Journal of Finance & Economics
Volume 1, Issue 2 (2013), 01-13
ISSN 2291-4951 E-ISSN 2291-496X
Published by Science and Education Centre of North America

Credit Frictions and the Bank Lending Channel: Evidence from a Group of European Banks

Nicholas Apergis[1*] and Efrosini Alevizopoulou[1]

[1] Department of Banking and Financial Management, University of Piraeus, Piraeus, Greece

[*]Correspondence: Nicholas Apergis, Department of Banking and Financial Management, University of Piraeus, 18534 Piraeus, Greece. Tel: 30-210-414-2429; E-mail: napergis@unipi.gr

***A*bstract:** Monetary policy decisions are transmitted into the economy through many channels, one of which is the bank lending channel. It is based on the central bank's actions that affect loan supply and real spending. This paper examines, spanning the period 1999-2010, whether for the case of European banks the operation of the bank lending channel can be modeled in a manner that better conforms to current institutional realities, such as credit frictions. The recent literature on monetary policy takes into account credit frictions and investigates monetary implications. We use interest rate spreads, that is, the difference between the interest rate available to savers and borrowers, as an indicator of the disruptions in the financial situation and incorporate them into the model for the estimation of the bank lending channel across eurozone countries. The results indicate that these credit frictions have an impact on the lending growth process.

JEL Classifications: E51, C33

Keywords: bank lending channel; credit frictions; European banks; panel data

1. Introduction

The recent crisis and the ongoing changes in the financial system both impose alterations in the way monetary policy works. The traditional channels of the transmission mechanism and, specifically, the credit and the bank lending channels, were severely criticized over the previous decade, whereas more attention was paid to the expectations channel. Additionally, the literature has overlooked the role of the banks as financial intermediaries as well as the frictions they may impose in the monetary transmission mechanism. This paper argues that the bank lending channel needs to adapt to the current situation and takes into consideration additional parameters that will allow it to operate more effectively in association with the real economy.

A number of authors support that the traditional literature on the bank lending channel should be modified. They suggest new variables that should be taken into account (Altunbas *et al.*, 2009; Gambacorta & Marques-Ibanez, 2011) or argue that certain assumptions in traditional research are misplaced and, hence, they recommend a reformulation of the bank lending channel (Bernanke, 2007; Disyatat, 2011). The traditional literature emphasizes the variables that characterize the bank's strength, such as capitalization, liquidity and size. Many studies (Kashyap & Stein, 1995 & 2000; Peek & Rosengreen, 1995; Stein, 1998; Van den Heuvel, 2002; Gambacorta & Mistrulli, 2004) conclude that well-capitalized, liquid and large banks are better equipped to confront with any changes in monetary policy. We should note, however, that there are other studies that reach controversial conclusions about the usefulness of the size as an indicator for the distributional effects of monetary policy (Ehrmann *et al.*, 2003; Gambacorta, 2005).

Disyatat (2004, 2011) also highlights the importance of the banks' balance sheet strength as well as their risk perception, through which the channel is supposed to be reinforced, albeit, he claims that the lending channel should be reformulated. The author also argues that the central condition that refers to the impact the monetary policy has on deposits is misplaced. Hence, the lending channel needs to be reformulated. He also points out that greater reliance of banks on market-based financing does not diminish the importance of the particular channel. On the contrary, it is reinforced taking into account, though, the banks' balance sheet strength as well as their risk perception.

There are studies, which argue that the financial market development has attenuated the impact of these characteristics on the banks' response to monetary policy decisions. They claim that development and innovations in financial markets have changed the effectiveness of the bank lending channel, by modifying the banks' incentives and affecting their ability to obtain liquidity and, hence, to provide credit (Gambacorta & Marques-Ibanez, 2011). Securitization as well as non-interest income revenues -- that is, revenues from investment banking, fees and commissions -- constitutes an alternative source of funding for banks (Altunbas *et al.*, 2009). Moreover, the previous literature has already referred to securitization in the form of loan sales that provides an alternative and less expensive way of funding for banks, when deposit market is competitive (James, 1988; Pennacchi, 1988). Innovations of securitization in conjunction with credit derivative market developments have improved the credit risk management for banks. They are able to transmit this type of risk to other economic agents, a development that may have a significant impact on the bank lending channel (Peek & Rosengren, 2009).

The goal of this paper is to incorporate the banking sector and specifically the credit frictions into the specification of the bank lending channel for a number of European banks spanning the period 1999-2010. The novelty of this study lies on the empirical attempt for the first time to use the spread between borrowing and lending interest rates as a proxy for credit frictions to investigate whether loan supply measures respond to monetary policy activities as well as whether there exists any role for asymmetric information on the mechanism of the bank lending channel. According to the bank lending channel literature, the monetary authorities affect loan supply by raising or lowering interest rates and by decreasing or increasing bank reserves. a view that was initially criticized by Romer and Romer (1990), has, on the contrary, decreased. Not only central banks' policy should be investigated, but also banks' incentives, since the financial intermediaries play an active role contrary to the notion of the previous literature.

Changes in financial conditions need to be taken explicitly into consideration. Securitization has proved to have led to a laxer screening of borrowers. Banks' business model has changed from "originate and hold" to "originate, repackage and sell". In this way, they transfer the risk from their balance sheet to other economic agents. Therefore, banks have fewer incentives to screen borrowers. That is, in the pre-crisis period, borrowers who would, otherwise, be denied credit, are able to get loans (Gambacorta & Marques-Ibanez, 2011). It is obvious that the development of financial markets provided banks with additional sources of liquidity and hence banks were more sheltered from the impact of monetary authorities' decisions. Banks are "obliged" to take into consideration credit frictions and the effects of asymmetric information and scrutinize borrowers, certain classes of whom -- due to the current financial situation -- rely on the bank credit again. The recent literature on macroeconomic analysis and monetary policy takes into account credit frictions and investigates monetary implications. McCulley and Toloui (2008) and Taylor (2008) have proposed that Taylor rules should be modified and incorporate financial conditions, as interest rate spreads and the target rate should adjust to the changes of credit spreads.

Thus, credit frictions is an important indicator of the financial situation and since variation in interest rate spreads indicates that there are disruptions in the financial situation, they should be incorporated into the model for the estimation of the bank lending channel. These spreads exist

between the interest rate available to savers and borrowers and we investigate the impact of a model that incorporates credit frictions on the operation of the bank lending channel across European countries.

The remainder of the paper is organized as follows: Section 2 describes the traditional bank lending channel as well the credit frictions literature. Section 3 presents and analyses the data set, Section .4 describes the econometric model. Section 5 reports the empirical findings and, finally, Section 6 concludes.

2. Literature Review

2.1 The Bank Lending Channel

This study considers how the monetary authorities affect the macroeconomy through the bank lending channel, which largely depends on the quantities of deposits and loans and the factors that determine these quantities. In particular, the monetary authorities implement an expansionary (contractionary) policy by increasing (decreasing) bank reserves and lowering (raising) interest rates. As reserves expand (contract), the banking system increases (decreases) deposits and loans. Therefore, businesses and consumers, who depend on bank lending, can increase (decrease) their purchases of durable goods and capital for investment. Hence, expansions (contractions) in bank reserves affect output positively (negatively) (Golodniuk, 2006).

The existing literature on the bank lending channel searches for this transmission mechanism in different economies or in a group of countries. More specifically, it examines whether the effect on lending responds differently, depending on the influence of the banking system, which, in turn, relies upon specific characteristics, such as capitalization, size, and liquidity. Most studies on the euro area economies provide empirical support to the presence of the channel, while the empirical analysis for the US case provides mixed results (Ehrmann *et al.*, 2003; Gambacorta, 2005). In addition, the majority of studies show that small banks do not exhibit more sensitivity to monetary policy shocks than large banks (Peek & Rosengren, 1995; Gambacorta, 2005; Golodniuk, 2006). The empirical implementation should cope with an important problem. More precisely, merely observing that both output and bank loans decrease after a negative change in monetary policy, does not necessarily imply that this change reflects a reduction in loan supply (Brissimis *et al.*, 2001). Such changes, however, may only reflect a reduction in loan demand. To resolve this issue, the literature uses a number of macroeconomic control variables, i.e. GDP and inflation, which affect the demand for loans (Kashyap *et al*., 1993).

2.2 Credit Frictions

Not taking into account financial intermediation comprises a weakness of conventional macroeconomic models as it was revealed by the recent crisis and the disruptions of financial and real activity. Standard models of monetary transmission mechanisms assume frictionless financial markets. They use a single interest rate, which simultaneously represents the policy rate, the rate of return that households receive on savings and the rate at which anyone can borrow. In real economies, however, more than single interest rates exist. Furthermore, these multiple rates are different from each other, allowing for the presence of spreads. Any variation in spreads can be considered as an indicator of changes in financial conditions.

Woodford (2010) sketches a theory appropriate for a market-based financial system. In this paper, intermediation plays a crucial role and credit frictions are able to impede the supply of loans. First, he describes the conventional macroeconomic model, which provides a straightforward way of how a central bank's target rate policy affects the level of economic activity. This model uses a single interest rate, the equilibrium value of which is determined in the credit market. In this model savers

lend directly ultimate borrowers. A shift in the level of their income modifies both the supply of and the demand for funds. Therefore, at each level of income, a different equilibrium interest rate exists, at which the supply of equals the demand for funds. Furthermore, a monetary policy reaction function indicates the relationship between the central bank's policy rate and the level of economic activity.

Second, the author introduces multiple interest rates, a feature of actual financial systems, as well as financial intermediaries, which acquire funds from savers and lend them, in turn, to ultimate borrowers. The implication of financial intermediation is the differentiation between the interest rate paid to savers and the rate at which borrowers finance their needs. The difference between the rates comprises the interest rate spread, at any given level of which a unique volume of intermediation exists. The degree to which borrowers are willing to pay a higher interest rate than the one required by savers indicates the demand for intermediation. On the other hand, the supply of intermediation shows the spread that is required to induce financial intermediaries to provide a specific volume of credit from savers to borrowers. The determinants of the supply of intermediation may be the marginal cost of lending of financial institutions as well as their capital or leverage (Zigrand *et al.*, 2010; Adrian *et al.*, 2010). Any changes in these determinants have as a consequence the disruption in the supply of intermediation, which yields less credit supply and higher spreads. This disruption will result in a decline in the target rate and economic activity as well.

The incorporation of the interest rate spread in the basic New Keynesian model of the transmission mechanism is attempted by Cúrdia and Woodford (2008), who find that not just a mere presence of the spread, but also the variation in spreads over time makes significant quantitative differences vis-a-vis the standard model. Similarly, a paper by Goodfriend and McCallum (2007) compares a simple New Keynesian model to a new model that allows for multiple interests and investigates quantitatively "how much a central bank can be misled by relying on a model without money and banking, when managing its interbank-rate policy instrument".

McCulley and Toloui (2008) and Taylor (2008) use a spread-adjusted Taylor rule, that is, they extend the Taylor rule by including the interest rate spread for the determination of the federal funds rate. They propose that the target rate should be adjusted to variations in spreads at any given level of inflation and output. Specifically, in the case of monetary policy tightening that is not justified by any changes in inflation or the output gap, they argue that the target rate should be lowered when spreads increase. Overall, it is of great significance to take into consideration credit frictions, because they create additional uncertainty to the conduct of monetary policy and to the effect that interest rate changes have on economic activity. According to Bean *et al.* (2002) and based on their New Keynesian macroeconomic model, financial frictions tend to amplify the impact of variations in official interest rates and their presence makes monetary policy to be more aggressive.

3. Data Description

Annual[i] balance sheet data for 616 European commercial and savings banks[ii, iii] are obtained from the Bankscope database. The sample of countries consists of Austria, Belgium, France, Germany and Luxembourg, which are used as the group of European countries with common currency -- hereafter referred as the Euro-group -- whereas the UK is examined separately. The time span runs from 1999 to 2010. The countries and the corresponding number of banks are presented in Table 1.

The balance sheet data[1] are the following: we use total loans as the dependent variable, whereas the strength of each bank in our analysis is measured by certain bank-specific characteristics. More

[1] Balance sheet data are deflated using the GDP deflator of each country.

specifically, size is defined as the log of total assets, capitalization is measured by the ratio of total equity to total assets and liquidity is computed by dividing liquid to total assets.

Table 1. Number of banks in each country

Country	Number of banks
Austria	63
Belgium	12
France	62
Germany	430
Luxembourg	30
Total (Eurogroup)	**597**
United Kingdom	**19**

To account for the monetary policy indicator, the EONIA interest rate for the ECB on main refinancing operation (MRO) is used for the countries-members of the European Monetary Union (EMU). This is a short-term open market operation in form of reverse transactions that allows it to control the degree of liquidity in the interbank market. The bank rate of the Bank of England is used as the interest rate for the UK, correspondingly. Data on short-term interest rates were obtained from the Bloomberg database.

Real GDP and inflation rates are used to isolate changes in total loans that are caused by movements in loan demand. To calculate inflation rates, we use the percentage changes of the Consumer Price Index (CPI) as well as the harmonized index (HICP) -- to check robustness. These data are derived from Datastream.

Credit frictions are measured by the interest rate spread, that is, the difference between two interest rates, the interest rate charged to borrowers and the interest rate paid to lenders. In our analysis, we construct the lending rate, because it is provided separately for households and corporations for each country. Specifically, the lending interest rate is the weighted sum of lending rates paid to households and corporations. As a weight, we use the outstanding amount of each of the loans to households and corporations divided with total loans.

Analytically, the specific lending rates that we use, concern the rates charged on consumer loans to households, housing loans to households and loans to corporations, whereas the deposit rates refer to the deposits with agreed maturity, a category that is common to all countries. Though, due to lack of data for Luxembourg (before 2003) and for the UK (the full sample period), we used the database of the central banks of each country and acquired the same categories of lending and deposit rates to accomplish compatibility as far as possible.

4. The Econometric Specification

We investigate the bank lending channel using the following baseline equation:

$$\Delta lnL_{ikt} = \alpha_k + \varphi_{ik}\Delta lnL_{ikt-1} + \sum_{j=0}^{n}\beta_j\Delta i_{kt-j} + \sum_{j=0}^{n}\delta_j\Delta lnGDP_{kt-j} + \sum_{j=0}^{n}\omega_j\pi_{kt-j} + u_{ikt} \qquad (1)$$

where k = 1, …, K and t = 1, …, T, k denotes the country, K equals five when we estimate the bank lending channel for the Euro-group and one when we estimate the lending channel for the United Kingdom, L_{ikt} denotes the loans of the i^{th} bank of country k in year t, i_{kt} denotes the monetary policy indicator of country k in year t, GDP_{kt} denotes the GDP of country k in year t, π_{kt} denotes the inflation rate of country k in year t, and u_{kt} denotes the error term.

In equation (1) we examine the reaction of loan growth to the actual short-term interest rate, the monetary policy indicator. To control for country-specific loan demand changes due to macroeconomic activity, we regress the growth rate of a country's lending (ΔlnL) on the real GDP growth rate ($\Delta lnGDP$) and on the inflation rate (π). According to the bank lending channel, the negative coefficient on the interest rate causes loans to fall after a monetary tightening. We estimate the model using the panel GMM estimator, suggested by Arellano and Bond (1991), where we only include statistically significant lags in the estimation. We also examine the effect of the changes in interest rate spreads on the loan growth. To include the interest rate spreads into the analysis, we incorporate this variable into the model:

$$\Delta \ln L_{ikt} = \alpha_k + \varphi_{ik}\Delta \ln L_{ikt-1} + \sum_{j=0}^{n} \beta_j \Delta i_{kt-j} + \sum_{j=0}^{n} \xi_j \Delta Spread_{kt-j} + \sum_{j=0}^{n} \delta_j \Delta \ln GDP_{kt-j} + \sum_{j=0}^{n} \omega_j \pi_{kt-j} + u_{ikt} \quad (2)$$

where $Spread_{kt}$ denotes the interest rate spread of country k in year t. We consider that the changes in spreads are more important than their corresponding levels, as they incorporate more information about the economic situation. Spreads are not constant over time, but change due to changing financial conditions. Therefore, increases in spreads indicate financial distress, which is associated with lower levels of employment and economic output (Cúrdia & Woodford, 2008).

4.1 Bank-Specific Characteristics

In the bank lending channel literature, banks with different characteristics react differently to a monetary shock. To test this, we also construct a similar model, which takes the following form:

$$\Delta \ln L_{ikt} = a_k + \varphi_{ik}\Delta \ln L_{ikt-1} + \sum_{j=0}^{n} \beta_j \Delta i_{kt-j} + \sum_{j=0}^{n} \delta_j \Delta \ln GDP_{kt-j} + \sum_{j=0}^{n} \omega_j \pi_{kt-j} + \gamma_{ik} BS_{ikt-1} + \sum_{j=0}^{n} \lambda_j \Delta i_{kt-j} BS_{ikt-1} + u_{ikt}. \quad (3)$$

This specification differs from equation (1), because it incorporates two additional terms – a bank-specific characteristic and its interaction with the monetary policy indicator. More specifically, we introduce three separate bank-specific characteristics (BS_{ik}) -- bank capitalization, asset size, and liquidity -- and the interaction terms ($\Delta i_{kt-j} BS_{ikt-1} : j = 1, \ldots, n$). Following Gambacorta (2005), we define the BS_{ik} as deviations from their respective means. Thus, the effect of the BS_{ik} on the growth rate of lending evaluated at the mean of the BS_{ik} equals γ_{ik}. When we incorporate financial frictions into the model, the above equation yields:

$$\begin{aligned}\Delta \ln L_{ikt} = a_k + \varphi_{ik}\Delta \ln L_{ikt-1} + \sum_{j=0}^{n}\beta_j \Delta i_{kt-j} + \sum_{j=0}^{n}\delta_j \Delta \ln GDP_{kt-j} + \gamma_{ik} Size_{ikt-1} \\ + \sum_{j=0}^{n}\lambda_j \Delta i_{kt-j} Size_{ikt-1} + \sum_{j=0}^{n}\omega_j \pi_{kt-j} + \gamma_{ik} Cap_{ikt-1} \\ + \sum_{j=0}^{n}\lambda_j \Delta i_{kt-j} Cap_{ikt-1} + \gamma_{ik} Liq_{ikt-1} + \sum_{j=0}^{n}\lambda_j \Delta i_{kt-j} Liq_{ikt-1} + u_{ikt}.\end{aligned} \quad (4)$$

where $Size_{ikt}$ denotes the size of the i^{th} bank in country k in year t, Cap_{ikt} denotes the capitalization of the i^{th} bank in country k in year t and Liq_{ikt} denotes the liquidity of the i^{th} bank in country k in year t. Equation (4) incorporates the interaction terms between the monetary policy indicator and each of the bank-specific characteristic. The interest rate spread term is also added to the model to illustrate the incorporation of financial frictions:

$$\begin{aligned}\Delta \ln L_{ikt} = a_k + \varphi_{ik}\Delta \ln L_{ikt-1} + \sum_{j=0}^{n}\beta_j \Delta i_{kt-j} + \sum_{j=0}^{n}\xi_j \Delta Spread_{kt-j} \\ + \sum_{j=0}^{n}\delta_j \Delta \ln GDP_{kt-j} + \gamma_{ik} Size_{ikt-1} + \sum_{j=0}^{n}\lambda_j \Delta i_{kt-j} Size_{ikt-1} \\ + \sum_{j=0}^{n}\omega_j \pi_{kt-j} + \gamma_{ik} Cap_{ikt-1} + \sum_{j=0}^{n}\lambda_j \Delta i_{kt-j} Cap_{ikt-1} + \gamma_{ik} Liq_{ikt-1} \\ + \sum_{j=0}^{n}\lambda_j \Delta i_{kt-j} Liq_{ikt-1} + u_{ikt}.\end{aligned} \quad (5)$$

5. Empirical Analysis

The entries in all tables report the coefficients of the variables and their corresponding p-values estimated for the Eurogroup and the UK. The first two columns indicate the results of the bank lending channel model that does not incorporate financial frictions, whereas the last two columns report the results of the model that includes them. As previously described, financial frictions are captured into the model by incorporating the interest rate spread.

5.1. Bank Lending Channel Results

The findings of the benchmark model expressed in equation (1) are reported in Table 2. The monetary policy indicator has the expected negative sign for all countries and is statistically significant at the 10-percent level in the Eurogroup and at the 5-percent level in the UK. This implies that an increase in the monetary policy rates leads to a reduction in loan growth, implying that the response of bank lending to a monetary policy shock has the expected negative sign. The coefficient of the monetary policy indicator also keeps its negative sign in the model that includes financial frictions, as is reported in the third and fourth column. The policy interest rate exerts its influence with a lag in both models and across all cases and the respective coefficients are almost the same in absolute numbers. These empirical findings seem to be consistent with the results (based on different econometric and modeling specifications though) reached by Bean *et al.* (2002), McCulley and Toloui (2008), and Taylor (2008), therefore, rendering validity to the conclusions as well as to policy implications of our empirical findings.

Table 2. The bank lending results

Dependent variable: annual growth rate of lending				
	Model without spread		**Model with spread**	
Eurogroup	**Coef**	**Prob**	**Coef**	**Prob**
ΔlnL_{ikt-1}	**0.0414**	0.0000	**0.0384**	0.0000
Δi_{kt-1}	**-0.5243**	0.0808	**-0.4078**	0.0693
$\Delta lnGDP_{kt-1}$	**0.5992**	0.0006	**0.4544**	0.0000
π^{cpi}_{kt-1}	**-0.0219**	0.0000	**-0.0175**	0.0000
$\Delta spread_{kt}$			**-0.3950**	0.0363
F-statistic			0.0029	0.9567
	Model without spread		**Model with spread**	
UK	**Coef**	**Prob**	**Coef**	**Prob**
ΔlnL_{ikt-1}	**-0.0650**	0.0000	**-0.0605**	0.0000
Δi_{kt-1}	**-4.6273**	0.0000	**-4.7100**	0.0000
$\Delta lnGDP_{kt-1}$	**2.1074**	0.0000	**2.2396**	0.0000
π^{cpi}_{kt-1}	**-0.0606**	0.0001	-0.0261	0.1238
$\Delta spread_{kt}$			**-10.4411**	0.0092
F-statistic			1.9464	0.1647

Notes: Coefficient and p-value estimates for the group of European countries and the U.K. according to the model that does not include and the one that includes the interest rate spread. Bolded coefficients prove statistically significant at either the 5 or the 10 percent level.

Table 3 also reports the coefficients and their corresponding p-values for real GDP growth and inflation. These two variables control for the loan demand effects and exert their influence with a lag. The coefficients of GDP growth exhibit a positive sign and are statistically significant at the 5-percent level, implying that changes in economic activity affect bank lending in a positive way. By contrast, the coefficient for inflation exhibits a negative sign and is statistically significant, except for the UK and particularly in the model, in which frictions are included.

As previously mentioned, there are small differences between the monetary policy coefficients of the two models, whereas it is obvious that loan supply is further negatively affected by another variable. All tables present the results of the two models: the second and third columns report the results of the model that does not incorporate frictions, whereas the entries in the fourth and fifth column show the results of the model, which includes frictions as an additional variable. This variable is the change in the interest rate spread, which exhibits a negative and statistically significant sign. In the UK the coefficient of the interest rate spread is larger than that of the monetary policy indicator, but smaller in the case of the Eurogroup.

Furthermore, we computed a test statistic, the Wald test, which measures how close the unrestricted estimates come to satisfying the restrictions under the null hypothesis. If the restrictions are in fact true, then the unrestricted estimates should come close to satisfying the restrictions. In our case, the null hypothesis concerns the coefficients of the monetary policy indicator and the interest rate spread, which are assumed to be equal. The results of the test are presented in the last row of each country and each table and the entries report the value and the probability of the F-statistic. We

accept the null hypothesis in all cases, implying that the effect of spreads on the loan supply is larger than that of the monetary policy indicator. In the Eurogroup and the UK, the p-value is greater than 0.05 and, therefore, we do not reject the null hypothesis.

Table 3. Bank lending channel results including capitalization, size and liquidity as bank-specific characteristics

Dependent variable: annual growth rate of lending				
	Model without spread		**Model with spread**	
Eurogroup	**Coef**	**Prob**	**Coef**	**Prob**
$\Delta \ln L_{ikt-1}$	**0.1236**	0.0000	**0.1233**	0.0000
Δi_{kt-1}	**-1.0903**	0.0711	**-1.5483**	0.0289
$\Delta \ln GDP_{kt-1}$	**1.3515**	0.0002	**1.5736**	0.0002
π^{cpi}_{kt-1}	**-0.0355**	0.0000	**-0.0385**	0.0000
$Size_{ikt-1}$	**0.0408**	0.0004	**0.0440**	0.0002
$\Delta_{ikt-1}*Size_{ikt-1}$	**-3.0891**	0.0001	**-3.0269**	0.0002
Cap_{ikt-1}	**0.0655**	0.0000	**0.0677**	0.0000
$\Delta_{ikt-1}*Cap_{ikt-1}$	0.1417	0.8928	-0.0357	0.9725
Liq_{ikt}	-0.0007	0.8717	-0.0022	0.6344
$\Delta_{ikt-1}*Liq_{ikt}$	**-2.4009**	0.0000	**-2.4210**	0.0000
$\Delta spread_{kt}$			**-0.8244**	0.0375
F-statistic			1.9746	0.1600
	Model without spread		**Model with spread**	
UK	**Coef**	**Prob**	**Coef**	**Prob**
$\Delta \ln L_{ikt-1}$	-0.0619	0.1581	-0.0718	0.0956
Δi_{kt-1}	-1.7566	0.6368	-2.5651	0.7703
$\Delta \ln GDP_{kt-1}$	3.4047	0.4960	2.2038	0.6392
π^{cpi}_{kt-1}	-0.0009	0.9903	-0.0037	0.9731
$Size_{ikt-1}$	**-0.1667**	0.0025	**-0.1690**	0.0012
$\Delta_{ikt-1}*Size_{ikt-1}$	2.1257	0.6806	1.7877	0.7209
Cap_{ikt-1}	-0.0452	0.2421	-0.0444	0.2539
$\Delta_{ikt-1}*Cap_{ikt-1}$	1.6800	0.6794	1.4853	0.6968
Liq_{ikt}	-0.0487	0.1993	-0.0548	0.1472
$\Delta_{ikt-1}*Liq_{ikt}$	**-4.2260**	0.0319	-4.2403	0.1001
$\Delta spread_{kt-1}$			-7.3216	0.8476
F-statistic			0.0249	0.8749

Notes: Capitalization, size and liquidity are used as bank-specific characteristics.

5.2 Results with Bank-Specific Characteristics

Table 3 reports the results of the estimation when all the characteristics as well as their interaction terms with the monetary policy indicator are included in the model. The incorporation of all the characteristics reports the same positive sign for capitalization in the Eurogroup, but the respective interaction term does not prove statistically significant. The sign of the size coefficient is also positive in the Eurogroup case, but negative in the case of the UK, adding to the controversial conclusions previously mentioned. The negative sign of the interaction term indicates that large banks do not differ from small ones in their lending response to a monetary policy action. No particular differences in their lending response appear across banks of various liquidity levels as well.

In the Eurogroup the coefficients of both the monetary policy indicator and spread change are negative and significant, whereas in the UK the corresponding coefficients prove statistically insignificant. The p-value of the F-statistic is larger than 0.05, therefore the null hypothesis that the coefficient of the monetary policy indicator equals that of the interest rate spread, is not rejected. Overall, in the UK, only the coefficients of size and of the interaction term between liquidity and the monetary policy indicator -- the latter in the model that includes the spread variable -- prove statistically significant, whereas the rest of the parameters are insignificant.

6. Conclusions

Disruptions in economic activity have imposed the need for conventional monetary policy to take into consideration of credit frictions. Frictions caused by asymmetric information alter the incentives of financial intermediaries, which, in turn, modify their behavior. Monetary policy should take explicitly into consideration this change in the way intermediaries react and include these observations into their analysis about the transmission mechanism. Specifically, the bank lending channel should take into consideration such financial frictions, since it is the mechanism through which monetary policy transmits its decisions to the real economy.

In this paper we investigated the performance of the bank lending channel under the presence of credit frictions in the Eurogroup and the UK over the period 1999-2010. These frictions were specified by the variation in the interest rate spreads, that is, the difference between the borrowing and the lending rate. The empirical findings indicated that the bank lending channel existed in all cases. The difference between the traditional model and the one that incorporated credit frictions was that they further affected loan supply. In other words, the change in lending cannot be merely explained by the alteration of any monetary policy indicator. This suggests that monetary authorities should take explicitly into consideration the spread variable to understand the way their actions affect loan growth and implement a more effective monetary policy.

The paper also examined whether bank lending responses to monetary policy shocks varied across banks with different strength -- the latter being described by size, capitalization and liquidity. The empirical results indicated that well-capitalized banks are able to buffer any monetary shocks. This is not the case, though, with large or more liquid banks, the results of which can be characterized as controversial, even when credit frictions are included into the analysis. These findings could be justified if we take into consideration the developments of financial markets and the alternative ways of financing. As a consequence, standard indicators of banks' strength may have become inadequate for the accurate assessment of their ability to provide loans. Even though, financial innovations necessitate the modification of traditional bank-specific characteristics, it is obvious from the empirical analysis, that the capital to asset ratio maintains its informative power. Therefore, capitalization remains an important parameter of banks' ability to confront with changes in monetary policy. This result is in accordance with the finding by Gambacorta and Marques-Ibanez (2011), who argued that capitalization influenced changes in loan supply, while, it was

perceived as bank risk by financial markets, determining lending. The changing conditions in financial markets, though, impose the modification of this characteristic as well, to include more information, since its importance both as a cushion and a measure of creditworthiness to financial markets has increased.

Confidence is a parameter of great importance for the transmission mechanism to work, especially for the bank lending channel, through which confidence is critical between banks and depositors, between banks and borrowers, even among banks themselves. The paper attempted to explain the operation of the bank lending channel under credit frictions and, to this end, used interest rate spreads as a proxy for these frictions. Nonetheless, further research should be made to investigate the overall impact of the lack of confidence, as well as of unconventional monetary policies.

Acknowledgements

The authors wish to express their gratitude to the Editor and two referees of this journal for their valuable and constructive comments that enhanced the quality of the paper. Needless to say, the usual disclaimer applies.

References

[1] Adrian, T., Moench, E., & Shin, H. S. (2010). *Macro Risk Premium and Intermediary Balance Sheet Quantities*. Federal Reserve Bank of New York Staff Report 428.

[2] Altunbas, Y., Gambacorta, L., & Marques-Ibanez, D. (2009). Securitization and the Bank Lending Channel. *European Economic Review, 53*, 996-1009.

[3] Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *Review of Economic Studies, 58*, 277-297.

[4] Bean, C., Larsen, J., & Nikolov, K. (2002). *Financial Frictions and the Monetary Transmission Mechanism: Theory, Evidence and Policy Implications*. European Central Bank, Working Paper Series, Working Paper No. 113.

[5] Bernanke, B. S. (2007). *The Financial Accelerator and the Credit Channel*. Speech at the conference on the Credit Channel of Monetary Policy in the Twenty-first century Conference, Federal Reserve Bank of Atlanta.

[6] Brissimis, S. N., Kamberoglou, N. C., & Simigiannis, G. T. (2001). *Is There a Bank Lending Channel of Monetary Policy in Greece? Evidence from Bank Level Data*. European Central Bank, Working Paper Series, Working Paper No. 104.

[7] Cúrdia, V., & Wodford, M. (2008). *Credit Frictions and Optimal Monetary Policy*. BIS Working Paper No 278.

[8] Disiyat, P. (2011). The Bank Lending Channel Revisited. *Journal of Money, Credit and Banking*, *43*, 711-734.

[9] Disiyat, P. (2004). Currency Crises and the Real Economy: The Role of Banks. *European Economic Review*, *48*(1), 75-90.

[10] Ehrmann, M., Gambacorta, L., Martinez-Pages, J., Sevestre, P., & Worms, A. (2003). Financial Systems and the Role of Banks in Monetary Policy Transmissions in the Euro Area. In I. Angeloni, A. Kashyap, & B. Mojon (Eds.), *Monetary Policy Transmission in the Euro Area*. Cambridge: Cambridge University Press.

[11] Gambacorta, L. (2005). Inside the Bank Lending Channel. *European Economic Review*, *49*(7), 1737-1759.

[12] Gambacorta, L., & Marques-Ibanez, D. (2011). The Bank Lending Channel: Lessons from the Crisis. *Economic Policy*, *26*(66), 135-182.

[13] Gambacorta, L., & Mistrulli, P. E. (2004). Does Bank Capital Affect Lending Behavior? *Journal of Financial Intermediation, 13*(4), 436-457.

[14] Golodniuk, I. (2006). Evidence on the Bank Lending Channel in Ukraine. *Research in International Business and Finance, 20*(2), 180-199.

[15] Goodfriend, M., & McCallum, B. T. (2007). Banking and Interest Rates in Monetary Policy Analysis: A Quantitative Exploration. *Journal of Monetary Economics*, *54*(5), 1480-1507.

[16] James, C. (1988). The Use of Loans Sales and Standby Letters of Credit by Commercial Banks. *Journal of Monetary Economics, 22*(3), 395-422.

[17] Kashyap, A. K., Stein, J. C., & Wilcox, D. W. (1993). Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance. *American Economic Review, 83*(1), 78-98.

[18] Kashyap, A. K., & Stein, J. C. (1995). The Impact of Monetary Policy on Bank Balance Sheets. *Carnegie Rochester Conference Series on Public Policy*, *42*, 151-195.

[19] Kashyap, A. K., & Stein, J. C. (2000). What Do a Million Observations on Banks Say About the Transmission of Monetary Policy? *American Economic Review, 90*(3), 407-428.

[20] McCulley, P., & Toloui, R. (2008). *Chasing the Neutral Rate Down: Financial Conditions, Monetary Policy and the Taylor Rule*. Global Central Bank Focus, PIMCO, February 20.

[21] Peek, J., & Rosengren, E. S. (1995). Bank Lending and the Transmission of Monetary Policy. In J. Peek, & E. S. Rosengren (Eds.)*, Is Bank Lending Important for the Transmission of Monetary Policy?* Federal Reserve Bank of Boston Conference Series, No 39.

[22] Peek, J., & Rosengren, E. S. (2009). The Role of Banks in the Transmission of Monetary Policy. In A. Berger, P. Molyneux, & J. Wilson (Eds.), *Handbook of Banking*. Oxford University Press, Oxford.

[23] Pennacchi, G. (1988). Loan Sales and the Cost of Bank Capital. *Journal of Finance, 43*(2), 375-396.

[24] Romer, C. D., & Romer D. H. (1990). New Evidence on the Monetary Transmission Mechanism. *Brooking Paper on Economic Activity, 21*(1), 149-214.

[25] Stein, J. C. (1998). An Adverse-Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy. *Rand Journal of Economics, 29*(3), 466-486.

[26] Taylor, J. B. (2008). *Monetary Policy and the State of the Economy*. Testimony before the Committee on Financial Services, U.S. House of Representatives, February 26.

[27] Van den Heuvel, S. J. (2002). Does Bank Capital Matter for Monetary Transmission? *Federal Reserve Bank of New York Economic Policy Review, 2002*(May), 259-265.

[28] Woodford, M. (2010). Financial Intermediation and Macroeconomic Analysis. *Journal of Economic Perspectives*, *24*(4), 21-44.

[29] Zigrand, J. P., Shin, H. S., & Danielsson, J. (2010). *Risk appetite and endogenous risk*. Financial Markets Group Discussion Paper No. 647.

Notes

[i] The BankScope database does not report quarterly data for our purposes.

[ii] The sample consists of banks that exist over the full sample period.

[iii] We omitted investment banks, due to their high dependence on non-interest sources of income. They may be more profitable compared to commercial banks, prior to periods of crisis, but their earnings turn out to be more volatile. Balance sheet data are deflated using the GDP deflator of each country.