *British Educational Research Journal*, iFirst Article on 03/03/2010. Available online: http://dx.doi.org/10.1080/01411920903452563 (last accessed 11 March 2010).

Roodman, D. (2005), "XTABOND2: Stata Module to Extend Xtabond Dynamic Panel Estimator". Available online: http://econpapers.repec.org/software/bocbocode/s435901.htm (last time accessed 21/02/2010).

Roodman, D. (2009, a), "How to do xtabond2: An Introduction to Difference and System GMM in STATA", *The Stata Journal*, Vol. 9, No. 1, pp. 86 – 136.

Roodman, D. (2009, b), "A Note on the Theme of too Many Instruments", *Oxford Bulletin of Economics and Statistics*, Vol. 71, Issue 1, pp. 135 – 158.

Rousseas, S. (1985), "A Mark–up Theory of Bank Loan Rates", *Journal of Post Keynesian Economics*, Vol. 8, No. 1, pp. 135 – 144.

Sander, H. and Kleimeier, S. (2004 a), "Convergence in Euro–Zone Retail Banking? What Interest Rate Pass–Through Tells Us about Monetary Policy Transmission, Competition and Integration", *Journal of International Money and Finance*, Vol. 23, No. 3, pp. 461 – 492.

Sander, H. and Kleimeier, S. (2004 b), "Interest Rate Pass–Through in and Enlarged Europe: The Role of Banking Market Structure for Monetary Policy Transmission in Transition Countries", *Limburg Institute of Financial Economics Working Paper*, (fortcoming). Available online: http://edocs.ub.unimaas.nl/loader/file.asp?id=953 (last accessed 21/01/2010).

Sarafidis, V., Yamagata, T. and Robertson, R. (2006), "A Test of Cross–section Dependence for a Linear Dynamic Panel Model with Regressors", Faculty of Economics, University of Cambridge. Available online: http://www.econ.cam.ac.uk/faculty/robertson/HCSDtest14Feb06.pdf (last accessed 3 April 2009).

Saunders, A. and Schumacher, L. (2000), "The Determinants of Bank Interest Rate Margins: an International Study", *Journal of International Money and Finance*, Vol. 19, No. 6, pp. 813 – 832.

Schmitz, B. (2004), "What Role Banks Play in Monetary Policy Transmission in EU New Member Countries?", Available online: http://www.mnb.hu/Root/Dokumentumtar/MNB/Kutatas/mnbhu_konf_fomenu/mnbhu_konf0410/schmitz.pdf (last accessed: 09/11/2010).

Sharpe, S., A. (1997), "The Effect of Consumer Switching Costs on Prices: A Theory and its Application to the Bank Deposit Market", *Review of Industrial Organization*, Vol. 12, No. 1, pp. 79 – 94.

Sorensen, C., K. and Werner, T. (2006), "Interest Rate Pass–Through in the Euro Area, a Cross Country Comparison", *European Central Bank Working Paper Series*, No. 580.

Sriram, S., S. (1999), "Survey on Literature on Demand for Money: Theoretical and Empirical Work with Special Reference to Error–Correction Models", *International Monetary Fund Working Paper*, No. 99/64.

Stiglitz, J., E. and Weiss, A. (1981), "Credit Rationing in Markets with Imperfect Information", *American Economic Review*, Vol. 71, No. 3, pp. 393 – 410.

Stock, J. and Watson, M., W. (1993), "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems", *Econometrica*, Vol. 6, No. 4, pp. 783 – 820.

Swamy, P., A., V., B. (1970), "Efficient Inference in a Random Coefficient Regression Model", *Econometrica*, Vol. 38, No. 2, pp. 311 – 323.

Theil, H. (1957), "Specification Errors and the Estimation of Economic Relationships", *Review of International Statistical Institute*, Vol. 25, No. 1, pp. 41 – 51.

Thompson, S., R., Sul, D. and Bohl, M., T. (2002), "Spatial Market Efficiency and Policy Regime Change: Seemingly Unrelated Error Correction Model Estimation", American *Journal of Agricultural Economics*, Vol. 84, No. 4, pp. 1042 – 1053.

Topi, J. and Vilmunen, J. (2003), "Transmission of Monetary Policy Shocks in Finland: Evidence from Bank Level Data on Loans". In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 372 – 381.

Trajkovic, M. (2006), "Aims and Instruments of the Monetary Policy: Recent Experiences" *National Bank of the Republic of Macedonia Working Paper*, No. 16.

Vaskov, M., Georgievska, Lj., Kabasi, R., Manova–Trajkovska, N. and Mitreska, A. (2010), "The Determinants of the Lending Interest Rates and Interest Rate Spread in the Republic of Macedonia", *National Bank of the Republic of Macedonia Working paper*, August 2010.

Velickovski, I. (2006), "Monetary Transmission Through the Interest Rate Channel and the Financial Markets in Macedonia: What Have we Done, What Have we Achieved and What Have we Learned?" *National Bank of the Republic of Macedonia Working Paper*, No. 17.

Velickovski, I. (2010), "*Potential Costs of Euro Adoption for Transition Countries: A Case Study for Macedonia*", VDM Publishing, Frankfurt.

Vesala, T. (2005), "Relationship Lending and Competition: Higher Switching Cost Does not Necessarily Imply Greater Relationship Benefits", *Bank of Finland Research Discussion Papers*, No. 3/2005.

Vogelvang, B. (2005), "*Econometrics Theory and Applications with EViews*", Pearson Education Limited, Harlow.

Westerlund, J. (2003), "A Panel Data Test of the Bank Lending Channel in Sweden", *Scandinavian Working Papers in Economics*, No. 2003:16.

Weth, M., A. (2002), "The Pass–Through from Matket Interest Rates to Bank Lending Rates in Germany", *Deutsche Bundesbank Discussion paper*, No. 11/02.

Windmeijer, F. (2005), "A Finite Sample Correction for the Variance of Linear Efficient Two–step GMM Estimators", *Journal of Econometrics*, Vol. 126, No. 1, pp. 25 – 51.

Wooldridge, J., M. (2002), "*Econometric Analysis of Cross Section and Panel Data*", 1st edition, The MIT Press, Cambridge Massachusetts.

Worms, A. (2003), "The Reaction of Bank Lending to Monetary Policy Measures in Germany". In: Angeloni, I., Kashyap, A., Mojon, B., K. (Eds.), "*Monetary Policy in the Euro Area*", Cambridge University Press, Cambridge 2003, pp. 270 – 283.

Wrobel, E. and Pawlowska, M. (2002), "Monetary Transmission in Poland: Some Evidence on Interest Rate and Credit Channels", *National Bank of Poland Working Paper*, No. 24.

Zellner, A. (1962), "An Efficient Method of Estimating Seemingly Unrelated Regression Equations and Tests of Aggregation Bias", *Journal of the American Statistical Association*, Vol. 57, No. 298, pp. 348 – 368.

Zellner, A. (1963), "Estimators for Seemingly Unrelated Regression Equations: Some Finite Sample Results", *Journal of the American Statistical Association*, Vol. 58, No. 304, pp. 977 – 992.

STAFFORDSHIRE UNIVERSITY
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ECONOMICS

THE INTEREST RATE AND BANK LENDING CHANNELS IN A SMALL, OPEN AND EUROISED ECONOMY WITH FIXED EXCHANGE RATE – THE CASE OF MACEDONIA

- APPENDICES -

JANE BOGOEV

A thesis submitted in partial fulfilment of the requirement of Staffordshire University for the degree of Doctor of Philosophy

June, 2011

APPENDICES

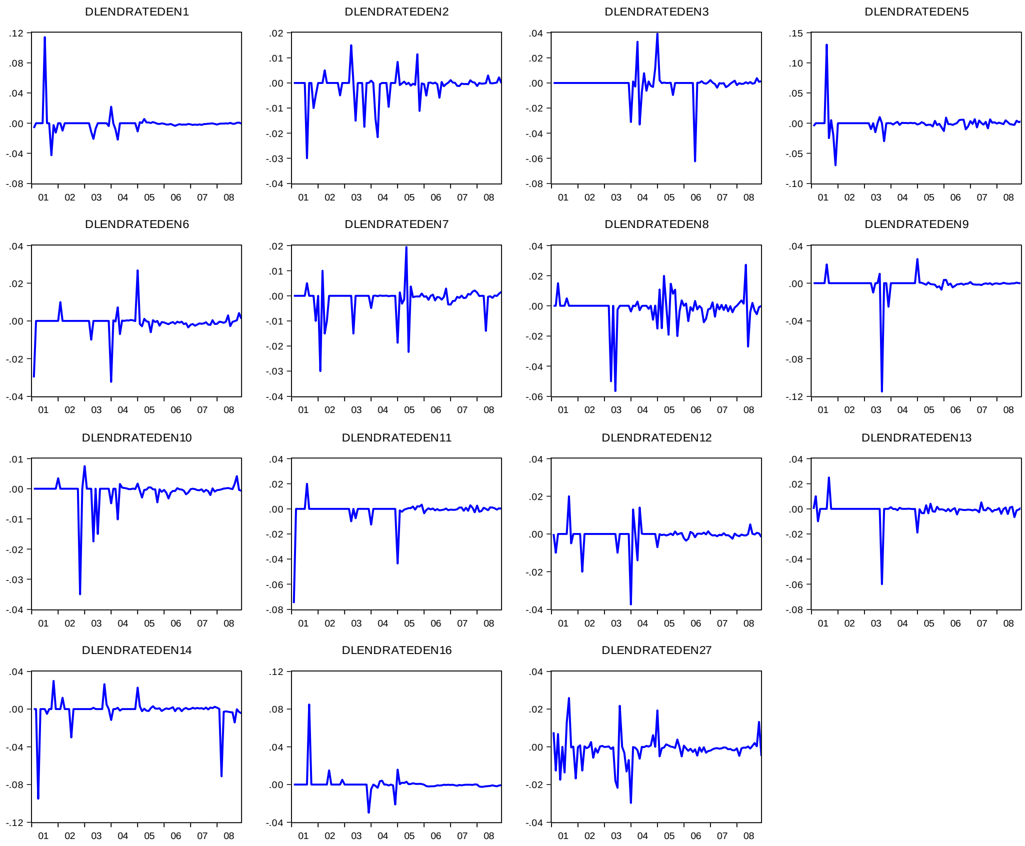
APPENDIX A: APPENDICES FROM CHAPTER 3

Appendix 3.1: Results for the cointegration relationship between banks' lending rates and 'cost of funds' rate.

Bank:	Engle-Granger test for cointegration between banks' lending rate and money market rate		Estimate of the Error Correction Term (ECT) from the Error Correction Model (ECM)	
	Estimated t-statistics	Rejection of the null hypothesis of non-cointegration at 10% level	Value of the ECT coefficient	t-statistics
bank 1	-1.755	NO	-0.157	-1.241
bank 2	-2.404	NO	-0.126**	-2.051
bank 3	-2.373	NO	-0.053	-0.600
bank 5	-2.019	NO	-0.082	-1.080
bank 6	-1.911	NO	-0.068	-0.647
bank 7	-3.360	YES	-0.132**	-2.359
bank 8	-3.465	YES	-0.171**	-2.092
bank 9	-2.050	NO	-0.107	-1.309
bank 10	-1.668	NO	-0.086	-1.108
bank 11	-2.389	NO	-0.072	-0.911
bank 12	-5.040	YES	-0.145**	-2.071
bank 13	-2.117	NO	-0.078	-0.845
bank 14	-0.986	NO	-0.035	-0.730
bank 16	-2.103	NO	-0.019	-0.246
bank 27	-2.256	NO	-0.105	-1.280

Note: critical values of the Engle-Granger cointegration test adjusted for a small sample according to MacKinnon (1991): for the 10% level of significance: 2.583; for the 5% level of sigifcance: 2.891.
Source: author's own calculations performed in Eviews 6
** significant at 5% level.

Appendix 3.2: Figures of 1st differences of the loan interest rates of the Macedonian banks for the period 2001-2008.



Source: author's own calculation based upon the data from NBRM.

Appendix 3.3: Unit root tests of the variables that enter in model 3.1 and diagnostic tests of unit root tests for the interets rate series (banks' lending rates and 'cost of funds' rate).

a) Unit root tests of the macroeconomic control and banks' specific variables that enter in equation 3.1.

Variable:	Augmented Dickey-Fuller (ADF) test with constant and trend		Augmented Dickey-Fuller (ADF) test with constant		Phillips-Perron (PP) test with constant and trend	Phillips-Perron (PP) test with constant	Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test with constant and trend	Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test with constant
	Lag length selection criteria: Akaike	Lag length selection criteria: Schwarz	Lag length selection criteria: Akaike	Lag length selection criteria: Schwarz				
dmbksinfl	-6.83***	-5.01***	-7.02***	-4.99***	-5.1***	-5.07***	0.107	0.148
dmbksipi	-5.85***	-7.71***	-6.05***	-7.5***	-7.82***	-7.66***	0.061	0.217
dmbkslhhi	-5.44***	-5.44***	-5.45***	-5.45***	-5.47***	-5.48***	0.072	0.082
dmbkslassets1	-5.43***	-5.43***	-5.45***	-5.45***	-5.46***	-5.48***	0.072	0.081
dmbksliquidity1	-4.76***	-5.62***	-5.65***	-5.65***	-5.62***	-5.65***	0.049	0.048
dmbkscapital1	-5.17***	-5.17***	-5.17***	-5.17***	-5.13***	-5.13***	0.074	0.095
dmbksNPLratio1	-5.44***	-5.51***	-5.07***	-5.54***	-5.21***	-5.24***	0.047	0.045
dmbksmatmisub1	-4.34***	-6.69***	-4.36***	-6.72***	-6.95***	-6.98***	0.108	0.121
dmbksrellending1	-5.7***	-5.7***	-5.69***	-5.69***	-5.72***	-5.7***	0.105	0.143
dmbksportdiv1	-5.3***	-5.3***	-5.31***	-5.31***	-5.4***	-5.41***	0.074	0.085
dmbkslassets2	-5.45***	-5.45***	-5.47***	-5.47***	-5.48***	-5.49***	0.072	0.081
dmbksliquidity2	-5.74***	-5.74***	-5.77***	-5.77***	-5.79***	-5.82***	0.064	0.065
dmbkscapital2	-4.86***	-5.03***	-4.78***	-5.01***	-5.03***	-5***	0.078	0.119
dmbksNPLratio2	-5.72***	-5.72***	-5.72***	-5.72***	-5.79***	-5.78***	0.08	0.116
dmbksmatmisub2	-4.42***	-6.49***	-4.44***	-6.53***	-6.71***	-6.74***	0.125	0.124
dmbksrellending2	-5.63***	-5.63***	-5.66***	-5.66***	-5.66***	-5.68***	0.083	0.09
dmbksportdiv2	-5.43***	-5.43***	-5.44***	-5.44***	-5.5***	-5.51***	0.077	0.087
dmbkslassets3	-5.47***	-5.47***	-5.49***	-5.49***	-5.5***	-5.51***	0.069	0.077
dmbksliquidity3	-5.19***	-5.19***	-5.18***	-5.18***	-5.23***	-5.21***	0.088	0.125
dmbkscapital3	-5.18***	-5.18***	-5.13***	-5.13***	-5.26***	-5.2***	0.095	0.179
dmbksNPLratio3	-5.36***	-5.36***	-5.36***	-5.36***	-5.43***	-5.43***	0.085	0.107
dmbksmatmisub3	-3.43*	-3.43*	-3.65***	-3.65***	-7.57***	-7.43***	0.105	0.216
dmbksrellending3	-2.89*	-7.52***	-3.06**	-7.46***	-7.7***	-7.67***	0.105	0.159
dmbksportdiv3	-5.3***	-5.3***	-5.29***	-5.29***	-5.33***	-5.32***	0.091	0.118
dmbkslassets5	-5.43***	-5.43***	-5.45***	-5.45***	-5.46***	-5.47***	0.072	0.082
dmbksliquidity5	-5.28***	-5.28***	-5.3***	-5.3***	-5.2***	-5.22***	0.065	0.07
dmbkscapital5	-5.43***	-5.43***	-5.44***	-5.44***	-5.37***	-5.37***	0.067	0.079
dmbksNPLratio5	-4.85***	-5.08***	-4.59***	-5.1***	-4.65***	-4.66***	0.066	0.071
dmbksmatmisub5	-5.72***	-5.72***	-5.75***	-5.75***	-5.77***	-5.8***	0.071	0.073
dmbksrellending5	-5.84***	-5.84***	-5.85***	-5.85***	-5.83***	-5.85***	0.088	0.099
dmbksportdiv5	-5.33***	-5.33***	-5.35***	-5.35***	-5.37***	-5.39***	0.073	0.081
dmbkslassets6	-5.46***	-5.46***	-5.47***	-5.47***	-5.49***	-5.5***	0.072	0.081
dmbksliquidity6	-5.19***	-5.44***	-5.1***	-5.45***	-5.39***	-5.39***	0.063	0.083
dmbkscapital6	-4.98***	-5.02***	-5.02***	-5.02***	-5.01***	-4.99***	0.076	0.107
dmbksNPLratio6	-6.39***	-4.91***	-6.18***	-4.89***	-4.92***	-4.89***	0.071	0.11
dmbksmatmisub6	-5.46***	-5.46***	-5.48***	-5.48***	-5.54***	-5.55***	0.074	0.08
dmbksrellending6	-6.37***	-6.37***	-6.41***	-6.41***	-6.36***	-6.39***	0.079	0.079
dmbksportdiv6	-5.39***	-5.39***	-5.4***	-5.4***	-5.42***	-5.34***	0.068	0.082
dmbkslassets7	-5.47***	-5.47***	-5.49***	-5.49***	-5.5***	-5.51***	0.072	0.08
dmbksliquidity7	-4.87***	-5.59***	-4.69***	-5.62***	-5.49***	-5.51***	0.053	0.054
dmbkscapital7	-4.89***	-4.89***	-4.85***	-4.85***	-4.92***	-4.86***	0.08	0.154
dmbksNPLratio7	-4.2***	-4.2***	-4.13***	-4.13***	-4.43***	-4.34***	0.113	0.199
dmbksmatmisub7	-4.34***	-4.34***	-4.03***	-4.03***	-4.34***	-4.03***	0.138	0.407
dmbksrellending7	-4.69***	-6.89***	-4.71***	-6.93***	-7.08***	-7.12***	0.104	0.103
dmbksportdiv7	-5.32***	-5.32***	-5.33***	-5.33***	-5.36***	-5.36***	0.071	0.086

Continued on next page.

Variable:	Augmented Dickey-Fuller (ADF) test with constant and trend		Augmented Dickey-Fuller (ADF) test with constant		Phillips-Perron (PP) test with constant and trend	Phillips-Perron (PP) test with constant	Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test with constant and trend	Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test with constant
	Lag length selection criteria: Akaike	Lag length selection criteria: Schwarz	Lag length selection criteria: Akaike	Lag length selection criteria: Schwarz				
dmbkslassets8	-5.43***	-5.43***	-5.45***	-5.45***	-5.46***	-5.48***	0.072	0.082
dmbksliquidity8	-5.51***	-5.51***	-5.54***	-5.54***	-5.58***	-5.61***	0.08	0.08
dmbkscapital8	-5.28***	-5.28***	-5.29***	-5.29***	-5.33***	-5.33***	0.072	0.092
dmbksNPLratio8	-5.6***	-5.6***	-5.62***	-5.62***	-5.65***	-5.66***	0.072	0.083
dmbksmatmisub8	-4.16***	-4.16***	-4.17***	-4.17***	-6.56***	-6.56***	0.132	0.176
dmbksrellending8	-4.21***	-6.39***	-4.23***	-6.42***	-6.64***	-6.67***	0.114	0.112
dmbksportdiv8	-5.24***	-5.24***	-5.25***	-5.25***	-5.34***	-5.35***	0.076	0.086
dmbkslassets9	-5.44***	-5.44***	-5.45***	-5.45***	-5.47***	-5.48***	0.072	0.083
dmbksliquidity9	-5.21***	-5.76***	-5.11***	-5.79***	-5.48***	-5.52***	0.042	0.042
dmbkscapital9	-5.96***	-5.96***	-5.98***	-5.98***	-5.96***	-5.98***	0.074	0.079
dmbksNPLratio9	-3.77**	-3.77**	-3.73***	-3.73***	-10.96***	-10.97***	0.071	0.11
dmbksmatmisub9	-3.48**	-3.77**	-3.31**	-3.53***	-3.79**	-3.53***	0.136	0.353
dmbksrellending9	-4.64***	-6.47***	-4.66***	-6.5***	-6.55***	-6.58***	0.103	0.109
dmbksportdiv9	-5.31***	-5.31***	-5.33***	-5.33***	-5.38***	-5.4***	0.086	0.088
dmbkslassets10	-5.46***	-5.46***	-5.47***	-5.47***	-5.49***	-5.5***	0.073	0.082
dmbksliquidity10	-5.32***	-5.32***	-5.34***	-5.34***	-5.24***	-5.27***	0.059	0.063
dmbkscapital10	-5.17***	-5.25***	-5.02***	-5.25***	-5.22***	-5.21***	0.069	0.094
dmbksNPLratio10	-4.16***	-6.06***	-4.19***	-6.07***	-6.1***	-6.11***	0.099	0.121
dmbksmatmisub10	-6***	-6***	-6.02***	-6.02***	-6.05***	-6.07***	0.065	0.074
dmbksrellending10	-5.56***	-5.56***	-5.58***	-5.58***	-5.58***	-5.6***	0.07	0.078
dmbksportdiv10	-5.31***	-5.31***	-5.32***	-5.32***	-5.4***	-5.41***	0.078	0.085
dmbkslassets11	-5.47***	-5.47***	-5.49***	-5.49***	-5.5***	-5.51***	0.071	0.08
dmbksliquidity11	-5.8***	-5.8***	-5.83***	-5.83***	-5.78***	-5.74***	0.055	0.056
dmbkscapital11	-4.8***	-4.8***	-4.77***	-4.77***	-4.92***	-4.88***	0.087	0.142
dmbksNPLratio11	-5.97***	-5.97***	-5.99***	-5.99***	-5.97***	-5.99***	0.077	0.088
dmbksmatmisub11	-5.4***	-5.4***	-5.42***	-5.42***	-5.49***	-5.46***	0.074	0.079
dmbksrellending11	-5.21***	-5.21***	-5.22***	-5.22***	-5.26***	-5.26***	0.078	0.092
dmbksportdiv11	-5.32***	-5.32***	-5.33***	-5.33***	-5.36***	-5.37***	0.07	0.079
dmbkslassets12	-5.44***	-5.44***	-5.46***	-5.46***	-5.47***	-5.48***	0.072	0.082
dmbksliquidity12	-5.84***	-5.84***	-5.88***	-5.88***	-5.84***	-5.88***	0.075	0.077
dmbkscapital12	-5.26***	-5.26***	-5.27***	-5.27***	-5.31***	-5.31***	0.072	0.091
dmbksNPLratio12	-6.56***	-6.56***	-6.57***	-6.57***	-6.54***	-6.54***	0.046	0.078
dmbksmatmisub12	-5.32***	-5.32***	-5.33***	-5.33***	-5.36***	-5.36***	0.066	0.085
dmbksrellending12	-5.37***	-5.37***	-5.38***	-5.38***	-5.4***	-5.35***	0.065	0.089
dmbksportdiv12	-5.21***	-5.21***	-5.22***	-5.22***	-5.26***	-5.27***	0.076	0.089
dmbkslassets13	-5.45***	-5.45***	-5.47***	-5.47***	-5.48***	-5.49***	0.071	0.081
dmbksliquidity13	-4.53***	-6.63***	-3.92***	-6.54***	-6.72***	-6.66***	0.091	0.187
dmbkscapital13	-5.07***	-5.07***	-5.06***	-5.06***	-5.14***	-5.12***	0.081	0.112
dmbksNPLratio13	-4.72***	-4.66***	-4.43***	-4.65***	-4.79***	-4.76***	0.079	0.108
dmbksmatmisub13	-5.73***	-5.73***	-5.74***	-5.74***	-5.8***	-5.81***	0.067	0.079
dmbksrellending13	-5.9***	-5.9***	-5.94***	-5.94***	-5.95***	-5.98***	0.067	0.066
dmbksportdiv13	-4.4***	-6.86***	-6.71***	-6.71***	-6.89***	-6.74***	0.101	0.237
dmbkslassets14	-5.41***	-5.41***	-5.43***	-5.43***	-5.45***	-5.46***	0.071	0.082
dmbksliquidity14	-5.89***	-5.89***	-5.5***	-6.73***	-6.47***	-6.5***	0.032	0.234
dmbkscapital14	-5.41***	-5.41***	-5.43***	-5.43***	-5.45***	-5.46***	0.074	0.083
dmbksNPLratio14	-5.96***	-5.94***	-6***	-5.96***	-5.47***	-5.5***	0.119	0.128
dmbksmatmisub14	-6.61***	-6.61***	-6.65***	-6.65***	-6.67***	-6.7***	0.077	0.077
dmbksrellending14	-5.15***	-5.15***	-5.13***	-5.13***	-5.19***	-5.16***	0.109	0.148
dmbksportdiv14	-5.33***	-5.33***	-5.35***	-5.35***	-5.42***	-5.44***	0.072	0.078
dmbkslassets16	-5.42***	-5.42***	-5.44***	-5.44***	-5.45***	-5.46***	0.072	0.082
dmbksliquidity16	-5.36***	-5.36***	-5.37***	-5.37***	-5.45***	-5.45***	0.079	0.096
dmbkscapital16	-5.63***	-5.63***	-5.64***	-5.64***	-5.68***	-5.69***	0.074	0.088
dmbksNPLratio16	-7.43***	-7.43***	-7.36***	-7.36***	-6.49***	-6.33***	0.051	0.132
dmbksmatmisub16	-4.24***	-4.24***	-4.25***	-4.25***	-6.32***	-6.32***	0.096	0.128
dmbksrellending16	-5.62***	-5.62***	-5.63***	-5.63***	-5.63***	-5.65***	0.068	0.08
dmbksportdiv16	-5.78***	-5.78***	-5.81***	-5.81***	-5.83***	-5.86***	0.063	0.066
dmbkslassets27	-5.43***	-5.43***	-5.44***	-5.44***	-5.46***	-5.47***	0.072	0.083
dmbksliquidity27	-5.58***	-5.58***	-5.61***	-5.61***	-5.64***	-5.67***	0.058	0.057
dmbkscapital27	-4.86***	-5.4***	-4.75***	-5.41***	-5.32***	-5.33***	0.064	0.076
dmbksNPLratio27	-5.93***	-5.25***	-5.38***	-5.25***	-5.03***	-5.02***	0.065	0.087
dmbksmatmisub27	-5.09***	-5.09***	-5.09***	-5.09***	-5.14***	-5.13***	0.096	0.119
dmbksrellending27	-6.01***	-6.01***	-6.04***	-6.04***	-6.01***	-6.05***	0.091	0.092
dmbksportdiv27	-6.04***	-6.04***	-6.06***	-6.06***	-5.91***	-5.93***	0.084	0.094

Notes: for the ADF and PP tests, ***/**/* denotes rejection of the the null hypothesis of unit root at 1%, 5% and 10% level of significance respectively, whereas for the KPSS test, ***/**/* denotes rejection of the the null hypothesis of no unit root at 1%, 5% and 10% level of significance respectively.
Source: author’s own calculations performed in Eviews 6.

b) Unit root tests and diagnostic tests of the unit root test (ADF) of the interest rate series (banks' lending rates and 'cost of funds' rate) that enter in equation 3.1.

Variable:	Augmented Dickey-Fuller (ADF) test with constant			Phillips-Perron (PP) test with constant	Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test with constant
		Lag length selection criteria	Number of lags		
dmbks	-4.59***	aic	4	-5.46***	0.08
dlendrateden1	-4.23***	aic	8	-9.28***	0.14
dlendrateden2	-2.91**	aic	8	-9.28***	0.27
dlendrateden3	-3.19**	aic	8	-10.33***	0.06
dlendrateden5	-4.06***	aic	10	-10.51***	0.04
dlendrateden6	-3.61***	aic	9	-11.76***	0.07
dlendrateden7	-2.95**	aic	8	-12.98***	0.15
dlendrateden8	-3.13**	aic	7	-11.06***	0.08
dlendrateden9	-3.01**	aic	7	-10.4***	0.09
dlendrateden10	-4.83***	aic	4	-9.99***	0.20
dlendrateden11	-3.29***	aic	6	-16.8***	0.17
dlendrateden12	-4.05***	aic	8	-12.74***	0.08
dlendrateden13	-3.18**	aic	6	-10.05***	0.10
dlendrateden14	-3.04**	aic	7	-9.44***	0.15
dlendrateden16	-3.68***	aic, sic	7	-9.7***	0.35
dlendrateden27	-2.92**	aic, sic	9	-9.94***	0.13

Diagnostic tests of the ADF unit root test			
Variable:	Breusch-Pagan-Godfrey test for autocorrelation (p-value)	Ramsey RESET test for functional form (p-value)	Koenker-Bassett test for heteroskedasticity (p-value)
dmbks	0.51	0.49	0.20
dlendrateden1	0.16	0.45	0.89
dlendrateden2	0.86	0.25	0.48
dlendrateden3	0.88	0.44	0.90
dlendrateden5	0.81	0.47	0.75
dlendrateden6	0.40	0.39	0.97
dlendrateden7	0.14	0.12	0.39
dlendrateden8	0.99	0.62	0.80
dlendrateden9	0.99	0.11	0.97
dlendrateden10	0.60	0.59	0.81
dlendrateden11	0.88	0.69	0.87
dlendrateden12	0.54	0.56	0.82
dlendrateden13	0.97	0.62	0.88
dlendrateden14	0.12	0.90	0.87
dlendrateden16	0.52	0.71	0.51
dlendrateden27	0.20	0.73	0.11

Notes: for the ADF and PP tests, ***/**/* denotes rejection of the the null hypothesis of unit root at 1%, 5% and 10% level of significance respectively, whereas for the KPSS test, ***/**/* denotes rejection of the the null hypothesis of no unit root at 1%, 5% and 10% level of significance respectively.
Source: author's own calculations performed in Eviews 6.

Appendix 3.4: Estimation output of the final model specification by using SUR model with FGLS estimator, including the Breusch-Pagan test and the F-tests for the joint significance of the regressors in the model.

```
. sureg (dlendrateden1= l.dmbks l.dmbkslassets1 l.dmbksliquidity1  l.dmbkscapital1
l.dmbksNPLratio1 l.dmbksma
> tmisub1 l.dmbksrellending1 l.dmbksportdiv1  l.dmbksinfl l.dmbksipi l.dmbkslhhi)
/*
> */ (dlendrateden2= l.dmbks l.dmbkslassets2 l.dmbksliquidity2  l.dmbkscapital2
l.dmbksNPLratio2 l.dmbksmatmi
> sub2 l.dmbksrellending2 l.dmbksportdiv2 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden3= l.dmbks l.dmbkslassets3 l.dmbksliquidity3  l.dmbkscapital3
l.dmbksNPLratio3 l.dmbksmatmi
> sub3 l.dmbksrellending3 l.dmbksportdiv3 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden5= l.dmbks l.dmbkslassets5 l.dmbksliquidity5  l.dmbkscapital5
l.dmbksNPLratio5 l.dmbksmatmi
> sub5 l.dmbksrellending5 l.dmbksportdiv5 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden6= l.dmbks l.dmbkslassets6 l.dmbksliquidity6  l.dmbkscapital6
l.dmbksNPLratio6 l.dmbksmatmi
> sub6 l.dmbksrellending6 l.dmbksportdiv6 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden7= l.dmbks l.dmbkslassets7 l.dmbksliquidity7  l.dmbkscapital7
l.dmbksNPLratio7 l.dmbksmatmi
> sub7 l.dmbksrellending7 l.dmbksportdiv7 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden8= l.dmbks l.dmbkslassets8 l.dmbksliquidity8  l.dmbkscapital8
l.dmbksNPLratio8 l.dmbksmatmi
> sub8 l.dmbksrellending8 l.dmbksportdiv8 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden9= l.dmbks l.dmbkslassets9 l.dmbksliquidity9  l.dmbkscapital9
l.dmbksNPLratio9 l.dmbksmatmi
> sub9 l.dmbksrellending9 l.dmbksportdiv9 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
>   */   (dlendrateden10=   l.dmbks   l.dmbkslassets10   l.dmbksliquidity10
l.dmbkscapital10 l.dmbksNPLratio10 l.dmbks
>  matmisub10  l.dmbksrellending10  l.dmbksportdiv10  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi) /*
>   */   (dlendrateden11=   l.dmbks   l.dmbkslassets11   l.dmbksliquidity11
l.dmbkscapital11 l.dmbksNPLratio11 l.dmbks
>  matmisub11  l.dmbksrellending11  l.dmbksportdiv11  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi) /*
>   */   (dlendrateden12=   l.dmbks   l.dmbkslassets12   l.dmbksliquidity12
l.dmbkscapital12 l.dmbksNPLratio12 l.dmbks
>  matmisub12  l.dmbksrellending12  l.dmbksportdiv12  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi) /*
>   */   (dlendrateden13=   l.dmbks   l.dmbkslassets13   l.dmbksliquidity13
l.dmbkscapital13 l.dmbksNPLratio13 l.dmbks
>  matmisub13  l.dmbksrellending13  l.dmbksportdiv13  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi) /*
>   */   (dlendrateden14=   l.dmbks   l.dmbkslassets14   l.dmbksliquidity14
l.dmbkscapital14 l.dmbksNPLratio14 l.dmbks
>  matmisub14  l.dmbksrellending14  l.dmbksportdiv14  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi) /*
>   */   (dlendrateden16=   l.dmbks   l.dmbkslassets16   l.dmbksliquidity16
l.dmbkscapital16 l.dmbksNPLratio16 l.dmbks
>  matmisub16  l.dmbksrellending16  l.dmbksportdiv16  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi) /*
>   */   (dlendrateden27=   l.dmbks   l.dmbkslassets27   l.dmbksliquidity27
l.dmbkscapital27 l.dmbksNPLratio27 l.dmbks
>  matmisub27  l.dmbksrellending27  l.dmbksportdiv27  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi) /*
> */  , small corr
```

```
Seemingly unrelated regression
----------------------------------------------------------------------
Equation          Obs  Parms        RMSE    "R-sq"     F-Stat        P
----------------------------------------------------------------------
dlendrate~n1       94     11    .0098268    0.5076       9.84   0.0000
dlendrate~n2       94     11    .0052423    0.2143       3.32   0.0002
dlendrate~n3       94     11    .0098832    0.1099       1.59   0.0950
dlendrated~5       94     11    .0122105    0.5135      10.45   0.0000
dlendrate~n6       94     11    .0045411    0.2291       3.53   0.0001
dlendrate~n7       94     11    .0059765    0.0467       0.64   0.7924
dlendrated~8       94     11    .0092397    0.2944       3.75   0.0000
dlendrated~9       94     11    .0126656    0.1280       2.86   0.0010
dlendrate~10       94     11    .0047583    0.0472       0.62   0.8096
dlendrate~11       94     11    .0054517    0.0841       1.63   0.0841
dlendrate~12       94     11    .0052273    0.2691       2.86   0.0010
dlendrate~13       94     11    .0073939    0.0921       1.58   0.0996
dlendrate~14       94     11    .0135382    0.1476       2.29   0.0090
dlendrate~16       94     11    .0094686    0.2008       2.41   0.0059
dlendrate~27       94     11    .0070736    0.1915       2.33   0.0077
----------------------------------------------------------------------
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
dlendrate~n1 |
       dmbks |
         L1. |   92.34472   49.77309     1.86   0.064    -5.304826    189.9943
dmbkslass~s1 |
         L1. |  -10.06286   2.827524    -3.56   0.000    -15.61017   -4.515558
dmbksliqu~y1 |
         L1. |   33.72923   5.707048     5.91   0.000      22.5326    44.92585
dmbkscapi~l1 |
         L1. |   27.58731   24.23432     1.14   0.255    -19.95787    75.13249
dmbksNPLr~o1 |
         L1. |  -26.19527   5.048149    -5.19   0.000    -36.09921   -16.29133
dmbksmatm~b1 |
         L1. |  -.1242323   .1587401    -0.78   0.434    -.4356636     .187199
dmbksrell~g1 |
         L1. |  -11.42973    5.05366    -2.26   0.024    -21.34448   -1.514986
dmbksport~v1 |
         L1. |  -9.663811   3.294637    -2.93   0.003    -16.12754   -3.200082
   dmbksinfl |
         L1. |   48.03154    10.4692     4.59   0.000     27.49207    68.57101
    dmbksipi |
         L1. |   2.590553   1.353466     1.91   0.056    -.0648055    5.245911
   dmbkslhhi |
         L1. |   12.07293   4.723695     2.56   0.011     2.805538    21.34032
       _cons |  -.0020565    .001021    -2.01   0.044    -.0040596   -.0000534
-------------+----------------------------------------------------------------
dlendrate~n2 |
       dmbks |
         L1. |   91.39723   50.74899     1.80   0.072     -8.16694    190.9614
dmbkslass~s2 |
         L1. |  -2.947832   2.922086    -1.01   0.313    -8.680656    2.784992
dmbksliqu~y2 |
         L1. |  -3.818499   3.237984    -1.18   0.239    -10.17108    2.534084
dmbkscapi~l2 |
         L1. |  -36.34179   17.37047    -2.09   0.037    -70.42082   -2.262754
dmbksNPLr~o2 |
         L1. |   1.000415   2.670289     0.37   0.708    -4.238411    6.239241
dmbksmatm~b2 |
         L1. |  -.3772697   .2866432    -1.32   0.188    -.9396335     .185094
dmbksrell~g2 |
         L1. |   15.79901   5.151273     3.07   0.002     5.692752    25.90526
dmbksport~v2 |
         L1. |   3.600758   2.389687     1.51   0.132    -1.087555    8.289071
   dmbksinfl |
         L1. |   6.637038   6.350807     1.05   0.296    -5.822575    19.09665
    dmbksipi |
         L1. |   1.909042   .7221425     2.64   0.008     .4922744    3.325809
   dmbkslhhi |
         L1. |  -5.702319   1.908993    -2.99   0.003    -9.447562   -1.957075
       _cons |  -.0009372   .0005325    -1.76   0.079     -.001982    .0001076
```

```
-------------+----------------------------------------------------------------
dlendrate~n3 |
       dmbks |
         L1. |  -52.48381   20.00828    -2.62   0.009    -91.73796   -13.22967
dmbksslass~s3 |
         L1. |   1.019202   .5719661     1.78   0.075    -.1029352    2.141339
dmbksliqu~y3 |
         L1. |   .0315741   1.336027     0.02   0.981     -2.58957    2.652719
dmbkscapi~l3 |
         L1. |    .919978   1.974989     0.47   0.641    -2.954742    4.794698
dmbksNPLr~o3 |
         L1. |  -1.900977   1.042798    -1.82   0.069    -3.946837    .1448825
dmbksmatm~b3 |
         L1. |  -.2190124   .9518129    -0.23   0.818    -2.086369    1.648344
dmbksrell~g3 |
         L1. |  -8.625943   9.862118    -0.87   0.382    -27.97438    10.72249
dmbksport~v3 |
         L1. |   2.022085   1.363841     1.48   0.138    -.6536271    4.697797
   dmbksinfl |
         L1. |    13.6044   11.49259     1.18   0.237    -8.942849    36.15164
    dmbksipi |
         L1. |   .3766749   1.485221     0.25   0.800    -2.537173    3.290522
   dmbkslhhi |
         L1. |   5.175698    2.33503     2.22   0.027     .5946158     9.75678
       _cons |    .000331   .0010231     0.32   0.746    -.0016761    .0023381
-------------+----------------------------------------------------------------
dlendrated~5 |
       dmbks |
         L1. |   456.8462   68.97749     6.62   0.000     321.5197    592.1728
dmbkslasse~5 |
         L1. |  -26.13058   4.069053    -6.42   0.000    -34.11363   -18.14753
dmbksliqui~5 |
         L1. |  -14.64723   4.455585    -3.29   0.001    -23.38862    -5.90584
dmbkscapit~5 |
         L1. |  -139.7176   21.78151    -6.41   0.000    -182.4506   -96.98457
dmbksNPLra~5 |
         L1. |   43.20206   8.540142     5.06   0.000      26.4472    59.95692
dmbksmatm~b5 |
         L1. |   5.879531   1.302378     4.51   0.000     3.324403    8.434658
dmbksrelle~5 |
         L1. |    3.62271    2.76692     1.31   0.191    -1.805695    9.051114
dmbksportd~5 |
         L1. |   2.483808    3.59709     0.69   0.490    -4.573303    9.540919
   dmbksinfl |
         L1. |   13.13673   11.74678     1.12   0.264    -9.909216    36.18267
    dmbksipi |
         L1. |   5.991558   1.746674     3.43   0.001     2.564768    9.418348
   dmbkslhhi |
         L1. |  -6.069326   4.609076    -1.32   0.188    -15.11185    2.973195
       _cons |  -.0020364   .0012221    -1.67   0.096     -.004434    .0003613
-------------+----------------------------------------------------------------
dlendrate~n6 |
       dmbks |
         L1. |  -10.23273   19.33431    -0.53   0.597     -48.1646    27.69915
dmbkslass~s6 |
         L1. |  -.9597794   .8421165    -1.14   0.255    -2.611923    .6923644
dmbksliqu~y6 |
         L1. |  -2.557735   1.412251    -1.81   0.070    -5.328423    .2129527
dmbkscapi~l6 |
         L1. |   3.190963   3.128997     1.02   0.308      -2.9478    9.329726
dmbksNPLr~o6 |
         L1. |  -5.115906   2.614586    -1.96   0.051    -10.24545    .0136363
dmbksmatm~b6 |
         L1. |  -1.956119   .4579104    -4.27   0.000    -2.854491   -1.057747
dmbksrell~g6 |
         L1. |   1.164645   1.305209     0.89   0.372    -1.396038    3.725328
dmbksport~v6 |
         L1. |   1.659876    1.46378     1.13   0.257    -1.211906    4.531659
   dmbksinfl |
         L1. |  -4.141527   3.977276    -1.04   0.298    -11.94452    3.661468
    dmbksipi |
         L1. |   .0574923   .6656178     0.09   0.931     -1.24838    1.363364
```

```
   dmbkslhhi |
         L1. |   3.610457   1.768122     2.04   0.041     .1415889    7.079325
       _cons |   .0000626   .0004653     0.13   0.893    -.0008503    .0009756
-------------+----------------------------------------------------------------
dlendrate~n7 |
       dmbks |
         L1. |   41.41637   23.98257     1.73   0.084    -5.634914    88.46765
dmbkslass~s7 |
         L1. |  -2.048689   1.224973    -1.67   0.095    -4.451957    .3545778
dmbksliqu~y7 |
         L1. |  -.4121785   1.566693    -0.26   0.793    -3.485865    2.661508
dmbkscapi~l7 |
         L1. |  -5.585771   3.369906    -1.66   0.098    -12.19717     1.02563
dmbksNPLr~o7 |
         L1. |   .9158516   2.187506     0.42   0.676    -3.375805    5.207508
dmbksmatm~b7 |
         L1. |  -.0032621   .0133259    -0.24   0.807    -.0294061    .0228819
dmbksrell~g7 |
         L1. |   1.861786   1.666711     1.12   0.264    -1.408125    5.131697
dmbksport~v7 |
         L1. |  -.1325282   3.651848    -0.04   0.971     -7.29707    7.032013
   dmbksinfl |
         L1. |   4.126418   6.024882     0.68   0.494    -7.693765     15.9466
    dmbksipi |
         L1. |   .0941532   .8323845     0.11   0.910    -1.538897    1.727204
   dmbkslhhi |
         L1. |  -1.283735   2.741053    -0.47   0.640    -6.661391    4.093921
       _cons |  -.0011763   .0006379    -1.84   0.065    -.0024277    .0000752
-------------+----------------------------------------------------------------

dlendrated~8 |
       dmbks |
         L1. |   34.21207   104.7728     0.33   0.744     -171.341    239.7652
dmbkslasse~8 |
         L1. |  -5.477015   7.292669    -0.75   0.453    -19.78446    8.830432
dmbksliqui~8 |
         L1. |   17.19069   6.339818     2.71   0.007     4.752639    29.62875
dmbkscapit~8 |
         L1. |   9.504138   9.929536     0.96   0.339    -9.976564    28.98484
dmbksNPLra~8 |
         L1. |  -1.504891   2.413021    -0.62   0.533    -6.238983    3.229201
dmbksmatm~b8 |
         L1. |   -.296141   .2553447    -1.16   0.246    -.7971005    .2048184
dmbksrelle~8 |
         L1. |   6.291298   5.262285     1.20   0.232     -4.03275    16.61535
dmbksportd~8 |
         L1. |   2.007435   1.790913     1.12   0.263    -1.506148    5.521017
   dmbksinfl |
         L1. |  -13.22504   8.718845    -1.52   0.130    -30.33049    3.880419
    dmbksipi |
         L1. |   1.326197   1.230816     1.08   0.281    -1.088534    3.740929
   dmbkslhhi |
         L1. |   4.058392   3.525055     1.15   0.250    -2.857394    10.97418
       _cons |  -.0018025   .0010037    -1.80   0.073    -.0037716    .0001666
-------------+----------------------------------------------------------------
dlendrated~9 |
       dmbks |
         L1. |  -93.83575   41.64002    -2.25   0.024    -175.5291   -12.14243
dmbkslasse~9 |
         L1. |   5.031677   1.516404     3.32   0.001     2.056651    8.006702
dmbksliqui~9 |
         L1. |   .1454861   2.628055     0.06   0.956    -5.010481    5.301453
dmbkscapit~9 |
         L1. |    22.3711   4.669074     4.79   0.000     13.21087    31.53133
dmbksNPLra~9 |
         L1. |  -9.197848   2.202531    -4.18   0.000    -13.51898   -4.876715
dmbksmatm~b9 |
         L1. |  -.0094856   .0258616    -0.37   0.714    -.0602233    .0412521
dmbksrelle~9 |
         L1. |  -4.708037   2.700634    -1.74   0.082     -10.0064    .5903221
dmbksportd~9 |
         L1. |   1.816193   1.779234     1.02   0.308    -1.674477    5.306863
```

```
   dmbksinfl |
         L1. |   5.656939   9.364413     0.60   0.546    -12.71505    24.02893
    dmbksipi |
         L1. |    .385747   1.837148     0.21   0.834    -3.218544    3.990038
   dmbkslhhi |
         L1. |   1.870578   5.015311     0.37   0.709    -7.968933    11.71009
       _cons |  -.0014957    .001314    -1.14   0.255    -.0040737    .0010823
-------------+----------------------------------------------------------------
dlendrate~10 |
       dmbks |
         L1. |   8.095724   16.95374     0.48   0.633    -25.16573    41.35718
dmbkslass~10 |
         L1. |    .530337   .9445682     0.56   0.575    -1.322806     2.38348
dmbksliqu~10 |
         L1. |  -2.568369   1.806942    -1.42   0.155      -6.1134    .9766611
dmbkscapi~10 |
         L1. |  -2.899201   6.271068    -0.46   0.644    -15.20238    9.403974
dmbksNPLr~10 |
         L1. |  -5.892491   8.444204    -0.70   0.485    -22.45913    10.67415
dmbksmat~b10 |
         L1. |  -.3607309   .2737581    -1.32   0.188    -.8978154    .1763536
dmbksrell~10 |
         L1. |  -2.874749   3.331381    -0.86   0.388    -9.410566    3.661069
dmbksport~10 |
         L1. |  -.3429443   2.384474    -0.14   0.886     -5.02103    4.335141
   dmbksinfl |
         L1. |  -4.713047   5.041449    -0.93   0.350    -14.60384    5.177744
    dmbksipi |
         L1. |  -.3990701   .6813286    -0.59   0.558    -1.735765    .9376247
   dmbkslhhi |
         L1. |   -1.64446   2.455999    -0.67   0.503    -6.462871     3.17395
       _cons |  -.0008291   .0005015    -1.65   0.099    -.0018129    .0001547
-------------+----------------------------------------------------------------


dlendrate~11 |
       dmbks |
         L1. |  -18.67646   20.97088    -0.89   0.373    -59.81912     22.4662
dmbkslass~11 |
         L1. |   .6348145   1.170151     0.54   0.588    -1.660898    2.930527
dmbksliqu~11 |
         L1. |  -2.089403   1.768223    -1.18   0.238     -5.55847    1.379664
dmbkscapi~11 |
         L1. |   2.437053   9.624962     0.25   0.800    -16.44611    21.32021
dmbksNPLr~11 |
         L1. |  -6.642538    8.81431    -0.75   0.451    -23.93528    10.65021
dmbksmat~b11 |
         L1. |  -.0482143   .5739483    -0.08   0.933     -1.17424    1.077812
dmbksrell~11 |
         L1. |  -3.555776   1.797414    -1.98   0.048    -7.082111   -.0294395
dmbksport~11 |
         L1. |   .4592165   2.058269     0.22   0.823    -3.578891    4.497324
   dmbksinfl |
         L1. |   7.348365   5.268002     1.39   0.163      -2.9869    17.68363
    dmbksipi |
         L1. |   .2932864   .7393907     0.40   0.692     -1.15732    1.743893
   dmbkslhhi |
         L1. |   1.428619   1.916453     0.75   0.456     -2.33126    5.188498
       _cons |  -.0008924   .0005659    -1.58   0.115    -.0020026    .0002177
-------------+----------------------------------------------------------------
dlendrate~12 |
       dmbks |
         L1. |  -55.95764   34.01442    -1.65   0.100    -122.6903    10.77506
dmbkslass~12 |
         L1. |   2.633027   2.439293     1.08   0.281    -2.152607    7.418662
dmbksliqu~12 |
         L1. |  -4.058571   2.792717    -1.45   0.146    -9.537587    1.420445
dmbkscapi~12 |
         L1. |   4.617286   11.17378     0.41   0.680     -17.3045    26.53907
dmbksNPLr~12 |
         L1. |   5.275861   4.991134     1.06   0.291    -4.516218    15.06794
dmbksmat~b12 |
```

```
          L1. |   .1706998   1.082836     0.16   0.875    -1.953711     2.29511
dmbksrell~12 |
          L1. |  -6.138524    3.83304    -1.60   0.110    -13.65854    1.381496
dmbksport~12 |
          L1. |  -.0364489   2.163471    -0.02   0.987    -4.280951    4.208054
   dmbksinfl |
          L1. |    5.09155   4.808501     1.06   0.290    -4.342221    14.52532
    dmbksipi |
          L1. |  -1.845681   .7110501    -2.60   0.010    -3.240686   -.4506754
   dmbkslhhi |
          L1. |    2.24314    1.84952     1.21   0.225    -1.385424    5.871703
       _cons |  -.0005821   .0005355    -1.09   0.277    -.0016326    .0004684
-------------+----------------------------------------------------------------
dlendrate~13 |
       dmbks |
          L1. |  -5.161985   25.38697    -0.20   0.839    -54.96855    44.64458
dmbkslass~13 |
          L1. |   .8629791   1.640306     0.53   0.599    -2.355129    4.081087
dmbksliqu~13 |
          L1. |  -.7220636   1.554151    -0.46   0.642    -3.771143    2.327016
dmbkscapi~13 |
          L1. |   7.167843   5.252915     1.36   0.173    -3.137822    17.47351
dmbksNPLr~13 |
          L1. |  -4.293394    2.05275    -2.09   0.037    -8.320673   -.2661156
dmbksmat~b13 |
          L1. |  -2.828972      1.022    -2.77   0.006    -4.834027   -.8239159
dmbksrell~13 |
          L1. |   3.686696   2.467209     1.49   0.135    -1.153708    8.527101
dmbksport~13 |
          L1. |   .0036885   .0189022     0.20   0.845    -.0333955    .0407726
   dmbksinfl |
          L1. |   1.617839   6.033735     0.27   0.789    -10.21971    13.45539
    dmbksipi |
          L1. |  -2.008251   .9944264    -2.02   0.044    -3.959211   -.0572909
   dmbkslhhi |
          L1. |  -1.000825   1.847612    -0.54   0.588    -4.625645    2.623995
       _cons |  -.0010794    .000762    -1.42   0.157    -.0025744    .0004156
-------------+----------------------------------------------------------------


dlendrate~14 |
       dmbks |
          L1. |   652.7195   147.4711     4.43   0.000     363.3967    942.0423
dmbkslass~14 |
          L1. |  -32.39401   7.716255    -4.20   0.000    -47.53248   -17.25553
dmbksliqu~14 |
          L1. |   1.109335   1.728423     0.64   0.521    -2.281649    4.500319
dmbkscapi~14 |
          L1. |   -2.34723   2.979515    -0.79   0.431    -8.192724    3.498265
dmbksNPLr~14 |
          L1. |  -9.175762     2.7437    -3.34   0.001    -14.55861   -3.792912
dmbksmat~b14 |
          L1. |  -.7376357   .5504115    -1.34   0.180    -1.817485    .3422136
dmbksrell~14 |
          L1. |  -4.056312   3.091801    -1.31   0.190     -10.1221    2.009475
dmbksport~14 |
          L1. |   14.35459   5.874365     2.44   0.015     2.829709    25.87948
   dmbksinfl |
          L1. |  -49.04058   17.74561    -2.76   0.006    -83.85559   -14.22557
    dmbksipi |
          L1. |  -1.666961   2.096594    -0.80   0.427    -5.780256    2.446335
   dmbkslhhi |
          L1. |  -30.65938   7.274969    -4.21   0.000    -44.93211   -16.38666
       _cons |  -.0013082   .0014909    -0.88   0.380    -.0042332    .0016169
-------------+----------------------------------------------------------------
dlendrate~16 |
       dmbks |
          L1. |  -71.39001   34.82303    -2.05   0.041    -139.7091   -3.070898
dmbkslass~16 |
          L1. |    6.17317   3.278367     1.88   0.060    -.2586396    12.60498
dmbksliqu~16 |
          L1. |   2.362943   2.334651     1.01   0.312    -2.217397    6.943283
```

```
dmbkscapi~16 |
         L1. |   9.429519    6.24144     1.51   0.131    -2.815529    21.67457
dmbksNPLr~16 |
         L1. |  -3.337131   5.612489    -0.59   0.552    -14.34824    7.673979
dmbksmat~b16 |
         L1. |   .1906806   1.173949     0.16   0.871    -2.112484    2.493845
dmbksrell~16 |
         L1. |   1.593676   1.642158     0.97   0.332    -1.628064    4.815415
dmbksport~16 |
         L1. |  -2.274039   2.919961    -0.78   0.436    -8.002695    3.454617
   dmbksinfl |
         L1. |    9.87018   7.745739     1.27   0.203    -5.326144     25.0665
    dmbksipi |
         L1. |   -.993535   1.355959    -0.73   0.464    -3.653783    1.666713
   dmbkslhhi |
         L1. |  -3.219737   4.389651    -0.73   0.463    -11.83177    5.392294
       _cons |  -.0003556   .0009568    -0.37   0.710    -.0022328    .0015215
-------------+----------------------------------------------------------------
dlendrate~27 |
       dmbks |
         L1. |  -9.911123   38.93497    -0.25   0.799    -86.29742    66.47518
dmbkslass~27 |
         L1. |  -.5893057   2.074012    -0.28   0.776    -4.658298    3.479687
dmbksliqu~27 |
         L1. |  -2.170141   2.329895    -0.93   0.352     -6.74115    2.400868
dmbkscapi~27 |
         L1. |   1.019941   4.118909     0.25   0.804    -7.060923    9.100806
dmbksNPLr~27 |
         L1. |   2.192856   2.388987     0.92   0.359    -2.494085    6.879796
dmbksmat~b27 |
         L1. |  -.5117128   .2038034    -2.51   0.012    -.9115535    -.111872
dmbksrell~27 |
         L1. |   4.216134   2.920649     1.44   0.149    -1.513871     9.94614
dmbksport~27 |
         L1. |  -.4140211   .5622673    -0.74   0.462     -1.51713     .689088
   dmbksinfl |
         L1. |   5.191656   6.468451     0.80   0.422    -7.498762    17.88207
    dmbksipi |
         L1. |  -.6191848    .971383    -0.64   0.524    -2.524936    1.286566
   dmbkslhhi |
         L1. |    2.46791   2.934797     0.84   0.401    -3.289852    8.225673
       _cons |  -.0007804   .0007216    -1.08   0.280     -.002196    .0006353
------------------------------------------------------------------------------
```

Correlation matrix of residuals:

	dlendrateden1	dlendrateden2	dlendrateden3	dlendrateden5	dlendrateden6
dlendrateden1	1.0000				
dlendrateden2	0.2255	1.0000			
dlendrateden3	-0.1717	-0.2534	1.0000		
dlendrateden5	0.0245	-0.2782	0.0512	1.0000	
dlendrateden6	-0.1121	-0.0574	0.4357	-0.0245	1.0000
dlendrateden7	0.0323	-0.1744	-0.0806	0.0698	-0.3270
dlendrateden8	0.0937	-0.0696	-0.0532	0.1129	-0.1547
dlendrateden9	-0.0943	0.0094	0.0058	0.1157	0.1175
dlendrateden10	0.0262	0.0441	-0.0629	0.0397	-0.0172
dlendrateden11	-0.0319	-0.3496	-0.3168	0.2765	-0.4602
dlendrateden12	-0.0116	-0.0793	-0.1537	-0.1446	-0.0020
dlendrateden13	-0.1229	-0.0018	-0.1999	-0.1540	-0.2353
dlendrateden14	-0.0782	-0.0799	0.1100	-0.0969	0.1463
dlendrateden16	-0.1815	0.0518	0.0427	-0.3658	-0.1224
dlendrateden27	-0.1370	-0.0876	0.1711	0.0951	0.3707

	dlendrateden7	dlendrateden8	dlendrateden9	dlendrateden10	dlendrateden11
dlendrateden7	1.0000				
dlendrateden8	0.0197	1.0000			
dlendrateden9	-0.1380	-0.1446	1.0000		
dlendrateden10	0.0172	-0.1251	-0.0308	1.0000	
dlendrateden11	0.2765	0.2090	-0.2395	-0.0686	1.0000
dlendrateden12	-0.0812	-0.0021	-0.2486	0.1731	0.1558
dlendrateden13	0.0315	-0.0219	0.7022	-0.0929	0.1271
dlendrateden14	-0.0048	-0.1976	0.0701	-0.0144	-0.1070
dlendrateden16	-0.0727	0.0421	-0.0095	0.0368	-0.3085

```
dlendrateden27        -0.1629        0.0294        0.0462        0.1584       -0.1828

               dlendrateden12 dlendrateden13 dlendrateden14 dlendrateden16 dlendrateden27
dlendrateden12         1.0000
dlendrateden13        -0.1015        1.0000
dlendrateden14        -0.0328        0.1780        1.0000
dlendrateden16         0.1706        0.1283        0.1289        1.0000
dlendrateden27         0.3120       -0.2121       -0.0234        0.2251        1.0000
```

Breusch-Pagan test of independence: chi2(105) = 305.253, Pr = 0.0000

F-test for joint significance of the parameters of the variables in all bank specific equations:

```
. test l.dmbks

 ( 1)  [dlendrateden1]L.dmbks = 0
 ( 2)  [dlendrateden2]L.dmbks = 0
 ( 3)  [dlendrateden3]L.dmbks = 0
 ( 4)  [dlendrateden5]L.dmbks = 0
 ( 5)  [dlendrateden6]L.dmbks = 0
 ( 6)  [dlendrateden7]L.dmbks = 0
 ( 7)  [dlendrateden8]L.dmbks = 0
 ( 8)  [dlendrateden9]L.dmbks = 0
 ( 9)  [dlendrateden10]L.dmbks = 0
 (10)  [dlendrateden11]L.dmbks = 0
 (11)  [dlendrateden12]L.dmbks = 0
 (12)  [dlendrateden13]L.dmbks = 0
 (13)  [dlendrateden14]L.dmbks = 0
 (14)  [dlendrateden16]L.dmbks = 0
 (15)  [dlendrateden27]L.dmbks = 0

       F( 15,  1230) =    6.19
            Prob > F =    0.0000

. test l.dmbksinfl

 ( 1)  [dlendrateden1]L.dmbksinfl = 0
 ( 2)  [dlendrateden2]L.dmbksinfl = 0
 ( 3)  [dlendrateden3]L.dmbksinfl = 0
 ( 4)  [dlendrateden5]L.dmbksinfl = 0
 ( 5)  [dlendrateden6]L.dmbksinfl = 0
 ( 6)  [dlendrateden7]L.dmbksinfl = 0
 ( 7)  [dlendrateden8]L.dmbksinfl = 0
 ( 8)  [dlendrateden9]L.dmbksinfl = 0
 ( 9)  [dlendrateden10]L.dmbksinfl = 0
 (10)  [dlendrateden11]L.dmbksinfl = 0
 (11)  [dlendrateden12]L.dmbksinfl = 0
 (12)  [dlendrateden13]L.dmbksinfl = 0
 (13)  [dlendrateden14]L.dmbksinfl = 0
 (14)  [dlendrateden16]L.dmbksinfl = 0
 (15)  [dlendrateden27]L.dmbksinfl = 0

       F( 15,  1230) =    3.76
            Prob > F =    0.0000

. test l.dmbksipi

 ( 1)  [dlendrateden1]L.dmbksipi = 0
 ( 2)  [dlendrateden2]L.dmbksipi = 0
 ( 3)  [dlendrateden3]L.dmbksipi = 0
 ( 4)  [dlendrateden5]L.dmbksipi = 0
 ( 5)  [dlendrateden6]L.dmbksipi = 0
 ( 6)  [dlendrateden7]L.dmbksipi = 0
 ( 7)  [dlendrateden8]L.dmbksipi = 0
 ( 8)  [dlendrateden9]L.dmbksipi = 0
 ( 9)  [dlendrateden10]L.dmbksipi = 0
 (10)  [dlendrateden11]L.dmbksipi = 0
 (11)  [dlendrateden12]L.dmbksipi = 0
 (12)  [dlendrateden13]L.dmbksipi = 0
```

```
 (13)  [dlendrateden14]L.dmbksipi = 0
 (14)  [dlendrateden16]L.dmbksipi = 0
 (15)  [dlendrateden27]L.dmbksipi = 0

       F( 15,  1230) =    2.61
            Prob > F =    0.0007

. test l.dmbkslhhi

 ( 1)  [dlendrateden1]L.dmbkslhhi = 0
 ( 2)  [dlendrateden2]L.dmbkslhhi = 0
 ( 3)  [dlendrateden3]L.dmbkslhhi = 0
 ( 4)  [dlendrateden5]L.dmbkslhhi = 0
 ( 5)  [dlendrateden6]L.dmbkslhhi = 0
 ( 6)  [dlendrateden7]L.dmbkslhhi = 0
 ( 7)  [dlendrateden8]L.dmbkslhhi = 0
 ( 8)  [dlendrateden9]L.dmbkslhhi = 0
 ( 9)  [dlendrateden10]L.dmbkslhhi = 0
 (10)  [dlendrateden11]L.dmbkslhhi = 0
 (11)  [dlendrateden12]L.dmbkslhhi = 0
 (12)  [dlendrateden13]L.dmbkslhhi = 0
 (13)  [dlendrateden14]L.dmbkslhhi = 0
 (14)  [dlendrateden16]L.dmbkslhhi = 0
 (15)  [dlendrateden27]L.dmbkslhhi = 0

       F( 15,  1230) =    3.55
            Prob > F =    0.0000

.   test   l.dmbkslassets1   l.dmbkslassets2   l.dmbkslassets3   l.dmbkslassets5
l.dmbkslassets6 l.dmbkslassets7 l.d
> mbkslassets8 l.dmbkslassets9 /*
>   */  l.dmbkslassets10  l.dmbkslassets11  l.dmbkslassets12  l.dmbkslassets13
l.dmbkslassets14 l.dmbkslassets16
>  l.dmbkslassets27

 ( 1)  [dlendrateden1]L.dmbkslassets1 = 0
 ( 2)  [dlendrateden2]L.dmbkslassets2 = 0
 ( 3)  [dlendrateden3]L.dmbkslassets3 = 0
 ( 4)  [dlendrateden5]L.dmbkslassets5 = 0
 ( 5)  [dlendrateden6]L.dmbkslassets6 = 0
 ( 6)  [dlendrateden7]L.dmbkslassets7 = 0
 ( 7)  [dlendrateden8]L.dmbkslassets8 = 0
 ( 8)  [dlendrateden9]L.dmbkslassets9 = 0
 ( 9)  [dlendrateden10]L.dmbkslassets10 = 0
 (10)  [dlendrateden11]L.dmbkslassets11 = 0
 (11)  [dlendrateden12]L.dmbkslassets12 = 0
 (12)  [dlendrateden13]L.dmbkslassets13 = 0
 (13)  [dlendrateden14]L.dmbkslassets14 = 0
 (14)  [dlendrateden16]L.dmbkslassets16 = 0
 (15)  [dlendrateden27]L.dmbkslassets27 = 0

       F( 15,  1230) =    6.46
            Prob > F =    0.0000

.  test  l.dmbksliquidity1  l.dmbksliquidity2  l.dmbksliquidity3  l.dmbksliquidity5
l.dmbksliquidity6 l.dmbksli
> quidity7 l.dmbksliquidity8 l.dmbksliquidity9 /*
>  */  l.dmbksliquidity10  l.dmbksliquidity11  l.dmbksliquidity12  l.dmbksliquidity13
l.dmbksliquidity14 l.dmbk
> sliquidity16 l.dmbksliquidity27

 ( 1)  [dlendrateden1]L.dmbksliquidity1 = 0
 ( 2)  [dlendrateden2]L.dmbksliquidity2 = 0
 ( 3)  [dlendrateden3]L.dmbksliquidity3 = 0
 ( 4)  [dlendrateden5]L.dmbksliquidity5 = 0
 ( 5)  [dlendrateden6]L.dmbksliquidity6 = 0
 ( 6)  [dlendrateden7]L.dmbksliquidity7 = 0
 ( 7)  [dlendrateden8]L.dmbksliquidity8 = 0
 ( 8)  [dlendrateden9]L.dmbksliquidity9 = 0
 ( 9)  [dlendrateden10]L.dmbksliquidity10 = 0
 (10)  [dlendrateden11]L.dmbksliquidity11 = 0
 (11)  [dlendrateden12]L.dmbksliquidity12 = 0
```

```
 (12)  [dlendrateden13]L.dmbksliquidity13 = 0
 (13)  [dlendrateden14]L.dmbksliquidity14 = 0
 (14)  [dlendrateden16]L.dmbksliquidity16 = 0
 (15)  [dlendrateden27]L.dmbksliquidity27 = 0

       F( 15,  1230) =    4.69
            Prob > F =    0.0000

.   test   l.dmbkscapital1   l.dmbkscapital2   l.dmbkscapital3   l.dmbkscapital5
l.dmbkscapital6 l.dmbkscapital7 l.d
> mbkscapital8 l.dmbkscapital9 /*
>   */   l.dmbkscapital10   l.dmbkscapital11   l.dmbkscapital12   l.dmbkscapital13
l.dmbkscapital14 l.dmbkscapital16
>  l.dmbkscapital27

 ( 1)  [dlendrateden1]L.dmbkscapital1 = 0
 ( 2)  [dlendrateden2]L.dmbkscapital2 = 0
 ( 3)  [dlendrateden3]L.dmbkscapital3 = 0
 ( 4)  [dlendrateden5]L.dmbkscapital5 = 0
 ( 5)  [dlendrateden6]L.dmbkscapital6 = 0
 ( 6)  [dlendrateden7]L.dmbkscapital7 = 0
 ( 7)  [dlendrateden8]L.dmbkscapital8 = 0
 ( 8)  [dlendrateden9]L.dmbkscapital9 = 0
 ( 9)  [dlendrateden10]L.dmbkscapital10 = 0
 (10)  [dlendrateden11]L.dmbkscapital11 = 0
 (11)  [dlendrateden12]L.dmbkscapital12 = 0
 (12)  [dlendrateden13]L.dmbkscapital13 = 0
 (13)  [dlendrateden14]L.dmbkscapital14 = 0
 (14)  [dlendrateden16]L.dmbkscapital16 = 0
 (15)  [dlendrateden27]L.dmbkscapital27 = 0

       F( 15,  1230) =    5.05
            Prob > F =    0.0000

.  test  l.dmbksNPLratio1  l.dmbksNPLratio2  l.dmbksNPLratio3  l.dmbksNPLratio5
l.dmbksNPLratio6 l.dmbksNPLrati
> o7 l.dmbksNPLratio8 l.dmbksNPLratio9 /*
>  */  l.dmbksNPLratio10  l.dmbksNPLratio11  l.dmbksNPLratio12  l.dmbksNPLratio13
l.dmbksNPLratio14 l.dmbksNPLr
> atio16 l.dmbksNPLratio27

 ( 1)  [dlendrateden1]L.dmbksNPLratio1 = 0
 ( 2)  [dlendrateden2]L.dmbksNPLratio2 = 0
 ( 3)  [dlendrateden3]L.dmbksNPLratio3 = 0
 ( 4)  [dlendrateden5]L.dmbksNPLratio5 = 0
 ( 5)  [dlendrateden6]L.dmbksNPLratio6 = 0
 ( 6)  [dlendrateden7]L.dmbksNPLratio7 = 0
 ( 7)  [dlendrateden8]L.dmbksNPLratio8 = 0
 ( 8)  [dlendrateden9]L.dmbksNPLratio9 = 0
 ( 9)  [dlendrateden10]L.dmbksNPLratio10 = 0
 (10)  [dlendrateden11]L.dmbksNPLratio11 = 0
 (11)  [dlendrateden12]L.dmbksNPLratio12 = 0
 (12)  [dlendrateden13]L.dmbksNPLratio13 = 0
 (13)  [dlendrateden14]L.dmbksNPLratio14 = 0
 (14)  [dlendrateden16]L.dmbksNPLratio16 = 0
 (15)  [dlendrateden27]L.dmbksNPLratio27 = 0

       F( 15,  1230) =    6.11
            Prob > F =    0.0000

.  test  l.dmbksmatmisub1  l.dmbksmatmisub2  l.dmbksmatmisub3  l.dmbksmatmisub5
l.dmbksmatmisub6 l.dmbksmatmisu
> b7 l.dmbksmatmisub8 l.dmbksmatmisub9 /*
>  */  l.dmbksmatmisub10  l.dmbksmatmisub11  l.dmbksmatmisub12  l.dmbksmatmisub13
l.dmbksmatmisub14 l.dmbksmatm
> isub16 l.dmbksmatmisub27

 ( 1)  [dlendrateden1]L.dmbksmatmisub1 = 0
 ( 2)  [dlendrateden2]L.dmbksmatmisub2 = 0
 ( 3)  [dlendrateden3]L.dmbksmatmisub3 = 0
 ( 4)  [dlendrateden5]L.dmbksmatmisub5 = 0
 ( 5)  [dlendrateden6]L.dmbksmatmisub6 = 0
```

```
 ( 6)  [dlendrateden7]L.dmbksmatmisub7 = 0
 ( 7)  [dlendrateden8]L.dmbksmatmisub8 = 0
 ( 8)  [dlendrateden9]L.dmbksmatmisub9 = 0
 ( 9)  [dlendrateden10]L.dmbksmatmisub10 = 0
 (10)  [dlendrateden11]L.dmbksmatmisub11 = 0
 (11)  [dlendrateden12]L.dmbksmatmisub12 = 0
 (12)  [dlendrateden13]L.dmbksmatmisub13 = 0
 (13)  [dlendrateden14]L.dmbksmatmisub14 = 0
 (14)  [dlendrateden16]L.dmbksmatmisub16 = 0
 (15)  [dlendrateden27]L.dmbksmatmisub27 = 0

       F( 15,  1230) =    4.19
            Prob > F =    0.0000

. test l.dmbksrellending1 l.dmbksrellending2 l.dmbksrellending3 l.dmbksrellending5 l.dmbksrellending6 l.dm
> bksrellending7 l.dmbksrellending8 l.dmbksrellending9 /*
>     */     l.dmbksrellending10     l.dmbksrellending11     l.dmbksrellending12 l.dmbksrellending13 l.dmbksrellending14 l
> .dmbksrellending16 l.dmbksrellending27

 ( 1)  [dlendrateden1]L.dmbksrellending1 = 0
 ( 2)  [dlendrateden2]L.dmbksrellending2 = 0
 ( 3)  [dlendrateden3]L.dmbksrellending3 = 0
 ( 4)  [dlendrateden5]L.dmbksrellending5 = 0
 ( 5)  [dlendrateden6]L.dmbksrellending6 = 0
 ( 6)  [dlendrateden7]L.dmbksrellending7 = 0
 ( 7)  [dlendrateden8]L.dmbksrellending8 = 0
 ( 8)  [dlendrateden9]L.dmbksrellending9 = 0
 ( 9)  [dlendrateden10]L.dmbksrellending10 = 0
 (10)  [dlendrateden11]L.dmbksrellending11 = 0
 (11)  [dlendrateden12]L.dmbksrellending12 = 0
 (12)  [dlendrateden13]L.dmbksrellending13 = 0
 (13)  [dlendrateden14]L.dmbksrellending14 = 0
 (14)  [dlendrateden16]L.dmbksrellending16 = 0
 (15)  [dlendrateden27]L.dmbksrellending27 = 0

       F( 15,  1230) =    2.85
            Prob > F =    0.0002

.   test   l.dmbksportdiv1   l.dmbksportdiv2   l.dmbksportdiv3   l.dmbksportdiv5 l.dmbksportdiv6 l.dmbksportdiv7 l.d
> mbksportdiv8 l.dmbksportdiv9 /*
>   */  l.dmbksportdiv10   l.dmbksportdiv11   l.dmbksportdiv12   l.dmbksportdiv13 l.dmbksportdiv14 l.dmbksportdiv16
>  l.dmbksportdiv27

 ( 1)  [dlendrateden1]L.dmbksportdiv1 = 0
 ( 2)  [dlendrateden2]L.dmbksportdiv2 = 0
 ( 3)  [dlendrateden3]L.dmbksportdiv3 = 0
 ( 4)  [dlendrateden5]L.dmbksportdiv5 = 0
 ( 5)  [dlendrateden6]L.dmbksportdiv6 = 0
 ( 6)  [dlendrateden7]L.dmbksportdiv7 = 0
 ( 7)  [dlendrateden8]L.dmbksportdiv8 = 0
 ( 8)  [dlendrateden9]L.dmbksportdiv9 = 0
 ( 9)  [dlendrateden10]L.dmbksportdiv10 = 0
 (10)  [dlendrateden11]L.dmbksportdiv11 = 0
 (11)  [dlendrateden12]L.dmbksportdiv12 = 0
 (12)  [dlendrateden13]L.dmbksportdiv13 = 0
 (13)  [dlendrateden14]L.dmbksportdiv14 = 0
 (14)  [dlendrateden16]L.dmbksportdiv16 = 0
 (15)  [dlendrateden27]L.dmbksportdiv27 = 0
       F( 15,  1230) =    1.75

            Prob > F =    0.0366
```

Appendix 3.5: Estimation results and estimation output of the final SUR model specification estimated with MLE, including the Breusch-Pagan test and the F-tests for the joint significance of the regressors in the model.

a) Estimation results of the model estimated with MLE.

VARIABLE:	Bank1	Bank2	Bank3	Bank5	Bank6	Bank7	Bank8	Bank9	Bank10	Bank11	Bank12	Bank13	Bank14	Bank16	Bank27
L.dmbks	133.0***	–47.47	–52.36**	368.0***	–3.03	45.89*	76.84	–82.66**	9.3	8.27	–59.52*	–16.49	677.4***	–108.9***	–31.85
	(43.13)	(50.56)	(20.56)	(57.83)	(17.44)	(23.79)	(103.7)	(35.51)	(16.94)	(19.16)	(31.55)	(20.30)	(147.8)	(32.66)	(35.88)
L.dmbkslassets	–13.50***	5.141*	0.83	–20.80***	–1.52*	–2.16*	–8.38	6.12***	1.22	–0.56	2.54	2.17*	–34.14***	11.48***	1.29
	(2.42)	(2.90)	(0.58)	(3.40)	(0.78)	(1.21)	(7.21)	(1.13)	(0.94)	(1.05)	(2.28)	(1.23)	(7.72)	(–2.99)	(–1.88)
L.dmbksliquidity	34.69***	–5.56*	1.02	–13.52***	–0.1	–0.55	19.40***	–3.15	–3.12*	–2.35	–1.6	0.1	0.72	1.12	1.16
	(4.93)	(3.2)	(1.28)	(3.74)	(1.20)	(1.54)	(6.28)	(2.06)	(1.81)	(1.58)	(2.51)	(1.23)	(1.73)	(2.17)	(2.23)
L.dmbkscapital	12.85	16.25	–0.06	–105.3***	–0.81	–6.28*	7.88	23.11***	–2.80	–4.81	10.87	12.45***	0.83	18.02***	2.87
	(19.88)	(17.25)	(1.94)	(17.65)	(2.85)	(3.33)	(9.84)	(3.32)	(6.26)	(8.66)	(10.28)	(3.93)	(2.99)	(5.63)	(3.71)
L.dmbksNPLratio	–28.84***	1.78	–1.42	31.72***	–4.86**	0.61	–1.72	–8.21***	–15.41*	5.14	5.78	–5.74***	–9.57***	–10.52**	5.04**
	(4.39)	(2.65)	(1.02)	(7.00)	(2.24)	(2.15)	(2.41)	(1.61)	(8.33)	(7.31)	(4.55)	(1.58)	(2.74)	(5.04)	(2.22)
L.dmbksmatmisub	–0.22	–0.86***	–0.53	4.54***	–1.54***	–0.00	–0.33	–0.04*	–0.51*	0.23	0.26	–2.52***	–0.9	0.13	–0.49**
	(0.14)	(0.29)	(0.91)	(1.09)	(0.38)	(0.01)	(0.25)	(0.02)	(0.27)	(0.52)	(0.97)	(0.84)	(0.55)	(1.09)	(0.2)
L.dmbksrellending	–12.62***	17.05***	–5.62	3.07	–0.17	1.93	8.28	–6.16***	–5.62*	–2.81*	–6.75*	3.14	–6.06**	1.34	6.79**
	(4.43)	(5.09)	(9.46)	(2.47)	(1.16)	(1.65)	(5.22)	(2.15)	(3.29)	(1.64)	(3.47)	(2.07)	(3.08)	(1.45)	(2.71)
L.dmbksportdiv	–13.09***	2.01	–0.15	0.12	–0.27	0.34	1.41	2.05	–1.66	–2.31	0.32	0.01	13.76**	–3.30	–1.4***
	(2.85)	(2.37)	(1.31)	(2.85)	(1.23)	(3.58)	(1.78)	(1.43)	(2.36)	(1.82)	(1.89)	(0.01)	(5.87)	(2.64)	(0.51)
L.dmbksinfl	47.92***	1.78	19.27*	8.72	–1.44	5.14	–14.69*	7.35	–6.06	11.44**	4.89	–0.70	–54.58***	4.28	1.27
	(9.96)	(6.34)	(11.44)	(11.14)	(3.89)	(5.9)	(8.72)	(9.40)	(5.07)	(5.18)	(4.60)	(5.59)	(17.77)	(7.69)	(6.65)
L.dmbksipi	2.37*	2.02***	0.68	5.59***	–0.42	0.22	1.34	–0.10	–0.35	0.27	–1.99***	–2.05**	–2.57	–0.97	–0.01
	(1.39)	(0.76)	(1.53)	(1.8)	(0.67)	(0.84)	(1.24)	(1.82)	(0.69)	(0.77)	(0.73)	(1.02)	(2.13)	(1.40)	(1.04)
L.dmbkslhhi	15.41***	–6.19***	5.62**	–5.28	4.01**	–1.68	3.8	–1.65	–2.84	0.56	2.57	–2.13	–31.06***	–8.77**	1.29
	(4.41)	(1.96)	(2.42)	(4.57)	(1.65)	(2.73)	(3.52)	(4.53)	(2.46)	(1.92)	(1.87)	(1.83)	(7.32)	(4.14)	(2.96)
Constant	–0.00**	–0.00*	0.00	–0.00	0.00	–0.00*	–0.00*	–0.00	–0.00	–0.00*	–0.00	–0.00*	–0.00	0.00	–0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
R-squared	0.48	0.15	0.04	0.47	0.18	0.04	0.29	0.07	0.02	0.02	0.24	0.04	0.12	0.12	0.09
RMSE	0.0101	0.0055	0.0103	0.0127	0.0047	0.0060	0.0093	0.0131	0.0048	0.0056	0.0053	0.0076	0.0138	0.0099	0.0075
F-stat for joint significance of the bank specific eqution	12.29***	2.95***	1.73*	10.03***	3.7***	0.72	3.83***	6.01***	1.17	2.61***	2.77***	3.21***	2.79***	3.48***	2.69***
Breusch-Pagan test for the contemporaneous covariance independence between the error terms chi2 (105) = 479.520; p-value = 0.000															

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's own calculations performed in STATA 10.

b) Size of the pass-through multipliers of lending rates estimated with MLE.

	DMBKS
Bank 1	0.07***
Bank 2	0.08***
Bank 3	0.05*
Bank 5	0.28***
Bank 6	0.11***
Bank 7	–0.16
Bank 8	0.16***
Bank 9	0.48***
Bank 10	–0.17
Bank 11	0.05***
Bank 12	0.16***
Bank 13	0.13***
Bank 14	–0.29***
Bank 16	0.24***
Bank 27	0.03***

***/**/* denotes joint significance by the overall F-test for the bank specific regression at 1%, 5% and 10% level of significance, respectively.
Source: Author’s own calculations.

c) Estimated signs of the rest of the independent variables in the model by MLE.

VARIABLE:	Assets	Liquidity	Capital	NPLratio	Mat–mismatch	Rel. lending	Portdiv.	Inflation	IPI	HHI
Bank 1	+ ***	– ***	–	+ ***	+	+ ***	+ ***	– ***	– *	– ***
Bank 2	– *	+ *	–	–	+ ***	– ***	–	–	– ***	+ ***
Bank 3	–	–	+	+	+	+	+	– *	–	– **
Bank 5	+ ***	+ ***	+ ***	– ***	– ***	–	–	–	– ***	+
Bank 6	+ *	+	+	+ **	+ ***	+	+	+	+	– **
Bank 7	+ *	+	+ *	–	+	–	–	–	–	+
Bank 8	+	– ***	–	+	+	–	–	+ *	–	–
Bank 9	– ***	+	– ***	+ ***	+ *	+ ***	–	–	+	+
Bank 10	–	+ *	+	+ *	+ *	+ *	+	+	+	+
Bank 11	+	+	+	–	–	+ *	+	– **	–	–
Bank 12	–	+	–	–	–	+ *	–	–	+ ***	–
Bank 13	– *	–	– ***	+ ***	+ ***	–	–	+	+ **	+
Bank 14	+ ***	–	–	+ ***	+	+ **	– **	+ ***	+	+ ***
Bank 16	– ***	–	– ***	+ **	–	–	+	–	+	+ **
Bank 27	–	–	–	– **	+ **	– **	+ ***	–	+	–
F-stat for joint signiicance of the variable in all bank specific regressions.	9.98***	5.84***	6.52***	8.21***	5.10***	3.84***	2.99***	5.17***	2.91***	4.72***

*** p<0.01, ** p<0.05, * p<0.1

d) Estimation output of the SUR model estimated with MLE, including the Breusch-Pagan test and the F-tests for the joint significance of the regressors in the model.

```
. sureg (dlendrateden1= l.dmbks l.dmbkslassets1 l.dmbksliquidity1  l.dmbkscapital1
l.dmbksNPLratio1 l.dmbksma
> tmisub1 l.dmbksrellending1 l.dmbksportdiv1  l.dmbksinfl l.dmbksipi l.dmbkslhhi)
/*
> */ (dlendrateden2= l.dmbks l.dmbkslassets2 l.dmbksliquidity2  l.dmbkscapital2
l.dmbksNPLratio2 l.dmbksmatmi
> sub2 l.dmbksrellending2 l.dmbksportdiv2 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden3= l.dmbks l.dmbkslassets3 l.dmbksliquidity3  l.dmbkscapital3
l.dmbksNPLratio3 l.dmbksmatmi
> sub3 l.dmbksrellending3 l.dmbksportdiv3 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden5= l.dmbks l.dmbkslassets5 l.dmbksliquidity5  l.dmbkscapital5
l.dmbksNPLratio5 l.dmbksmatmi
> sub5 l.dmbksrellending5 l.dmbksportdiv5 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden6= l.dmbks l.dmbkslassets6 l.dmbksliquidity6  l.dmbkscapital6
l.dmbksNPLratio6 l.dmbksmatmi
> sub6 l.dmbksrellending6 l.dmbksportdiv6 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden7= l.dmbks l.dmbkslassets7 l.dmbksliquidity7  l.dmbkscapital7
l.dmbksNPLratio7 l.dmbksmatmi
> sub7 l.dmbksrellending7 l.dmbksportdiv7 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden8= l.dmbks l.dmbkslassets8 l.dmbksliquidity8  l.dmbkscapital8
l.dmbksNPLratio8 l.dmbksmatmi
> sub8 l.dmbksrellending8 l.dmbksportdiv8 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
> */ (dlendrateden9= l.dmbks l.dmbkslassets9 l.dmbksliquidity9  l.dmbkscapital9
l.dmbksNPLratio9 l.dmbksmatmi
```

```
> sub9 l.dmbksrellending9 l.dmbksportdiv9 l.dmbksinfl l.dmbksipi l.dmbkslhhi) /*
>     */    (dlendrateden10=    l.dmbks    l.dmbkslassets10    l.dmbksliquidity10
l.dmbkscapital10 l.dmbksNPLratio10 l.dmbks
>   matmisub10   l.dmbksrellending10   l.dmbksportdiv10   l.dmbksinfl   l.dmbksipi
l.dmbkslhhi) /*
>     */    (dlendrateden11=    l.dmbks    l.dmbkslassets11    l.dmbksliquidity11
l.dmbkscapital11 l.dmbksNPLratio11 l.dmbks
>   matmisub11   l.dmbksrellending11   l.dmbksportdiv11   l.dmbksinfl   l.dmbksipi
l.dmbkslhhi) /*
>     */    (dlendrateden12=    l.dmbks    l.dmbkslassets12    l.dmbksliquidity12
l.dmbkscapital12 l.dmbksNPLratio12 l.dmbks
>   matmisub12   l.dmbksrellending12   l.dmbksportdiv12   l.dmbksinfl   l.dmbksipi
l.dmbkslhhi) /*
>     */    (dlendrateden13=    l.dmbks    l.dmbkslassets13    l.dmbksliquidity13
l.dmbkscapital13 l.dmbksNPLratio13 l.dmbks
>   matmisub13   l.dmbksrellending13   l.dmbksportdiv13   l.dmbksinfl   l.dmbksipi
l.dmbkslhhi) /*
>     */    (dlendrateden14=    l.dmbks    l.dmbkslassets14    l.dmbksliquidity14
l.dmbkscapital14 l.dmbksNPLratio14 l.dmbks
>   matmisub14   l.dmbksrellending14   l.dmbksportdiv14   l.dmbksinfl   l.dmbksipi
l.dmbkslhhi) /*
>     */    (dlendrateden16=    l.dmbks    l.dmbkslassets16    l.dmbksliquidity16
l.dmbkscapital16 l.dmbksNPLratio16 l.dmbks
>   matmisub16   l.dmbksrellending16   l.dmbksportdiv16   l.dmbksinfl   l.dmbksipi
l.dmbkslhhi) /*
>     */    (dlendrateden27=    l.dmbks    l.dmbkslassets27    l.dmbksliquidity27
l.dmbkscapital27 l.dmbksNPLratio27 l.dmbks
>   matmisub27   l.dmbksrellending27   l.dmbksportdiv27   l.dmbksinfl   l.dmbksipi
l.dmbkslhhi) /*
> */   , isure small corr

Iteration 1:   tolerance =   11.16935
Iteration 2:   tolerance =   1.029817
Iteration 3:   tolerance =   1.713325
Iteration 4:   tolerance =   3.395104
Iteration 5:   tolerance =   .4223553
Iteration 6:   tolerance =   .1921408
Iteration 7:   tolerance =      .2201
Iteration 8:   tolerance =   .2640581
Iteration 9:   tolerance =   .2155524
Iteration 10:   tolerance =   .1670694
Iteration 11:   tolerance =   .1350381
Iteration 12:   tolerance =   .1462089
Iteration 13:   tolerance =   .1617844
Iteration 14:   tolerance =    .182453
Iteration 15:   tolerance =   .2110862
Iteration 16:   tolerance =   .2532158
Iteration 17:   tolerance =   .3210511
Iteration 18:   tolerance =   .4479279
Iteration 19:   tolerance =   .7688605
Iteration 20:   tolerance =   2.052753
Iteration 21:   tolerance =   .6375623
Iteration 22:   tolerance =   .5779624
Iteration 23:   tolerance =     .61929
Iteration 24:   tolerance =   .3627846
Iteration 25:   tolerance =   .2525297
Iteration 26:   tolerance =   .1912547
Iteration 27:   tolerance =   .1522927
Iteration 28:   tolerance =   .1253608
Iteration 29:   tolerance =   .1056525
Iteration 30:   tolerance =  .09062104
Iteration 31:   tolerance =  .07879077
Iteration 32:   tolerance =  .06924787
Iteration 33:   tolerance =  .06139618
Iteration 34:   tolerance =  .05483021
Iteration 35:   tolerance =  .04926462
Iteration 36:   tolerance =   .0444927
Iteration 37:   tolerance =  .04036107
Iteration 38:   tolerance =  .03675353
Iteration 39:   tolerance =  .03358041
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Iteration 40:   tolerance =  .03077138
Iteration 41:   tolerance =  .02827053
Iteration 42:   tolerance =  .02603285
Iteration 43:   tolerance =  .02402164
Iteration 44:   tolerance =  .02220674
Iteration 45:   tolerance =  .02056306
Iteration 46:   tolerance =  .01906963
Iteration 47:   tolerance =  .01770872
Iteration 48:   tolerance =  .01646526
Iteration 49:   tolerance =  .01532636
Iteration 50:   tolerance =  .01428092
Iteration 51:   tolerance =  .01331933
Iteration 52:   tolerance =  .01243322
Iteration 53:   tolerance =  .01161529
Iteration 54:   tolerance =  .01085911
Iteration 55:   tolerance =  .01015901
Iteration 56:   tolerance =  .00950997
Iteration 57:   tolerance =  .00890753
Iteration 58:   tolerance =  .00834772
Iteration 59:   tolerance =  .00782696
Iteration 60:   tolerance =  .00734207
Iteration 61:   tolerance =  .00689016
Iteration 62:   tolerance =  .00646864
Iteration 63:   tolerance =  .00607515
Iteration 64:   tolerance =  .00570758
Iteration 65:   tolerance =  .00536396
Iteration 66:   tolerance =  .00504255
Iteration 67:   tolerance =  .00474174
Iteration 68:   tolerance =  .00446003
Iteration 69:   tolerance =  .00419609
Iteration 70:   tolerance =  .00394868
Iteration 71:   tolerance =  .00371666
Iteration 72:   tolerance =  .00349897
Iteration 73:   tolerance =  .00329466
Iteration 74:   tolerance =  .00310282
Iteration 75:   tolerance =  .00292265
Iteration 76:   tolerance =  .00275336
Iteration 77:   tolerance =  .00259426
Iteration 78:   tolerance =  .00244469
Iteration 79:   tolerance =  .00230404
Iteration 80:   tolerance =  .00217174
Iteration 81:   tolerance =  .00204728
Iteration 82:   tolerance =  .00193015
Iteration 83:   tolerance =  .00181991
Iteration 84:   tolerance =  .00171613
Iteration 85:   tolerance =  .00161841
Iteration 86:   tolerance =  .00152639
Iteration 87:   tolerance =   .0014397
Iteration 88:   tolerance =  .00135805
Iteration 89:   tolerance =  .00128111
Iteration 90:   tolerance =  .00120862
Iteration 91:   tolerance =  .00114029
Iteration 92:   tolerance =  .00107589
Iteration 93:   tolerance =  .00101519
Iteration 94:   tolerance =  .00095796
Iteration 95:   tolerance =    .000904
Iteration 96:   tolerance =  .00085312
Iteration 97:   tolerance =  .00080514
Iteration 98:   tolerance =  .00075988
Iteration 99:   tolerance =   .0007172
Iteration 100:   tolerance =  .00067695
Iteration 101:   tolerance =  .00063897
Iteration 102:   tolerance =  .00060314
Iteration 103:   tolerance =  .00056934
Iteration 104:   tolerance =  .00053745
Iteration 105:   tolerance =  .00050736
Iteration 106:   tolerance =  .00047897
Iteration 107:   tolerance =  .00045217
Iteration 108:   tolerance =  .00042689
Iteration 109:   tolerance =  .00040302
```

```
Iteration 110:   tolerance =   .0003805
Iteration 111:   tolerance =  .00035925
Iteration 112:   tolerance =  .00033919
Iteration 113:   tolerance =  .00032025
Iteration 114:   tolerance =  .00030238
Iteration 115:   tolerance =   .0002855
Iteration 116:   tolerance =  .00026958
Iteration 117:   tolerance =  .00025454
Iteration 118:   tolerance =  .00024035
Iteration 119:   tolerance =  .00022695
Iteration 120:   tolerance =   .0002143
Iteration 121:   tolerance =  .00020236
Iteration 122:   tolerance =  .00019108
Iteration 123:   tolerance =  .00018044
Iteration 124:   tolerance =  .00017039
Iteration 125:   tolerance =   .0001609
Iteration 126:   tolerance =  .00015194
Iteration 127:   tolerance =  .00014348
Iteration 128:   tolerance =  .00013549
Iteration 129:   tolerance =  .00012795
Iteration 130:   tolerance =  .00012083
Iteration 131:   tolerance =   .0001141
Iteration 132:   tolerance =  .00010775
Iteration 133:   tolerance =  .00010176
Iteration 134:   tolerance =   .0000961
Iteration 135:   tolerance =  .00009075
Iteration 136:   tolerance =  .00008571
Iteration 137:   tolerance =  .00008093
Iteration 138:   tolerance =  .00007643
Iteration 139:   tolerance =  .00007218
Iteration 140:   tolerance =  .00006817
Iteration 141:   tolerance =  .00006438
Iteration 142:   tolerance =   .0000608
Iteration 143:   tolerance =  .00005742
Iteration 144:   tolerance =  .00005423
Iteration 145:   tolerance =  .00005121
Iteration 146:   tolerance =  .00004836
Iteration 147:   tolerance =  .00004567
Iteration 148:   tolerance =  .00004314
Iteration 149:   tolerance =  .00004074
Iteration 150:   tolerance =  .00003847
Iteration 151:   tolerance =  .00003633
Iteration 152:   tolerance =  .00003432
Iteration 153:   tolerance =  .00003241
Iteration 154:   tolerance =  .00003061
Iteration 155:   tolerance =  .00002891
Iteration 156:   tolerance =   .0000273
Iteration 157:   tolerance =  .00002578
Iteration 158:   tolerance =  .00002435
Iteration 159:   tolerance =  .00002299
Iteration 160:   tolerance =  .00002172
Iteration 161:   tolerance =  .00002051
Iteration 162:   tolerance =  .00001937
Iteration 163:   tolerance =  .00001829
Iteration 164:   tolerance =  .00001728
Iteration 165:   tolerance =  .00001632
Iteration 166:   tolerance =  .00001541
Iteration 167:   tolerance =  .00001455
Iteration 168:   tolerance =  .00001375
Iteration 169:   tolerance =  .00001298
Iteration 170:   tolerance =  .00001226
Iteration 171:   tolerance =  .00001158
Iteration 172:   tolerance =  .00001094
Iteration 173:   tolerance =  .00001033
Iteration 174:   tolerance =  9.756e-06
Iteration 175:   tolerance =  9.212e-06
Iteration 176:   tolerance =  8.701e-06
Iteration 177:   tolerance =  8.217e-06
Iteration 178:   tolerance =  7.761e-06
Iteration 179:   tolerance =  7.329e-06
```

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Iteration 180:   tolerance =  6.922e-06
Iteration 181:   tolerance =  6.537e-06
Iteration 182:   tolerance =  6.174e-06
Iteration 183:   tolerance =  5.832e-06
Iteration 184:   tolerance =  5.508e-06
Iteration 185:   tolerance =  5.200e-06
Iteration 186:   tolerance =  4.914e-06
Iteration 187:   tolerance =  4.639e-06
Iteration 188:   tolerance =  4.384e-06
Iteration 189:   tolerance =  4.138e-06
Iteration 190:   tolerance =  3.907e-06
Iteration 191:   tolerance =  3.692e-06
Iteration 192:   tolerance =  3.486e-06
Iteration 193:   tolerance =  3.293e-06
Iteration 194:   tolerance =  3.109e-06
Iteration 195:   tolerance =  2.936e-06
Iteration 196:   tolerance =  2.773e-06
Iteration 197:   tolerance =  2.619e-06
Iteration 198:   tolerance =  2.473e-06
Iteration 199:   tolerance =  2.337e-06
Iteration 200:   tolerance =  2.207e-06
Iteration 201:   tolerance =  2.085e-06
Iteration 202:   tolerance =  1.969e-06
Iteration 203:   tolerance =  1.859e-06
Iteration 204:   tolerance =  1.756e-06
Iteration 205:   tolerance =  1.657e-06
Iteration 206:   tolerance =  1.567e-06
Iteration 207:   tolerance =  1.480e-06
Iteration 208:   tolerance =  1.397e-06
Iteration 209:   tolerance =  1.320e-06
Iteration 210:   tolerance =  1.246e-06
Iteration 211:   tolerance =  1.177e-06
Iteration 212:   tolerance =  1.109e-06
Iteration 213:   tolerance =  1.050e-06
Iteration 214:   tolerance =  9.924e-07

Seemingly unrelated regression, iterated
----------------------------------------------------------------------
Equation          Obs  Parms        RMSE    "R-sq"     F-Stat        P
----------------------------------------------------------------------
dlendrate~n1       94     11    .0101111    0.4787      12.29   0.0000
dlendrate~n2       94     11    .0054533    0.1498       2.95   0.0007
dlendrate~n3       94     11    .0102552    0.0416       1.73   0.0612
dlendrated~5       94     11    .0127092    0.4730      10.03   0.0000
dlendrate~n6       94     11    .0046717    0.1840       3.70   0.0000
dlendrate~n7       94     11    .0060029    0.0383       0.72   0.7190
dlendrated~8       94     11    .0092801    0.2882       3.83   0.0000
dlendrated~9       94     11    .0130628    0.0725       6.01   0.0000
dlendrate~10       94     11    .0048274    0.0193       1.17   0.3033
dlendrate~11       94     11    .0056297    0.0233       2.61   0.0027
dlendrate~12       94     11    .0053473    0.2352       2.77   0.0015
dlendrate~13       94     11    .0076192    0.0359       3.21   0.0003
dlendrate~14       94     11    .0137809    0.1168       2.79   0.0014
dlendrate~16       94     11    .0099235    0.1222       3.48   0.0001
dlendrate~27       94     11    .0075113    0.0883       2.69   0.0020
----------------------------------------------------------------------

------------------------------------------------------------------------------
             |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
dlendrate~n1 |
       dmbks |
         L1. |   133.0369   43.13261     3.08   0.002     48.41531    217.6586
dmbkslass~s1 |
         L1. |   -13.5034   2.414548    -5.59   0.000    -18.24049   -8.766309
dmbksliqu~y1 |
         L1. |   34.68963   4.925829     7.04   0.000     25.02567    44.35358
dmbkscapi~l1 |
         L1. |   12.84803   19.87968     0.65   0.518     -26.1538    51.84986
dmbksNPLr~o1 |
```

```
         L1. |  -28.83805   4.387688    -6.57   0.000    -37.44623   -20.22987
dmbksmatm~b1 |
         L1. |  -.2175591   .1430595    -1.52   0.129    -.4982266    .0631085
dmbksrell~g1 |
         L1. |  -12.61953   4.433999    -2.85   0.004    -21.31857   -3.920493
dmbksport~v1 |
         L1. |  -13.09393   2.849491    -4.60   0.000    -18.68433   -7.503532
   dmbksinfl |
         L1. |   47.92288   9.964285     4.81   0.000       28.374    67.47176
    dmbksipi |
         L1. |   2.373003   1.385351     1.71   0.087    -.3449087    5.090915
   dmbkslhhi |
         L1. |    15.4147   4.408741     3.50   0.000     6.765215    24.06419
       _cons |  -.0022115   .0010519    -2.10   0.036    -.0042752   -.0001477
-------------+----------------------------------------------------------------
dlendrate~n2 |
       dmbks |
         L1. |  -47.47062    50.5587    -0.94   0.348    -146.6615    51.72022
dmbkslass~s2 |
         L1. |   5.140818   2.903393     1.77   0.077    -.5553337    10.83697
dmbksliqu~y2 |
         L1. |  -5.555022    3.19938    -1.74   0.083    -11.83187    .7218243
dmbkscapi~l2 |
         L1. |   16.24958    17.2501     0.94   0.346     -17.5933    50.09245
dmbksNPLr~o2 |
         L1. |   1.781183   2.648655     0.67   0.501    -3.415199    6.977564
dmbksmatm~b2 |
         L1. |  -.8562663   .2850631    -3.00   0.003     -1.41553   -.2970025
dmbksrell~g2 |
         L1. |   17.05063   5.093498     3.35   0.001     7.057724    27.04354
dmbksport~v2 |
         L1. |    2.01295   2.368127     0.85   0.395    -2.633066    6.658966
   dmbksinfl |
         L1. |   1.780658   6.337435     0.28   0.779    -10.65272    14.21404
    dmbksipi |
         L1. |   2.016384   .7552197     2.67   0.008     .5347223    3.498045
   dmbkslhhi |
         L1. |  -6.188176   1.961815    -3.15   0.002    -10.03705   -2.339302
       _cons |   -.000937   .0005592    -1.68   0.094    -.0020341    .0001602
-------------+----------------------------------------------------------------
dlendrate~n3 |
       dmbks |
         L1. |  -52.35528    20.5552    -2.55   0.011    -92.68242   -12.02815
dmbkslass~s3 |
         L1. |   .8270286    .579599     1.43   0.154    -.3100835    1.964141
dmbksliqu~y3 |
         L1. |   1.023224   1.283327     0.80   0.425    -1.494529    3.540977
dmbkscapi~l3 |
         L1. |  -.0575841   1.943826    -0.03   0.976    -3.871166    3.755998
dmbksNPLr~o3 |
         L1. |  -1.414842   1.015648    -1.39   0.164    -3.407436    .5777519
dmbksmatm~b3 |
         L1. |  -.5309824   .9105495    -0.58   0.560    -2.317384     1.25542
dmbksrell~g3 |
         L1. |  -5.622757   9.463282    -0.59   0.553    -24.18872     12.9432
dmbksport~v3 |
         L1. |  -.1509964   1.312805    -0.12   0.908    -2.726581    2.424588
   dmbksinfl |
         L1. |   19.27209   11.44226     1.68   0.092    -3.176424     41.7206
    dmbksipi |
         L1. |   .6826157   1.529389     0.45   0.655    -2.317884    3.683115
   dmbkslhhi |
         L1. |   5.615068   2.416001     2.32   0.020     .8751282    10.35501
       _cons |   .0004479   .0010737     0.42   0.677    -.0016587    .0025544
-------------+----------------------------------------------------------------
dlendrated~5 |
       dmbks |
         L1. |   368.0195   57.82982     6.36   0.000     254.5635    481.4755
dmbkslasse~5 |
         L1. |  -20.79769   3.402624    -6.11   0.000    -27.47328    -14.1221
```

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dmbksliqui~5 |
         L1. |   -13.5241   3.740726    -3.62   0.000    -20.86301   -6.185187
dmbkscapit~5 |
         L1. |  -105.3426   17.64699    -5.97   0.000    -139.9642   -70.72111
dmbksNPLra~5 |
         L1. |   31.72315   7.001325     4.53   0.000     17.98729    45.45901
dmbksmatm~b5 |
         L1. |   4.543474   1.093908     4.15   0.000     2.397342    6.689606
dmbksrelle~5 |
         L1. |   3.070648   2.467328     1.24   0.214     -1.76999    7.911287
dmbksportd~5 |
         L1. |   .1240771   2.847451     0.04   0.965    -5.462321    5.710475
   dmbksinfl |
         L1. |   8.723613   11.13757     0.78   0.434    -13.12713    30.57436
    dmbksipi |
         L1. |   5.592856   1.797358     3.11   0.002      2.06663    9.119083
   dmbkslhhi |
         L1. |  -5.276646   4.564613    -1.16   0.248    -14.23193    3.678643
       _cons |  -.0017734   .0012997    -1.36   0.173    -.0043232    .0007764
-------------+----------------------------------------------------------------

dlendrate~n6 |
       dmbks |
         L1. |  -3.033655   17.43555    -0.17   0.862    -37.24036    31.17305
dmbkslass~s6 |
         L1. |  -1.522914   .7789074    -1.96   0.051    -3.051048    .0052203
dmbksliqu~y6 |
         L1. |  -.9960674   1.202549    -0.83   0.408    -3.355341    1.363207
dmbkscapi~l6 |
         L1. |  -.8070679   2.844684    -0.28   0.777    -6.388037    4.773901
dmbksNPLr~o6 |
         L1. |  -4.858421   2.243947    -2.17   0.031     -9.26081   -.4560329
dmbksmatm~b6 |
         L1. |  -1.543199   .3813163    -4.05   0.000    -2.291301   -.7950965
dmbksrell~g6 |
         L1. |  -.1739594   1.161283    -0.15   0.881    -2.452274    2.104356
dmbksport~v6 |
         L1. |  -.2711075    1.23354    -0.22   0.826    -2.691184    2.148969
   dmbksinfl |
         L1. |  -1.444057   3.885128    -0.37   0.710    -9.066269    6.178156
    dmbksipi |
         L1. |  -.4231277   .6648456    -0.64   0.525    -1.727485    .8812293
   dmbkslhhi |
         L1. |   4.008327     1.6518     2.43   0.015     .7676703    7.248984
       _cons |    .000175   .0004787     0.37   0.715    -.0007641    .0011141
-------------+----------------------------------------------------------------
dlendrate~n7 |
       dmbks |
         L1. |    45.8932   23.79103     1.93   0.054    -.7822894    92.56869
dmbkslass~s7 |
         L1. |  -2.163208   1.212783    -1.78   0.075     -4.54256    .2161437
dmbksliqu~y7 |
         L1. |  -.5520511   1.542061    -0.36   0.720    -3.577412     2.47331
dmbkscapi~l7 |
         L1. |   -6.27749   3.324937    -1.89   0.059    -12.80067    .2456851
dmbksNPLr~o7 |
         L1. |   .6054463   2.148613     0.28   0.778    -3.609905    4.820798
dmbksmatm~b7 |
         L1. |  -.0003662   .0130649    -0.03   0.978    -.0259982    .0252658
dmbksrell~g7 |
         L1. |   1.928494   1.646739     1.17   0.242    -1.302234    5.159222
dmbksport~v7 |
         L1. |   .3349567   3.580766     0.09   0.925    -6.690129    7.360042
   dmbksinfl |
         L1. |   5.136068   5.994544     0.86   0.392    -6.624594    16.89673
    dmbksipi |
         L1. |   .2215944   .8375366     0.26   0.791    -1.421564    1.864753
   dmbkslhhi |
         L1. |  -1.680577     2.7266    -0.62   0.538    -7.029878    3.668724
       _cons |  -.0011763   .0006421    -1.83   0.067    -.0024361    .0000834
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-------------+----------------------------------------------------------------
dlendrated~8 |
       dmbks |
         L1. |   76.84358   103.6769     0.74   0.459    -126.5596    280.2467
dmbkslasse~8 |
         L1. |  -8.382984   7.210272    -1.16   0.245    -22.52878    5.762809
dmbksliqui~8 |
         L1. |   19.39971   6.276561     3.09   0.002     7.085763    31.71366
dmbkscapit~8 |
         L1. |   7.875686   9.837678     0.80   0.424     -11.4248    27.17617
dmbksNPLra~8 |
         L1. |  -1.723351   2.407302    -0.72   0.474    -6.446224    2.999523
dmbksmatm~b8 |
         L1. |  -.3273894    .253386    -1.29   0.197    -.8245061    .1697272
dmbksrelle~8 |
         L1. |   8.275492   5.217272     1.59   0.113    -1.960245    18.51123
dmbksportd~8 |
         L1. |   1.412582   1.777108     0.79   0.427    -2.073917    4.899082
   dmbksinfl |
         L1. |  -14.69207   8.716592    -1.69   0.092     -31.7931    2.408965
    dmbksipi |
         L1. |   1.344207   1.239529     1.08   0.278    -1.087618    3.776032
   dmbkslhhi |
         L1. |   3.796246   3.519764     1.08   0.281    -3.109159    10.70165
       _cons |  -.0018496   .0010094    -1.83   0.067      -.00383    .0001308
-------------+----------------------------------------------------------------


dlendrated~9 |
       dmbks |
         L1. |  -82.65665   35.51214    -2.33   0.020    -152.3277   -12.98558
dmbkslasse~9 |
         L1. |   6.114547   1.125574     5.43   0.000      3.90629    8.322805
dmbksliqui~9 |
         L1. |  -3.144995   2.059455    -1.53   0.127    -7.185428    .8954387
dmbkscapit~9 |
         L1. |   23.11281   3.320894     6.96   0.000     16.59757    29.62806
dmbksNPLra~9 |
         L1. |  -8.209928   1.606432    -5.11   0.000    -11.36158   -5.058277
dmbksmatm~b9 |
         L1. |  -.0418047   .0213976    -1.95   0.051    -.0837844    .0001751
dmbksrelle~9 |
         L1. |  -6.159725   2.154249    -2.86   0.004    -10.38614   -1.933316
dmbksportd~9 |
         L1. |   2.054066   1.425656     1.44   0.150    -.7429199    4.851053
   dmbksinfl |
         L1. |   7.352836   9.400595     0.78   0.434    -11.09014    25.79581
    dmbksipi |
         L1. |  -.1026595   1.818943    -0.06   0.955    -3.671235    3.465916
   dmbkslhhi |
         L1. |  -1.648804   4.534265    -0.36   0.716    -10.54455    7.246945
       _cons |  -.0018306   .0013525    -1.35   0.176    -.0044841    .0008228
-------------+----------------------------------------------------------------
dlendrate~10 |
       dmbks |
         L1. |   9.299999   16.94044     0.55   0.583    -23.93535    42.53535
dmbkslass~10 |
         L1. |   1.214712   .9415124     1.29   0.197     -.632436     3.06186
dmbksliqu~10 |
         L1. |  -3.116642   1.804565    -1.73   0.084    -6.657009    .4237239
dmbkscapi~10 |
         L1. |  -2.801191   6.261447    -0.45   0.655    -15.08549    9.483106
dmbksNPLr~10 |
         L1. |  -15.40511   8.325047    -1.85   0.064    -31.73797    .9277547
dmbksmat~b10 |
         L1. |   -.512003   .2724606    -1.88   0.060    -1.046542    .0225359
dmbksrell~10 |
         L1. |  -5.621705   3.290161    -1.71   0.088    -12.07665    .8332446
dmbksport~10 |
         L1. |  -1.662304   2.355736    -0.71   0.481    -6.284011    2.959402
```

```
   dmbksinfl |
         L1. |  -6.059609   5.070321    -1.20   0.232    -16.00704    3.887825
    dmbksipi |
         L1. |  -.3543071   .6907607    -0.51   0.608    -1.709507    1.000893
   dmbkslhhi |
         L1. |  -2.842859   2.463798    -1.15   0.249     -7.67657    1.990853
       _cons |  -.0007304   .0005092    -1.43   0.152    -.0017294    .0002686
-------------+----------------------------------------------------------------
dlendrate~11 |
       dmbks |
         L1. |    8.26562   19.15592     0.43   0.666    -29.31628    45.84752
dmbkslass~11 |
         L1. |   -.557416    1.05377    -0.53   0.597    -2.624802     1.50997
dmbksliqu~11 |
         L1. |  -2.348594   1.583246    -1.48   0.138    -5.454756    .7575674
dmbkscapi~11 |
         L1. |  -4.806907   8.657343    -0.56   0.579     -21.7917    12.17789
dmbksNPLr~11 |
         L1. |   5.134597   7.313879     0.70   0.483    -9.214461    19.48366
dmbksmat~b11 |
         L1. |   .2315549   .5161322     0.45   0.654    -.7810421    1.244152
dmbksrell~11 |
         L1. |   -2.80905   1.640523    -1.71   0.087    -6.027583    .4094828
dmbksport~11 |
         L1. |  -2.307213   1.814571    -1.27   0.204    -5.867209    1.252784
   dmbksinfl |
         L1. |   11.44202   5.177799     2.21   0.027     1.283726    21.60032
    dmbksipi |
         L1. |   .2669313    .765994     0.35   0.728    -1.235868    1.769731
   dmbkslhhi |
         L1. |   .5587463   1.921965     0.29   0.771    -3.211946    4.329439
       _cons |  -.0011152   .0005882    -1.90   0.058    -.0022692    .0000388
-------------+----------------------------------------------------------------


dlendrate~12 |
       dmbks |
         L1. |  -59.52117   31.54572    -1.89   0.059    -121.4106    2.368216
dmbkslass~12 |
         L1. |   2.536768   2.274511     1.12   0.265    -1.925581    6.999118
dmbksliqu~12 |
         L1. |  -1.596236   2.507303    -0.64   0.524      -6.5153    3.322828
dmbkscapi~12 |
         L1. |   10.87033   10.27752     1.06   0.290    -9.293093    31.03374
dmbksNPLr~12 |
         L1. |   5.779746   4.549512     1.27   0.204    -3.145917    14.70541
dmbksmat~b12 |
         L1. |   .2623761   .9690937     0.27   0.787    -1.638884    2.163636
dmbksrell~12 |
         L1. |  -6.745812   3.470625    -1.94   0.052    -13.55481    .0631879
dmbksport~12 |
         L1. |   .3197345   1.893163     0.17   0.866    -3.394452    4.033921
   dmbksinfl |
         L1. |   4.886832   4.600811     1.06   0.288    -4.139475    13.91314
    dmbksipi |
         L1. |  -1.992863   .7278455    -2.74   0.006    -3.420819   -.5649069
   dmbkslhhi |
         L1. |   2.567865   1.866529     1.38   0.169    -1.094068    6.229797
       _cons |  -.0005493    .000553    -0.99   0.321    -.0016342    .0005356
-------------+----------------------------------------------------------------
dlendrate~13 |
       dmbks |
         L1. |  -16.49177   20.30292    -0.81   0.417    -56.32396    23.34041
dmbkslass~13 |
         L1. |   2.167754   1.225297     1.77   0.077    -.2361489    4.571657
dmbksliqu~13 |
         L1. |   .0990819   1.231745     0.08   0.936    -2.317473    2.515636
dmbkscapi~13 |
         L1. |   12.44685    3.93045     3.17   0.002     4.735719    20.15798
dmbksNPLr~13 |
```

```
         L1. |  -5.741936   1.579019    -3.64   0.000    -8.839805   -2.644067
dmbksmat~b13 |
         L1. |  -2.524032   .8349981    -3.02   0.003     -4.16221   -.8858533
dmbksrell~13 |
         L1. |   3.141008   2.071281     1.52   0.130    -.9226273    7.204643
dmbksport~13 |
         L1. |   .0133667   .0138196     0.97   0.334    -.0137459    .0404793
   dmbksinfl |
         L1. |  -.6997181   5.591926    -0.13   0.900    -11.67049    10.27105
    dmbksipi |
         L1. |  -2.045893   1.021653    -2.00   0.045    -4.050269   -.0415165
   dmbkslhhi |
         L1. |  -2.128884   1.830501    -1.16   0.245    -5.720135    1.462366
       _cons |  -.0013591   .0007824    -1.74   0.083    -.0028941     .000176
-------------+----------------------------------------------------------------
dlendrate~14 |
       dmbks |
         L1. |   677.3629   147.7837     4.58   0.000     387.4269     967.299
dmbkslass~14 |
         L1. |   -34.1378   7.723863    -4.42   0.000    -49.29121    -18.9844
dmbksliqu~14 |
         L1. |    .717844   1.726107     0.42   0.678    -2.668596    4.104284
dmbkscapi~14 |
         L1. |   .8252107       2.99     0.28   0.783    -5.040855    6.691276
dmbksNPLr~14 |
         L1. |  -9.568224   2.743435    -3.49   0.001    -14.95055   -4.185894
dmbksmat~b14 |
         L1. |  -.8964508   .5515774    -1.63   0.104    -1.978588    .1856859
dmbksrell~14 |
         L1. |  -6.060396   3.076723    -1.97   0.049     -12.0966   -.0241898
dmbksport~14 |
         L1. |   13.76152   5.867213     2.35   0.019     2.250671    25.27238
   dmbksinfl |
         L1. |  -54.58295   17.76838    -3.07   0.002    -89.44264   -19.72327
    dmbksipi |
         L1. |  -2.572531   2.130458    -1.21   0.227    -6.752265    1.607203
   dmbkslhhi |
         L1. |  -31.06338   7.320826    -4.24   0.000    -45.42607   -16.70069
       _cons |  -.0014251   .0015206    -0.94   0.349    -.0044085    .0015582
-------------+----------------------------------------------------------------


dlendrate~16 |
       dmbks |
         L1. |  -108.8797     32.661    -3.33   0.001    -172.9572    -44.8023
dmbkslass~16 |
         L1. |   11.47948   2.989908     3.84   0.000     5.613596    17.34536
dmbksliqu~16 |
         L1. |   1.119782   2.166194     0.52   0.605    -3.130062    5.369626
dmbkscapi~16 |
         L1. |   18.01822   5.633967     3.20   0.001      6.96497    29.07147
dmbksNPLr~16 |
         L1. |  -10.52456   5.037389    -2.09   0.037    -20.40739   -.6417316
dmbksmat~b16 |
         L1. |   .1305346   1.088426     0.12   0.905    -2.004843    2.265912
dmbksrell~16 |
         L1. |   1.335095   1.452315     0.92   0.358    -1.514193    4.184384
dmbksport~16 |
         L1. |  -3.303288   2.638886    -1.25   0.211    -8.480504    1.873928
   dmbksinfl |
         L1. |   4.275502   7.687585     0.56   0.578    -10.80673    19.35773
    dmbksipi |
         L1. |  -.9687207   1.400547    -0.69   0.489    -3.716445    1.779004
   dmbkslhhi |
         L1. |  -8.773592   4.141286    -2.12   0.034    -16.89836   -.6488256
       _cons |  -.0000627   .0010145    -0.06   0.951     -.002053    .0019276
-------------+----------------------------------------------------------------
dlendrate~27 |
       dmbks |
         L1. |  -31.84713   35.88446    -0.89   0.375    -102.2487     38.5544
```

```
dmbkslass~27 |
         L1. |   1.289323   1.883786     0.68   0.494    -2.406466    4.985112
dmbksliqu~27 |
         L1. |   1.160115   2.230201     0.52   0.603    -3.215303    5.535534
dmbkscapi~27 |
         L1. |   2.867379   3.709705     0.77   0.440    -4.410671    10.14543
dmbksNPLr~27 |
         L1. |   5.036074   2.217976     2.27   0.023      .684639    9.387509
dmbksmat~b27 |
         L1. |  -.4868298   .1968039    -2.47   0.014    -.8729384   -.1007213
dmbksrell~27 |
         L1. |   6.786308   2.712633     2.50   0.012     1.464408    12.10821
dmbksport~27 |
         L1. |  -1.395606   .5109216    -2.73   0.006    -2.397981    -.393232
   dmbksinfl |
         L1. |   1.272688   6.653943     0.19   0.848    -11.78165    14.32702
    dmbksipi |
         L1. |  -.0135658   1.043377    -0.01   0.990    -2.060562     2.03343
   dmbkslhhi |
         L1. |   1.292048    2.95664     0.44   0.662    -4.508568    7.092663
       _cons |  -.0005309   .0007832    -0.68   0.498    -.0020675    .0010057
------------------------------------------------------------------------------
```

Correlation matrix of residuals:

```
               dlendrateden1  dlendrateden2  dlendrateden3  dlendrateden5  dlendrateden6
 dlendrateden1        1.0000
 dlendrateden2        0.1862         1.0000
 dlendrateden3       -0.1961        -0.2355         1.0000
 dlendrateden5        0.0281        -0.4928         0.0314         1.0000
 dlendrateden6       -0.2113        -0.0487         0.6068        -0.0764         1.0000
 dlendrateden7        0.0350        -0.1860        -0.1168         0.0811        -0.3694
 dlendrateden8        0.1189        -0.0506        -0.0902         0.0547        -0.1775
 dlendrateden9       -0.1121        -0.0365        -0.0078         0.1475        -0.0365
dlendrateden10       -0.0944         0.0492        -0.0434         0.0603         0.0253
dlendrateden11        0.0330        -0.3620        -0.3290         0.4035        -0.5046
dlendrateden12       -0.0799         0.0736        -0.0809        -0.3053         0.1355
dlendrateden13       -0.2573         0.0466        -0.2233        -0.1514        -0.3233
dlendrateden14       -0.2132        -0.0686         0.1370        -0.1334         0.2280
dlendrateden16       -0.4169         0.2693        -0.0572        -0.4999         0.0002
dlendrateden27       -0.2595        -0.0344         0.2876        -0.0591         0.5038

               dlendrateden7  dlendrateden8  dlendrateden9 dlendrateden10 dlendrateden11
 dlendrateden7        1.0000
 dlendrateden8        0.0495         1.0000
 dlendrateden9       -0.0936        -0.1319         1.0000
dlendrateden10       -0.0122        -0.1108        -0.0418         1.0000
dlendrateden11        0.3046         0.2549        -0.2340        -0.0608         1.0000
dlendrateden12       -0.1236        -0.0376        -0.3106         0.2189         0.0390
dlendrateden13        0.0850        -0.0124         0.7470        -0.0947         0.1222
dlendrateden14       -0.0166        -0.2329         0.0661        -0.0230        -0.0503
dlendrateden16       -0.1096        -0.0199         0.0924         0.0722        -0.3804
dlendrateden27       -0.1880         0.0243        -0.0129         0.2467        -0.2114

              dlendrateden12 dlendrateden13 dlendrateden14 dlendrateden16 dlendrateden27
dlendrateden12        1.0000
dlendrateden13       -0.0823         1.0000
dlendrateden14        0.0642         0.1572         1.0000
dlendrateden16        0.2663         0.2373         0.1099         1.0000
dlendrateden27        0.4839        -0.1409         0.0260         0.3246         1.0000
```

Breusch-Pagan test of independence: chi2(105) = 479.520, Pr = 0.0000

F-test for joint significance of the parameters of the variables in all bank specific equations:

```
. test l.dmbks
```

```
 ( 1)  [dlendrateden1]L.dmbks = 0
 ( 2)  [dlendrateden2]L.dmbks = 0
 ( 3)  [dlendrateden3]L.dmbks = 0
 ( 4)  [dlendrateden5]L.dmbks = 0
 ( 5)  [dlendrateden6]L.dmbks = 0
 ( 6)  [dlendrateden7]L.dmbks = 0
 ( 7)  [dlendrateden8]L.dmbks = 0
 ( 8)  [dlendrateden9]L.dmbks = 0
 ( 9)  [dlendrateden10]L.dmbks = 0
 (10)  [dlendrateden11]L.dmbks = 0
 (11)  [dlendrateden12]L.dmbks = 0
 (12)  [dlendrateden13]L.dmbks = 0
 (13)  [dlendrateden14]L.dmbks = 0
 (14)  [dlendrateden16]L.dmbks = 0
 (15)  [dlendrateden27]L.dmbks = 0

       F( 15,  1230) =    6.64
            Prob > F =    0.0000

. test l.dmbksinfl

 ( 1)  [dlendrateden1]L.dmbksinfl = 0
 ( 2)  [dlendrateden2]L.dmbksinfl = 0
 ( 3)  [dlendrateden3]L.dmbksinfl = 0
 ( 4)  [dlendrateden5]L.dmbksinfl = 0
 ( 5)  [dlendrateden6]L.dmbksinfl = 0
 ( 6)  [dlendrateden7]L.dmbksinfl = 0
 ( 7)  [dlendrateden8]L.dmbksinfl = 0
 ( 8)  [dlendrateden9]L.dmbksinfl = 0
 ( 9)  [dlendrateden10]L.dmbksinfl = 0
 (10)  [dlendrateden11]L.dmbksinfl = 0
 (11)  [dlendrateden12]L.dmbksinfl = 0
 (12)  [dlendrateden13]L.dmbksinfl = 0
 (13)  [dlendrateden14]L.dmbksinfl = 0
 (14)  [dlendrateden16]L.dmbksinfl = 0
 (15)  [dlendrateden27]L.dmbksinfl = 0

       F( 15,  1230) =    5.17
            Prob > F =    0.0000

. test l.dmbksipi

 ( 1)  [dlendrateden1]L.dmbksipi = 0
 ( 2)  [dlendrateden2]L.dmbksipi = 0
 ( 3)  [dlendrateden3]L.dmbksipi = 0
 ( 4)  [dlendrateden5]L.dmbksipi = 0
 ( 5)  [dlendrateden6]L.dmbksipi = 0
 ( 6)  [dlendrateden7]L.dmbksipi = 0
 ( 7)  [dlendrateden8]L.dmbksipi = 0
 ( 8)  [dlendrateden9]L.dmbksipi = 0
 ( 9)  [dlendrateden10]L.dmbksipi = 0
 (10)  [dlendrateden11]L.dmbksipi = 0
 (11)  [dlendrateden12]L.dmbksipi = 0
 (12)  [dlendrateden13]L.dmbksipi = 0
 (13)  [dlendrateden14]L.dmbksipi = 0
 (14)  [dlendrateden16]L.dmbksipi = 0
 (15)  [dlendrateden27]L.dmbksipi = 0

       F( 15,  1230) =    2.91
            Prob > F =    0.0001

. test l.dmbkslhhi

 ( 1)  [dlendrateden1]L.dmbkslhhi = 0
 ( 2)  [dlendrateden2]L.dmbkslhhi = 0
 ( 3)  [dlendrateden3]L.dmbkslhhi = 0
 ( 4)  [dlendrateden5]L.dmbkslhhi = 0
 ( 5)  [dlendrateden6]L.dmbkslhhi = 0
 ( 6)  [dlendrateden7]L.dmbkslhhi = 0
 ( 7)  [dlendrateden8]L.dmbkslhhi = 0
```

```
 ( 8)  [dlendrateden9]L.dmbkslhhi = 0
 ( 9)  [dlendrateden10]L.dmbkslhhi = 0
 (10)  [dlendrateden11]L.dmbkslhhi = 0
 (11)  [dlendrateden12]L.dmbkslhhi = 0
 (12)  [dlendrateden13]L.dmbkslhhi = 0
 (13)  [dlendrateden14]L.dmbkslhhi = 0
 (14)  [dlendrateden16]L.dmbkslhhi = 0
 (15)  [dlendrateden27]L.dmbkslhhi = 0

       F( 15,  1230) =    4.72
            Prob > F =    0.0000

.   test   l.dmbkslassets1   l.dmbkslassets2   l.dmbkslassets3   l.dmbkslassets5
l.dmbkslassets6 l.dmbkslassets7 l.d
> mbkslassets8 l.dmbkslassets9 /*
>   */  l.dmbkslassets10  l.dmbkslassets11  l.dmbkslassets12  l.dmbkslassets13
l.dmbkslassets14 l.dmbkslassets16
>  l.dmbkslassets27

 ( 1)  [dlendrateden1]L.dmbkslassets1 = 0
 ( 2)  [dlendrateden2]L.dmbkslassets2 = 0
 ( 3)  [dlendrateden3]L.dmbkslassets3 = 0
 ( 4)  [dlendrateden5]L.dmbkslassets5 = 0
 ( 5)  [dlendrateden6]L.dmbkslassets6 = 0
 ( 6)  [dlendrateden7]L.dmbkslassets7 = 0
 ( 7)  [dlendrateden8]L.dmbkslassets8 = 0
 ( 8)  [dlendrateden9]L.dmbkslassets9 = 0
 ( 9)  [dlendrateden10]L.dmbkslassets10 = 0
 (10)  [dlendrateden11]L.dmbkslassets11 = 0
 (11)  [dlendrateden12]L.dmbkslassets12 = 0
 (12)  [dlendrateden13]L.dmbkslassets13 = 0
 (13)  [dlendrateden14]L.dmbkslassets14 = 0
 (14)  [dlendrateden16]L.dmbkslassets16 = 0
 (15)  [dlendrateden27]L.dmbkslassets27 = 0

       F( 15,  1230) =    9.98
            Prob > F =    0.0000

.  test  l.dmbksliquidity1  l.dmbksliquidity2  l.dmbksliquidity3  l.dmbksliquidity5
l.dmbksliquidity6 l.dmbksli
> quidity7 l.dmbksliquidity8 l.dmbksliquidity9 /*
>  */ l.dmbksliquidity10  l.dmbksliquidity11  l.dmbksliquidity12  l.dmbksliquidity13
l.dmbksliquidity14 l.dmbk
> sliquidity16 l.dmbksliquidity27

 ( 1)  [dlendrateden1]L.dmbksliquidity1 = 0
 ( 2)  [dlendrateden2]L.dmbksliquidity2 = 0
 ( 3)  [dlendrateden3]L.dmbksliquidity3 = 0
 ( 4)  [dlendrateden5]L.dmbksliquidity5 = 0
 ( 5)  [dlendrateden6]L.dmbksliquidity6 = 0
 ( 6)  [dlendrateden7]L.dmbksliquidity7 = 0
 ( 7)  [dlendrateden8]L.dmbksliquidity8 = 0
 ( 8)  [dlendrateden9]L.dmbksliquidity9 = 0
 ( 9)  [dlendrateden10]L.dmbksliquidity10 = 0
 (10)  [dlendrateden11]L.dmbksliquidity11 = 0
 (11)  [dlendrateden12]L.dmbksliquidity12 = 0
 (12)  [dlendrateden13]L.dmbksliquidity13 = 0
 (13)  [dlendrateden14]L.dmbksliquidity14 = 0
 (14)  [dlendrateden16]L.dmbksliquidity16 = 0
 (15)  [dlendrateden27]L.dmbksliquidity27 = 0

       F( 15,  1230) =    5.84
            Prob > F =    0.0000

.   test   l.dmbkscapital1   l.dmbkscapital2   l.dmbkscapital3   l.dmbkscapital5
l.dmbkscapital6 l.dmbkscapital7 l.d
> mbkscapital8 l.dmbkscapital9 /*
>   */  l.dmbkscapital10  l.dmbkscapital11  l.dmbkscapital12  l.dmbkscapital13
l.dmbkscapital14 l.dmbkscapital16
>  l.dmbkscapital27
```

```
 ( 1)  [dlendrateden1]L.dmbkscapital1 = 0
 ( 2)  [dlendrateden2]L.dmbkscapital2 = 0
 ( 3)  [dlendrateden3]L.dmbkscapital3 = 0
 ( 4)  [dlendrateden5]L.dmbkscapital5 = 0
 ( 5)  [dlendrateden6]L.dmbkscapital6 = 0
 ( 6)  [dlendrateden7]L.dmbkscapital7 = 0
 ( 7)  [dlendrateden8]L.dmbkscapital8 = 0
 ( 8)  [dlendrateden9]L.dmbkscapital9 = 0
 ( 9)  [dlendrateden10]L.dmbkscapital10 = 0
 (10)  [dlendrateden11]L.dmbkscapital11 = 0
 (11)  [dlendrateden12]L.dmbkscapital12 = 0
 (12)  [dlendrateden13]L.dmbkscapital13 = 0
 (13)  [dlendrateden14]L.dmbkscapital14 = 0
 (14)  [dlendrateden16]L.dmbkscapital16 = 0
 (15)  [dlendrateden27]L.dmbkscapital27 = 0

       F( 15,  1230) =    6.52
            Prob > F =    0.0000

.  test  l.dmbksNPLratio1  l.dmbksNPLratio2  l.dmbksNPLratio3  l.dmbksNPLratio5 l.dmbksNPLratio6 l.dmbksNPLrati
> o7 l.dmbksNPLratio8 l.dmbksNPLratio9 /*
>  */  l.dmbksNPLratio10  l.dmbksNPLratio11  l.dmbksNPLratio12  l.dmbksNPLratio13 l.dmbksNPLratio14 l.dmbksNPLr
> atio16 l.dmbksNPLratio27

 ( 1)  [dlendrateden1]L.dmbksNPLratio1 = 0
 ( 2)  [dlendrateden2]L.dmbksNPLratio2 = 0
 ( 3)  [dlendrateden3]L.dmbksNPLratio3 = 0
 ( 4)  [dlendrateden5]L.dmbksNPLratio5 = 0
 ( 5)  [dlendrateden6]L.dmbksNPLratio6 = 0
 ( 6)  [dlendrateden7]L.dmbksNPLratio7 = 0
 ( 7)  [dlendrateden8]L.dmbksNPLratio8 = 0
 ( 8)  [dlendrateden9]L.dmbksNPLratio9 = 0
 ( 9)  [dlendrateden10]L.dmbksNPLratio10 = 0
 (10)  [dlendrateden11]L.dmbksNPLratio11 = 0
 (11)  [dlendrateden12]L.dmbksNPLratio12 = 0
 (12)  [dlendrateden13]L.dmbksNPLratio13 = 0
 (13)  [dlendrateden14]L.dmbksNPLratio14 = 0
 (14)  [dlendrateden16]L.dmbksNPLratio16 = 0
 (15)  [dlendrateden27]L.dmbksNPLratio27 = 0

       F( 15,  1230) =    8.21
            Prob > F =    0.0000

.  test  l.dmbksmatmisub1  l.dmbksmatmisub2  l.dmbksmatmisub3  l.dmbksmatmisub5 l.dmbksmatmisub6 l.dmbksmatmisu
> b7 l.dmbksmatmisub8 l.dmbksmatmisub9 /*
>  */  l.dmbksmatmisub10  l.dmbksmatmisub11  l.dmbksmatmisub12  l.dmbksmatmisub13 l.dmbksmatmisub14 l.dmbksmatm
> isub16 l.dmbksmatmisub27

 ( 1)  [dlendrateden1]L.dmbksmatmisub1 = 0
 ( 2)  [dlendrateden2]L.dmbksmatmisub2 = 0
 ( 3)  [dlendrateden3]L.dmbksmatmisub3 = 0
 ( 4)  [dlendrateden5]L.dmbksmatmisub5 = 0
 ( 5)  [dlendrateden6]L.dmbksmatmisub6 = 0
 ( 6)  [dlendrateden7]L.dmbksmatmisub7 = 0
 ( 7)  [dlendrateden8]L.dmbksmatmisub8 = 0
 ( 8)  [dlendrateden9]L.dmbksmatmisub9 = 0
 ( 9)  [dlendrateden10]L.dmbksmatmisub10 = 0
 (10)  [dlendrateden11]L.dmbksmatmisub11 = 0
 (11)  [dlendrateden12]L.dmbksmatmisub12 = 0
 (12)  [dlendrateden13]L.dmbksmatmisub13 = 0
 (13)  [dlendrateden14]L.dmbksmatmisub14 = 0
 (14)  [dlendrateden16]L.dmbksmatmisub16 = 0
 (15)  [dlendrateden27]L.dmbksmatmisub27 = 0

       F( 15,  1230) =    5.10
```

```
           Prob > F =    0.0000

. test l.dmbksrellending1 l.dmbksrellending2 l.dmbksrellending3 l.dmbksrellending5
l.dmbksrellending6 l.dm
> bksrellending7 l.dmbksrellending8 l.dmbksrellending9 /*
>      */     l.dmbksrellending10     l.dmbksrellending11     l.dmbksrellending12
l.dmbksrellending13 l.dmbksrellending14 l
> .dmbksrellending16 l.dmbksrellending27

 ( 1)  [dlendrateden1]L.dmbksrellending1 = 0
 ( 2)  [dlendrateden2]L.dmbksrellending2 = 0
 ( 3)  [dlendrateden3]L.dmbksrellending3 = 0
 ( 4)  [dlendrateden5]L.dmbksrellending5 = 0
 ( 5)  [dlendrateden6]L.dmbksrellending6 = 0
 ( 6)  [dlendrateden7]L.dmbksrellending7 = 0
 ( 7)  [dlendrateden8]L.dmbksrellending8 = 0
 ( 8)  [dlendrateden9]L.dmbksrellending9 = 0
 ( 9)  [dlendrateden10]L.dmbksrellending10 = 0
 (10)  [dlendrateden11]L.dmbksrellending11 = 0
 (11)  [dlendrateden12]L.dmbksrellending12 = 0
 (12)  [dlendrateden13]L.dmbksrellending13 = 0
 (13)  [dlendrateden14]L.dmbksrellending14 = 0
 (14)  [dlendrateden16]L.dmbksrellending16 = 0
 (15)  [dlendrateden27]L.dmbksrellending27 = 0

       F( 15,  1230) =    3.84
            Prob > F =    0.0000

.   test   l.dmbksportdiv1   l.dmbksportdiv2   l.dmbksportdiv3   l.dmbksportdiv5
l.dmbksportdiv6 l.dmbksportdiv7 l.d
> mbksportdiv8 l.dmbksportdiv9 /*
>   */   l.dmbksportdiv10   l.dmbksportdiv11   l.dmbksportdiv12   l.dmbksportdiv13
l.dmbksportdiv14 l.dmbksportdiv16
>  l.dmbksportdiv27

 ( 1)  [dlendrateden1]L.dmbksportdiv1 = 0
 ( 2)  [dlendrateden2]L.dmbksportdiv2 = 0
 ( 3)  [dlendrateden3]L.dmbksportdiv3 = 0
 ( 4)  [dlendrateden5]L.dmbksportdiv5 = 0
 ( 5)  [dlendrateden6]L.dmbksportdiv6 = 0
 ( 6)  [dlendrateden7]L.dmbksportdiv7 = 0
 ( 7)  [dlendrateden8]L.dmbksportdiv8 = 0
 ( 8)  [dlendrateden9]L.dmbksportdiv9 = 0
 ( 9)  [dlendrateden10]L.dmbksportdiv10 = 0
 (10)  [dlendrateden11]L.dmbksportdiv11 = 0
 (11)  [dlendrateden12]L.dmbksportdiv12 = 0
 (12)  [dlendrateden13]L.dmbksportdiv13 = 0
 (13)  [dlendrateden14]L.dmbksportdiv14 = 0
 (14)  [dlendrateden16]L.dmbksportdiv16 = 0
 (15)  [dlendrateden27]L.dmbksportdiv27 = 0

       F( 15,  1230) =    2.99
            Prob > F =    0.0001
```

Appendix 3.6: Estimation results and estimation output of the final model specification estimated with OLS equation-by-equation.

a) Estimation results of the model estimated with OLS equation-by-equation.

VARIABLE:	Bank1	Bank2	Bank3	Bank5	Bank6	Bank7	Bank8	Bank9	Bank10	Bank11	Bank12	Bank13	Bank14	Bank16	Bank27
L.dmbks	82.52	112.4*	-53.47**	527.8***	-3.94	28.58	1.89	-134.5*	4.71	-32.03	-64.16	-0.19	582.3***	-51.08	19.27
	(56.88)	(65.43)	(22.82)	(90.09)	(26.04)	(27.08)	(121.1)	(75.21)	(18.63)	(31.14)	(40.95)	(48.69)	(167.2)	(42.80)	(51.81)
L.dmbkslassets	-10.01***	-4.55	1.05	-29.26***	-0.72	-1.32	-3.5	3.89	0.68	0.50	3.35	-0.18	-28.47***	4.26	-2.94
	(3.25)	(3.77)	(0.66)	(5.33)	(1.07)	(1.39)	(8.45)	(3.08)	(1.04)	(1.77)	(2.92)	(3.29)	(8.75)	(4.18)	(2.79)
L.dmbksliquidity	37.17***	0.22	-1.67	-20.94***	-3.96*	0.34	15.95**	-0.06	-2.17	-2.98	-8.18**	-2.23	0.55	4.90	-6.97**
	(6.55)	(4.16)	(1.70)	(5.73)	(2.03)	(1.82)	(7.27)	(4.56)	(1.99)	(2.81)	(3.45)	(2.87)	(1.97)	(3.00)	(2.9)
L.dmbkscapital	33.08	-43.03*	1.74	-170.6***	4.14	-4.36	11.03	23.52**	0.2	1.30	-1.79	1.49	-3.58	3.49	-1.12
	(28.05)	(22.78)	(2.47)	(29.11)	(4.19)	(3.87)	(11.46)	(9.87)	(6.92)	(14.58)	(13.57)	(9.87)	(3.36)	(7.90)	(5.58)
L.dmbksNPLratio	-29.98***	-1.07	-1.80	57.67***	-4.88	1.4	-2.57	-12.05***	-2.63	-26.42*	5.1	-1.44	-7.22**	-3.40	-0.91
	(5.77)	(3.50)	(1.31)	(11.32)	(3.77)	(2.55)	(2.72)	(4.43)	(9.41)	(15.36)	(6.09)	(3.49)	(3.16)	(7.55)	(3.14)
L.dmbksmatmisub	0.02	-0.21	-0.28	7.02***	-2.14***	0.00	-0.24	0.00	-0.37	-0.47	-0.31	-3.62**	-0.61	0.97	-0.55**
	(0.18)	(0.37)	(1.22)	(1.68)	(0.7)	(0.02)	(0.29)	(0.04)	(0.30)	(0.91)	(1.34)	(1.78)	(0.62)	(1.49)	(0.25)
L.dmbksrellending	-17.17***	13.61**	-5.98	2.13	1.54	1.04	4.31	-4.84	-1.8	-2.94	-5.73	6.72*	-3.39	1.76	1.73
	(5.75)	(6.56)	(12.68)	(3.4)	(1.71)	(1.90)	(6.03)	(4.96)	(3.71)	(2.74)	(4.65)	(3.84)	(3.53)	(2.3)	(3.81)
L.dmbksportdiv	-7.76**	1.05	4.19**	7.8	2.16	-0.69	2.83	0.2	-0.38	0.39	0.97	0.01	13.91**	1.56	0.72
	(3.77)	(3.05)	(1.74)	(4.8)	(2.18)	(4.29)	(2.04)	(3.42)	(2.64)	(3.24)	(2.71)	(0.04)	(6.71)	(3.75)	(0.75)
L.dmbksinfl	49.05***	12.99*	4.98	7.8	-5.49	1.65	-13.72	8.64	-5.77	2.68	4.00	5.65	-44.84**	13.24	9.72
	(11.59)	(7.41)	(13.83)	(14.07)	(4.67)	(6.73)	(9.72)	(11.44)	(5.49)	(6.71)	(5.59)	(8.68)	(19.95)	(9.00)	(7.46)
L.dmbksipi	3.09**	1.67**	-0.42	5.55***	0.34	0.01	1.36	0.46	-0.41	0.50	-1.8**	-1.96*	-0.87	-0.39	-1.46
	(1.46)	(0.79)	(1.68)	(1.95)	(0.78)	(0.9)	(1.32)	(2.48)	(0.73)	(0.84)	(0.78)	(1.14)	(2.29)	(1.55)	(1.07)
L.dmbkslhhi	13.26**	-4.67**	5.16*	-8.87*	2.29	-1.04	4.65	9.76	-1.71	3.75	2.29	0.38	-28.07***	-2.40	3.67
	(5.29)	(2.17)	(2.61)	(5.27)	(2.22)	(3.07)	(3.9)	(8.27)	(2.68)	(2.38)	(2.05)	(2.23)	(8.19)	(5.53)	(3.52)
Constant	-0.00*	-0.00	0.00	-0.00*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
R-squared	0.52	0.23	0.14	0.54	0.24	0.06	0.3	0.16	0.05	0.12	0.29	0.12	0.16	0.23	0.24
RMSE	0.00969	0.00518	0.00971	0.01187	0.00451	0.00595	0.00921	0.01245	0.00474	0.00536	0.00515	0.00729	0.01347	0.00932	0.00685
F-stat for joint significance of the bank specific eqution	8.11***	2.25**	1.22	8.76***	2.37**	0.44	3.18***	1.39	0.42	0.97	3.05***	1	1.38	2.18**	2.36**

Standard Errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's own calculations performed in STATA 10.

b) Size of the pass-through multipliers of lending rates estimated with OLS equation-by-equation.

	DMBKS
Bank 1	0.00***
Bank 2	0.11**
Bank 3	0.24
Bank 5	0.46***
Bank 6	0.18**
Bank 7	-0.15
Bank 8	0.21***
Bank 9	0.29
Bank 10	0.05
Bank 11	0.03
Bank 12	0.15***
Bank 13	0.07
Bank 14	-0.33
Bank 16	0.15**
Bank 27	0.15**

***/**/* denotes joint significance by the overall F-test for the bank specific regression at 1%, 5% and 10% level of significance, respectively.
Source: Author's own calculations.

c) Estimated signs of the rest of the independent variables in the model by OLS equation-by-equation.

VARIABLE:	Assets	Liquidity	Capital	NPLratio	Mat–mismatch	Rel. lending	Portdiv.	Inflation	IPI	HHI
Bank 1	+ ***	– ***	–	+ ***	–	+ ***	+ **	– ***	– **	– **
Bank 2	+	–	+ *	+	+	– **	–	– *	– **	+ **
Bank 3	–	+	–	+	+	+	– **	–	+	– *
Bank 5	+ ***	+ ***	+ ***	– ***	– ***	–	–	–	– **	+ *
Bank 6	+	+ *	–	+	+ ***	–	–	+	–	–
Bank 7	+	–	+	–	–	–	+	–	–	+
Bank 8	+	– **	–	+	+	–	–	+	–	–
Bank 9	–	+	– **	+ ***	–	+	–	–	–	–
Bank 10	–	+	–	+	+	+	+	+	+	+
Bank 11	–	+	–	+ *	+	+	–	–	–	–
Bank 12	–	+ **	+	–	+	+	–	–	+ **	–
Bank 13	+	+	–	+	+ **	– *	–	–	+ *	–
Bank 14	+ ***	–	+	+ **	+	+	– **	+ **	+	+ ***
Bank 16	–	–	–	+	–	–	–	–	+	+
Bank 27	+	+ **	+	+	+ **	–	–	–	+	–

d) Estimation output of the model estimated with OLS equation-by-equation.

```
. regress dlendrateden1 l.dmbks l.dmbkslassets1 l.dmbksliquidity1  l.dmbkscapital1
l.dmbksNPLratio1 l.dmbksma
> tmisub1 l.dmbksrellending1 l.dmbksportdiv1  l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    8.11
       Model |  .008377899    11  .000761627           Prob > F      =  0.0000
    Residual |  .007703825    82  .000093949           R-squared     =  0.5210
-------------+------------------------------           Adj R-squared =  0.4567
       Total |  .016081724    93  .000172922           Root MSE      =  .00969

------------------------------------------------------------------------------
dlendrate~n1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   82.52462   56.87814     1.45   0.151    -30.62412    195.6734
dmbkslass~s1 |
         L1. |  -10.01001    3.24511    -3.08   0.003    -16.46557   -3.554458
dmbksliqu~y1 |
         L1. |   37.16702   6.547766     5.68   0.000     24.14143    50.19261
dmbkscapi~l1 |
         L1. |   33.07987   28.05295     1.18   0.242    -22.72638    88.88611
dmbksNPLr~o1 |
         L1. |   -29.9793   5.769142    -5.20   0.000    -41.45596   -18.50264
dmbksmatm~b1 |
         L1. |   .0191582   .1806887     0.11   0.916    -.3402893    .3786056
dmbksrell~g1 |
         L1. |  -17.17019    5.74926    -2.99   0.004     -28.6073   -5.733085
dmbksport~v1 |
         L1. |  -7.763437   3.764802    -2.06   0.042    -15.25283   -.2740461
   dmbksinfl |
         L1. |   49.04686   11.58875     4.23   0.000     25.99315    72.10058
    dmbksipi |
         L1. |   3.085163   1.461809     2.11   0.038     .1771597    5.993165
   dmbkslhhi |
         L1. |     13.258   5.292338     2.51   0.014     2.729852    23.78615
       _cons |  -.0018308   .0010987    -1.67   0.099    -.0040165     .000355
------------------------------------------------------------------------------

. regress dlendrateden2 l.dmbks l.dmbkslassets2 l.dmbksliquidity2  l.dmbkscapital2
l.dmbksNPLratio2 l.dmbksma
> tmisub2 l.dmbksrellending2 l.dmbksportdiv2 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    2.25
       Model |  .000665758    11  .000060523           Prob > F      =  0.0188
    Residual |  .002202355    82  .000026858           R-squared     =  0.2321
-------------+------------------------------           Adj R-squared =  0.1291
       Total |  .002868112    93   .00003084           Root MSE      =  .00518

------------------------------------------------------------------------------
dlendrate~n2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   112.3856   65.42985     1.72   0.090    -17.77518    242.5464
dmbkslass~s2 |
         L1. |  -4.551724   3.772897    -1.21   0.231    -12.05722     2.95377
dmbksliqu~y2 |
         L1. |   .2180745   4.156117     0.05   0.958    -8.049766    8.485915
dmbkscapi~l2 |
         L1. |  -43.02647    22.7763    -1.89   0.062    -88.33578    2.282844
dmbksNPLr~o2 |
         L1. |   -1.06561   3.504197    -0.30   0.762    -8.036574    5.905354
dmbksmatm~b2 |
         L1. |  -.2098086    .368212    -0.57   0.570    -.9422996    .5226825
dmbksrell~g2 |
         L1. |   13.61164   6.560109     2.07   0.041     .5614981    26.66179
dmbksport~v2 |
```

```
         L1. |   1.047695   3.048461     0.34   0.732    -5.016665    7.112055
   dmbksinfl |
         L1. |   12.98531   7.406038     1.75   0.083     -1.74766    27.71828
    dmbksipi |
         L1. |   1.673488   .7876007     2.12   0.037     .1066991    3.240277
   dmbkslhhi |
         L1. |   -4.66489   2.167065    -2.15   0.034    -8.975873   -.3539067
       _cons |  -.0008852   .0005721    -1.55   0.126    -.0020233    .0002529
------------------------------------------------------------------------------

. regress dlendrateden3 l.dmbks l.dmbkslassets3 l.dmbksliquidity3  l.dmbkscapital3
l.dmbksNPLratio3 l.dmbksma
> tmisub3 l.dmbksrellending3 l.dmbksportdiv3 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    1.22
       Model |  .001265851    11  .000115077           Prob > F      =  0.2871
    Residual |  .007732692    82  .000094301           R-squared     =  0.1407
-------------+------------------------------           Adj R-squared =  0.0254
       Total |  .008998544    93  .000096759           Root MSE      =  .00971

------------------------------------------------------------------------------
dlendrate~n3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |  -53.46612   22.81622    -2.34   0.022    -98.85486   -8.077383
dmbkslass~s3 |
         L1. |   1.048889   .6583913     1.59   0.115    -.2608607    2.358639
dmbksliqu~y3 |
         L1. |  -1.665514   1.703249    -0.98   0.331    -5.053818     1.72279
dmbkscapi~l3 |
         L1. |   1.742277   2.472506     0.70   0.483    -3.176326    6.660879
dmbksNPLr~o3 |
         L1. |  -1.804448   1.312284    -1.38   0.173       -4.415    .8061035
dmbksmatm~b3 |
         L1. |   -.279975   1.222053    -0.23   0.819    -2.711028    2.151078
dmbksrell~g3 |
         L1. |   -5.98099   12.68373    -0.47   0.639    -31.21296    19.25098
dmbksport~v3 |
         L1. |   4.192854   1.736622     2.41   0.018     .7381594    7.647548
   dmbksinfl |
         L1. |   4.983224    13.8276     0.36   0.719    -22.52428    32.49072
    dmbksipi |
         L1. |  -.4196117   1.680726    -0.25   0.803    -3.763111    2.923887
   dmbkslhhi |
         L1. |   5.160977   2.613358     1.97   0.052    -.0378248    10.35978
       _cons |   .0002211   .0011095     0.20   0.843    -.0019861    .0024283
------------------------------------------------------------------------------

. regress dlendrateden5 l.dmbks l.dmbkslassets5 l.dmbksliquidity5  l.dmbkscapital5
l.dmbksNPLratio5 l.dmbksma
> tmisub5 l.dmbksrellending5 l.dmbksportdiv5 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    8.76
       Model |  .013576954    11  .001234269           Prob > F      =  0.0000
    Residual |  .011554708    82  .000140911           R-squared     =  0.5402
-------------+------------------------------           Adj R-squared =  0.4786
       Total |  .025131661    93  .000270233           Root MSE      =  .01187

------------------------------------------------------------------------------
dlendrated~5 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |    527.799   90.09384     5.86   0.000     348.5737    707.0244
dmbkslasse~5 |
         L1. |  -29.25752   5.331947    -5.49   0.000    -39.86446   -18.65058
dmbksliqui~5 |
         L1. |  -20.93771   5.725044    -3.66   0.000    -32.32665   -9.548771
dmbkscapit~5 |
         L1. |    -170.56   29.11028    -5.86   0.000    -228.4696   -112.6504
dmbksNPLra~5 |
```

```
         L1. |   57.66814   11.32331     5.09   0.000     35.14247    80.19381
dmbksmatm~b5 |
         L1. |   7.021846   1.683042     4.17   0.000     3.673739    10.36995
dmbksrelle~5 |
         L1. |   2.127277    3.39788     0.63   0.533    -4.632188    8.886743
dmbksportd~5 |
         L1. |   7.797349   4.795404     1.63   0.108    -1.742237    17.33694
   dmbksinfl |
         L1. |   7.797425   14.06638     0.55   0.581    -20.18508    35.77993
    dmbksipi |
         L1. |   5.546017   1.948166     2.85   0.006     1.670494     9.42154
   dmbkslhhi |
         L1. |  -8.866011   5.265324    -1.68   0.096    -19.34042    1.608396
       _cons |  -.0024594    .001319    -1.86   0.066    -.0050834    .0001645
------------------------------------------------------------------------------

. regress dlendrateden6 l.dmbks l.dmbkslassets6 l.dmbksliquidity6  l.dmbkscapital6
l.dmbksNPLratio6 l.dmbksma
> tmisub6 l.dmbksrellending6 l.dmbksportdiv6 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    2.37
       Model |  .000528966    11  .000048088           Prob > F      =  0.0135
    Residual |  .001664385    82  .000020297           R-squared     =  0.2412
-------------+------------------------------           Adj R-squared =  0.1394
       Total |  .002193351    93  .000023584           Root MSE      =  .00451

------------------------------------------------------------------------------
dlendrate~n6 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |    -3.9409   26.04152    -0.15   0.880    -55.74577    47.86397
dmbkslass~s6 |
         L1. |  -.7235559   1.066785    -0.68   0.500    -2.845731    1.398619
dmbksliqu~y6 |
         L1. |  -3.963238   2.031116    -1.95   0.054    -8.003774    .0772981
dmbkscapi~l6 |
         L1. |   4.137099   4.193511     0.99   0.327    -4.205131    12.47933
dmbksNPLr~o6 |
         L1. |  -4.879545   3.774175    -1.29   0.200    -12.38758    2.628492
dmbksmatm~b6 |
         L1. |  -2.135916   .6946919    -3.07   0.003    -3.517879   -.7539521
dmbksrell~g6 |
         L1. |   1.534901   1.710422     0.90   0.372    -1.867674    4.937476
dmbksport~v6 |
         L1. |   2.160286   2.175689     0.99   0.324    -2.167853    6.488426
   dmbksinfl |
         L1. |  -5.488694   4.672688    -1.17   0.244    -14.78416     3.80677
    dmbksipi |
         L1. |   .3398314   .7773868     0.44   0.663    -1.206639    1.886301
   dmbkslhhi |
         L1. |   2.286388   2.218238     1.03   0.306    -2.126395     6.69917
       _cons |  -.0000145   .0005076    -0.03   0.977    -.0010242    .0009952
------------------------------------------------------------------------------

. regress dlendrateden7 l.dmbks l.dmbkslassets7 l.dmbksliquidity7  l.dmbkscapital7
l.dmbksNPLratio7 l.dmbksma
> tmisub7 l.dmbksrellending7 l.dmbksportdiv7 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    0.44
       Model |  .000169682    11  .000015426           Prob > F      =  0.9355
    Residual |  .002902717    82  .000035399           R-squared     =  0.0552
-------------+------------------------------           Adj R-squared = -0.0715
       Total |  .003072399    93  .000033037           Root MSE      =  .00595

------------------------------------------------------------------------------
dlendrate~n7 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   28.58264   27.08247     1.06   0.294    -25.29301     82.4583
dmbkslass~s7 |
```

```
         L1. |  -1.315499   1.390147    -0.95   0.347    -4.080944    1.449947
dmbksliqu~y7 |
         L1. |   .3360915   1.820881     0.18   0.854     -3.28622    3.958403
dmbkscapi~l7 |
         L1. |  -4.361051   3.864985    -1.13   0.262    -12.04974    3.327636
dmbksNPLr~o7 |
         L1. |   1.396956   2.550409     0.55   0.585    -3.676621    6.470533
dmbksmatm~b7 |
         L1. |   .0009106   .0155968     0.06   0.954    -.0301165    .0319377
dmbksrell~g7 |
         L1. |   1.037197   1.902887     0.55   0.587    -2.748251    4.822645
dmbksport~v7 |
         L1. |  -.6870377   4.288939    -0.16   0.873    -9.219104    7.845029
   dmbksinfl |
         L1. |   1.653701    6.72978     0.25   0.807    -11.73398    15.04138
    dmbksipi |
         L1. |   .0072379   .8987253     0.01   0.994    -1.780613    1.795089
   dmbkslhhi |
         L1. |   -1.04316    3.07094    -0.34   0.735    -7.152238    5.065917
       _cons |  -.0011187   .0006882    -1.63   0.108    -.0024877    .0002503
------------------------------------------------------------------------------

. regress dlendrateden8 l.dmbks l.dmbkslassets8 l.dmbksliquidity8  l.dmbkscapital8
l.dmbksNPLratio8 l.dmbksma
> tmisub8 l.dmbksrellending8 l.dmbksportdiv8 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    3.18
       Model |  .00296683    11  .000269712           Prob > F      =  0.0012
    Residual |  .006954012    82  .000084805           R-squared     =  0.2991
-------------+------------------------------           Adj R-squared =  0.2050
       Total |  .009920841    93  .000106676           Root MSE      =  .00921

------------------------------------------------------------------------------
dlendrated~8 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   1.893504   121.1129     0.02   0.988    -239.0386    242.8256
dmbkslasse~8 |
         L1. |  -3.496554   8.450954    -0.41   0.680    -20.30819    13.31508
dmbksliqui~8 |
         L1. |   15.94774   7.268405     2.19   0.031     1.488569    30.40691
dmbkscapit~8 |
         L1. |   11.02871   11.46275     0.96   0.339    -11.77435    33.83177
dmbksNPLra~8 |
         L1. |  -2.573752   2.717677    -0.95   0.346    -7.980077    2.832573
dmbksmatm~b8 |
         L1. |  -.2358299   .2920615    -0.81   0.422    -.8168332    .3451734
dmbksrelle~8 |
         L1. |    4.31231   6.030079     0.72   0.477    -7.683438    16.30806
dmbksportd~8 |
         L1. |   2.834257   2.042363     1.39   0.169    -1.228653    6.897168
   dmbksinfl |
         L1. |  -13.72119   9.716179    -1.41   0.162    -33.04976    5.607388
    dmbksipi |
         L1. |   1.362746   1.321553     1.03   0.305    -1.266244    3.991736
   dmbkslhhi |
         L1. |   4.652707   3.894985     1.19   0.236    -3.095659    12.40107
       _cons |  -.0016231   .0010842    -1.50   0.138    -.0037799    .0005336
------------------------------------------------------------------------------

. regress dlendrateden9 l.dmbks l.dmbkslassets9 l.dmbksliquidity9  l.dmbkscapital9
l.dmbksNPLratio9 l.dmbksma
> tmisub9 l.dmbksrellending9 l.dmbksportdiv9 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    1.39
       Model |  .002372542    11  .000215686           Prob > F      =  0.1928
    Residual |  .012713105    82  .000155038           R-squared     =  0.1573
-------------+------------------------------           Adj R-squared =  0.0442
       Total |  .015085647    93  .000162211           Root MSE      =  .01245
```

```
------------------------------------------------------------------------------
dlendrated~9 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   -134.452   75.21065    -1.79   0.078      -284.07    15.16592
dmbkslasse~9 |
         L1. |   3.891409   3.076469     1.26   0.209    -2.228668    10.01149
dmbksliqui~9 |
         L1. |  -.0569173    4.55575    -0.01   0.990    -9.119755    9.005921
dmbkscapit~9 |
         L1. |    23.5246   9.871849     2.38   0.019     3.886346    43.16285
dmbksNPLra~9 |
         L1. |  -12.05013   4.430802    -2.72   0.008    -20.86441   -3.235852
dmbksmatm~b9 |
         L1. |   .0020024   .0451224     0.04   0.965    -.0877603    .0917651
dmbksrelle~9 |
         L1. |  -4.837868   4.962939    -0.97   0.333    -14.71073    5.034998
dmbksportd~9 |
         L1. |   .1964907   3.414577     0.06   0.954    -6.596191    6.989172
   dmbksinfl |
         L1. |   8.642312   11.43772     0.76   0.452    -14.11095    31.39557
    dmbksipi |
         L1. |   .4614469   2.482296     0.19   0.853     -4.47663    5.399523
   dmbkslhhi |
         L1. |   9.757271    8.26529     1.18   0.241    -6.685024    26.19957
       _cons |  -.0015992   .0015035    -1.06   0.291    -.0045902    .0013918
------------------------------------------------------------------------------

. regress dlendrateden10 l.dmbks l.dmbkslassets10 l.dmbksliquidity10 l.dmbkscapital10 l.dmbksNPLratio10 l.dm
> bksmatmisub10 l.dmbksrellending10 l.dmbksportdiv10 l.dmbksinfl l.dmbksipi l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    0.42
       Model |  .00010341    11  9.4009e-06           Prob > F      =  0.9443
    Residual |  .001845154    82  .000022502           R-squared     =  0.0531
-------------+------------------------------           Adj R-squared = -0.0740
       Total |  .001948565    93  .000020952           Root MSE      =  .00474

------------------------------------------------------------------------------
dlendrate~10 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   4.704683   18.63382     0.25   0.801    -32.36393    41.77329
dmbkslass~10 |
         L1. |   .6777204   1.039208     0.65   0.516    -1.389596    2.745037
dmbksliqu~10 |
         L1. |  -2.164736   1.989963    -1.09   0.280    -6.123407    1.793934
dmbkscapi~10 |
         L1. |   .1986214   6.917521     0.03   0.977    -13.56253    13.95977
dmbksNPLr~10 |
         L1. |  -2.632528   9.407215    -0.28   0.780    -21.34648    16.08142
dmbksmat~b10 |
         L1. |  -.3708971   .3014552    -1.23   0.222    -.9705876    .2287934
dmbksrell~10 |
         L1. |  -1.797092   3.711624    -0.48   0.630    -9.180695    5.586511
dmbksport~10 |
         L1. |  -.3780762   2.641824    -0.14   0.887    -5.633506    4.877354
   dmbksinfl |
         L1. |  -5.770373   5.493279    -1.05   0.297    -16.69825     5.15751
    dmbksipi |
         L1. |  -.4079395   .7338268    -0.56   0.580    -1.867755    1.051876
   dmbkslhhi |
         L1. |  -1.709636   2.681287    -0.64   0.525     -7.04357    3.624297
       _cons |  -.0008448   .0005383    -1.57   0.120    -.0019158    .0002261
------------------------------------------------------------------------------

. regress dlendrateden11 l.dmbks l.dmbkslassets11 l.dmbksliquidity11 l.dmbkscapital11 l.dmbksNPLratio11 l.dm
> bksmatmisub11 l.dmbksrellending11 l.dmbksportdiv11 l.dmbksinfl l.dmbksipi l.dmbkslhhi
```

```
      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    0.97
       Model |  .000305861    11  .000027806           Prob > F      =  0.4817
    Residual |  .002354989    82  .000028719           R-squared     =  0.1149
-------------+------------------------------           Adj R-squared = -0.0038
       Total |   .00266085    93  .000028611           Root MSE      =  .00536

------------------------------------------------------------------------------
dlendrate~11 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |  -32.03115   31.14227    -1.03   0.307    -93.98306    29.92075
dmbkslass~11 |
         L1. |   .5002787   1.772052     0.28   0.778    -3.024897    4.025455
dmbksliqu~11 |
         L1. |  -2.982993   2.806155    -1.06   0.291     -8.56533    2.599344
dmbkscapi~11 |
         L1. |   1.300449    14.5763     0.09   0.929    -27.69645    30.29735
dmbksNPLr~11 |
         L1. |  -26.42202   15.36111    -1.72   0.089    -56.98017    4.136122
dmbksmat~b11 |
         L1. |  -.4741683   .9120468    -0.52   0.605     -2.28852    1.340183
dmbksrell~11 |
         L1. |   -2.93917   2.743437    -1.07   0.287     -8.39674      2.5184
dmbksport~11 |
         L1. |   .3918492   3.240589     0.12   0.904    -6.054715    6.838413
   dmbksinfl |
         L1. |   2.681961   6.710419     0.40   0.690     -10.6672    16.03112
    dmbksipi |
         L1. |   .5038795   .8396524     0.60   0.550    -1.166457    2.174216
   dmbkslhhi |
         L1. |   3.746055   2.377191     1.58   0.119    -.9829347    8.475045
       _cons |  -.0006443   .0006293    -1.02   0.309    -.0018961    .0006075
------------------------------------------------------------------------------

.   regress   dlendrateden12   l.dmbks   l.dmbkslassets12   l.dmbksliquidity12
l.dmbkscapital12 l.dmbksNPLratio12 l.dm
>  bksmatmisub12  l.dmbksrellending12  l.dmbksportdiv12  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    3.05
       Model |  .000891017    11  .000081002           Prob > F      =  0.0018
    Residual |  .002174701    82  .000026521           R-squared     =  0.2906
-------------+------------------------------           Adj R-squared =  0.1955
       Total |  .003065719    93  .000032965           Root MSE      =  .00515

------------------------------------------------------------------------------
dlendrate~12 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |  -64.16057   40.94975    -1.57   0.121    -145.6227    17.30152
dmbkslass~12 |
         L1. |   3.344855   2.924124     1.14   0.256    -2.472158    9.161868
dmbksliqu~12 |
         L1. |   -8.17862   3.449243    -2.37   0.020    -15.04026   -1.316976
dmbkscapi~12 |
         L1. |  -1.790191   13.56611    -0.13   0.895    -28.77751    25.19713
dmbksNPLr~12 |
         L1. |   5.098153   6.089866     0.84   0.405    -7.016531    17.21284
dmbksmat~b12 |
         L1. |   -.306842   1.340383    -0.23   0.820    -2.973291    2.359607
dmbksrell~12 |
         L1. |  -5.724865   4.653352    -1.23   0.222    -14.98186    3.532135
dmbksport~12 |
         L1. |   .9697863   2.707141     0.36   0.721    -4.415579    6.355151
   dmbksinfl |
         L1. |   4.004448   5.591472     0.72   0.476    -7.118771    15.12767
    dmbksipi |
         L1. |  -1.796907   .7757502    -2.32   0.023    -3.340121   -.2536923
   dmbkslhhi |
```

```
         L1. |   2.285777   2.046658     1.12   0.267    -1.785679    6.357232
       _cons |  -.0006069   .0005772    -1.05   0.296    -.0017551    .0005413
------------------------------------------------------------------------------

.    regress    dlendrateden13    l.dmbks    l.dmbkslassets13    l.dmbksliquidity13
l.dmbkscapital13 l.dmbksNPLratio13 l.dm
>  bksmatmisub13  l.dmbksrellending13  l.dmbksportdiv13  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    1.00
       Model |  .000584074    11  .000053098           Prob > F      =  0.4536
    Residual |  .004353351    82   .00005309           R-squared     =  0.1183
-------------+------------------------------           Adj R-squared =  0.0000
       Total |  .004937425    93  .000053091           Root MSE      =  .00729

------------------------------------------------------------------------------
dlendrate~13 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |  -.1900397   48.68556    -0.00   0.997    -97.04113    96.66105
dmbkslass~13 |
         L1. |  -.1752378   3.289869    -0.05   0.958    -6.719834    6.369359
dmbksliqu~13 |
         L1. |   -2.23073   2.870916    -0.78   0.439    -7.941897    3.480437
dmbkscapi~13 |
         L1. |   1.490767   9.869052     0.15   0.880    -18.14192    21.12346
dmbksNPLr~13 |
         L1. |  -1.440779   3.494288    -0.41   0.681     -8.39203    5.510472
dmbksmat~b13 |
         L1. |  -3.620446   1.776652    -2.04   0.045    -7.154773   -.0861197
dmbksrell~13 |
         L1. |   6.721705   3.843397     1.75   0.084    -.9240358    14.36745
dmbksport~13 |
         L1. |   .0083569   .0386707     0.22   0.829    -.0685715    .0852852
   dmbksinfl |
         L1. |   5.646902   8.679594     0.65   0.517    -11.61958    22.91338
    dmbksipi |
         L1. |  -1.960137    1.13641    -1.72   0.088    -4.220819    .3005456
   dmbkslhhi |
         L1. |   .3775512   2.226483     0.17   0.866    -4.051632    4.806734
       _cons |  -.0007676   .0008739    -0.88   0.382     -.002506    .0009708
------------------------------------------------------------------------------

.    regress    dlendrateden14    l.dmbks    l.dmbkslassets14    l.dmbksliquidity14
l.dmbkscapital14 l.dmbksNPLratio14 l.dm
>  bksmatmisub14  l.dmbksrellending14  l.dmbksportdiv14  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    1.38
       Model |  .002761063    11  .000251006           Prob > F      =  0.1961
    Residual |  .014871596    82  .000181361           R-squared     =  0.1566
-------------+------------------------------           Adj R-squared =  0.0434
       Total |  .017632659    93  .000189598           Root MSE      =  .01347

------------------------------------------------------------------------------
dlendrate~14 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   582.3208   167.1887     3.48   0.001     249.7292    914.9123
dmbkslass~14 |
         L1. |  -28.46813    8.75065    -3.25   0.002    -45.87596   -11.06029
dmbksliqu~14 |
         L1. |   .5492261   1.974469     0.28   0.782    -3.378622    4.477074
dmbkscapi~14 |
         L1. |  -3.574627   3.363005    -1.06   0.291    -10.26472    3.115461
dmbksNPLr~14 |
         L1. |  -7.215206   3.163432    -2.28   0.025    -13.50828   -.9221322
dmbksmat~b14 |
         L1. |  -.6130781    .615709    -1.00   0.322    -1.837919    .6117631
dmbksrell~14 |
```

```
         L1. |  -3.394325   3.531094    -0.96   0.339    -10.41879    3.630145
dmbksport~14 |
         L1. |   13.90861   6.709968     2.07   0.041     .5603499    27.25688
   dmbksinfl |
         L1. |  -44.84349   19.94899    -2.25   0.027    -84.52839   -5.158598
    dmbksipi |
         L1. |  -.8650012    2.28812    -0.38   0.706    -5.416801    3.686799
   dmbkslhhi |
         L1. |  -28.07034    8.18926    -3.43   0.001    -44.36138   -11.77929
       _cons |  -.0013275   .0016085    -0.83   0.412    -.0045274    .0018724
------------------------------------------------------------------------------
```

```
.  regress  dlendrateden16  l.dmbks  l.dmbkslassets16  l.dmbksliquidity16
l.dmbkscapital16 l.dmbksNPLratio16 l.dm
>  bksmatmisub16  l.dmbksrellending16  l.dmbksportdiv16  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    2.18
       Model |  .002080719    11  .000189156           Prob > F      =  0.0233
    Residual |  .007118178    82  .000086807           R-squared     =  0.2262
-------------+------------------------------           Adj R-squared =  0.1224
       Total |  .009198897    93  .000098913           Root MSE      =  .00932

------------------------------------------------------------------------------
dlendrate~16 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |  -51.07732   42.80006    -1.19   0.236    -136.2203    34.06564
dmbkslass~16 |
         L1. |   4.264439   4.177441     1.02   0.310    -4.045822     12.5747
dmbksliqu~16 |
         L1. |   4.902822     3.0012     1.63   0.106    -1.067522    10.87317
dmbkscapi~16 |
         L1. |   3.493284   7.903928     0.44   0.660    -12.23015    19.21671
dmbksNPLr~16 |
         L1. |  -3.401698    7.55294    -0.45   0.654     -18.4269    11.62351
dmbksmat~b16 |
         L1. |   .9700018   1.489092     0.65   0.517    -1.992277    3.932281
dmbksrell~16 |
         L1. |   1.761572   2.296738     0.77   0.445    -2.807371    6.330515
dmbksport~16 |
         L1. |    1.55903   3.754358     0.42   0.679    -5.909583    9.027644
   dmbksinfl |
         L1. |   13.23681   9.003493     1.47   0.145    -4.674002    31.14763
    dmbksipi |
         L1. |  -.3868147   1.536125    -0.25   0.802    -3.442657    2.669027
   dmbkslhhi |
         L1. |  -2.401479   5.533536    -0.43   0.665    -13.40945    8.606487
       _cons |  -.0006002   .0010307    -0.58   0.562    -.0026505    .0014501
------------------------------------------------------------------------------
```

```
.  regress  dlendrateden27  l.dmbks  l.dmbkslassets27  l.dmbksliquidity27
l.dmbkscapital27 l.dmbksNPLratio27 l.dm
>  bksmatmisub27  l.dmbksrellending27  l.dmbksportdiv27  l.dmbksinfl  l.dmbksipi
l.dmbkslhhi

      Source |       SS       df       MS              Number of obs =      94
-------------+------------------------------           F( 11,    82) =    2.36
       Model |  .001222136    11  .000111103           Prob > F      =  0.0136
    Residual |  .003852438    82  .000046981           R-squared     =  0.2408
-------------+------------------------------           Adj R-squared =  0.1390
       Total |  .005074575    93  .000054565           Root MSE      =  .00685

------------------------------------------------------------------------------
dlendrate~27 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       dmbks |
         L1. |   19.27302   51.80657     0.37   0.711    -83.78676    122.3328
dmbkslass~27 |
         L1. |  -2.941283   2.791144    -1.05   0.295    -8.493758    2.611193
dmbksliqu~27 |
```

```
         L1. |  -6.967809   2.897541    -2.40   0.018    -12.73194   -1.203677
dmbkscapi~27 |
         L1. |  -1.120265   5.582157    -0.20   0.841    -12.22495    9.984423
dmbksNPLr~27 |
         L1. |  -.9089528   3.139808    -0.29   0.773    -7.155032    5.337126
dmbksmat~b27 |
         L1. |  -.5535619   .2539932    -2.18   0.032    -1.058835   -.0482885
dmbksrell~27 |
         L1. |   1.726617   3.809956     0.45   0.652    -5.852599    9.305833
dmbksport~27 |
         L1. |   .7172387   .7499406     0.96   0.342     -.774632     2.20911
   dmbksinfl |
         L1. |   9.716702   7.454649     1.30   0.196    -5.112969    24.54637
    dmbksipi |
         L1. |   -1.46271   1.067255    -1.37   0.174    -3.585821    .6604005
   dmbkslhhi |
         L1. |   3.668995   3.517045     1.04   0.300    -3.327528    10.66552
       _cons |  -.0010997   .0007841    -1.40   0.165    -.0026595      .00046
------------------------------------------------------------------------------
```

Appendix 3.7: Estimation results and estimation output of the SUR model specification estimated by FGLS by substituting the MBKS rate with the CB Bills rate, including the Breusch-Pagan test and the F-tests for the joint significance of the regressors in the model.

a) Estimation results of the model by substituting the MBKS rate with the CB Bills rate.

VARIABLE:	Bank1	Bank2	Bank3	Bank5	Bank6	Bank7	Bank8	Bank9	Bank10	Bank11	Bank12	Bank13	Bank14	Bank16	Bank27
L.cb_rate_28_days	-0.06**	-0.03*	0.03	0.05	0.02	-0.01	0.03	0.02	0.00	0.01	0.00	0.03	0.05	0.11***	0.05**
	(0.02)	(0.02)	(0.03)	(0.03)	(0.01)	(0.02)	(0.03)	(0.04)	(0.01)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)
L.dcb28lassets	-1.49	0.38	0.34	1.94	0.25	-0.51	-3.22**	2.28	2.21***	-0.23	0.98	-0.48	1.78	-4.74**	1.19
	(0.94)	(0.68)	(0.47)	(1.62)	(0.66)	(0.86)	(1.52)	(1.45)	(0.84)	(0.62)	(0.83)	(0.58)	(1.79)	(1.87)	(1.14)
L.dcb28liquidity	19.90***	6.85*	0.2	-20.72***	0.99	0.64	5.54	1.11	0.03	-2.74	2.5	1.77	-0.88	-1.93	-0.22
	(3.56)	(3.67)	(1.27)	(4.08)	(1.59)	(1.53)	(3.98)	(2.45)	(1.83)	(1.68)	(2.76)	(1.16)	(1.84)	(2.68)	(2.73)
L.dcb28capital	58.78***	20.09**	-1.05	6.66	0.09	-0.21	-1.15	5.71	6.07	-5.59	9.38	0.97	-2.78	-4.69	2.13
	(12.82)	(8.38)	(1.84)	(9.11)	(2.58)	(2.69)	(4.74)	(4.76)	(4.23)	(5.31)	(6.78)	(2.29)	(4.49)	(3.80)	(1.83)
L.dcb28NPLratio	-9.27***	-5.87**	-0.7	34.11***	-1.84	-0.43	0.26	0.73	-13.17*	-7.96	-7.45*	-2.53**	2.04	11.70**	0.47
	(2.68)	(2.69)	(0.99)	(7.15)	(2.08)	(2.13)	(2.15)	(2.67)	(6.92)	(6.97)	(4.38)	(1.24)	(2.62)	(5.30)	(1.77)
L.dcb28matmisub	0.39***	0.42*	0.24	4.76***	-0.02	-0.01	-0.11	0.02	-1.02***	-0.52	-0.63	1.83**	0.30	-1.59	-0.33**
	(0.13)	(0.24)	(0.97)	(1.21)	(0.51)	(0.01)	(0.27)	(0.026)	(0.28)	(0.51)	(1.27)	(0.89)	(0.52)	(1.29)	(0.17)
L.dcb28rellending	-4.27	-7.59	-5.59	-6.67***	-1.30	0.55	-2.51	-1.1	-4.02	-0.59	6.42	-5.79***	-1.47	1.11	1.62
	(3.17)	(5.85)	(10.47)	(2.55)	(1.40)	(0.93)	(4.08)	(1.45)	(2.55)	(1.5)	(5.80)	(1.92)	(3.14)	(1.17)	(2.04)
L.dcb28portdiv	3.33**	0.54	1	-4.38	-1.59	-0.71	0.64	1.65	-3.09	0.53	-5.39**	0.01	10.64	-3.03	-1.11*
	(1.55)	(2.70)	(1.62)	(3.82)	(1.34)	(4.10)	(1.68)	(1.81)	(2.13)	(1.79)	(2.67)	(0.01)	(7.38)	(2.64)	(0.59)
L.dcb28infl	40.09***	-2.34	4.44	-41.34***	-2.19	2.80	-0.93	-3.89	-8.74**	5.71	2.51	-4.44	-19.55	1.27	-5.60
	(6.14)	(5.72)	(9.06)	(10.71)	(3.56)	(6.13)	(6.87)	(9.04)	(3.85)	(4.57)	(4.15)	(5.00)	(15.10)	(6.38)	(5.47)
L.dcb28ipi	2.11*	0.32	0.7	-2.74	0.09	-0.52	0.68	0.85	-0.3	0.9	0.23	-0.08	1.38	-2.43	0.89
	(1.2)	(0.85)	(1.55)	(1.71)	(0.73)	(0.89)	(1.43)	(1.96)	(0.65)	(0.82)	(0.87)	(1.05)	(2.56)	(1.6)	(1.2)
L.dcb28lhhi	1.72	-1.33	-0.64	-3.12	-0.28	1.08	5.95*	-4.93	-4.06**	0.86	-2.26	1.06	-3.77	9.81**	-2.36
	(2.30)	(1.67)	(0.94)	(3.67)	(1.39)	(1.96)	(3.09)	(3.15)	(1.7)	(1.38)	(1.86)	(1.14)	(3.32)	(3.93)	(2.40)
Constant	0.00	0.00	-0.00	-0.01**	-0.00*	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00**	-0.01	-0.01***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	94	94	94	94	94	94	94	94	94	94	94	94	94	94	94
R-squared	0.72	0.17	0.02	0.57	0.06	0.07	0.20	0.03	0.2	0.08	0.04	0.01	0.05	0.16	0.13
RMSE	0.0074	0.0054	0.0104	0.0114	0.0050	0.0059	0.0098	0.0133	0.0044	0.0055	0.0062	0.0077	0.0143	0.0097	0.0073
F-stat for joint significance of the bank specific eqution	23.15***	1.95**	0.29	12.9***	1.29	0.6	2.48***	1.33	2.47***	0.75	0.62	1.7*	0.64	2.11**	1.63*
Breusch-Pagan test for the contemporaneous covariance independence between the error terms chi2 (105) = 328.962; p-value = 0.000															

Standard Errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's own calculations performed in STATA 10.

b) Size of the pass-through multipliers of lending rates by substituting the MBKS rate with the CB Bills rate.

	DMBKS
Bank 1	-0.37***
Bank 2	-0.11**
Bank 3	-0.04
Bank 5	0.78***
Bank 6	0.04
Bank 7	0.05
Bank 8	-0.21***
Bank 9	0.31
Bank 10	-0.34***
Bank 11	0.07
Bank 12	0.06
Bank 13	0.19*
Bank 14	-0.43
Bank 16	0.07**
Bank 27	0.04*

***/**/* denotes joint significance by the overall F-test for the bank specific regression at 1%, 5% and 10% level of significance, respectively.
Source: Author's own calculations.

c) Estimated signs of the rest of the independent variables in the model by substituting the MBKS rate with the CB Bills rate.

VARIABLE:	Assets	Liquidity	Capital	NPLratio	Mat–mismatch	Rel. lending	Portdiv.	Inflation	IPI	HHI
Bank 1	–	+ ***	+ ***	– ***	+ ***	–	+ **	+ ***	+ *	+
Bank 2	+	+ *	+ **	– **	+ *	–	+	–	+	–
Bank 3	+	+	–	–	+	–	+	+	+	–
Bank 5	+	– ***	+	+ ***	+ ***	– ***	–	– ***	–	–
Bank 6	+	+	+	–	–	–	–	–	+	–
Bank 7	–	+	–	–	–	+	–	+	–	+
Bank 8	– **	+	–	+	–	–	+	–	+	+ *
Bank 9	+	+	+	+	+	–	+	–	+	–
Bank 10	+ ***	+	+	– *	– ***	–	–	– **	–	– **
Bank 11	–	–	–	–	–	–	+	+	+	+
Bank 12	+	+	+	– *	–	+	– **	+	+	–
Bank 13	–	+	+	– **	+ **	– ***	+	–	–	+
Bank 14	+	–	–	+	+	–	+	–	+	–
Bank 16	– **	–	–	+ **	–	+	–	+	–	+ **
Bank 27	+	–	+	+	– **	+	– *	–	+	–
F-stat for joint signiicance of the variable in all bank specific regressions.	2.09***	4.14***	2.37***	3.72***	3.42***	1.92**	1.59*	4.82***	1.09	1.90**

*** p<0.01, ** p<0.05, * p<0.1

d) Estimation output of the SUR model estimated with FGLS, including the Breusch-Pagan test and the F-tests for the joint significance of the regressors in the model.

```
.  sureg  (dlendrateden1=  l.cb_rate_28_days  l.dcb28lassets1  l.dcb28liquidity1
l.dcb28capital1 l.dcb28NPLratio1
>   l.dcb28matmisub1  l.dcb28rellending1  l.dcb28portdiv1   l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>   */   (dlendrateden2=  l.cb_rate_28_days   l.dcb28lassets2   l.dcb28liquidity2
l.dcb28capital2 l.dcb28NPLratio2 l.
>  dcb28matmisub2  l.dcb28rellending2  l.dcb28portdiv2  l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>   */   (dlendrateden3=  l.cb_rate_28_days   l.dcb28lassets3   l.dcb28liquidity3
l.dcb28capital3 l.dcb28NPLratio3 l.
>  dcb28matmisub3  l.dcb28rellending3  l.dcb28portdiv3  l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>   */   (dlendrateden5=  l.cb_rate_28_days   l.dcb28lassets5   l.dcb28liquidity5
l.dcb28capital5 l.dcb28NPLratio5 l.
>  dcb28matmisub5  l.dcb28rellending5  l.dcb28portdiv5  l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>   */   (dlendrateden6=  l.cb_rate_28_days   l.dcb28lassets6   l.dcb28liquidity6
l.dcb28capital6 l.dcb28NPLratio6 l.
>  dcb28matmisub6  l.dcb28rellending6  l.dcb28portdiv6  l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>   */   (dlendrateden7=  l.cb_rate_28_days   l.dcb28lassets7   l.dcb28liquidity7
l.dcb28capital7 l.dcb28NPLratio7 l.
>  dcb28matmisub7  l.dcb28rellending7  l.dcb28portdiv7  l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>   */   (dlendrateden8=  l.cb_rate_28_days   l.dcb28lassets8   l.dcb28liquidity8
l.dcb28capital8 l.dcb28NPLratio8 l.
>  dcb28matmisub8  l.dcb28rellending8  l.dcb28portdiv8  l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>   */   (dlendrateden9=  l.cb_rate_28_days   l.dcb28lassets9   l.dcb28liquidity9
l.dcb28capital9 l.dcb28NPLratio9 l.
>  dcb28matmisub9  l.dcb28rellending9  l.dcb28portdiv9  l.dcb28infl  l.dcb28ipi
l.dcb28lhhi) /*
>  */  (dlendrateden10=  l.cb_rate_28_days  l.dcb28lassets10  l.dcb28liquidity10
l.dcb28capital10 l.dcb28NPLratio
> 10 l.dcb28matmisub10 l.dcb28rellending10 l.dcb28portdiv10 l.dcb28infl l.dcb28ipi
l.dcb28lhhi) /*
>  */  (dlendrateden11=  l.cb_rate_28_days  l.dcb28lassets11  l.dcb28liquidity11
l.dcb28capital11 l.dcb28NPLratio
> 11 l.dcb28matmisub11 l.dcb28rellending11 l.dcb28portdiv11 l.dcb28infl l.dcb28ipi
l.dcb28lhhi) /*
>  */  (dlendrateden12=  l.cb_rate_28_days  l.dcb28lassets12  l.dcb28liquidity12
l.dcb28capital12 l.dcb28NPLratio
> 12 l.dcb28matmisub12 l.dcb28rellending12 l.dcb28portdiv12 l.dcb28infl l.dcb28ipi
l.dcb28lhhi) /*
>  */  (dlendrateden13=  l.cb_rate_28_days  l.dcb28lassets13  l.dcb28liquidity13
l.dcb28capital13 l.dcb28NPLratio
> 13 l.dcb28matmisub13 l.dcb28rellending13 l.dcb28portdiv13 l.dcb28infl l.dcb28ipi
l.dcb28lhhi) /*
>  */  (dlendrateden14=  l.cb_rate_28_days  l.dcb28lassets14  l.dcb28liquidity14
l.dcb28capital14 l.dcb28NPLratio
> 14 l.dcb28matmisub14 l.dcb28rellending14 l.dcb28portdiv14 l.dcb28infl l.dcb28ipi
l.dcb28lhhi) /*
>  */  (dlendrateden16=  l.cb_rate_28_days  l.dcb28lassets16  l.dcb28liquidity16
l.dcb28capital16 l.dcb28NPLratio
> 16 l.dcb28matmisub16 l.dcb28rellending16 l.dcb28portdiv16 l.dcb28infl l.dcb28ipi
l.dcb28lhhi) /*
>  */  (dlendrateden27=  l.cb_rate_28_days  l.dcb28lassets27  l.dcb28liquidity27
l.dcb28capital27 l.dcb28NPLratio
> 27 l.dcb28matmisub27 l.dcb28rellending27 l.dcb28portdiv27 l.dcb28infl l.dcb28ipi
l.dcb28lhhi) /*
> */   , small corr

Seemingly unrelated regression
----------------------------------------------------------------------
```

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
dlendrate~n1	94	11	.0074335	0.7182	22.13	0.0000
dlendrate~n2	94	11	.0053794	0.1727	1.85	0.0418
dlendrate~n3	94	11	.0103537	0.0231	0.28	0.9889
dlendrated~5	94	11	.0114447	0.5726	12.98	0.0000
dlendrate~n6	94	11	.0050263	0.0555	1.15	0.3200
dlendrate~n7	94	11	.0059169	0.0656	0.58	0.8425
dlendrated~8	94	11	.0098192	0.2031	2.26	0.0101
dlendrated~9	94	11	.0133404	0.0326	1.34	0.1975
dlendrate~10	94	11	.004363	0.1989	2.28	0.0092
dlendrate~11	94	11	.0054518	0.0840	0.88	0.5588
dlendrate~12	94	11	.0062311	-0.0385	0.61	0.8214
dlendrate~13	94	11	.0077284	0.0080	1.69	0.0696
dlendrate~14	94	11	.0143033	0.0486	0.61	0.8189
dlendrate~16	94	11	.0097132	0.1590	2.21	0.0122
dlendrate~27	94	11	.0073203	0.1341	1.53	0.1151

	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dlendrate~n1						
cb_rate_28~s						
L1.	-.0567653	.022629	-2.51	0.012	-.1011611	-.0123696
dcb28lass~s1						
L1.	-1.491053	.9396903	-1.59	0.113	-3.334626	.3525202
dcb28liqu~y1						
L1.	19.89604	3.556961	5.59	0.000	12.91766	26.87442
dcb28capi~l1						
L1.	58.78268	12.82003	4.59	0.000	33.63113	83.93423
dcb28NPLr~o1						
L1.	-9.266256	2.674898	-3.46	0.001	-14.51412	-4.018388
dcb28matm~b1						
L1.	.3933908	.129474	3.04	0.002	.1393765	.647405
dcb28rell~g1						
L1.	-4.271547	3.17403	-1.35	0.179	-10.49866	1.955565
dcb28port~v1						
L1.	3.334398	1.54905	2.15	0.032	.2953247	6.373471
dcb28infl						
L1.	40.0932	6.140349	6.53	0.000	28.04648	52.13991
dcb28ipi						
L1.	2.106647	1.19601	1.76	0.078	-.2397985	4.453092
dcb28lhhi						
L1.	1.72234	2.302632	0.75	0.455	-2.795181	6.23986
_cons	.0025665	.0020238	1.27	0.205	-.0014039	.006537
dlendrate~n2						
cb_rate_28~s						
L1.	-.0289267	.0161401	-1.79	0.073	-.060592	.0027385
dcb28lass~s2						
L1.	.376809	.6774449	0.56	0.578	-.9522664	1.705884
dcb28liqu~y2						
L1.	6.849999	3.671514	1.87	0.062	-.3531255	14.05312
dcb28capi~l2						
L1.	20.08645	8.384119	2.40	0.017	3.63769	36.5352
dcb28NPLr~o2						
L1.	-5.871437	2.688165	-2.18	0.029	-11.14533	-.5975406
dcb28matm~b2						
L1.	.4210309	.2402629	1.75	0.080	-.0503396	.8924015
dcb28rell~g2						
L1.	-7.589659	5.849221	-1.30	0.195	-19.06521	3.885895
dcb28port~v2						
L1.	.5427219	2.703423	0.20	0.841	-4.761109	5.846553
dcb28infl						
L1.	-2.342241	5.715553	-0.41	0.682	-13.55555	8.871072
dcb28ipi						
L1.	.3210099	.845359	0.38	0.704	-1.337495	1.979515
dcb28lhhi						
L1.	-1.329601	1.665112	-0.80	0.425	-4.596376	1.937174
_cons	.0010622	.0014811	0.72	0.473	-.0018436	.0039679

```
dlendrate~n3 |
cb_rate_28~s |
         L1. |   .0260041   .0294997     0.88   0.378    -.0318713    .0838795
dcb28lass~s3 |
         L1. |   .3417259   .4695528     0.73   0.467    -.5794871    1.262939
dcb28liqu~y3 |
         L1. |   .1945678   1.267548     0.15   0.878    -2.292228    2.681363
dcb28capi~l3 |
         L1. |  -1.051269   1.844044    -0.57   0.569    -4.669089    2.566552
dcb28NPLr~o3 |
         L1. |  -.6951974   .9890968    -0.70   0.482    -2.635701    1.245306
dcb28matm~b3 |
         L1. |   .2443366   .9663457     0.25   0.800    -1.651532    2.140205
dcb28rell~g3 |
         L1. |  -5.594039   10.46705    -0.53   0.593    -26.12929    14.94121
dcb28port~v3 |
         L1. |    .994788   1.618514     0.61   0.539    -2.180565    4.170141
   dcb28infl |
         L1. |   4.439794    9.05656     0.49   0.624    -13.32822    22.20781
    dcb28ipi |
         L1. |   .6950297   1.545919     0.45   0.653    -2.337899    3.727959
   dcb28lhhi |
         L1. |  -.6418895   .9408067    -0.68   0.495    -2.487653    1.203874
       _cons |  -.0030629   .0027561    -1.11   0.267    -.0084701    .0023442
-------------+----------------------------------------------------------------
dlendrated~5 |
cb_rate_28~s |
         L1. |   .0499279    .033533     1.49   0.137    -.0158603    .1157162
dcb28lasse~5 |
         L1. |   1.938729   1.615895     1.20   0.230    -1.231487    5.108946
dcb28liqui~5 |
         L1. |  -20.71518   4.078438    -5.08   0.000    -28.71665   -12.71371
dcb28capit~5 |
         L1. |   6.656983   9.104596     0.73   0.465    -11.20527    24.51924
dcb28NPLra~5 |
         L1. |   34.10886   7.153186     4.77   0.000     20.07507    48.14266
dcb28matm~b5 |
         L1. |   4.757948   1.204837     3.95   0.000     2.394184    7.121712
dcb28relle~5 |
         L1. |  -6.671654   2.545259    -2.62   0.009    -11.66518   -1.678125
dcb28portd~5 |
         L1. |   -4.37466   3.816292    -1.15   0.252    -11.86182    3.112503
   dcb28infl |
         L1. |  -41.34386   10.71039    -3.86   0.000    -62.35652    -20.3312
    dcb28ipi |
         L1. |   -2.74113   1.710587    -1.60   0.109    -6.097121    .6148608
   dcb28lhhi |
         L1. |  -3.122496   3.665611    -0.85   0.394    -10.31404    4.069046
       _cons |   -.006662   .0031092    -2.14   0.032    -.0127619   -.0005622
-------------+----------------------------------------------------------------
dlendrate~n6 |
cb_rate_28~s |
         L1. |   .0201591   .0139116     1.45   0.148    -.0071341    .0474522
dcb28lass~s6 |
         L1. |   .2490287   .6605705     0.38   0.706    -1.046941    1.544998
dcb28liqu~y6 |
         L1. |   .9886423    1.58589     0.62   0.533    -2.122707    4.099991
dcb28capi~l6 |
         L1. |   .0944271    2.58359     0.04   0.971    -4.974303    5.163157
dcb28NPLr~o6 |
         L1. |   -1.84124   2.084337    -0.88   0.377     -5.93049     2.24801
dcb28matm~b6 |
         L1. |  -.0205358   .5085521    -0.04   0.968    -1.018261    .9771898
dcb28rell~g6 |
         L1. |  -1.300132   1.403218    -0.93   0.354    -4.053099    1.452834
dcb28port~v6 |
         L1. |  -1.587947    1.34084    -1.18   0.237    -4.218534     1.04264
   dcb28infl |
         L1. |  -2.185519   3.564264    -0.61   0.540    -9.178229    4.807192
    dcb28ipi |
         L1. |   .0859151   .7343203     0.12   0.907    -1.354744    1.526574
   dcb28lhhi |
```

```
         L1. |  -.2797882   1.385033    -0.20   0.840    -2.997076      2.4375
       _cons |  -.0021529   .0012978    -1.66   0.097     -.004699    .0003932
-------------+----------------------------------------------------------------
dlendrate~n7 |
cb_rate_28~s |
         L1. |  -.0073255   .0176769    -0.41   0.679    -.0420057    .0273547
dcb28lass~s7 |
         L1. |  -.5135911   .8640776    -0.59   0.552     -2.20882    1.181638
dcb28liqu~y7 |
         L1. |   .6442946   1.530384     0.42   0.674    -2.358157    3.646747
dcb28capi~l7 |
         L1. |  -.2114552   2.690176    -0.08   0.937    -5.489297    5.066387
dcb28NPLr~o7 |
         L1. |  -.4317994   2.133461    -0.20   0.840    -4.617425    3.753826
dcb28matm~b7 |
         L1. |  -.0050232   .0121749    -0.41   0.680     -.028909    .0188625
dcb28rell~g7 |
         L1. |   .5445797   .9253489     0.59   0.556    -1.270857    2.360017
dcb28port~v7 |
         L1. |  -.7081736   4.102209    -0.17   0.863    -8.756275    7.339928
   dcb28infl |
         L1. |   2.803811   6.125145     0.46   0.647    -9.213078     14.8207
    dcb28ipi |
         L1. |   -.515822   .8909002    -0.58   0.563    -2.263674     1.23203
   dcb28lhhi |
         L1. |   1.077232   1.959077     0.55   0.583     -2.76627    4.920734
       _cons |  -.0003772   .0016075    -0.23   0.815    -.0035309    .0027765
-------------+----------------------------------------------------------------
dlendrated~8 |
cb_rate_28~s |
         L1. |   .0330687    .029202     1.13   0.258    -.0242225    .0903599
dcb28lasse~8 |
         L1. |  -3.222467   1.521334    -2.12   0.034    -6.207164   -.2377704
dcb28liqui~8 |
         L1. |    5.54012   3.981756     1.39   0.164    -2.271665    13.35191
dcb28capit~8 |
         L1. |   -1.15377   4.743317    -0.24   0.808    -10.45966    8.152117
dcb28NPLra~8 |
         L1. |   .2629564   2.146272     0.12   0.903    -3.947802    4.473715
dcb28matm~b8 |
         L1. |  -.1113277   .2697755    -0.41   0.680    -.6405988    .4179434
dcb28relle~8 |
         L1. |  -2.512892   4.076539    -0.62   0.538    -10.51063    5.484848
dcb28portd~8 |
         L1. |   .6349275   1.677627     0.38   0.705    -2.656399    3.926254
   dcb28infl |
         L1. |   -.927388    6.87248    -0.13   0.893    -14.41047    12.55569
    dcb28ipi |
         L1. |   .6762104   1.427885     0.47   0.636    -2.125149    3.477569
   dcb28lhhi |
         L1. |   5.945608   3.088896     1.92   0.054    -.1144798     12.0057
       _cons |  -.0040807   .0026636    -1.53   0.126    -.0093064    .0011451
-------------+----------------------------------------------------------------
dlendrated~9 |
cb_rate_28~s |
         L1. |   .0227668    .036909     0.62   0.537    -.0496447    .0951784
dcb28lasse~9 |
         L1. |   2.283773   1.447378     1.58   0.115    -.5558311    5.123376
dcb28liqui~9 |
         L1. |   1.113639   2.445451     0.46   0.649    -3.684078    5.911355
dcb28capit~9 |
         L1. |   5.710535   4.763992     1.20   0.231    -3.635915    15.05698
dcb28NPLra~9 |
         L1. |    .727881   2.668438     0.27   0.785    -4.507312    5.963074
dcb28matm~b9 |
         L1. |   .0189955   .0260436     0.73   0.466    -.0320992    .0700902
dcb28relle~9 |
         L1. |  -1.098478   1.448202    -0.76   0.448    -3.939698    1.742742
dcb28portd~9 |
         L1. |   1.650305   1.808354     0.91   0.362    -1.897495    5.198106
   dcb28infl |
         L1. |  -3.893405   9.043346    -0.43   0.667     -21.6355    13.84869
```

```
    dcb28ipi |
         L1. |   .8517202   1.963997     0.43   0.665    -3.001434    4.704875
   dcb28lhhi |
         L1. |  -4.930931   3.149072    -1.57   0.118    -11.10908    1.247216
       _cons |  -.0040295     .00343    -1.17   0.240    -.0107589    .0026999
-------------+----------------------------------------------------------------
dlendrate~10 |
cb_rate_28~s |
         L1. |   .0034889   .0124137     0.28   0.779    -.0208653    .0278432
dcb28lass~10 |
         L1. |   2.207087   .8345556     2.64   0.008     .5697774    3.844397
dcb28liqu~10 |
         L1. |   .0267842   1.830727     0.01   0.988    -3.564909    3.618478
dcb28capi~10 |
         L1. |    6.06465   4.229519     1.43   0.152     -2.23322    14.36252
dcb28NPLr~10 |
         L1. |  -13.16729   6.919371    -1.90   0.057    -26.74237    .4077833
dcb28mat~b10 |
         L1. |  -1.019979   .2750591    -3.71   0.000    -1.559616   -.4803415
dcb28rell~10 |
         L1. |  -4.017023   2.545453    -1.58   0.115    -9.010934    .9768867
dcb28port~10 |
         L1. |  -3.088407   2.130345    -1.45   0.147    -7.267918    1.091105
   dcb28infl |
         L1. |  -8.738304   3.846654    -2.27   0.023    -16.28503   -1.191575
    dcb28ipi |
         L1. |  -.2963123   .6504532    -0.46   0.649    -1.572433    .9798083
   dcb28lhhi |
         L1. |  -4.056565   1.695669    -2.39   0.017    -7.383288   -.7298423
       _cons |  -.0008202   .0011587    -0.71   0.479    -.0030934     .001453
-------------+----------------------------------------------------------------
dlendrate~11 |
cb_rate_28~s |
         L1. |   .0121981   .0158974     0.77   0.443    -.0189909    .0433871
dcb28lass~11 |
         L1. |  -.2332389   .6230559    -0.37   0.708    -1.455609    .9891311
dcb28liqu~11 |
         L1. |  -2.743095   1.681952    -1.63   0.103    -6.042908    .5567172
dcb28capi~11 |
         L1. |  -5.585552   5.309711    -1.05   0.293    -16.00265    4.831542
dcb28NPLr~11 |
         L1. |  -7.958881   6.968105    -1.14   0.254    -21.62957    5.711806
dcb28mat~b11 |
         L1. |  -.5243306    .513315    -1.02   0.307    -1.531401    .4827393
dcb28rell~11 |
         L1. |  -.5853298   1.496964    -0.39   0.696    -3.522214    2.351555
dcb28port~11 |
         L1. |   .5327569   1.785132     0.30   0.765    -2.969484    4.034998
   dcb28infl |
         L1. |   5.707385   4.566962     1.25   0.212    -3.252513    14.66728
    dcb28ipi |
         L1. |   .8948109   .8187942     1.09   0.275    -.7115769    2.501199
   dcb28lhhi |
         L1. |   .8578787   1.375975     0.62   0.533    -1.841639    3.557396
       _cons |  -.0018532   .0014442    -1.28   0.200    -.0046865    .0009802
-------------+----------------------------------------------------------------
dlendrate~12 |
cb_rate_28~s |
         L1. |   .0013578   .0182016     0.07   0.941    -.0343518    .0370674
dcb28lass~12 |
         L1. |   .9778867   .8326589     1.17   0.240    -.6557021    2.611476
dcb28liqu~12 |
         L1. |   2.497669   2.759716     0.91   0.366    -2.916603    7.911941
dcb28capi~12 |
         L1. |   9.375265   6.779059     1.38   0.167    -3.924534    22.67506
dcb28NPLr~12 |
         L1. |   -7.45294   4.384286    -1.70   0.089    -16.05445    1.148567
dcb28mat~b12 |
         L1. |  -.6316922   1.273378    -0.50   0.620    -3.129926    1.866541
dcb28rell~12 |
         L1. |   6.417903    5.80432     1.11   0.269    -4.969561    17.80537
dcb28port~12 |
```

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         L1. |  -5.392055   2.666086    -2.02   0.043    -10.62263   -.1614752
   dcb28infl |
         L1. |    2.50518   4.154302     0.60   0.547    -5.645122    10.65548
    dcb28ipi |
         L1. |   .2312638    .872173     0.27   0.791    -1.479848    1.942375
   dcb28lhhi |
         L1. |  -2.258422   1.854614    -1.22   0.224    -5.896979    1.380134
       _cons |  -.0011847   .0016417    -0.72   0.471    -.0044055    .0020361
-------------+----------------------------------------------------------------
dlendrate~13 |
cb_rate_28~s |
         L1. |   .0313884   .0203089     1.55   0.122    -.0084556    .0712324
dcb28lass~13 |
         L1. |  -.4817693   .5800489    -0.83   0.406    -1.619764    .6562256
dcb28liqu~13 |
         L1. |    1.76826   1.162703     1.52   0.129     -.512841     4.04936
dcb28capi~13 |
         L1. |   .9649244   2.291526     0.42   0.674    -3.530807    5.460656
dcb28NPLr~13 |
         L1. |  -2.532136   1.239068    -2.04   0.041    -4.963057   -.1012151
dcb28mat~b13 |
         L1. |   1.827306   .8929837     2.05   0.041      .075366    3.579246
dcb28rell~13 |
         L1. |  -5.793229   1.921989    -3.01   0.003    -9.563968    -2.02249
dcb28port~13 |
         L1. |    .012794   .0144849     0.88   0.377    -.0156238    .0412119
   dcb28infl |
         L1. |  -4.438531   5.000838    -0.89   0.375    -14.24965    5.372586
    dcb28ipi |
         L1. |  -.0750914   1.049733    -0.07   0.943    -2.134558    1.984375
   dcb28lhhi |
         L1. |   1.061578   1.141026     0.93   0.352    -1.176995    3.300151
       _cons |  -.0038683   .0019276    -2.01   0.045      -.00765   -.0000866
-------------+----------------------------------------------------------------
dlendrate~14 |
cb_rate_28~s |
         L1. |   .0536729    .043789     1.23   0.221    -.0322366    .1395823
dcb28lass~14 |
         L1. |   1.775958   1.791827     0.99   0.322    -1.739418    5.291333
dcb28liqu~14 |
         L1. |   -.882556   1.835133    -0.48   0.631    -4.482894    2.717782
dcb28capi~14 |
         L1. |  -2.781233    4.49053    -0.62   0.536    -11.59118    6.028713
dcb28NPLr~14 |
         L1. |   2.036727   2.615551     0.78   0.436    -3.094708    7.168162
dcb28mat~b14 |
         L1. |   .3019799    .517621     0.58   0.560     -.713538    1.317498
dcb28rell~14 |
         L1. |  -1.474475   3.140593    -0.47   0.639    -7.635986    4.687036
dcb28port~14 |
         L1. |   10.64278   7.376081     1.44   0.149    -3.828311    25.11388
   dcb28infl |
         L1. |  -19.55129   15.09933    -1.29   0.196    -49.17458      10.072
    dcb28ipi |
         L1. |   1.376025   2.562093     0.54   0.591    -3.650532    6.402581
   dcb28lhhi |
         L1. |  -3.773256   3.324389    -1.14   0.257    -10.29536    2.748844
       _cons |  -.0054583   .0039248    -1.39   0.165    -.0131584    .0022418
-------------+----------------------------------------------------------------
dlendrate~16 |
cb_rate_28~s |
         L1. |   .1143007   .0269478     4.24   0.000      .061432    .1671693
dcb28lass~16 |
         L1. |  -4.742238   1.871286    -2.53   0.011    -8.413504   -1.070972
dcb28liqu~16 |
         L1. |  -1.927121   2.681316    -0.72   0.472    -7.187581    3.333339
dcb28capi~16 |
         L1. |  -4.689229   3.800041    -1.23   0.217    -12.14451     2.76605
dcb28NPLr~16 |
         L1. |   11.70029   5.301092     2.21   0.027     1.300105    22.10047
dcb28mat~b16 |
         L1. |  -1.593359   1.293063    -1.23   0.218    -4.130212    .9434946
```

```
dcb28rell~16 |
         L1. |   1.107684   1.174228     0.94   0.346    -1.196027    3.411396
dcb28port~16 |
         L1. |  -3.024713   2.636891    -1.15   0.252    -8.198015     2.14859
   dcb28infl |
         L1. |   1.269875   6.380054     0.20   0.842    -11.24712    13.78687
    dcb28ipi |
         L1. |  -2.430744    1.59849    -1.52   0.129    -5.566813    .7053249
   dcb28lhhi |
         L1. |   9.809243   3.926672     2.50   0.013     2.105528    17.51296
       _cons |  -.0091991   .0024804    -3.71   0.000    -.0140655   -.0043327
-------------+----------------------------------------------------------------
dlendrate~27 |
cb_rate_28~s |
         L1. |   .0462829   .0213567     2.17   0.030     .0043834    .0881825
dcb28lass~27 |
         L1. |   1.189364   1.136666     1.05   0.296    -1.040654    3.419382
dcb28liqu~27 |
         L1. |  -.2242598   2.734389    -0.08   0.935    -5.588842    5.140322
dcb28capi~27 |
         L1. |   2.129474   1.830658     1.16   0.245    -1.462084    5.721033
dcb28NPLr~27 |
         L1. |   .4703129    1.77003     0.27   0.791    -3.002298    3.942924
dcb28mat~b27 |
         L1. |  -.3335565   .1681242    -1.98   0.047    -.6633985   -.0037145
dcb28rell~27 |
         L1. |   1.620794   2.037791     0.80   0.427    -2.377138    5.618726
dcb28port~27 |
         L1. |  -1.114029   .5857489    -1.90   0.057    -2.263206    .0351487
   dcb28infl |
         L1. |  -5.601285   5.470751    -1.02   0.306    -16.33432    5.131752
    dcb28ipi |
         L1. |   .8935742   1.194505     0.75   0.455    -1.449919    3.237067
   dcb28lhhi |
         L1. |  -2.359811   2.400247    -0.98   0.326    -7.068844    2.349221
       _cons |  -.0050964   .0019185    -2.66   0.008    -.0088604   -.0013325
------------------------------------------------------------------------------
```

Correlation matrix of residuals:

	dlendrateden1	dlendrateden2	dlendrateden3	dlendrateden5	dlendrateden6
dlendrateden1	1.0000				
dlendrateden2	0.1876	1.0000			
dlendrateden3	-0.2374	-0.0655	1.0000		
dlendrateden5	-0.2411	-0.0935	0.0225	1.0000	
dlendrateden6	-0.3004	0.0779	0.5683	-0.0453	1.0000
dlendrateden7	-0.0690	-0.1691	-0.0887	0.0076	-0.2719
dlendrateden8	0.1036	0.0524	-0.0255	0.1584	-0.0684
dlendrateden9	-0.0493	0.0032	0.0570	0.0489	0.0894
dlendrateden10	-0.0221	0.0109	-0.0618	-0.0279	0.0589
dlendrateden11	-0.0618	-0.3071	-0.2795	0.2124	-0.3534
dlendrateden12	-0.0301	0.0476	0.0049	-0.0891	0.3122
dlendrateden13	0.0601	-0.0356	-0.1653	-0.1324	-0.2267
dlendrateden14	0.0104	-0.0989	0.1168	-0.0812	0.1523
dlendrateden16	0.1021	0.1645	0.0350	-0.2156	0.0966
dlendrateden27	0.0135	0.1219	0.2319	0.0077	0.4837

	dlendrateden7	dlendrateden8	dlendrateden9	dlendrateden10	dlendrateden11
dlendrateden7	1.0000				
dlendrateden8	0.0256	1.0000			
dlendrateden9	-0.0822	-0.0588	1.0000		
dlendrateden10	0.0169	-0.0584	0.0264	1.0000	
dlendrateden11	0.2998	0.2470	-0.1870	-0.0571	1.0000
dlendrateden12	0.0265	0.0167	-0.0463	0.1689	0.2707
dlendrateden13	0.1196	0.0046	0.7475	-0.0260	0.1977
dlendrateden14	-0.0089	-0.1869	0.0150	-0.0538	-0.1524
dlendrateden16	-0.0169	-0.1033	0.0692	0.0267	-0.2142
dlendrateden27	-0.0909	0.1121	0.0831	0.1923	-0.0905

	dlendrateden12	dlendrateden13	dlendrateden14	dlendrateden16	dlendrateden27
dlendrateden12	1.0000				
dlendrateden13	0.1077	1.0000			
dlendrateden14	-0.0217	0.0494	1.0000		
dlendrateden16	0.3514	0.2254	0.0197	1.0000	
dlendrateden27	0.5012	-0.0391	-0.0524	0.4014	1.0000

Breusch-Pagan test of independence: chi2(105) = 328.962, Pr = 0.0000

F-test for joint significance of the parameters of the variables in all bank specific equations:

```
. test l.cb_rate_28_days

 ( 1)  [dlendrateden1]L.cb_rate_28_days = 0
 ( 2)  [dlendrateden2]L.cb_rate_28_days = 0
 ( 3)  [dlendrateden3]L.cb_rate_28_days = 0
 ( 4)  [dlendrateden5]L.cb_rate_28_days = 0
 ( 5)  [dlendrateden6]L.cb_rate_28_days = 0
 ( 6)  [dlendrateden7]L.cb_rate_28_days = 0
 ( 7)  [dlendrateden8]L.cb_rate_28_days = 0
 ( 8)  [dlendrateden9]L.cb_rate_28_days = 0
 ( 9)  [dlendrateden10]L.cb_rate_28_days = 0
 (10)  [dlendrateden11]L.cb_rate_28_days = 0
 (11)  [dlendrateden12]L.cb_rate_28_days = 0
 (12)  [dlendrateden13]L.cb_rate_28_days = 0
 (13)  [dlendrateden14]L.cb_rate_28_days = 0
 (14)  [dlendrateden16]L.cb_rate_28_days = 0
 (15)  [dlendrateden27]L.cb_rate_28_days = 0

       F( 15,  1230) =    3.23
            Prob > F =    0.0000

. test l.dcb28infl

 ( 1)  [dlendrateden1]L.dcb28infl = 0
 ( 2)  [dlendrateden2]L.dcb28infl = 0
 ( 3)  [dlendrateden3]L.dcb28infl = 0
 ( 4)  [dlendrateden5]L.dcb28infl = 0
 ( 5)  [dlendrateden6]L.dcb28infl = 0
 ( 6)  [dlendrateden7]L.dcb28infl = 0
 ( 7)  [dlendrateden8]L.dcb28infl = 0
 ( 8)  [dlendrateden9]L.dcb28infl = 0
 ( 9)  [dlendrateden10]L.dcb28infl = 0
 (10)  [dlendrateden11]L.dcb28infl = 0
 (11)  [dlendrateden12]L.dcb28infl = 0
 (12)  [dlendrateden13]L.dcb28infl = 0
 (13)  [dlendrateden14]L.dcb28infl = 0
 (14)  [dlendrateden16]L.dcb28infl = 0
 (15)  [dlendrateden27]L.dcb28infl = 0

       F( 15,  1230) =    4.82
            Prob > F =    0.0000

. test l.dcb28ipi

 ( 1)  [dlendrateden1]L.dcb28ipi = 0
 ( 2)  [dlendrateden2]L.dcb28ipi = 0
 ( 3)  [dlendrateden3]L.dcb28ipi = 0
 ( 4)  [dlendrateden5]L.dcb28ipi = 0
 ( 5)  [dlendrateden6]L.dcb28ipi = 0
 ( 6)  [dlendrateden7]L.dcb28ipi = 0
 ( 7)  [dlendrateden8]L.dcb28ipi = 0
 ( 8)  [dlendrateden9]L.dcb28ipi = 0
 ( 9)  [dlendrateden10]L.dcb28ipi = 0
 (10)  [dlendrateden11]L.dcb28ipi = 0
 (11)  [dlendrateden12]L.dcb28ipi = 0
 (12)  [dlendrateden13]L.dcb28ipi = 0
 (13)  [dlendrateden14]L.dcb28ipi = 0
 (14)  [dlendrateden16]L.dcb28ipi = 0
 (15)  [dlendrateden27]L.dcb28ipi = 0

       F( 15,  1230) =    1.09
            Prob > F =    0.3650

. test l.dcb28lhhi
```

```
 ( 1)  [dlendrateden1]L.dcb28lhhi = 0
 ( 2)  [dlendrateden2]L.dcb28lhhi = 0
 ( 3)  [dlendrateden3]L.dcb28lhhi = 0
 ( 4)  [dlendrateden5]L.dcb28lhhi = 0
 ( 5)  [dlendrateden6]L.dcb28lhhi = 0
 ( 6)  [dlendrateden7]L.dcb28lhhi = 0
 ( 7)  [dlendrateden8]L.dcb28lhhi = 0
 ( 8)  [dlendrateden9]L.dcb28lhhi = 0
 ( 9)  [dlendrateden10]L.dcb28lhhi = 0
 (10)  [dlendrateden11]L.dcb28lhhi = 0
 (11)  [dlendrateden12]L.dcb28lhhi = 0
 (12)  [dlendrateden13]L.dcb28lhhi = 0
 (13)  [dlendrateden14]L.dcb28lhhi = 0
 (14)  [dlendrateden16]L.dcb28lhhi = 0
 (15)  [dlendrateden27]L.dcb28lhhi = 0

       F( 15,  1230) =    1.90
            Prob > F =    0.0197

.   test   l.dcb28lassets1   l.dcb28lassets2   l.dcb28lassets3   l.dcb28lassets5
l.dcb28lassets6 l.dcb28lassets7 l.d
> cb28lassets8 l.dcb28lassets9 /*
>   */   l.dcb28lassets10   l.dcb28lassets11   l.dcb28lassets12   l.dcb28lassets13
l.dcb28lassets14 l.dcb28lassets16
>  l.dcb28lassets27

 ( 1)  [dlendrateden1]L.dcb28lassets1 = 0
 ( 2)  [dlendrateden2]L.dcb28lassets2 = 0
 ( 3)  [dlendrateden3]L.dcb28lassets3 = 0
 ( 4)  [dlendrateden5]L.dcb28lassets5 = 0
 ( 5)  [dlendrateden6]L.dcb28lassets6 = 0
 ( 6)  [dlendrateden7]L.dcb28lassets7 = 0
 ( 7)  [dlendrateden8]L.dcb28lassets8 = 0
 ( 8)  [dlendrateden9]L.dcb28lassets9 = 0
 ( 9)  [dlendrateden10]L.dcb28lassets10 = 0
 (10)  [dlendrateden11]L.dcb28lassets11 = 0
 (11)  [dlendrateden12]L.dcb28lassets12 = 0
 (12)  [dlendrateden13]L.dcb28lassets13 = 0
 (13)  [dlendrateden14]L.dcb28lassets14 = 0
 (14)  [dlendrateden16]L.dcb28lassets16 = 0
 (15)  [dlendrateden27]L.dcb28lassets27 = 0

       F( 15,  1230) =    2.09
            Prob > F =    0.0085

.  test  l.dcb28liquidity1  l.dcb28liquidity2  l.dcb28liquidity3  l.dcb28liquidity5
l.dcb28liquidity6 l.dcb28li
> quidity7 l.dcb28liquidity8 l.dcb28liquidity9 /*
> */ l.dcb28liquidity10  l.dcb28liquidity11  l.dcb28liquidity12  l.dcb28liquidity13
l.dcb28liquidity14 l.dcb2
> 8liquidity16 l.dcb28liquidity27

 ( 1)  [dlendrateden1]L.dcb28liquidity1 = 0
 ( 2)  [dlendrateden2]L.dcb28liquidity2 = 0
 ( 3)  [dlendrateden3]L.dcb28liquidity3 = 0
 ( 4)  [dlendrateden5]L.dcb28liquidity5 = 0
 ( 5)  [dlendrateden6]L.dcb28liquidity6 = 0
 ( 6)  [dlendrateden7]L.dcb28liquidity7 = 0
 ( 7)  [dlendrateden8]L.dcb28liquidity8 = 0
 ( 8)  [dlendrateden9]L.dcb28liquidity9 = 0
 ( 9)  [dlendrateden10]L.dcb28liquidity10 = 0
 (10)  [dlendrateden11]L.dcb28liquidity11 = 0
 (11)  [dlendrateden12]L.dcb28liquidity12 = 0
 (12)  [dlendrateden13]L.dcb28liquidity13 = 0
 (13)  [dlendrateden14]L.dcb28liquidity14 = 0
 (14)  [dlendrateden16]L.dcb28liquidity16 = 0
 (15)  [dlendrateden27]L.dcb28liquidity27 = 0

       F( 15,  1230) =    4.14
            Prob > F =    0.0000
```

```
.   test   l.dcb28capital1   l.dcb28capital2   l.dcb28capital3   l.dcb28capital5
l.dcb28capital6 l.dcb28capital7 l.d
> cb28capital8 l.dcb28capital9 /*
>   */  l.dcb28capital10  l.dcb28capital11  l.dcb28capital12  l.dcb28capital13
l.dcb28capital14 l.dcb28capital16
>  l.dcb28capital27

 ( 1)  [dlendrateden1]L.dcb28capital1 = 0
 ( 2)  [dlendrateden2]L.dcb28capital2 = 0
 ( 3)  [dlendrateden3]L.dcb28capital3 = 0
 ( 4)  [dlendrateden5]L.dcb28capital5 = 0
 ( 5)  [dlendrateden6]L.dcb28capital6 = 0
 ( 6)  [dlendrateden7]L.dcb28capital7 = 0
 ( 7)  [dlendrateden8]L.dcb28capital8 = 0
 ( 8)  [dlendrateden9]L.dcb28capital9 = 0
 ( 9)  [dlendrateden10]L.dcb28capital10 = 0
 (10)  [dlendrateden11]L.dcb28capital11 = 0
 (11)  [dlendrateden12]L.dcb28capital12 = 0
 (12)  [dlendrateden13]L.dcb28capital13 = 0
 (13)  [dlendrateden14]L.dcb28capital14 = 0
 (14)  [dlendrateden16]L.dcb28capital16 = 0
 (15)  [dlendrateden27]L.dcb28capital27 = 0

       F( 15,  1230) =    2.37
            Prob > F =    0.0023

.  test  l.dcb28NPLratio1  l.dcb28NPLratio2  l.dcb28NPLratio3  l.dcb28NPLratio5
l.dcb28NPLratio6 l.dcb28NPLrati
> o7 l.dcb28NPLratio8 l.dcb28NPLratio9 /*
>  */  l.dcb28NPLratio10  l.dcb28NPLratio11  l.dcb28NPLratio12  l.dcb28NPLratio13
l.dcb28NPLratio14 l.dcb28NPLr
> atio16 l.dcb28NPLratio27

 ( 1)  [dlendrateden1]L.dcb28NPLratio1 = 0
 ( 2)  [dlendrateden2]L.dcb28NPLratio2 = 0
 ( 3)  [dlendrateden3]L.dcb28NPLratio3 = 0
 ( 4)  [dlendrateden5]L.dcb28NPLratio5 = 0
 ( 5)  [dlendrateden6]L.dcb28NPLratio6 = 0
 ( 6)  [dlendrateden7]L.dcb28NPLratio7 = 0
 ( 7)  [dlendrateden8]L.dcb28NPLratio8 = 0
 ( 8)  [dlendrateden9]L.dcb28NPLratio9 = 0
 ( 9)  [dlendrateden10]L.dcb28NPLratio10 = 0
 (10)  [dlendrateden11]L.dcb28NPLratio11 = 0
 (11)  [dlendrateden12]L.dcb28NPLratio12 = 0
 (12)  [dlendrateden13]L.dcb28NPLratio13 = 0
 (13)  [dlendrateden14]L.dcb28NPLratio14 = 0
 (14)  [dlendrateden16]L.dcb28NPLratio16 = 0
 (15)  [dlendrateden27]L.dcb28NPLratio27 = 0

       F( 15,  1230) =    3.72
            Prob > F =    0.0000

.  test  l.dcb28matmisub1  l.dcb28matmisub2  l.dcb28matmisub3  l.dcb28matmisub5
l.dcb28matmisub6 l.dcb28matmisu
> b7 l.dcb28matmisub8 l.dcb28matmisub9 /*
>  */  l.dcb28matmisub10  l.dcb28matmisub11  l.dcb28matmisub12  l.dcb28matmisub13
l.dcb28matmisub14 l.dcb28matm
> isub16 l.dcb28matmisub27

 ( 1)  [dlendrateden1]L.dcb28matmisub1 = 0
 ( 2)  [dlendrateden2]L.dcb28matmisub2 = 0
 ( 3)  [dlendrateden3]L.dcb28matmisub3 = 0
 ( 4)  [dlendrateden5]L.dcb28matmisub5 = 0
 ( 5)  [dlendrateden6]L.dcb28matmisub6 = 0
 ( 6)  [dlendrateden7]L.dcb28matmisub7 = 0
 ( 7)  [dlendrateden8]L.dcb28matmisub8 = 0
 ( 8)  [dlendrateden9]L.dcb28matmisub9 = 0
 ( 9)  [dlendrateden10]L.dcb28matmisub10 = 0
 (10)  [dlendrateden11]L.dcb28matmisub11 = 0
 (11)  [dlendrateden12]L.dcb28matmisub12 = 0
 (12)  [dlendrateden13]L.dcb28matmisub13 = 0
 (13)  [dlendrateden14]L.dcb28matmisub14 = 0
```

```
 (14)  [dlendrateden16]L.dcb28matmisub16 = 0
 (15)  [dlendrateden27]L.dcb28matmisub27 = 0

       F( 15,  1230) =    3.42
            Prob > F =    0.0000

. test l.dcb28rellending1 l.dcb28rellending2 l.dcb28rellending3 l.dcb28rellending5
l.dcb28rellending6 l.dc
> b28rellending7 l.dcb28rellending8 l.dcb28rellending9 /*
>     */     l.dcb28rellending10     l.dcb28rellending11     l.dcb28rellending12
l.dcb28rellending13 l.dcb28rellending14 l
> .dcb28rellending16 l.dcb28rellending27

 ( 1)  [dlendrateden1]L.dcb28rellending1 = 0
 ( 2)  [dlendrateden2]L.dcb28rellending2 = 0
 ( 3)  [dlendrateden3]L.dcb28rellending3 = 0
 ( 4)  [dlendrateden5]L.dcb28rellending5 = 0
 ( 5)  [dlendrateden6]L.dcb28rellending6 = 0
 ( 6)  [dlendrateden7]L.dcb28rellending7 = 0
 ( 7)  [dlendrateden8]L.dcb28rellending8 = 0
 ( 8)  [dlendrateden9]L.dcb28rellending9 = 0
 ( 9)  [dlendrateden10]L.dcb28rellending10 = 0
 (10)  [dlendrateden11]L.dcb28rellending11 = 0
 (11)  [dlendrateden12]L.dcb28rellending12 = 0
 (12)  [dlendrateden13]L.dcb28rellending13 = 0
 (13)  [dlendrateden14]L.dcb28rellending14 = 0
 (14)  [dlendrateden16]L.dcb28rellending16 = 0
 (15)  [dlendrateden27]L.dcb28rellending27 = 0

       F( 15,  1230) =    1.93
            Prob > F =    0.0176

.   test   l.dcb28portdiv1   l.dcb28portdiv2   l.dcb28portdiv3   l.dcb28portdiv5
l.dcb28portdiv6 l.dcb28portdiv7 l.d
> cb28portdiv8 l.dcb28portdiv9 /*
>   */   l.dcb28portdiv10   l.dcb28portdiv11   l.dcb28portdiv12   l.dcb28portdiv13
l.dcb28portdiv14 l.dcb28portdiv16
>  l.dcb28portdiv27

 ( 1)  [dlendrateden1]L.dcb28portdiv1 = 0
 ( 2)  [dlendrateden2]L.dcb28portdiv2 = 0
 ( 3)  [dlendrateden3]L.dcb28portdiv3 = 0
 ( 4)  [dlendrateden5]L.dcb28portdiv5 = 0
 ( 5)  [dlendrateden6]L.dcb28portdiv6 = 0
 ( 6)  [dlendrateden7]L.dcb28portdiv7 = 0
 ( 7)  [dlendrateden8]L.dcb28portdiv8 = 0
 ( 8)  [dlendrateden9]L.dcb28portdiv9 = 0
 ( 9)  [dlendrateden10]L.dcb28portdiv10 = 0
 (10)  [dlendrateden11]L.dcb28portdiv11 = 0
 (11)  [dlendrateden12]L.dcb28portdiv12 = 0
 (12)  [dlendrateden13]L.dcb28portdiv13 = 0
 (13)  [dlendrateden14]L.dcb28portdiv14 = 0
 (14)  [dlendrateden16]L.dcb28portdiv16 = 0
 (15)  [dlendrateden27]L.dcb28portdiv27 = 0

       F( 15,  1230) =    1.59
            Prob > F =    0.0685
```

APPENDIX B: APPENDICES FROM CHAPTER 5

Appendix 5.1: Long-run coefficients of outstanding loans in domestic currency and foreign currency. Two-step "system" GMM estimates with Windmeijer (2005) corrected standard errors.

a) Stock of loans in domestic currency. The regressions reported are ordered in the same order as the ones in table 5.4.

	1st year	2nd year	3rd year	Cumulative	3-Year multiplier	Long-run	Long-run multiplier
Regression 1 from table 5.4 - model with size							
MBKS	-0.05*	-0.04	-0.71*	-0.16*	3.32***	-0.27	5.66
lCPI1	3.78**	3.13	-5.70**	12.62**	3.32***	21.49	5.66
lGDPr	-2.05	-1.69	-3.08	-6.83	3.32***	11.63	5.66
SizeNorm	0.37	0.30**	0.55***	1.21***	3.32***	2.07	5.66
SizenormMBKS	-0.010	-0.01	-0.02	-0.05	3.32***	-0.08	5.66
Joint significance of the bank specific variable and its interaction term (p-value)	0.26	0.12	0.15	0.21	0.02**	0.42	0.22
Regression 2 from table 5.4 - model with liquidity							
MBKS	-0.08**	-0.07*	-0.13**	-0.28**	3.43***	-0.56	6.72
lCPI1	2.94*	2.50	4.63**	10.06*	3.43***	19.72	6.72
lGDPr	-2.80	-2.38	-4.41	-9.6	3.43***	-18.83	6.72
Liquid2Norm	0.63	0.54	0.98	2.16	3.43***	4.23	6.72
Liquid2normMBKS	-0.21	-0.18	-0.33	-0.72	3.43***	-1.41	6.72
Joint significance of the bank specific variable and its interaction term (p-value)	0.19	0.93	0.88	0.92	0.04**	0.94	0.44
Regression 3 from table 5.4 - model with capital							
MBKS	-0.04**	-0.03*	-0.06**	-0.14**	3.32***	-0.23	5.64
lCPI1	3.11**	2.56*	4.67**	10.34*	3.32***	17.57	5.64
lGDPr	-2.08	-1.71	-3.12	-6.91	3.32***	11.73	5.64
CapitalNorm	-2.18**	-1.79***	-3.26***	-7.23***	3.32***	-12.28	5.64
CapitalnormMBKS	0.21***	1.73***	0.31***	0.70***	3.39***	1.19*	6.24
Joint significance of the bank specific variable and its interaction term (p-value)	0.00***	0.00***	0.00***	0.00***	0.00***	0.00*	0.13

*** / ** / * denotes significance at 1%, 5% and 10% level of significance, respectively.

Computations have been done in STATA 10.

b) Stock of loans in foreign currency. The regressions reported are ordered in the same order as the ones in table 5.5.

	1st year	2nd year	3rd year	Cumulative	3-Year multiplier	Long-run	Long-run multiplier
Regression 1 form table 5.5 - model with size							
EUR	-0.27*	-0.08*	-0.11**	-0.47**	1.73***	-0.39**	1.46***
lCPI1	2.67	0.84	1.10	4.60	1.73***	3.89	1.46***
lGDPr	0.42	0.13	0.17	0.71	1.73***	0.61	1.46***
SizeNorm	0.43	0.13	0.18	0.75	1.73***	0.63	1.46***
SizenormEUR	0.17***	0.05*	0.07**	0.29**	1.73***	0.25**	1.46***
Joint significance of the bank specific variable and its interaction term (p-value)	0.00***	0.08*	0.06**	0.05*	0.00***	0.09*	0.02**
Regression 2 from table 5.5 - model with liquidity							
EUR	-0.26**	-0.12	-0.17*	-0.55*	2.12***	-0.48*	1.84***
lCPI1	5.57	2.54	3.70	11.82	2.12***	10.25	1.84***
lGDPr	0.10	0.04	0.06	0.20	2.12***	0.18	1.84***
Liquid2Norm	-0.34	-0.15	-0.22	-0.71	2.12***	-0.62	1.84***
Liquid2normEUR	0.38	0.18	0.25	0.81	2.12***	0.70	1.84***
Joint significance of the bank specific variable and its interaction term (p-value)	0.90	0.85	0.63	0.73	0.08*	0.29	0.15
Regression 3 from table 5.5 - model with capital							
EUR	-0.20**	-0.11*	-0.18**	-0.49**	2.51***	-0.47*	2.40*
lCPI1	1.26	0.74	1.17	3.16	2.51***	3.03	2.40*
lGDPr	0.47	0.27	0.43	1.17	2.51***	1.12	2.40*
CapitalNorm	-2.75	-1.60*	-2.54***	-6.89*	2.51***	-6.60*	2.40*
CapitalnormEUR	0.11	0.07	0.10	0.28	2.51***	0.27	2.40*
Joint significance of the bank specific variable and its interaction term (p-value)	0.41	0.26	0.08*	0.36	0.06*	0.24	0.09*

*** / ** / * denotes significance at 1%, 5% and 10% level of significance, respectively.

Computations have been done in STATA 10.

Appendix 5.2: STATA output for the domestic currency loans. The regressions reported are in the same order as the ones in table 5.4.

Printout from regression 1 from table 5.4:

```
xtabond2 lLoansDen l.lLoansDen     MBKS  lCPI1  lGDPr  SizeNorm  SizenormMBKS,
gmm(lLoansDen   MBKS lCPI1 lGDPr SizeNorm SizenormMBKS , eq(diff) laglimits(5 6)
collapse) gmm(lLoansDen    MBKS  lCPI1  lGDPr  SizeNorm  SizenormMBKS  ,  eq(level)
laglimits(1 1) collapse)   twostep  robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =       144
Time variable : datevar                         Number of groups   =        20
Number of instruments = 17                      Obs per group: min =         2
F(6, 19)      =    170.10                                      avg =      7.20
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
   lLoansDen |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lLoansDen |
         L1. |   .8233207   .2740483     3.00   0.007     .2497311     1.39691
        MBKS |  -.0473356   .0247298    -1.91   0.071    -.0990958    .0044245
       lCPI1 |   3.796568   1.756459     2.16   0.044     .1202576    7.472878
       lGDPr |  -2.054235   2.212017    -0.93   0.365     -6.68404     2.57557
    SizeNorm |   .3648752   .2282489     1.60   0.126    -.1128553    .8426056
SizenormMBKS |  -.0135983   .0187296    -0.73   0.477    -.0527998    .0256033
       _cons |   10.92123   19.26911     0.57   0.578    -29.40948    51.25194
------------------------------------------------------------------------------
Instruments for first differences equation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(5/6).(lLoansDen MBKS lCPI1 lGDPr SizeNorm SizenormMBKS) collapsed
Instruments for levels equation
  Standard
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(lLoansDen MBKS lCPI1 lGDPr SizeNorm SizenormMBKS) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.59  Pr > z =  0.112
Arellano-Bond test for AR(2) in first differences: z =  -1.04  Pr > z =  0.297
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(10)   =  16.72  Prob > chi2 =  0.081
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(10)   =  11.05  Prob > chi2 =  0.354
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(4)    =   5.08  Prob > chi2 =  0.279
    Difference (null H = exogenous): chi2(6)    =   5.96  Prob > chi2 =  0.427
  gmm(lLoansDen MBKS lCPI1 lGDPr SizeNorm SizenormMBKS, collapse eq(diff) lag(5
6))
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(10)    =  11.05  Prob > chi2 =  0.354
```

```
  gmm(lLoansDen MBKS lCPI1 lGDPr SizeNorm SizenormMBKS, collapse eq(level) lag(1
1))
    Hansen test excluding group:     chi2(4)    =   5.08  Prob > chi2 =  0.279
    Difference (null H = exogenous): chi2(6)    =   5.96  Prob > chi2 =  0.427

. test SizeNorm=SizenormMBKS=0

 ( 1)  SizeNorm - SizenormMBKS = 0
 ( 2)  SizeNorm = 0

       F(  2,    19) =    1.45
            Prob > F =    0.2597
```

Printout from regression 2 from table 5.4:

```
xtabond2 lLoansDen l.lLoansDen    MBKS lCPI1 lGDPr Liquid2Norm   Liquid2normMBKS,
gmm(lLoansDen MBKS lCPI1 lGDPr Liquid2Norm  Liquid2normMBKS , eq(diff) laglimits(6
7) collapse)   gmm(lLoansDen MBKS lCPI1 lGDPr Liquid2Norm   Liquid2normMBKS ,
eq(level) laglimits(1 1) collapse)    twostep  robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =       144
Time variable : datevar                         Number of groups   =        20
Number of instruments = 16                      Obs per group: min =         2
F(6, 19)      =     38.60                                      avg =      7.20
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
   lLoansDen |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lLoansDen |
         L1. |   .8511829   .2754114     3.09   0.006     .2747402    1.427625
        MBKS |  -.0826458   .0349605    -2.36   0.029    -.1558188   -.0094727
       lCPI1 |   2.935282   1.649022     1.78   0.091    -.5161601    6.386725
       lGDPr |  -2.801629   1.914779    -1.46   0.160    -6.809306    1.206049
 Liquid2Norm |    .629661   1.573932     0.40   0.694    -2.664617    3.923938
Liquid2nor~S |  -.2102705    .182219    -1.15   0.263    -.5916593    .1711182
       _cons |   23.99175   17.64407     1.36   0.190    -12.93771     60.9212
------------------------------------------------------------------------------
Instruments for first differences equation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(6/7).(lLoansDen MBKS lCPI1 lGDPr Liquid2Norm Liquid2normMBKS) collapsed
Instruments for levels equation
  Standard
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(lLoansDen MBKS lCPI1 lGDPr Liquid2Norm Liquid2normMBKS) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.67  Pr > z =  0.095
Arellano-Bond test for AR(2) in first differences: z =   0.37  Pr > z =  0.712
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(9)    =  15.24  Prob > chi2 =  0.085
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(9)    =   9.45  Prob > chi2 =  0.397
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(3)    =   2.15  Prob > chi2 =  0.542
```

```
    Difference (null H = exogenous): chi2(6)    =   7.30  Prob > chi2 =  0.294
  gmm(lLoansDen  MBKS  lCPI1  lGDPr  Liquid2Norm  Liquid2normMBKS,  collapse  eq(diff)
lag(6 7))
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(9)    =   9.45  Prob > chi2 =  0.397
  gmm(lLoansDen  MBKS  lCPI1  lGDPr  Liquid2Norm  Liquid2normMBKS,  collapse  eq(level)
lag(1 1))
    Hansen test excluding group:     chi2(3)    =   2.15  Prob > chi2 =  0.542
    Difference (null H = exogenous): chi2(6)    =   7.30  Prob > chi2 =  0.294

. test Liquid2Norm=Liquid2normMBKS=0

 ( 1)  Liquid2Norm - Liquid2normMBKS = 0
 ( 2)  Liquid2Norm = 0

       F(  2,    19) =    1.84
            Prob > F =    0.1858
```

Printout from regression 3 from table 5.4:

```
xtabond2 lLoansDen l.lLoansDen    MBKS lCPI1 lGDPr CapitalNorm   CapitalnormMBKS,
gmm(lLoansDen MBKS lCPI1 lGDPr CapitalNorm  CapitalnormMBKS , eq(diff) laglimits(3
6) collapse)   gmm(lLoansDen    MBKS lCPI1 lGDPr CapitalNorm   CapitalnormMBKS ,
eq(level) laglimits(1 1) collapse)    twostep  robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =       144
Time variable : datevar                         Number of groups   =        20
Number of instruments = 25                      Obs per group: min =         2
F(6, 19)      =    425.53                                      avg =      7.20
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
   lLoansDen |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lLoansDen |
         L1. |   .8228464   .1705067     4.83   0.000     .4659718    1.179721
        MBKS |  -.0422338   .0198344    -2.13   0.047    -.0837478   -.0007199
       lCPI1 |   3.113355   1.379536     2.26   0.036     .2259533    6.000757
       lGDPr |  -2.078528   1.326879    -1.57   0.134    -4.855718    .6986629
 CapitalNorm |  -2.174604   .7968783    -2.73   0.013     -3.84249   -.5067187
Capitalnor~S |   .2102586   .0461743     4.55   0.000     .1136146    .3069026
       _cons |   14.31266   10.31734     1.39   0.181    -7.281779    35.90711
------------------------------------------------------------------------------
Instruments for first differences equation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(3/6).(lLoansDen MBKS lCPI1 lGDPr CapitalNorm CapitalnormMBKS) collapsed
Instruments for levels equation
  Standard
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(lLoansDen MBKS lCPI1 lGDPr CapitalNorm CapitalnormMBKS) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.64  Pr > z =  0.100
Arellano-Bond test for AR(2) in first differences: z =  -1.29  Pr > z =  0.196
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(18)   =  23.14  Prob > chi2 =  0.185
  (Not robust, but not weakened by many instruments.)
```

```
Hansen test of overid. restrictions: chi2(18)   =  13.90  Prob > chi2 =  0.735
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(12)   =  15.28  Prob > chi2 =  0.226
    Difference (null H = exogenous): chi2(6)    =  -1.38  Prob > chi2 =  1.000
  gmm(lLoansDen  MBKS  lCPI1  lGDPr  CapitalNorm  CapitalnormMBKS,  collapse  eq(diff)
lag(3 6))
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(18)   =  13.90  Prob > chi2 =  0.735
  gmm(lLoansDen  MBKS  lCPI1  lGDPr  CapitalNorm  CapitalnormMBKS,  collapse  eq(level)
lag(1 1))
    Hansen test excluding group:     chi2(12)   =  15.28  Prob > chi2 =  0.226
    Difference (null H = exogenous): chi2(6)    =  -1.38  Prob > chi2 =  1.000

. test CapitalNorm=CapitalnormMBKS=0

 ( 1)  CapitalNorm - CapitalnormMBKS = 0
 ( 2)  CapitalNorm = 0

       F(  2,    19) =   10.53
            Prob > F =    0.0008
```

Appendix 5.3: STATA output for the foreign currency loans. The regressions reported are in the same order as the ones in table 5.5.

Printout from regression 1 from table 5.5:

```
xtabond2 lLoansFX l.lLoansFX EUR lCPI1 lGDPr SizeNorm SizenormEUR , gmm(lLoansFX
lCPI1 lGDPr SizeNorm SizenormEUR , eq(diff) laglimits(6 8) collapse)  gmm(lLoansFX
lCPI1 lGDPr SizeNorm  SizenormEUR , eq(level) laglimits(1 1) collapse) iv(EUR)
twostep robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan/Hansen statistics may be negative.
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =       105
Time variable : datevar                         Number of groups   =        16
Number of instruments = 18                      Obs per group: min =         2
F(6, 15)      =     35.84                                      avg =      6.56
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
    lLoansFX |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lLoansFX |
         L1. |   .3139783   .1346632     2.33   0.034     .0269504    .6010062
         EUR |  -.2702277   .1418533    -1.90   0.076    -.5725808    .0321254
       lCPI1 |   2.665219   4.678162     0.57   0.577    -7.306049    12.63649
       lGDPr |   .4152888   3.094225     0.13   0.895    -6.179896    7.010474
    SizeNorm |   .4329871   .4619433     0.94   0.363    -.5516216    1.417596
 SizenormEUR |   .1702216   .0561006     3.03   0.008      .050646    .2897972
       _cons |  -7.973982    27.3904    -0.29   0.775    -66.35524    50.40727
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(EUR)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(6/8).(lLoansFX lCPI1 lGDPr SizeNorm SizenormEUR) collapsed
Instruments for levels equation
  Standard
    _cons
     EUR
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(lLoansFX lCPI1 lGDPr SizeNorm SizenormEUR) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.05  Pr > z =  0.293
Arellano-Bond test for AR(2) in first differences: z =  -1.01  Pr > z =  0.313
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(11)   =   7.00  Prob > chi2 =  0.799
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(11)   =  10.76  Prob > chi2 =  0.463
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(6)    =   3.84  Prob > chi2 =  0.698
    Difference (null H = exogenous): chi2(5)    =   6.92  Prob > chi2 =  0.227
  gmm(lLoansFX lCPI1 lGDPr SizeNorm SizenormEUR, collapse eq(diff) lag(6 8))
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(11)   =  10.76  Prob > chi2 =  0.463
```

```
  gmm(lLoansFX lCPI1 lGDPr SizeNorm SizenormEUR, collapse eq(level) lag(1 1))
    Hansen test excluding group:     chi2(6)    =   3.84  Prob > chi2 =  0.698
    Difference (null H = exogenous): chi2(5)    =   6.92  Prob > chi2 =  0.227
  iv(EUR)
    Hansen test excluding group:     chi2(10)   =   5.86  Prob > chi2 =  0.827
    Difference (null H = exogenous): chi2(1)    =   4.90  Prob > chi2 =  0.027

. test SizeNorm=SizenormEUR=0
 ( 1)  SizeNorm - SizenormEUR = 0
 ( 2)  SizeNorm = 0

       F(  2,    15) =   23.10
            Prob > F =    0.0000
```

Printout from regression 2 from table 5.5:

```
xtabond2 lLoansFX l.lLoansFX EUR lCPI1 lGDPr Liquid2Norm Liquid2normEUR ,
gmm(lLoansFX lCPI1 lGDPr Liquid2Norm Liquid2normEUR , eq(diff) laglimits(2 6)
collapse) gmm(lLoansFX lCPI1 lGDPr Liquid2Norm Liquid2normEUR , eq(level)
laglimits(2 2) collapse) iv(EUR) twostep  robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =       105
Time variable : datevar                         Number of groups   =        16
Number of instruments = 29                      Obs per group: min =         2
F(6, 15)      =      8.42                                      avg =      6.56
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
    lLoansFX |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lLoansFX |
         L1. |   .4562001   .1788429     2.55   0.022     .0750054    .8373948
         EUR |  -.2587501   .1022309    -2.53   0.023    -.4766502   -.0408501
       lCPI1 |   5.571937   7.670002     0.73   0.479    -10.77629    21.92016
       lGDPr |   .0958647   4.144091     0.02   0.982    -8.737056    8.928785
 Liquid2Norm |  -.3360854   11.86262    -0.03   0.978    -25.62066    24.94849
Liquid2nor~R |   .3836467   3.122115     0.12   0.904    -6.270984    7.038277
       _cons |  -18.83308    36.3593    -0.52   0.612     -96.3311    58.66495
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(EUR)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(2/6).(lLoansFX lCPI1 lGDPr Liquid2Norm Liquid2normEUR) collapsed
Instruments for levels equation
  Standard
    _cons
    EUR
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL2.(lLoansFX lCPI1 lGDPr Liquid2Norm Liquid2normEUR) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -0.98  Pr > z =  0.325
Arellano-Bond test for AR(2) in first differences: z =  -0.95  Pr > z =  0.340
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(22)   =  53.24  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(22)   =  13.09  Prob > chi2 =  0.931
```

```
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(17)   =  12.32  Prob > chi2 =  0.780
    Difference (null H = exogenous): chi2(5)    =   0.76  Prob > chi2 =  0.979
  gmm(lLoansFX lCPI1 lGDPr Liquid2Norm Liquid2normEUR, collapse eq(diff) lag(2 6))
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(22)   =  13.09  Prob > chi2 =  0.931
  gmm(lLoansFX  lCPI1  lGDPr  Liquid2Norm  Liquid2normEUR,  collapse  eq(level)  lag(2
2))
    Hansen test excluding group:     chi2(17)   =  12.32  Prob > chi2 =  0.780
    Difference (null H = exogenous): chi2(5)    =   0.76  Prob > chi2 =  0.979
  iv(EUR)
    Hansen test excluding group:     chi2(21)   =  13.93  Prob > chi2 =  0.873
    Difference (null H = exogenous): chi2(1)    =  -0.84  Prob > chi2 =  1.000

. test Liquid2Norm=Liquid2normEUR=0

 ( 1)  Liquid2Norm - Liquid2normEUR = 0
 ( 2)  Liquid2Norm = 0

       F(  2,    15) =    0.11
            Prob > F =    0.8984
```

Printout from regression 3 from table 5.5:

```
xtabond2  lLoansFX  l.lLoansFX  EUR  lCPI1  lGDPr  CapitalNorm  CapitalnormEUR  ,
gmm(lLoansFX  lCPI1  lGDPr  CapitalNorm  CapitalnormEUR  ,  eq(diff)  laglimits(4  6)
collapse)   gmm(lLoansFX  lCPI1  lGDPr  CapitalNorm  CapitalnormEUR  ,  eq(level)
laglimits(2 2) collapse) iv(EUR) twostep  robust small
Favoring space over speed. To switch, type or click on mata: mata set matafavor
speed, perm.
Warning: Number of instruments may be large relative to number of observations.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step
estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: bank                            Number of obs      =       105
Time variable : datevar                         Number of groups   =        16
Number of instruments = 21                      Obs per group: min =         2
F(6, 15)      =     19.89                                      avg =      6.56
Prob > F      =     0.000                                      max =         8
------------------------------------------------------------------------------
             |              Corrected
    lLoansFX |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    lLoansFX |
         L1. |   .5832316   .2314899     2.52   0.024     .0898225    1.076641
         EUR |  -.1967412   .0876777    -2.24   0.040    -.3836217   -.0098607
       lCPI1 |   1.262381   3.590676     0.35   0.730    -6.390963    8.915725
       lGDPr |   .4678718   1.904109     0.25   0.809    -3.590641    4.526385
 CapitalNorm |  -2.748932   2.210895    -1.24   0.233    -7.461342    1.963479
Capitalnor~R |   .1115129   .4305141     0.26   0.799    -.8061061    1.029132
       _cons |  -5.531399   16.13417    -0.34   0.736    -39.92058    28.85778
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(EUR)
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(4/6).(lLoansFX lCPI1 lGDPr CapitalNorm CapitalnormEUR) collapsed
Instruments for levels equation
  Standard
```

```
    _cons
    EUR
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL2.(lLoansFX lCPI1 lGDPr CapitalNorm CapitalnormEUR) collapsed
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -0.98  Pr > z =  0.325
Arellano-Bond test for AR(2) in first differences: z =  -0.94  Pr > z =  0.346
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(14)   =   7.46  Prob > chi2 =  0.916
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(14)   =   8.67  Prob > chi2 =  0.851
  (Robust, but can be weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Hansen test excluding group:     chi2(9)    =   9.99  Prob > chi2 =  0.351
    Difference (null H = exogenous): chi2(5)    =  -1.32  Prob > chi2 =  1.000
  gmm(lLoansFX lCPI1 lGDPr CapitalNorm CapitalnormEUR, collapse eq(diff) lag(4 6))
    Hansen test excluding group:     chi2(0)    =   0.00  Prob > chi2 =      .
    Difference (null H = exogenous): chi2(14)   =   8.67  Prob > chi2 =  0.851
  gmm(lLoansFX  lCPI1  lGDPr  CapitalNorm  CapitalnormEUR,  collapse  eq(level)  lag(2
2))
    Hansen test excluding group:     chi2(9)    =   9.99  Prob > chi2 =  0.351
    Difference (null H = exogenous): chi2(5)    =  -1.32  Prob > chi2 =  1.000
  iv(EUR)
    Hansen test excluding group:     chi2(13)   =   8.99  Prob > chi2 =  0.774
    Difference (null H = exogenous): chi2(1)    =  -0.32  Prob > chi2 =  1.000

. test CapitalNorm=CapitalnormEUR=0

 ( 1)  CapitalNorm - CapitalnormEUR = 0
 ( 2)  CapitalNorm = 0

       F(  2,    15) =    0.95
            Prob > F =    0.4085
```

Appendix 5.4: Estimates of outstanding loans in domestic and foreign currency. One-step "system" GMM estimates with robust standard errors by restricting and collapsing the instrument sets with the xtabond2 command.

a) in domestic currency

Dependent variable: log of the stock of loans in domestic currency

VARIABLES:	Regression 1	Regression 2	Regression 3
	Controlling for size	Controlling for liquid2	Controlling for capital
L.lLoansDen	**0.822*** **	**0.544** **	**0.739*** **
Robust S.E.	0.149	0.229	0.145
MBKS	**-0.0403***	**-0.0321***	**-0.0393***
Robust S.E.	0.021	0.0179	0.0207
lCPI1	**2.779***	1.695	**2.502***
Robust S.E.	1.419	1.534	1.394
lGDPr	-1.23	0.64	-1.298
Robust S.E.	1.593	1.644	1.218
SizeNorm	0.254		
Robust S.E.	0.158		
SizenormMBKS	0.00811		
Robust S.E.	0.0169		
Liquid2Norm		**-2.276** **	
Robust S.E.		0.943	
Liquid2normMBKS		0.186	
Robust S.E.		0.17	
CapitalNorm			**-2.677*** **
Robust S.E.			0.707
CapitalnormMBKS			**0.224*** **
Robust S.E.			0.04
Constant	5.4	-8.886	8.627
Robust S.E.	14.72	12.17	9.886
Number of observations:	144	144	144
Number of banks	20	20	20
Number of instruments	17	19	22
F-test for the significance of the whole regression (p-value)	F(6, 19) = 377.22 (0.00)	F(6, 19) = 100.15 (0.00)	F(6, 19) = 483.71 (0.00)
F-test for the joint significance of the bank specific char. and the interaction term (p-value)	F(2, 19) = 1.97 (0.17)	F(2, 19) = 3.01 (0.11)	F(2, 19) = 15.82 (0.00)
AR(1)/(p-value)	-1.61 (0.11)	-1.45 (0.15)	-1.60 (0.11)
AR(2)/(p-value)	-1.24 (0.22)	-1.92 (0.6)	-1.66 (0.10)
Sargan (p-value)	0.88	0.12	0.38
Hansen (p-value)	0.74	0.20	0.62
Diff. in Hansen (p-value)	0.60	0.18	0.63

*** / ** / * denotes significance at 1%, 5% and 10% level of significance, respectively.

Source: Computations have been done in STATA 10.

b) in foreign currency

Dependent variable: log of the stock of loans in foreign currency

VARIABLES:	Regression 1	Regression 2	Regression 3
	Controlling for size	Controlling for liquid2	Controlling for capital
L.lLoansFX	**0.316***	**0.399****	**0.810*****
Robust S.E.	0.183	0.136	0.219
EUR	**-0.343*****	**-0.281***	**-0.281****
Robust S.E.	0.129	0.16	0.125
lCPI1	4.756	-2.952	8.32
Robust S.E.	5.909	4.575	7.063
lGDPr	0.186	1.427	-4.065
Robust S.E.	2.866	2.934	2.797
SizeNorm	0.425		
Robust S.E.	0.517		
SizenormEUR	**0.161****		
Robust S.E.	0.070		
Liquid2Norm		**12.38***	
Robust S.E.		6.599	
Liquid2normEUR		-4.129	
Robust S.E.		2.484	
CapitalNorm			-1.885
Robust S.E.			2.839
CapitalnormEUR			-0.00513
Robust S.E.			0.577
Constant	-14.575	4.492	15.31
Robust S.E.	25.763	22.91	15.24
Number of observations:	105	105	105
Number of banks	16	16	16
Number of instruments	18	22	22
F-test for the significance of the whole regression (p-value)	F(6, 15) = 18.84 (0.00)	F(6, 15) = 18.48 (0.00)	F(6, 15) = 79.74 (0.00)
F-test for the joint significance of the bank specific char. and the interaction term (p-value)	F(2, 15) = 14.77 (0.00)	F(2, 15) = 1.89 (0.12)	F(2, 15) = 2.27 (0.14)
AR(1)/(p-value)	-2.43 (0.02)	-1.84 (0.07)	-1.40 (0.16)
AR(2)/(p-value)	-1.05 (0.30)	-1.11 (0.27)	-1.14 (0.26)
Sargan (p-value)	0.80	0.65	0.64
Hansen (p-value)	0.46	0.90	0.84
Diff. in Hansen (p-value)	0.23	1.00	0.79

*** / ** / * denotes significance at 1%, 5% and 10% level of significance, respectively.

Computations have been done in STATA 10.

Appendix 5.5: Estimates of outstanding loans in domestic and foreign currency, respectively. One-step "difference" GMM estimates with robust standard errors (Robust S.E.).

a) in domestic currency.

Dependent variable: log of the stock of loans in domestic currency.

VARIABLES:	Regression 1	Regression 2	Regression 3
	Controlling for size	Controlling for liquid2	Controlling for capital
L.lLoansDen	**0.541*** **	**0.267***	**0.535*** **
Robust S.E.	0.102	0.139	0.0815
MBKS	**-0.0273** **	-0.0108	**-0.0297***
Robust S.E.	0.0137	0.0157	0.0156
lCPI1	**2.858** **	**1.945** **	**2.657** **
Robust S.E.	1.117	0.936	1.069
lGDPr	0.0622	1.696	-0.0431
Robust S.E.	1.146	1.154	1.081
SizeNorm	0.175		
Robust S.E.	0.164		
SizenormMBKS	-0.0161		
Robust S.E.	0.0111		
Liquid2Norm		-0.464	
Robust S.E.		0.678	
Liquid2normMBKS		-0.156	
Robust S.E.		0.127	
CapitalNorm			-0.994
Robust S.E.			0.658
CapitalnormMBKS			**0.135** **
Robust S.E.			0.0559
Constant	-7.072	**-19.35***	-4.778
Robust S.E.	9.692	9.993	9.679
Number of observations:	124	124	124
Number of banks	20	20	20
Number of instruments	58	58	63
Wald test for the significance of the whole regression (p-value)	chi2(6) = 365.88 (0.00)	chi2(6) = 408.62 (0.00)	chi2(6) = 343.83 (0.00)
Wald test for the joint significance of the bank specific char. and the interaction term (p-value)	chi2(2) = 2.45 (0.29)	chi2(2) = 17.58 (0.00)	chi2(2) = 6.01 (0.05)
AR(1)/(p-value)	-1.53 (0.13)	-1.62 (0.11)	-1.52 (0.13)
AR(2)/(p-value)	-1.93 (0.05)	-0.28 (0.78)	-1.86 (0.06)
Sargan (p-value)	0.24	0.15	0.83

*** / ** / * denotes significance at 1%, 5% and 10% level of significance, respectively.

Computations have been done in STATA 10.

b) in foreign currency.

Dependent variable: log of the stock of loans in foreign currency

VARIABLES:	Regression 1	Regression 2	Regression 3
	Controlling for size	Controlling for liquid2	Controlling for capital
L.lLoansFX	0.0107	-0.0945	0.00878
Robust S.E.	0.191	0.164	0.203
EUR	**-0.404***	-0.107	**-0.342*****
Robust S.E.	0.216	0.149	0.127
lCPI1	0.509	**-12.67***	-0.39
Robust S.E.	6.346	7.446	5.935
lGDPr	**5.334***	**7.974*****	4.637
Robust S.E.	2.89	3.059	3.327
SizeNorm	-0.0122		
Robust S.E.	0.72		
SizenormEUR	**0.216****		
Robust S.E.	0.088		
Liquid2Norm		-0.509	
Robust S.E.		3.436	
Liquid2normEUR		-1.692	
Robust S.E.		1.191	
CapitalNorm			**4.558***
Robust S.E.			2.337
CapitalnormEUR			**-1.461*****
Robust S.E.			0.348
Constant	-54.43*	-26.21	-41.73
Robust S.E.	32.14	26.2	33.98
Number of observations:	88	88	88
Number of banks	16	16	16
Number of instruments	61	58	62
Wald test for the significance of the whole regression (p-value)	chi2(6) = 65.13 (0.00)	chi2(6) = 308.73 (0.00)	chi2(6) = 137.99 (0.00)
Wald test for the joint significance of the bank specific char. and the interaction term (p-value)	chi2(2) = 12.28 (0.00)	chi2(2) = 29.00 (0.00)	chi2(2) = 44.51 (0.00)
AR(1)/(p-value)	-0.45 (0.65)	-0.47 (0.64)	-0.36 (0.72)
AR(2)/(p-value)	-0.93 (0.35)	-0.99 (0.32)	-0.93 (0.35)
Sargan (p-value)	0.01	0.02	0.03

*** / ** / * denotes significance at 1%, 5% and 10% level of significance, respectively.

Computations have been done in STATA 10.

APPENDIX C: PROFESSIONAL DEVELOPMENT

In this appendix I report the main achievements in my professional development during my work on this thesis (2007 – 2010).

Professional training:

- 11/2008: Postgraduate Certificate in Research Methods, Staffordshire University, UK.
- 09/03/2009 – 13/03/2009: Seminar on the subject: "Macroeconomic Modelling and Forecasting II", organised by the National Bank of the Republic of Macedonia and the JTC Economics + Finance, LLC. Skopje, Republic of Macedonia.

Participation at conferences:

- 25/11/2010: *"Fiscal Policy in the Crisis and Beyond: Short-term Impacts and Long-term Implications"*, organised by The Institute of Economics Zagreb, Croatia. Presented paper together with Angeloska-Bezoska, A., Mitreska A. and Kadievska-Vojnovic M.: "Investigating the Cyclical Behaviour of Fiscal Policy in the Republic of Macedonia During the Period of Transition".
- 20/09/2010: *"PhD conference in Monetary and Financial Economics"*, organised by Bristol Business School, UK. Presented paper: "Empirical Investigation of the Determinants of Pass-through Adjustment of Lending Rates in Macedonia - a SUR Approach".
- 14/07/2010–16/07/2010: *"Openness and Growth: Lessons for Transition and Development"*, organised by the Osteuropa-Institut Regensburg and Akademie für Politische, Tutzing, Germany. Presented paper: "The role of banks in the monetary transmission in a small open transition economy with a fixed exchange rate regime – the case of Macedonia"

- 17/09/2010 – 18/09/2009: "*20 Years of Transition in Central and Eastern Europe: Money, Banking and Financial Markets*", organised by the London Metropolitan Business School, UK. Presented paper: "Empirical Investigation of the Bank Lending Channel in the Republic of Macedonia".
- Participant on four PhD mini-conferences on 10/12/2010; 24/11/2009; 04/12/2008 and 19/12/2007 organised by Staffordshire University, UK; where I have presented some of the chapters of my PhD thesis.

Journal articles:

- Bogoev, J. (2010), "Banks' Risk Preferences' and their Impact on the Loan Supply Function - Empirical Investigation for the Case of the Republic of Macedonia", *Economic Trends and Economic Policy*, No. 124/2010, pp. 63-109.
- Bogoev, J. (2010), "Comparative Analysis of Credit Growth and the Bank Lending Channel Among the South Eastern European Economies During Periods of Economic Growth and Economic Recession", *CEA Journal of Economics*, Vol. 5, Issue 1, pp. 59-72.
- Bogoev, J., Bojceva-Terzijan, S., Egert, B. and Petrovska, M. (2008), "Real Exchange Rate Dynamics in Macedonia: Old Wisdoms and New Insights", in the Special Issue: "Recent Developments in International Money and Finance", *The Open-Access, Open-Assessment E-Journal*, Vol. 2, 2008-12. Available on the web-site:

  http://www.economics-ejournal.org/economics/journalarticles/2008-18 (last accessed 03/12/2010).