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## **Assessing the Potential Strength of a Bank Capital Channel in Europe: A Principal Component Analysis**

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**Abstract:**

*The asymmetric impact of the recent financial crisis on the European countries' real activity raised the question of the heterogeneity of the transmission channels of shocks in the euro area. In this article, we suggest an assessment of this heterogeneity based on the banks' capital channel (BCC). To this end, we follow an original and global perspective, studying the combination of several key indicators through a Principal Component Analysis (PCA). Based on data collected before the beginning of the crisis, the analysis identifies Germany and Italy as the European economies a priori the most exposed to a financial shock passing through the BCC, while Finland, France or Spain would be the least exposed. The comparison of these a priori results to the post-crisis economic performance of the largest European countries supports the idea of a heterogeneous bank capital channel inside the union.*

**Key words:** *European countries, financial heterogeneity, bank capital channel, principal component analysis*

**JEL Classification:** E32, E44, G15, G21

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## 1. Introduction

In the context of the financial crisis which characterized the global economic environment in the last three years, the role of the credit market (namely of the financial intermediaries) in the shock propagation to the real economy becomes obvious.

Banks have been unprecedentedly affected by the current global financial crisis. While no defaulting *per se* is to be deplored in the euro area, a great number of banking institutions have registered historical losses (see *OCDE Bank Profitability Statistics* for 2008, for example). Moreover, all of them have suffered from a collapse in their market value, in line with the depreciation of their assets. To restore the situation, rapid reorganizations had been proceeded with acquisitions (Dresdner Bank, HBOS, Alliance & Leicester, etc.), whereas some banking institutions had been rescued with public funds (Dexia, Fortis, Bayern LB).

Knowing the importance of the financial intermediation in European countries, especially for SMEs, these observations raise some concerns about the economic activity adjustment. According to the "bank capital channel" theory (see *Blum & Hellwig, 1995; Chen, 2001; Van den Heuvel, 2006; Chami & Cosimano, 2001; Leveuge, 2009; Meh & Moran 2010*), banks' balance sheet structures determine the conditions under which banks may procure funds and the way they finally pass on them to corporate financing. Because of an agency problem between banks and their creditors, the formers bear an external financial premium which is negatively related to their capital ratio, and which is ultimately passed on to the credit conditions to firms.

Concretely, the confidence crisis in the banking sector has rendered difficult the funding for numerous banks which suffer from depreciation of their equity and loan portfolios. This promptly led to a credit crunch and/or a tightening of corporate credit standards. Thus, in line with the bank capital channel theory, banks behaved as procyclical vectors for the transmission of financial shocks. So, the effects of the current financial crisis would have been more or less crushing depending on the importance of this channel in each European country.

There are nevertheless few empirical studies about this channel at the European scale, so that we do not have accurate measure of its intensity in the different member countries. The papers collected by *Angeloni & al. (2003)* and the study of *Chatelain & al. (2003)* are the main references found in the literature. They provide evidence about the presence of a banks' capital channel for the transmission of shocks in the most part of the European countries. Face to shocks, banks with low level of liquidity or capitalization are thus systematically affected by more restrictive conditions when procuring funds on the credit market. Subsequently, they tighten the credit conditions for firms (namely for the SME's which do not have access to another form of external finance), affecting the investment decisions and the global output.

However, if there are particular reasons to assume the heterogeneity of the banks' capital channel inside the euro area<sup>1</sup>, it is not clear which European countries would be the most or the least affected by this channel.

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<sup>1</sup> Actually, unlike for the large firms, the financing constraints for SMEs significantly differ from a country to another in the euro area (*ECB, 2007*). This heterogeneity cannot be explained by national differences in their own financial structures (*Vermeulen, 2002*). Since the external financing of the SMEs comes quite exclusively from the credit market (while the large firms can also choose the stock

In this article, we suggest an assessment of the possible transmission of the recent financial crisis through this banks' capital channel. To this end, we follow a macroeconomic and global perspective, and we study the combination of several key indicators through a Principal Component Analysis (PCA). The rationale for such a method is threefold.

First, the PCA is a recognized and rigorous method, provided that the role of each considered variable is a priori clearly identified in a theoretical background. Second, it constitutes an original and further method in the perspective of assessing the potential intensity of the BCC. Finally, it allows to by-pass the practical problems arising from panel data estimations: micro-data harmonization, distinction between the characteristics of lenders on the one hand, and those of borrowers on the other hand, choice of the dependent variable, distinction between supply and demand effects, inability to infer macroeconomic conclusions, etc. Moreover, estimating the elasticity of the credit supply to the banks' balance sheet structures does not suffice for assessing the intensity and the underlying effects of a financial shock on real activity (see the intensity of the BCC). It depends on the economies' exposure, a feature which is taken into account in our PCA.

The rest of the paper is organized as follows. The Section 2 briefly describes the data and the methodology used in the analysis. The Section 3 introduces the empirical results of the present study and discusses the pertinence of the results in line with the recent macroeconomic adjustments in the European countries. The impact of the financial heterogeneity for the macroeconomic policy design in a monetary union is then briefly discussed and some concluding remarks are provided in Section 4.

## 2. Data and methodology

In order to understand the influence of banks' balance sheet on corporate loan rates and to assess the intensity of the banks' capital channel, we propose a Principal Component Analysis followed by a classification exercise. Data used consist of national indicators that could directly or indirectly explain the presence of a banks' capital channel for the transmission of shocks, by influencing the banking sector functioning.

Annually collected data concern nine European states, members of the monetary union (*Germany, France, Italy, Spain, Finland, Austria, Netherland, Belgium and Ireland*). It is the largest sample of countries of the euro area we could study, given the unavailability of some national data necessary to this analysis. Moreover, the largest countries of the union are included in the sample, motivating our choice. Indexes of concentration and competitiveness in the banking market, banks balance sheet structural indicators, price indicators or indexes of the banks' profitability or liquidity are considered in the study. Other potential determinants for the bank capital channel (hereafter BCC) are also taken into account: the importance of the bank loans' substitutes in the economy, the existence of strong relationships among national banks, or the dependency of domestic agents to banking credit. In order to extract structural features of the banking market functioning, we conduct our analysis by using the arithmetic mean of the variables, computed with data available for each country after 1999.

*Table 1* explicitly describes the set of the selected indicators, their sources and their expected influence on the BCC manifestation. Each indicator reflects structural, institutional or behavioral characteristics for a given country. Indeed, indicators (A) are useful to identify

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market or the corporate bonds market), such differences could be reasonably explained by structural specificities of the banking sectors.

national specificities of the banks' financial structure and their impact on the determination of prices on the credit market. Indicators (**B**) define the financial behavior of agents (their relative preference for the banking credit or for financial substitutes). Finally, indicators (**C**) mainly represent institutional features of banks (concentration and competitiveness on the banking sector, the more or less strong relationships among banks and between banks and their clients). However, the interpretation of some indicators can be ambiguous. The *Bank Liquidity Index*, for example, is certainly a structural ratio based on the banks' balance sheet analysis, but it can simultaneously translate stronger relationships among banks - if the ratios *Interbank Deposits/Total Assets* and *Interbank Deposits/Total Liabilities* are simultaneously important.

Table 1. Data used for the Principal Component Analysis

INDICATOR	EXPECTED EFFECT ON THE BANK CAPITAL CHANNEL	SOURCE
(A) <i>Bank Capitalization</i> ( <i>Bank Capital/Total Asset</i> )	<b>Negative effect:</b> For banks with higher capitalization, the transmission of shocks is less amplified by the BCC. Bank inside capital can be seen as a guaranty for the creditors to be paid.	Eurosystem Annual Data (Source: Netherland Bank) Period for the mean value computation: 2001-2007
(A) <i>Bank liquidity</i> <sup>2</sup> ( <i>Cash and interbank deposits/Total Asset</i> )	<b>Negative effect:</b> The higher the bank liquidity, the better the immunization of its balance sheet against unsuitable shocks.	OECD Bank Profitability Statistics Period for the mean value computation: 1999-2005
(A) <i>Bank profitability</i> ( <i>Benefit/Total Asset</i> )	<b>Negative effect:</b> a lower value of this indicator describes a less performing banking system. The trust of investors in this system lowers; they ask for a higher remuneration from banks, amplifying the role of the bank capital channel in the economy.	OECD Bank Profitability Statistics Period for the mean value computation: 1999-2005
(A) <i>Bank Liabilities Cost</i> ( <i>Interest paid /Loans</i> )	<b>Positive effect:</b> a higher average cost of banking liabilities used to insure loans to firms would increase the cost for the firms' external financing through the bank capital channel.	OECD Bank Profitability Statistics Period for the mean value computation: 1999-2005
(A) <i>Interest rate on the bank loans to non-financial corporations</i>	<b>Positive effect:</b> the higher the interest rate on the bank loans to non-financial corporations, the higher the expected influence of the bank capital channel at the macroeconomic level (in addition to the classical firms' balance sheet channel)	Eurosystem Data (Source: Banque de France) Period for the mean value computation: 2001-2007
(B) <i>Stock Market Capitalization/GDP</i>	<b>Negative effect:</b> The stock market represents a substitute to the credit market and limits the influence of the BCC on the financing cost of firms	Eurostat, World financial exchanges FMI and Euronext Paris / Brussels / Amsterdam /

<sup>2</sup> Securities from the banks' portfolio are not included in the liquidity indicator for the following reason. Interbank deposits at the liability side of banks' balance sheet are generally guaranteed by securities that appear at the asset side. From the data used in the analysis we observe that the amount of securities on the asset side is always lower than the amount of the interbank deposits at the liability side. Subsequently, securities could not be really considered as assets to be converted into liquidity by the bank, at every moment (as is the case for the cash and interbank deposits at asset side of the balance sheet).

	in the economy.	Lisbon Fact Book. Period for the mean value computation: 1999-2007.
(B) <i>Outstanding Corporate Debt Securities/GDP</i>	<b>Negative effect:</b> Another substitute to the banking market, with negative impact on the influence of the bank capital channel on the economy.	BIS Securities Statistics and Syndicated Loans. Period for the mean value computation: 1999-2005
(B) <i>Bank loans to non-financial corporations/GDP</i>	<b>Positive effect:</b> If the financing of the economy is strongly linked to the bank credit market, the bank capital channel is expected to have a stronger influence on the transmission of shocks.	OECD Bank Profitability Statistics and Eurostat : Period for the mean value computation: 1999-2005
(C) <i>Herfindahl Index</i> (index of concentration and competitiveness in the banking sector)	<b>Negative effect:</b> a higher degree of concentration in European countries banking sectors (further to mergers and acquisitions between international banks) gives rise to stronger competitiveness among banks. More efficiency (e.g. informational scale economies) and improvement of loans conditions are expected ( <i>Berger &amp; al., 1993; Ratti &amp; al., 2008</i> ). Moreover, face to shocks, banks with important size, issued from mergers and acquisitions, are able to better react to unfavorable shocks compared to small banks.	<i>Yin &amp; Huang (2006)</i> and European Central Bank Statistics. Period for the mean value computation: 2001-2004
(C) <i>Interbank deposits / Total Liabilities</i>	<b>Negative effect:</b> When shocks arise, interbank deposits constitute a banks' liability cheaper than others. Their amplitude could be associated to stronger interbank relationships that act as a barrier to the propagation of shocks.	OECD Bank Profitability Statistics Period for the mean value computation: 1999-2005
(C) <i>Banks' shares and participations / Total Asset</i> <sup>3</sup>	<b>Positive effect:</b> It represents an exposure indicator to the market risk. A higher exposure is supposed to facilitate the manifestation of the BCC.	OECD Bank Profitability Statistics Period for the mean value computation: 1999-2005

The methodology employed consists in applying a *Principal Component Analysis* to this set of data. This analysis, based on the study of correlations among variables, follows four main steps:

(i) *Normalization of the variables and computation of the correlation matrix.* To avoid difficulties due to the different metrics of the 11 original variables ( $x^j, j = \overline{1, p}, \text{ and } p = 11$ ), they are all transformed into variables with “zero” mean

<sup>3</sup> This indicator could also reflect relationships between banks and non-financial corporations. This interpretation would be preferred if the analysis dealt with the firms' balance sheet channel, as strong such relationships would reduce the asymmetric information and lower financing premium for firms. They have however little influence on the banks' financing cost, which directly depends on the exposure of banks' balance sheet to risks.

and “unit” standard deviation  $\left( \hat{x}^j = \frac{x^j - \bar{x}^j}{\sigma_{x^j}}, \text{ for } \bar{x}^j = \frac{1}{P} \sum_{j=1}^P x^j \text{ and } \sigma_{x^j} = \sqrt{\frac{1}{P} \sum_{j=1}^P (x^j - \bar{x}^j)^2} \right)$ .

The normalized variables are then used to compute the correlation matrix.

(ii) *Extraction of the number of principal components.* Each country  $i$  ( $i = \overline{1, N}$  and  $N = 9$ ) is thus described by a vector  $\hat{x}_i = (\hat{x}_i^1, \hat{x}_i^2, \dots, \hat{x}_i^p)$ . Starting from the correlation analysis,  $p$  principal components ( $c^j, j = \overline{1, p}$ ) can be extracted, which represent linear combinations of the original variables:  $c^j = \mu_1^j \hat{x}^1 + \mu_2^j \hat{x}^2 + \dots + \mu_p^j \hat{x}^p$ . Each component  $c^j$  explains a part of the global data dispersion. The explanatory power of the components extracted progressively diminishes and becomes insignificant for computed eigenvalues lower than 1 (*Kaiser, 1960*). The *Cattel (1966)* graphical criterion is also used to determine the number of principal components with significant explanatory power. However, this choice must also be coherent with the economic aim of the analysis.

(iii) *Economic interpretation of the principal components.* This is a key step. The analyst needs to give an economic signification of each principal component retained. To this aim, the negative and positive correlations of each component with the original variables must be reviewed in order to extract its economic interpretation<sup>4</sup>. The empirical results of the present analysis will be discussed in the following section.

(iv) *Interpretation of the individual projection of the European countries in the principal components space.* In the principal components space, each entity (here the European countries) will be represented by a point. The coordinates of each point give the projection of the entity on the principal components previously extracted. For more than two components, the interpretation can be facilitated by analyzing the projection of an entity on different plans (considering different couples of components). The position of entities in these plans will be interpreted by taking into account the signification previously given to the principal components. The following analysis is narrowly based on this procedure.

### 3. Empirical results

Applying the *PCA* technique to the set of data previously discussed allows us to identify four principal components, which explain together 90% of the global data dispersion. The information contained in the 11 original variables can thus be summarized by the 4 principal components that simultaneously satisfy the *Kaiser (1960)* and the *Cattel (1966)* criteria<sup>5</sup>. The main results of the principal component extraction procedure are reported in *Table 2*.

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<sup>4</sup> To facilitate the interpretation, this operation is usually preceded with an orthogonal rotation of the principal components initially extracted, because the extraction algorithm automatically maximizes the variance explained by the first component extracted, making more difficult the interpretation of results (*Jolliffe, 2002*).

<sup>5</sup> Starting from the fifth component, eigenvalues are lower than one and the explanatory power becomes insignificant.



Table 2. Results for the principal components extraction

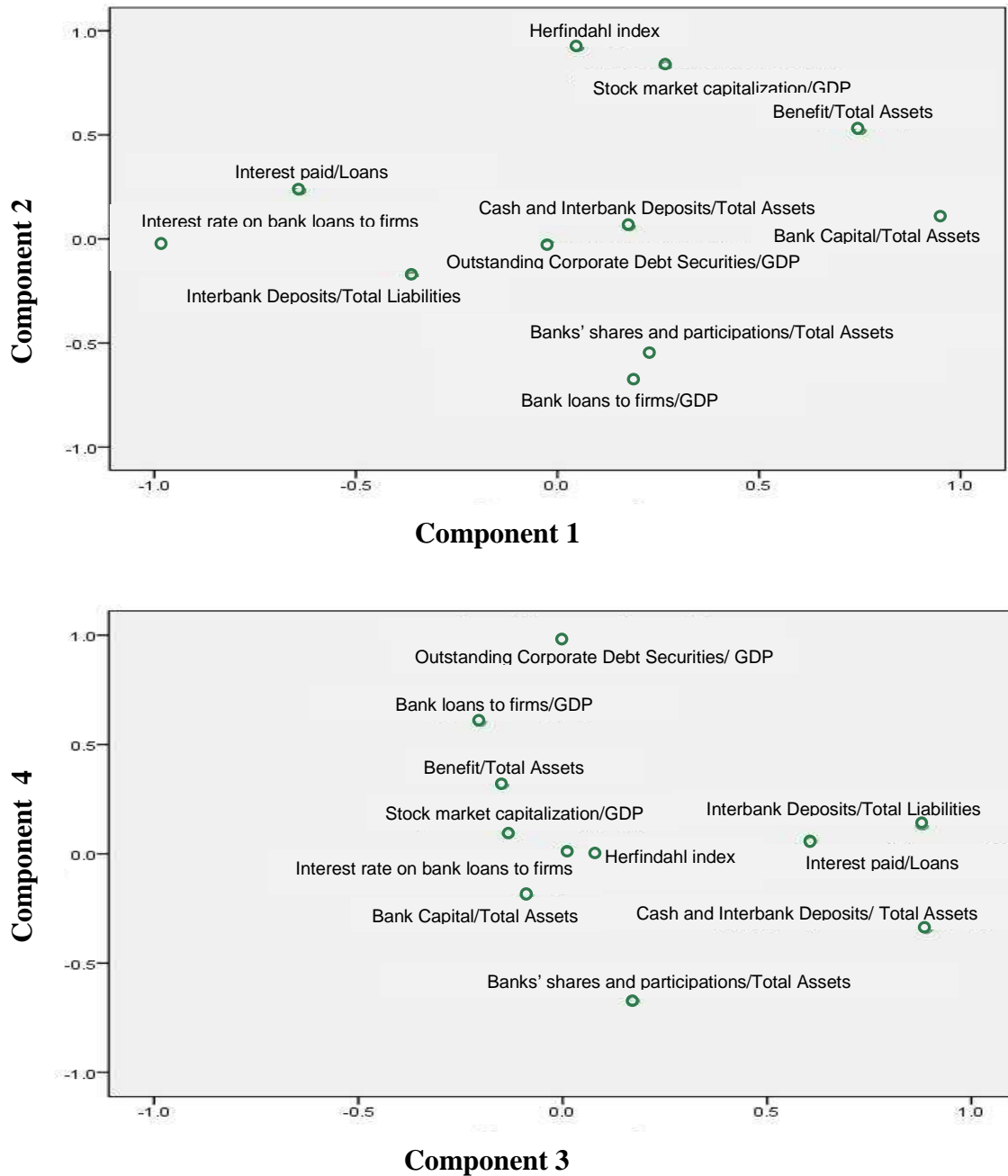
Component	Initial principal components extraction			Principal components after orthogonal rotation		
	Eigen value	% of the global dispersion explained by component	Cumulative % of the global dispersion explained	Eigen value	% of the global dispersion explained by component	Cumulative % of the global dispersion explained
1	3.743	34.027	34.027	3.149	28.623	28.623
2	2.549	23.169	57.196	2.696	24.507	53.130
3	2.339	21.263	78.459	2.058	18.705	71.835
4	1.323	12.023	<b>90.481</b>	2.051	18.647	<b>90.481</b>

The left-hand side of the table sums up the results obtained for the initial extraction of the principal components. To facilitate the interpretations of the results, the right-hand side gives the solution after an orthogonal rotation of axes in the principal components space. The cumulative explanatory power of the four components is unchanged, but the distribution of the dispersion explained by component is more homogenous after the orthogonal rotation.

With this transformation, the economic interpretation of the 4 principal components from the point of view of the potential strength of the BCC is as follows. The first component gives the direct influence of the banks' financial position on the cost of financing for firms in the European countries. The other components complete the analysis by considering three alternative mechanisms likely to limit the influence of the BCC. Thus, the measures taken by banks to prevent the lack of liquidity in bad time reassure the agents about the banking system, what tends to reduce the propagation of shocks through the BCC. But the existence of stock or corporate bond markets as potential substitutes to the banking market could also reduce the potential strength of the BCC. The larger the role of these markets for the firms' financing, the stronger the firms' negotiating power in relation with banks, the lower the possibility for banks to directly pass their financing costs on to firms.

The study of the correlation of the principal components with the original variables confirms these arguments.

Figure 1. Correlations of the principal components with the original variables



As shown in *Figure 1*, the first component extracted is characterized by a strong positive correlation with the ratio *Bank Capital/Total Assets*, and with the *Bank Profitability Ratio*. Negative correlations concern in the same time the *interest rate on the bank loans to firms* and the *costs of the banking liabilities used to finance these loans*. It thus appears that in countries with a low capitalization or low profitability of the banking system, the cost of banks' liabilities is higher, with a potential repercussion on firms financing. On the contrary, in countries with high performance of the banking system and high level of capitalization, the

cost of external finance for banks and for firms are simultaneously lower. Subsequently, the BCC is expected to be more important in the first category of countries than in the second one. In the principal components space, the projections of these countries on the first component axis will implicitly correspond to negative values. Positive values will be associated to countries where the influence of the BCC is weak compared to the euro area reference (which is standardized to zero in the following graphs).

The second component depicts the influence of the capital market development on the potential strength (or weakness from this specific view) of the BCC. It is indeed positively related to the degree of concentration on the banking sector (*Herfindahl Index*), to the *Stock Market Capitalization/GDP* and to the *bank profitability* ratio. The highest negative correlations appear for the *Bank loans to firms/GDP* ratio and for the ratio *Banks' shares and participations/Total Assets*. In other words, in countries with well developed capital markets, the relative weight of the credit market in the financing of the economy diminishes and the BCC is expected to have less influence for the transmission of shocks. The lower strength of this channel is also supported by the higher degree of concentration on the banking market in these countries, corroborated to a lower exposition of the banks' balance sheets to the market risk (low *Banks' shares and participations/Total Assets* ratio). At the opposite, there are other European countries more dependent on the banking market, with a banking system mainly made of smaller banks (low *Herfindahl Index*) which maintain stronger relations with their clients, but are implicitly more exposed to the market risk (high *Banks' shares and participations/Total Assets* ratio). All in all, such countries are expected to be more exposed to the transmission of shocks through the BCC than the previous ones. Their projections on the second principal component will correspond once again to negative values, the positive values being associated to countries less affected by the BCC.

The third component deals with the banks characteristics that prevent the liquidity risk, what is likely to weaken the potential manifestation of the BCC. The positive correlations of this component with the *Banks' Liquidity ratio (Cash and Interbank deposits/Total Assets)* and with the ratio *Interbank Deposits/Total Liabilities* support this idea. For countries whose projections on the third component axis correspond to high positive values, the banking sector is more exposed to liquidity risk. Banks try to improve their financial position either by keeping more liquid assets in their portfolio, or by developing strong interbank relationships. The value of the *Interbank Deposits* in *Total Liabilities* can express the banks' capacity to obtain support from other banks if needed. Certainly, these liabilities are not free of charge. They increase the financing costs for banks (see the positive correlation of the third component with the ratio *interest paid/Loans* too), but they would be however less onerous than other financing sources in a bad economic conjecture period. By improving the financial position of banks, this kind of practices limits the impact of the BCC in the economy.

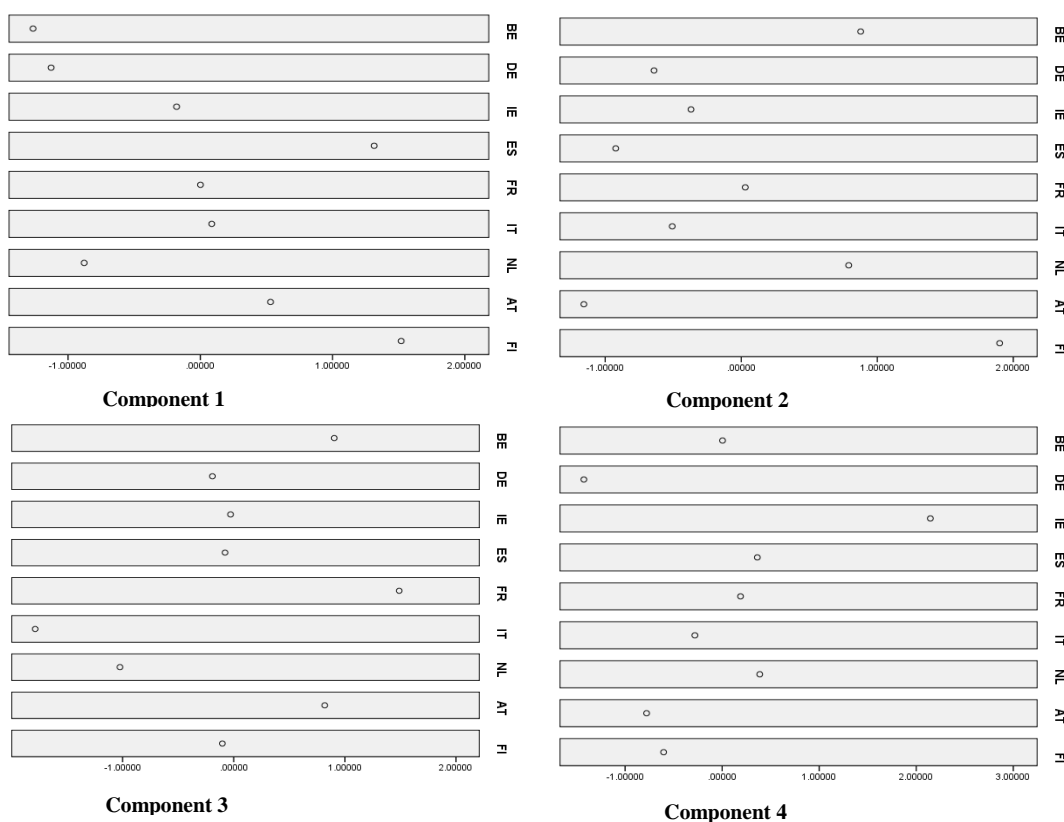
Finally, by analyzing the correlations of the fourth principal component with the initial variables, we recognize another mechanism that could reduce the impact of the BCC in the economy: the presence of the corporate debt securities market (*bond market*) as substitute to the banking market for firms. As for the interpretation of the second principal component, this alternative financing for firms should reduce the possibility for banks to pass integrally their financing costs on to firms. Countries where the corporate debt securities market is more developed should thus be less affected by shocks transmitted through the BCC. As the fourth principal component is positively related to the variable *Outstanding Corporate Debt Securities/GDP*, these countries will be projected on the positive values part of this axis.

The fact that the variable *Bank loans to firms/GDP* is also positively correlated to the fourth principal component simply corresponds to the idea that the firms' access to corporate

debt securities markets is conditional to a previous certification of their financial health, usually obtained on the banking market (see *Diamond, 1991; Hoshi & al., 1993*, for example)<sup>6</sup>. While these two markets can develop simultaneously, it is their substitutability that explains the potential strength of the BCC. This fact is even clearer if we take into consideration the variable negatively correlated to the last principal component: *Banks' Shares and Participations/Total Assets*. This indicator of the banks' exposure to the market risk appears to be lower in countries where the corporate debt securities market is more developed relative to the credit market. Such situation reduces even more the influence of the BCC for the transmission of shocks, and confirms the projection of the countries less affected by this channel on positive values of the fourth axis in the principal component space.

The position of the projection of each individual country on the fourth axis of the principal components space is depicted in *Figure 2*.

*Figure 2. The projection of individual countries in the principal components space*



This representation allows to represent distinctly the position of the nine European countries with regards to the 4 components revealed. Those countries situated on the left-hand side of the graphs depicted in *Figure 2*, are the most exposed to the BCC, and inversely.

Thus, a financial accelerator mechanism passing by the BCC exists in European countries. The study of *Figure 2*, component by component, allows us to identify national specificities that could explain an asymmetric impact of this channel.

<sup>6</sup> See for instance *Petersen & Rajan (1994)*, *Houston & James (1996)* or *Datta & al. (1999)* for empirical studies supporting the idea of the certification obtained by firms on the credit market before accessing the corporate debt market.

From the first component graph, it appears that Belgium, Germany and Netherlands are the most likely to be affected by the BCC. On the contrary, if we take into consideration only structural particularities like the banks' profitability or capitalization, Spain and Finland would be less sensitive to this channel. If we take into consideration the banks' exposition to the liquidity risk (see the third component graph), Italy and Netherlands seems to be the countries with the least liquid banking sector, compared to the euro area as a whole, contrary to Belgium, Austria or France. For these last countries, banks' balance sheets are less sensitive to shocks, being protected by good strategies to insure liquidity. The strength of the BCC is likely to be weak in these countries, but strong in Italy and Netherlands.

Heterogeneous situations also emerge when considering the incidence of the external financing alternatives offered to firms in the different countries. The low development of the stock market as substitute to the credit market and the low degree of concentration on the banking market (see the second component graph) amplify the potential impact of the BCC in Austria, Spain, Germany or Italy compared to the union-wide situation. Belgium, Netherlands and Finland are expected to be less affected by shocks, from this point of view. According to the fourth component graph, the development of the corporate bond market in Ireland should limit the propagation of shocks by the BCC, while it produces an accelerator effect in Germany, Austria and Finland relative to the euro area as a whole.

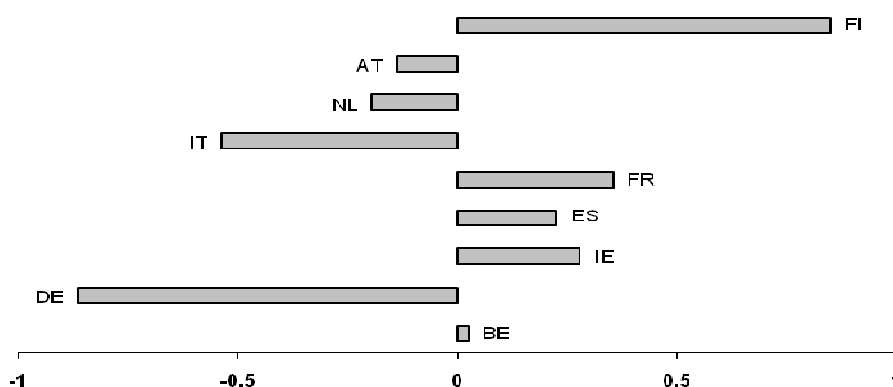
Nevertheless, all in all, some factors can counteract, so that it can be difficult to infer from *figure 2* the expected strength of the BCC for any country. To make these results clearer, we finally compute an individual score for each country. An individual score takes into account the marks get by each country according to the four criteria defined by the four principal components previously discussed. These marks are weighted by the explaining power of each component in the dispersion of the original set of data (see the part of the total dispersion explained by each principal component)<sup>7</sup>. The main conclusions are summarized in *Figure 3*. Positive scores can now be associated to the countries likely to be less sensitive to propagation of shocks through the BCC. The "zero" score corresponds to the average potential strength of the BCC at the union-wide level. Finally, negative values depict countries expected to be more sensitive to shocks compared to this benchmark.

As depicted in *figure 3*, the strength of the BCC for the transmission of shocks would be relatively weak in Finland, France, Ireland or Spain, and it would be high in Germany or Italy, for example. Belgium seems to be the closest country to the union-wide benchmark, from this point of view. Corroborated to the results obtained by component in *figure 2*, the lower influence of the BCC in France could be mainly explained by the good liquidity position of the banking system. On the contrary, the low liquidity of the Italian banks and the very weak development of other market substitutes for banking credit could justify an important impact of the BCC in this country. As for Germany, the low banking capitalization and profitability, the exposition of their financial situation to the market risk or the weak development of alternative financing solutions to the credit market concur to explain the high potential strength of the BCC in this country.

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<sup>7</sup> The data in *Table 2* for the % of the global dispersion explained by component and for the % of the global dispersion explained by the four components extracted, allow us to obtain the following weights for the computation of the final individual score: 31.63% for the first component, 27.08% for the second one, 20.67% and 20.61% for the third and fourth components, respectively.

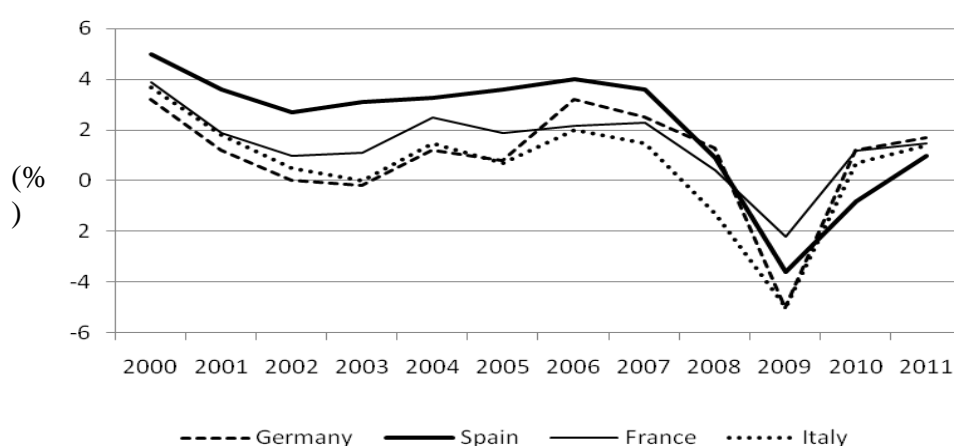
Figure 3. The potential strength of the Bank Capital Channel in the European Countries



We can easily observe from *Figure 3* that asymmetries do not affect only small countries, but also the largest countries of the euro area: Germany, France, Italy and Spain. They thus could produce heterogeneous transmission of the common shocks within the union.

Previous studies in the literature have been dedicated to the analysis of the monetary policy transmission in the largest countries of the euro area. The results are not opposite to ours. For instance, *Clausen & Hayo (2006)* found a stronger effect of the common monetary policy shocks to the real activity in Italy and Germany, compared to France. *Fountas & Papagapitos (2001)* have also highlighted the importance of the firms' external finance premium to explain the business cycles in Germany and Italy, contrary to the French case. The present work refines these results. According to the BCC theory, the firms' external finance premium contains a component that does not depend on their own financial situation, but on the balance sheet of their creditors. And our results suggest that structural asymmetries of national banking systems could be responsible for the asymmetric transmission of shocks in the euro area (see also this idea to *Favero & al., 1999*).

Figure 4. Annual Output Growth in the largest four European countries



Source: Eurostat

The recent financial crisis is also useful to verify the conclusion of our study. Starting from 2007, external financial shocks coming from United States affected the global economy. The Lehmann Brothers Default in September 2008 induced an economic recession all around the world. The European countries have not reacted in a symmetric way to this shock.

Speaking about the largest European countries, the subsequent recession was indeed more deep in Germany and Italy than in France and Spain (see *Figure 4*), as suggested by our analysis<sup>8</sup>.

#### **4. Conclusion**

In order to explain the asymmetric reaction of the real variables to shocks in the European countries, this paper proposes an assessment of the potential strength of the bank capital channel in Europe. To this end, an original and global perspective is employed, studying the combination of several key indicators through a Principal Component Analysis. Based on data collected before the beginning of the recent financial crisis, the analysis suggests that the largest countries of the union could be affected by the heterogeneity of this transmission mechanism of shocks. Germany and Italy appear to be the European economies a priori the most exposed to shocks from this point of view, while France or Spain figure among the countries the least sensitive to shocks. The comparison of these a priori results to the post-crisis economic performance of the largest European countries supports the idea of a heterogeneous bank capital channel inside the union.

However, the BCC should not be seen here as an explanation of the recent financial crisis. It just represents a potential transmission mechanism for shocks, whose heterogeneity is evaluated during ‘normal’ periods, rather than during an instability period where the asymmetric information is such that the usual mechanisms stop to work. More deep analyses including such periods should be conducted for a better understanding the role of the European banking markets heterogeneity in the current crisis.

But, since the financial heterogeneity could explain the asymmetric transmission of shocks in the euro area, specific questions arise about the conduct of the macroeconomic policy. Is it really optimal for the ECB to take decisions in order to stabilize only the aggregate magnitudes (inflation and output) in the union? Should it rather consider national divergences when choosing the monetary policy? Besides, how national fiscal policies should be coordinated inside the union in order to limit the effects of the financial heterogeneity?

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<sup>8</sup> Nevertheless, as national upturns depend on the reflationary measures taken by Governments, the BCC role in the transmission of the shock is difficult to evaluate after 2009.

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