“The credit channel transmission of monetary policy in the European Union: a panel data approach”

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The credit channel transmission of monetary policy in the European Union: a panel data approach

Abstract

This paper seeks to contribute to the analysis of the financial integration, the importance of bank performance conditions and the bank lending channel transmission of monetary policy in the European Union countries since 1999. Using pooled panel OLS estimations and dynamic Arellano-Bond GMM estimations with quarterly data for 26 EU countries for the period from Q1 1999 to Q3 2006 it confirms the high degree of integration between the EU financial systems, as well as the importance of bank performance conditions to the credit-lending channel of monetary policy in the EU. Furthermore, it demonstrates not only the quite high degree of openness of the financial markets but also their indebtedness and the dependence of the EU banking institutions on the financial resources of other countries.

Keywords: European integration, bank credit, monetary policy transmission, panel estimates.
JEL Classification: E4, E5, G2.

Introduction

The introduction of the single currency has accelerated the process of consolidation and financial integration, not only in the Economic and Monetary Union (EMU), but in the whole European Union (EU), in which the new member states also have a voice, in spite of the possible heterogeneous nature of their financial systems.

The process of financial integration is, on the one hand, a necessary pre-requisite for the adoption of the single currency and the implementation of the single monetary policy, with the predominance of the banking intermediation in the context of the EU. On the other hand, this process raises the potential to incite liquidity crises, which could become contagious and affect the increasingly integrated European financial system.

More efficient credit sectors should contribute to the economic benefits of the other sectors and agents which use financial services and they also represent a necessary condition for the transmission mechanism of monetary policy.

According to the credit and lending view, the effectiveness of monetary policy depends basically on the banking system, since imperfections, such as asymmetric information and the subsequent phenomena of adverse selection and moral hazard, exist in the capital markets, which increase the particular difficulties felt by some economic agents to finance their investment and consumption plans. Under these conditions, central banks control the supply of money, but the banking institutions also play an important role in the money-creation process, as well as in the mobilization and allocation of financial resources.

In addition, more efficient banking sectors are generally recognized as a necessary condition for the transmission mechanism of monetary policy and the way that banks adapt lending in response to monetary policy decisions varies according to their specific political and economic environment.

However, there is no agreement on the precise specification of the ways in which monetary policy influences the economy. Hence, it is an area meriting further investigation (Goddart et al., 2007).

Following these vectors of research, this paper seeks to contribute to the analysis of the financial integration, the importance of bank performance conditions and the bank lending channel transmission of monetary policy in the EU countries since 1999.

The main contributions are to be found in:

1. The use of quarterly data, between Q1 1999 and Q3 2006, for 26 EU[1] countries (the only exception is Luxembourg, for which it was not possible to obtain all the data). This is in contrast with most of the empirical studies in this area, which analyze only sub-sets of EU countries – all of the EMU, or some of its more significant members, or some new EU member states – to test the importance of the credit channel transmission of monetary policy;
2. The adaptation of the Bernanke and Blinder (1988) model with the introduction of four ratios to represent the bank-performance conditions: bank deposits/GDP; bonds and money market instruments/GDP; foreign assets/GDP; and foreign assets/foreign liabilities;
3. The use of panel data estimations – pooled panel OLS estimations and dynamic Arellano-Bond

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[1] More precisely, we use the data for Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden and United Kingdom.

Generalized Method of Moments (GMM) estimations – not only to confirm the importance of the bank lending channel, but also to draw conclusions on the level of financial integration of the EU countries.

The remainder of the paper is organized as follows: Section 1 presents the contextual setting and the relevant literature; the methodological framework and the data are presented in Section 2; Section 3 displays the results obtained; finally in the last Section, we make our concluding remarks.

1. Contextual setting and literature

In recent years and particularly during the last decade, the banking activity has had to adapt to profound transformations, due to advances in information and financial technologies and changes in institutional and regulatory conditions, together with shocks from the socio-economic and financial environment.

In the EU, the structural changes arising first from the adoption of the single currency and a common monetary policy and then from the recent historically remarkable enlargement, which brought the entry of ten countries at the same time, followed shortly after by two more countries, have had a profound impact, not only in the Euro area but also throughout the entire EU-27, where the financial sector has experienced an intensification of competition in banking services.

Some authors have already analyzed the degrees of integration through the common trends which may be identified in the context of the pressures of globalization and which affect all the EU countries (not only the EMU members) with particular intensity, due to the process of disintermediation, new technologies and increased competition (Belaisch et al., 2001; Gardener et al., 2002; Melnik and Nissim, 2006).

The increasingly competitive environment of the EU banking sector and the process of concentration as well as the decline in the number of banks in almost all EU countries, did not eliminate much of the excess capacity in the system. Moreover, there is evidence that large banks continue to have efficiency advantages over the smaller banks (Altunbas et al., 1997; Cabral et al., 2002; Casu and Molyneux, 2000; Jansen and de Haan, 2003; Molyneux, 2003; Baele et al., 2004; Romero-Ávila, 2003 and 2007).

In Barros et al. (2007), the efficiency of almost 1400 commercial banks operating in the EU between 1993 and 2001 was analyzed. The study confirmed the importance of country-level characteristics and firm-level features to explain the probability of a bank being a best (worst) performer. In particular, we concluded that smaller-sized banks with higher loan intensity and foreign banks from countries upholding common law traditions have a higher probability of best performance.

It is generally recognized that nowadays special attention must be paid to the EU banking sector following the most recent enlargements mentioned above, particularly regarding those countries formerly under the Soviet Union sphere of influence, given that in a quite short period of time, the banks in these countries moved from the structure of socialist banking, in which the financial organizations were used to support the central banking system, to a market economy and the concomitant decentralization and liberalization of the banking systems.

In most of these Eastern and Central European countries, forms and programs were introduced to amend property rights, together with processes of privatizations of part of the State property. As a result, the importance of the private sector and firms increased in these countries, as did the particularly relevant role of their financial intermediaries and banking institutions. There is a fairly strong consensus on the increased performance and efficiency of the banks under the new market conditions in these countries. Several studies (Holscher, 2000; Winkler, 2002; Backhaus, 2003; Sztyber, 2003; Hanousek and Kocenda, 2003; Stephen and Backhaus, 2003; Tchipev, 2003; Dimitrova, 2004; Bonin and Watchel, 2004; Bonin et al., 2005-a, 2005-b; Freis and Taci, 2005; Fries et al., 2006) confirm the relevant improvements in efficiency of the banking systems of the new EU members and the effects of ownership, concluding that foreign-owned banks are usually more cost-efficient.

Other studies examine how, and to what extent, the banking sectors of the new member-states have integrated with those of the older EU members and the process of nominal and real convergence of these countries to EU standards (ECB, 2004 and 2005; Kocenda et al., 2006).

The transmission of monetary policy to the non-monetary economic sectors also requires more efficient banking and the way that banks adapt lending in response to monetary policy decisions varies according to their specific political and economic environment. However, in spite of all the theoretical and empirical advances in this area, there is still no agreement about the precise specification of the ways in which monetary policy influences the economy. Thus, it is acknowledged as an area meriting further investigation (Goddart et al., 2007).

Some contributions to the explanation of the classic interest-rate channel transmission of monetary policy (Taylor, 1995; Cecchetti, 1995; Bean et al., 2002) imply that the influence of interest rates on economic

activity affects, at least, the components of domestic demand. Nowadays, the traditional interest-rate channel is not the only transmission mechanism of monetary policy. Mishkin (1995, 2001) adds an asset-price channel and an exchange-rate channel, summing up the new different mechanisms as "other asset prices" and the "credit view".

This credit channel may be seen as the development and extension of the conventional interest-rate effect (also developed by Bernanke and Getler, 1995, as well as Hubbard, 1995), taking into account the rising evaluation and monitoring costs for lenders, due to the information asymmetries in credit markets which provoke adverse selection and moral hazard effects.

According to this credit view, monetary policy decisions will affect not only the credit demand side, through the balance sheet channel, but also the supply side, through the bank lending channel. More precisely, for instance, the tightening of monetary policy, through the balance sheet channel will make external finance more costly for borrowers with the increase of their interest expenses and the reduction of their collateral while, through the bank lending channel, the reduction of the banks' liquidity will force banking institutions to reduce lending.

However, such a reduction also reflects the banks' characteristics and the environment in which banks are operating. Lending by smaller and relatively under-capitalized or illiquid banks is usually more sensitive to interest rate movements (Kashyap and Stein, 1997, 2000; Kishan and Opiela, 2006).

This paper follows the vectors of research that adapt and develop the pioneer Bernanke and Blinder (1988) model, and particularly:

1. The empirical papers that recently have tested the existence of a bank lending channel for the transmission of monetary policies in the Euro zone, obtaining rather similar conclusions on the relative homogeneity of the behavior of the EU banking institutions (Erhmann et al., 2001; Fountas and Papagapitos, 2001; Topi and Vilmunen, 2001; Van Els et al., 2001; Worms, 2001; Altunbas et al., 2002; Angeloni et al., 2002; Gambacorta, 2004; Gambacorta and Mistrulli, 2004; Ferreira, 2007).
2. The other contributions that analyze the transmission channels of monetary policy in different EU countries, including the new member-states in Central and Eastern Europe (Golinelli and Rovelli, 2005; Elbourne and de Haan, 2006; Ferreira, 2008).

2. Methodological framework and used data

2.1. The model. The used model is an adaptation of the Bernanke and Blinder (1988) model.

In the money market, we will assume that money equals deposits held at banks by the non-monetary sectors. So, for the demand function, we consider that the nominal deposits held in banks by the private sector will depend positively on the GDP and negatively on the interest rate on bonds:

$$Dep^d = a_0 + a_1\ GDP + a_2\ \ i_{bonds}, \qquad (1)$$

where Dep^d = deposits, d meaning demand; GDP = Gross Domestic Product; i_{bonds} = interest rate on bonds; $a_1 > 0$; $a_2 < 0$.

On the other side, money supply will depend not only on the interest rate on bonds, but also on the influence of monetary policy (represented here by the relevant monetary policy interest rate, which is defined by the Central Bank):

$$Dep^s = b_0 + b_1\ i_{bonds} + b_2\ i_{mon.pol.}, \qquad (2)$$

where Dep^s = deposits, s meaning supply; i_{bonds} = interest rate on bonds; $i_{mon.pol.}$ = monetary policy interest rate; $b_1 > 0$; $b_2 < 0$.

At the same time, in the credit market, the demand for lending depends positively on the GDP, negatively on the interest rate on lending/borrowing and positively on the interest rate on bonds:

$$Lend^d = c_0 + c_1\ GDP + \ c_2\ i_{lend} + c_3\ \ i_{bonds}, \quad (3)$$

where $Lend^d$ = bank lending, d meaning demand; GDP = Gross Domestic Product; i_{lend} = interest rate on lending; i_{bonds} = interest rate on bonds; $c_1 > 0$; $c_2 < 0$; $c_3 > 0$.

Assuming the relevance of one or more bank-performance characteristics ($Char_x$) which may exert either positive or negative influences on lending, we define the supply in the money market as depending on the deposits of the private sectors in banks, as well as on the bank characteristics, the interest rate on lending/borrowing and the interest rate on bonds:

$$Lend^s = d_0 + d_1 Dep + d_2 Car_x + d_3 i_{lend} + d_4 i_{bonds}, \quad (4)$$

with $Lend^s$ = lending, s meaning supply; Dep = bank deposits of the private sector; Car_x = bank characteristics (x = 1,..X); i_{lend} = interest rate on lending; i_{bonds} = interest rate on bonds; $d_1 > 0$; d_2 may be > 0 or < 0 so $\boldsymbol{d_2 = ?}$; $d_3 > 0$; $d_4 < 0$.

So, clearing the money market – equations (1) and (2) – we obtain:

$$i_{bonds} = \frac{b_0 - a_0}{a_2 - b_1} - \frac{a_1}{a_2 - b_1} GDP + \frac{b_2}{a_2 - b_1} i_{mon.pol}$$

or

$$i_{bonds} = e_0 + e_1 GDP + e_2 i_{mon.pol}, \quad (5)$$

with $e_1 > 0$; $e_2 > 0$.

At the same time, if money demand equals money supply:

$$Dep^d = Dep^s = \frac{a_2 b_0 - a_0 b_1}{a_2 - b_1} - \frac{a_1 b_1}{a_2 - b_1} GDP + \frac{a_2 b_2}{a_2 - b_1} i_{mon.pol}$$

or

$$Dep = f_0 + f_1 GDP + f_2 i_{mon.pol}, \quad (6)$$

where $f_1 > 0$; $f_2 < 0$.

Clearing the credit market – equations (3) and (4) – we first obtain the expression of the interest rate on lending:

$$i_{lends} = \frac{d_0 - c_0}{c_2 - d_3} - \frac{d_1}{c_2 - d_3} Dep + \frac{d_2}{c_2 - d_3} Car_x +$$

$$+ \frac{d_4 - c_3}{c_2 - d_3} i_{bond} - \frac{c_1}{c_2 - d_3} GDP$$

or

$$i_{lend} = g_0 + g_1 Dep + g_2 Car_x + g_3 i_{bond} + g_4 GDP, \quad (7)$$

with: $g_1 < 0$; g_2 may be > 0 or < 0 so $\boldsymbol{g_2 = ?}$; $g_3 > 0$; $g_4 > 0$.

Using this definition of the interest rate on lending, and admitting the credit market equilibrium, we get:

$$Lend^d = Lend^s = \frac{c_2 d_0 - c_0 d_3}{c_2 - d_3} - \frac{c_1 d_3}{c_2 - d_3} GDP +$$

$$+ \frac{c_2 d_4 - c_3 d_3}{c_2 - d_3} i_{bond} + \frac{c_2 d_1}{c_2 - d_3} Dep + \frac{c_2 d_2}{c_2 - d_3} Car_x$$

or

$$Lend = h_0 + h_1 GDP + h_2 i_{bond} + h_3 Dep + h_4 Car_x, \quad (8)$$

Now: $h_1 > 0$; $h_2 > 0$ if $c_2 d_4 < c_3 d_3$ or $h_2 < 0$ if $c_2 d_4 > c_3 d_3$; so $\boldsymbol{h_2 = ?}$; $h_3 > 0$; h_4 may be > 0 or < 0 so $\boldsymbol{h_4 = ?}$.

Remembering the expressions of the interest rate on bonds and deposits – equations (5) and (6)

$$i_{bonds} = e_0 + e_1 GDP + e_2 i_{mon.pol}, \quad (5)$$

$$Dep = f_0 + f_1 GDP + f_2 i_{mon.pol}, \quad (6)$$

and introducing these expressions into the equation (8), we obtain the reduced form of the expression for lending, which is the basis of our estimations:

$$Lend = (h_0 + h_2 e_0 + h_3 f_0) + (h_1 + h_2 e_1 + h_3 f_1) GDP +$$
$$+ (h_2 e_2 + h_3 f_2) i_{mon.pol} + h_4 Car_x$$

or

$$Lend = \alpha_0 + \alpha_1 GDP + \alpha_2 i_{mon.pol} + \alpha_3 Car_x, \quad (9)$$

where *Lend* = bank lending; *GDP* = Gross Domestic Product; $i_{mon.pol.}$ = monetary policy interest rate; Car_x = bank characteristics (x = 1,..X); $\alpha_1 > 0$ if $h_2 > 0$; otherwise α_1 may be < 0 ; so $\boldsymbol{\alpha_1 = ?}$; $\alpha_2 > 0$ if $h_2 > 0$ and $h_2 e_2 > h_3 f_2$; otherwise α_2 may be < 0 ; so $\boldsymbol{\alpha_2 = ?}$; α_3 may be > 0 or < 0 so $\boldsymbol{\alpha_3 = ?}$.

2.2. The data. To build our panel, we use Eurostat and International Financial Statistics (IFS) quarterly data for the period from Q1 1999 to Q3 2006 (31 quarters) and 26 EU countries, amounting to 806 observations. As mentioned previously, Luxembourg has been excluded, as it was not possible to collect all of the necessary data for this country.

For the dependent variable (bank lending) we use the natural logarithm of the ratio of the domestic credit provided by the banking institutions to GDP. To explain the growth of this bank lending, we will consider (always in natural logarithms):

- the real GDP per capita, representing the macroeconomic conditions of the different EU countries;
- the discount rate (end of the period) which is the monetary policy interest rate;
- the four ratios which represent the bank performance conditions, more precisely:
  - the ratio of deposits to GDP, that is, the total deposits in the banking institutions which are important sources of resources for credit lending. For instance, according to the macroeconomic money multiplier mechanism, bank lending will mainly depend on the collected deposits and the legal minimum reserves;
  - the ratio of the bonds and money market instruments to GDP, as a proxy of the development of the financial markets in these countries, which are mostly bank-dominated. Since healthy financial markets and developed financial institutions are a guarantee for the direct and indirect financing of the bank clients' activities, we may expect that this ratio will exert a positive influence on bank lending;
  - the ratio of foreign assets to GDP, introducing the influence of the other countries, more specifically, the financial resources obtained from foreign partners, represented by the entry of assets, in particular to pay their debts and financial obligations, and consequently, more resources to be applied in the domestic bank lending;

- the ratio of foreign assets to foreign liabilities, representing the financial situation of the banking institutions towards other countries, as they may receive payments from foreign debtors. On the other hand, they also have financial obligations towards foreign creditors, which implies the payment of debts and obligations to other countries. Therefore, the influence of this ratio on bank lending will reveal not only the openness of the financial markets, but mainly the degree of dependence on the other countries' financial resources.

In Appendix A, we present the summary statistics of these series, while the matrix of the correlations is presented in Appendix B.

2.3. Unit root tests. The collected data for 26 EU countries for a time period of 31 quarters (806 observations in total) does not lend itself to the application of single time series unit root tests. Therefore, we opt to use panel unit root tests, which are more adequate in this case (see, among others, Karlsson and Lothgren, 2000; Wooldridge, 2002; Basile et al., 2005). These tests not only increase the power of unit root tests due to the span of the observations, but also minimize the risks of structural breaks due to possible changes in policy regimes.

Among the available panel unit root tests, we choose the Levin, Lin and Chu (2002) test, which may be viewed as a pooled Dickey-Fuller test or as an augmented Dickey-Fuller test when lags are included, and the null hypothesis is the existence of non-stationarity. This test is adequate for heterogeneous panels of moderate size, as is the present case, and it assumes that there is a common unit root process.

According to the results obtained with the deterministic constant and trend up to 3 lags (see Appendix C), the existence of the null hypothesis may be rejected for all the variables, mostly with no lags, except for the monetary policy interest rate when lags are equal to one or two, while for the ratio of bonds and money market instruments to GDP the best results are obtained with three lags.

3. Empirical estimations

Using the reduced form (equation (9)) of the presented model, and the series described above, we will explain the response of bank lending to relevant macroeconomic conditions, as well as to some specific characteristics of the banking institutions and indicators representing their performance conditions, by the estimation of the following equation (all variables in natural logarithms[1]):

$$(\text{Bank Lending/GDP})_{it} = \varphi_0 + \varphi_1 \text{ real GDP per cap.}_{it} + \varphi_2 \text{ Interest rate}_{it} + \varphi_3 (\text{Deposits/GDP})_{it} + \varphi_4 (\text{Bonds and Money Market Instruments/GDP})_{it} + \varphi_5 (\text{Foreign Assets/GDP})_{it} + \varphi_6 (\text{Foreign Assets/Foreign Liabilities})_{it} + \eta_i + \nu_t + u_{it},$$

where $i = 1,..., 26$ (EU countries); $t = 1,..., 31$ (quarters, between Q1 1999 and Q3 2006); η_i = country dummies; ν_t = time (quarter) dummies; u_{it} = error term.

Therefore, with a panel of 806 observations, we will use a panel data approach which not only provides more observations for estimations, but also reduces the possibility of multi-collinearity among the different variables.

To check for the robustness of the results and the relative importance of the macroeconomic, monetary policy and bank performance conditions for the explanation of the bank lending growth, we will present the results of three equations: the first including all the explaining variables; the second excluding the real GDP per capita but including all the other five explaining variables (monetary policy interest rate and the four ratios representing bank performance conditions); and the last equation explaining the bank lending growth only by the bank performance conditions. In our model these bank performance conditions are represented by: the deposits / GDP ratio, the bonds and money market instruments / GDP ratio; the foreign assets / GDP ratio and the foreign assets / foreign liabilities ratio.

For the estimations, we will use:

- pooled panel ordinary least squares (OLS) robust estimates, following Wooldridge (2002); and
- dynamic panel Generalized Method of Moments (GMM) estimates, following the methodology developed by Arellano and Bond (1991), Blundell and Bond (1998), Windmeijer (2000) and Bond (2002).

3.1. Pooled panel OLS robust estimations. With pooled total, ordinary least squares (OLS) robust estimates, we test the degree of integration assuming a common intercept and a single set of slope coefficients for all the panel observations.

The obtained results for the three presented equations are reported in Table 1 and in all situations reveal consistency. In line with the previously presented unit root tests, the best results were obtained without any lagged variables[2], indicating the dynamic and immediate reaction of bank lending growth to the real per-capita GDP growth, the monetary policy interest rate and the four bank performance indicators and conditions included in our model.

[1] Good explanations of the advantages and importance of using logarithmic transformation in regression estimates are available, among others in Beauchamp and Olson (1973) or Bartik (1985).

[2] The results of the estimations including lagged variables are available from the author upon request.

Table 1. Pooled OLS robust estimations (*)

	EQUATION I	EQUATION II	EQUATION III
Real GDP per capita			
coef.	.3054466		
T-statistic	2.73		
P-value	0.006		
Interest rate			
coef.	.108883	.0944373	
T-statistic	3.28	2.77	
P-value	0.001	0.006	
Deposits/GDP			
coef.	.1937137	.2126949	.1918622
T-statistic	3.84	4.16	3.77
P-value	0.000	0.000	0.000
Bonds and money market instruments / GDP			
coef.	.1401866	.1427856	.159362
T-statistic	6.78	7.02	8.20
P-value	0.000	0.000	0.000
Foreign assets / GDP			
coef.	.1706834	.1625786	.1774548
T-statistic	4.45	4.40	4.92
P-value	0.000	0.000	0.000
Foreign assets / Foreign liabilities			
coef.	-.135372	-.1475844	-.1393685
T-statistic	-5.44	-6.11	-5.68
P-value	0.000	0.000	0.000
constant			
coef.	-.5142468	.8122658	.97971
T-statistic	-1.10	5.93	9.23
P-value	0.270	0.000	0.000
	N = 806	N = 806	N = 806
	F (61, 744) = 1119.72 Prob > F = 0.0000	F (60, 745) = 1226.02 Prob > F = 0.0000	F (59, 746) = 1237.57 Prob > F = 0.0000
	R-squared = 0.9773	R-squared = 0.9769	R-squared = 0.9766

Notes: (*) Time and country dummies were included in the estimations and the obtained results are available upon request.

According to the results presented in Table 1, the three models are statistically acceptable, as not only the values of the R-squares and the F-statistics are very high but also the t-statistics and the correspondent p-values of all variables are quite significant.

In all situations, only the ratio of foreign assets to foreign liabilities has a negative influence on the bank lending growth, confirming the high degree of foreign dependence and indebtedness of the EU financial systems during this period.

All the other explanatory variables contribute positively to bank lending growth. In addition, the relative high influence of the ratio of the bonds and money market instruments to GDP confirms that the EU financial and credit systems continue to be bank-dominated, since the increase of the bonds and money market instruments are in line with the bank lending growth.

The positive contribution of the monetary policy interest rate to bank lending is not a surprise, in view of the fact that during this period, the ECB in particular, as well as the central banks of the non-EMU member-states, maintained interest rates at historically low levels, thereby contributing to the growth of the ratio bank lending to GDP.

3.2. Arellano-Bond dynamic panel GMM estimations. In addition, we present the results obtained with dynamic Arellano-Bond panel GMM estimates (two-step difference), which consider the model as a system of equations, one for each time period. The equations differ by their individual moment condition sets, since they all include the endogenous and exogenous variables in first differences as instruments with suitable lags of their own levels. By this use of instruments based on lagged values of the explanatory variables, GMM controls for the potential endogeneity of all explanatory variables, although only for "weak" endogeneity and not for full endogeneity, as explained by Bond (2002).

Next, we check for the quality of the estimations by the Hansen test for over-identifying restrictions and the Arellano-Bond tests for autocorrelation.

Table 2. Arellano-Bond dynamic panel GMM two-step difference estimations

	EQUATION I	EQUATION II	EQUATION III
Real GDP per capita			
coef.	-.1541594		
z	-6.01		
P>|z|	0.000		
Interest rate (lag1)			
coef.	.0530916	.0512398	
z	4.97	4.30	
P>|z|	0.000	0.000	
Deposits/GDP			
coef.	.4676554	.4839136	.5198482
z	22.21	18.63	20.54
P>|z|	0.000	0.000	0.000
Bonds and money market instruments/GDP (lag3)			
coef.	.2189317	.1646729	.0797324
z	8.16	8.69	4.13
P>|z|	0.000	0.000	0.000
Foreign assets/GDP			
coef.	.0611868	.0809159	.086716
z	3.87	4.90	8.26
P>|z|	0.000	0.000	0.000
Foreign assets/Foreign liabilities			
coef.	-.1879588	-.1997773	-.1983791
z	-8.67	-10.83	-25.70
P>|z|	0.000	0.008	0.000
	N = 702	N = 702	N = 702
Hansen test of overid. restrictions:	chi^2(129) = 21.30 Prob > chi2 = 1.000	chi^2 (130) = 24.46 Prob > chi2 = 1.000	chi^2 (131) = 22.67 Prob > chi2 = 1.000

Table 2. Arellano-Bond dynamic panel GMM two-step difference estimations

	EQUATION I	EQUATION II	EQUATION III
Arellano-Bond test for AR(1) in first differences:	z = -1.88 Pr > z = 0.060	z = -2.30 Pr > z = 0.022	z = -1.93 Pr > z = 0.053
Arellano-Bond test for AR(2) in first differences:	z = -0.36 Pr > z = 0.719	z = -0.67 Pr > z = 0.501	z = -0.75 Pr > z = 0.456

Table 2 reports the obtained results with dynamic Arellano-Bond two-step difference GMM estimations for the three presented equations. Now, reinforcing the conclusions of the presented unit root tests, the best results in statistical terms are obtained with lagged values, but only for the monetary policy interest rate and for the ratio of bonds and money market instruments to GDP.

In all situations, the Hansen test[1] clearly does not reject the null that the instruments are valid and that they are not correlated with the errors. At the same time, according to the results of the Arellano-Bond tests, and as required for the validity of the instruments, we may always accept that the residuals are clearly MA (1), but not MA (2).

Furthermore, except for the growth of the real GDP per capita[2] (included only in equation (1), all the results obtained with Arellano-Bond dynamic GMM estimates are in line with those obtained with the pooled panel OLS estimates.

With regard to real growth of the GDP per capita, we know that while it may be possible to admit a positive relation between real GDP growth and bank lending growth, it may also be true that during at least some of the considered time periods, bank lending was not so directly connected with the productive activities. This may be due either to the relatively independent and more productive financing of the productive activities, or to the channelling of credit towards less productive activities, such as home buying or private consumption, with no remarkable future productive multiplier effects.

Concluding remarks

This paper confirms the high degree of integration among the EU financial systems, as well as the importance of bank performance conditions to the credit-lending channel of monetary policy in the EU countries during recent years.

We contribute to the existing empirical evidence by the introduction into an adaptation of the Bernanke and Blinder (1988) model not only of the real GDP per capita or the monetary policy interest rate, but also of some specific variables, representing the bank performance conditions, to explain bank lending to GDP, namely, the bank deposits / GDP ratio; the bonds and money market instruments / GDP ratio, the foreign assets / GDP ratio and the foreign assets / foreign liabilities ratio.

The consistency of the obtained results, using pooled OLS and dynamic Arellano-Bond GMM panel estimations, allows us to conclude that the EU banking institutions have similar reactions to the variations of the macroeconomic conditions, in particular to the monetary policy interest rates as well as to the variations of the bank performance conditions. The results also confirm the importance of these variables to the bank lending growth (more precisely, the growth of the ratio of the domestic credit provided by the banking institutions to GDP) in the EU countries.

With reference to the real GDP per capita, the obtained results, although statistically robust, are inconclusive as to the positive or negative influence of this variable on the bank lending to GDP growth during this period. With OLS robust estimates, which consider a fully integrated panel, with common intercept and a single set of slope coefficients, we conclude that a faster growth of the real GDP per capita will contribute to a faster growth of the bank lending to GDP growth. However, when using Arellano-Bond GMM estimations, which consider the model as a system of equations, one for each time period, we found a negative influence of the real GDP per capita growth to bank lending growth.

Thus, we may conclude that, in at least some of the considered time periods, bank lending was not positively related to the real GDP per capita growth. This may be true in some EU countries, where the historically low levels of interest rates oriented bank credit to many non-productive activities[3]. These results are corroborated with the clear positive contributions of the monetary policy interest rate to bank lending growth.

Furthermore, the results obtained with the four included bank performance conditions allow us to state that:

[1] The Hansen test is a test of over-identifying restrictions. The null hypothesis for this test is that the instruments are valid in the sense that they are not correlated with the errors in the first-differenced equation. Under the null, this test statistic has a χ^2_q distribution with q equal to the total number of instruments minus the number of parameters in the model.

[2] To check the robustness of these results, we estimate several equations with and without lags and in all situations with Arellano-Bond GMM estimates (two-step difference), the real GDP per capita has a negative influence on the bank lending to GDP. The results are available upon request.

[3] Since we are using panel data estimates we can not identify exactly the countries where bank lending growth is more negatively correlated with GDP growth. Nevertheless, it is well known that more efficient and well developed banking institutions should contribute to a more productive use of bank lending and that during the considered time period the EU countries and their banking institutions were still adapting to the new market and credit conditions and particularly to the intensification of competition.

1. the growth of the ratio of deposits to GDP exerts a positive influence on the bank lending growth, confirming the intermediate role of financial institutions and the fact that the capacity to attract savings (in the form of deposits) is always a good condition in which to provide credit to those who need financing;
2. the growth of the ratio of bonds and money market instruments to GDP, which can be considered as a proxy of the development of the financial markets in the EU countries, also contributes positively to bank lending. This is symptomatic not only of the fact that the EU financial markets continue to be bank-dominated, but also that the development of the financial systems is always a good condition for the direct and indirect financing of the bank clients' activities;
3. as expected, the growth of the ratio of foreign assets to GDP also exerts a positive influence on the bank lending growth, as the entry of foreign assets received from the other countries increases the resources to concede credit to the domestic banks' clients;
4. the growth of the ratio of foreign assets to foreign liabilities contributes negatively to the domestic bank lending growth, revealing not only the openness of the financial markets, but more importantly, their indebtedness and the dependence of the EU banking institutions on other countries' financial resources.

Finally, it is clear that the total credit provided by the UE banking institutions depends on the macroeconomic conditions, and particularly on the monetary policy decisions. At the same time, bank lending is an essential transmission channel of monetary policy decisions, but it still depends on the performance conditions of the different financial institutions.

Taking into account the lessons of the recent banking and financial crisis, future research in this area will have to underline the relevance of more efficient banking sectors and their specific role in the transmission mechanisms of monetary policy.

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Appendix A. Summary statistics

VARIABLES (all in natural logarithms)	Mean	Std. dev.	Min	Max	Observations
Bank lending/GDP:					
overall	.9634144	1.106034	-3.23828	3.39354	N = 806
between		1.10247	-2.791806	3.356673	n = 26
within		.2305816	.0820338	3.117834	T = 31
Real GDP per capita:					
overall	6.051168	2.678176	1.34968	12.66796	N = 806
between		2.72726	1.443205	12.42524	n = 26
within		.1089511	5.524108	6.514988	T = 31
Interest rate:					
overall	1.481935	.56964	-.02703	3.55535	N = 806
between		.4792346	.7142648	3.06961	n = 26
within		.3215321	.4369553	2.581846	T = 31
Deposits/GDP:					
overall	1.295129	1.519575	-2.77394	6.04847	N = 806
between		1.528612	-2.488646	5.997196	n = 26
within		.2439945	-.3845842	1.981864	T = 31
Bonds and money market instruments/GDP:					
overall	-.0795288	1.750138	-5.39641	2.28638	N = 806
between		1.695878	-3.744695	1.986973	n = 26
within		.5423645	-2.622679	1.495851	T = 31
Foreign assets/GDP :					
overall	-.080594	2.21202	-10.41371	3.23734	N = 806
between		2.240099	-9.21917	2.771957	n = 26
within		.2489938	-1.275133	.6851366	T = 31
Foreign assets/Foreign liabilities :					
overall	-.0051242	.7618599	-2.47735	2.88475	N = 806
between		.6818787	-1.203865	2.336299	n = 26
within		.3644169	-1.446609	2.090331	T = 31

Appendix B. Correlation matrix (*)

	Real lending/ GDP	Real GDP per capita	Interest rate	Deposits/ GDP	Bonds and money market instruments/ GDP	Foreign as-sets/GDP	Foreign as-sets/Foreign liabilities
Bank lending/GDP	1.0000						
Real GDP per capita	-0.1951	1.0000					

Appendix B (cont). Correlation matrix (*)

	Real lending/ GDP	Real GDP per capita	Interest rate	Deposits/ GDP	Bonds and money market instruments/ GDP	Foreign assets/GDP	Foreign assets/Foreign liabilities
Interest rate	-0.4227	0.1853	1.0000				
Deposits/GDP	0.7154	-0.1843	-0.3777	1.0000			
Bonds and money market instruments/GDP	0.4828	-0.4132	-0.3314	0.4144	1.0000		
Foreign assets/GDP	0.8005	-0.2019	-0.5605	0.6140	0.5878	1.0000	
Foreign assets/Foreign liabilities	0.2235	-0.1555	-0.2109	0.4341	0.1835	0.3939	1.0000

Notes: **(*)** Several of these correlations seem rather high and, in order to reduce the multicollinearity problems, we could have tried an orthogonalization test, but, following among others, Gujarati (2003) these correlations can be considered in an acceptable range.

Appendix C. Panel unit root tests – Levin-Lin-Chu

VARIABLES	Lags	Coefficients	T-value	T-stat.	P>t	N
Bank lending / GDP	0	-0.85254	-48.179	-43.23521	0.0000	750
	1	-0.50974	-15.206	2.11907	0.9830	725
	2	-0.40864	-10.955	9.39903	1.0000	700
	3	-0.38976	-11.328	10.91595	1.0000	675
Real GDP per capita	0	-1.01649	-28.060	-18.99302	0.0000	750
	1	-1.57624	-38.559	-26.68914	0.0000	725
	2	-1.89295	-26.221	-7.30147	0.0000	700
	3	-0.37484	-8.712	25.39089	1.0000	675
Interest rate	0	-0.16644	-8.404	0.48152	0.6849	750
	1	-0.22246	-14.416	-5.64454	0.0000	725
	2	-0.26835	-15.240	-5.20633	0.0000	700
	3	-0.29185	-13.809	-1.49730	0.0672	675
Deposits / GDP	0	-0.40334	-13.622	-5.38483	0.0000	750
	1	-0.38278	-11.697	-2.25471	0.0121	725
	2	-0.30752	-9.013	1.43541	0.9244	700
	3	-0.24927	-7.173	4.77273	1.0000	675
Bonds and money market instruments / GDP	0	-0.20377	-8.980	-0.24074	0.4049	750
	1	-0.22969	-9.423	-0.19688	0.4220	725
	2	-0.20166	-7.782	2.50132	0.9938	700
	3	-0.34266	-12.507	-2.97402	0.0015	675
Foreign assets / GDP	0	-0.29999	-11.244	-2.56597	0.0051	750
	1	-0.29557	-10.280	-0.78186	0.2171	725
	2	-0.28142	-8.924	1.69569	0.9550	700
	3	-0.31657	-9.217	2.43607	0.9926	675
Foreign assets / Foreign liabilities	0	-0.17329	-9.362	-1.78288	0.0373	750
	1	-0.19161	-9.696	-1.77454	0.0380	725
	2	-0.20652	-9.886	-1.47377	0.0703	700
	3	-0.25318	-11.463	-2.60665	0.0046	675