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Do non-financial firms react to monetary policy actions as banks do?

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Abstract: The theory of the bank lending channel indicates that financial institutions with larger size, higher capitalisation and higher liquidity present a greater capacity to maintain their levels of credit supply in a situation of monetary contraction. However, there is a paucity of (European) studies that analyse the bank lending channel from the non-financial firms' perspective. This paper analyzes the impact of monetary policy actions on a large sample of Spanish firms. The empirical evidence for Spain shows that the impact of size, solvency and liquidity are similar for banks and non-financial firms. (93 words)

Key words: monetary policy transmission, bank lending channel, liquidity, non-financial firms, banks.
JEL Codes: E51, G21, D21.

1. Introduction.

In terms of the theoretical foundations of the bank lending channel, the existing empirical evidence indicates that financial institutions with greater size, a higher level of capitalisation, and a higher proportion of liquid assets exhibit greater capacity to maintain the level of their credit investments when faced with a hardening of monetary conditions, without needing to resort to other alternative sources of finance (Kashyap and Stein, 2000). In the case of non-financial firms, however, there is very limited empirical evidence, particularly en Europe. This article analyses whether the existing evidence for banks is similar to what non-financial firms exhibit.

According to the proposition of Modigliani and Miller (1958) –under the assumption of perfect markets and information – the market value of a firm is independent of its financial structure. Investment decisions depend only on the expected rate of return. In this context, it is indifferent to firms whether they use their own capital or obtain external finance in order to carry out their investment projects. Likewise, the distinction between bank debt and non-bank debt is not relevant, as the providers of both types of finance face the same conditions of supply.

The empirical evidence shows that firms do not carry out their business in a world characterised by fulfilment of the theoretical assumptions of the perfect information model (Kashyap *et al*., 1994; Bernanke et al., 1996). In the presence of asymmetries of information, and given the non-perfect substitutive character of the different sources of finance, firms show, within the alternatives available, the following order of preferences: own resources, trade credit, finance from the capital markets and bank credit (Myers and Majluf, 1984; Calomiris and Hubbard, 1990). The way in which this structure is materialised determines the composition of the balance sheet, as well as the external finance premium, borne because of the cost assumed in the valuation of the collateral offered, and the control carried out during the period in which a debtor position is maintained (Stiglitz and Weiss, 1981).

Given the relevance of information asymmetries in the process of credit supply (from any lender the firm can interact with), the theory of the balance sheet channel establishes that transformations in the structure of firms' balance sheets – originated by the propagation of the economic cycle – may alter its capacity to capture resources and expenditure, leading to the generation of endogenous credit cycles (Kiyotaki and Moore, 1997). In this context, the financial wealth of firms determines their possibilities of obtaining finance, as it acts as collateral for the possible non-repayment of the capital contributed (Gertler, 1988). The theory of the bank lending channel shows that the financial wealth together with the composition of the financial debt, and the structural financial characteristics of the firm (i.e. its level of capital and liquidity), determine the degree of access to bank credit, especially when the supply of credit shrinks following a tightening of monetary conditions (Kashyap and Stein, 1995; Stein, 1988; Kishan and Opiela, 2000). Consequently, it is expected that smaller firms and those with a lower level of capital will be affected to a larger extent by a contractive disturbance of monetary policy (Kashyap et al., 1996).

Firms of larger size present less severe problems of moral risk and adverse selection, because of the greater transparency with which they operate. This is perceived by the markets, so that they have, compared to small production units, a greater capacity for debt and for replacing bank credit by other types of financing when official interest rates rise (Hubbard, 1998). Likewise, those firms with greater strength of own capital will display – in the face of restrictions in the markets where they seek external finance – a greater capacity to carry out their investment projects (Baccheta and Caminal, 2000). Consequently, it is easy to observe that the operativity of the bank lending channel is similar, when these two criteria are taken into account, for both financial and non financial firms.

A different conclusion is obtained when the analysis takes into account the level of liquidity, given the ambiguity of the empirical results obtained. On the one hand, there is some empirical evidence to confirm that the holding of liquid assets above a certain threshold limits the possibilities of obtaining external resources, as it decreases the possibilities of transformation of the asset portfolio, as

well as the net value of the firm, and therefore of the collateral that can be offered (Morellec, 2001). On the other hand, other studies maintain that firms with a substantial cushion of liquidity are better placed to grant and obtain finance from other firms in the economy, especially when there have been successive falls in interest rates. This last interpretation is consistent with that corresponding to financial intermediation (Myers and Rajan, 1998). Furthermore its fulfilment seems to confirm that non-financial firms respond in a similar way to financial institutions to changes in the orientation of monetary policy. To our knowledge, there is very little empirical evidence for Europe on the hypothesis that non-financial firms respond in a similar way to banks. This is a very important issue for the actions of policymakers, central banks, banking institutions and non-financial firms in the context of the European financial integration. European firms tend to rely on bank loans to larger extent than their US counterparts. This paper aims to contribute to the existing literature by offering empirical evidence in this area taking the Spanish case as reference. The choice of this country as the analytical framework is of special relevance fundamentally because of: 1) firms' heavy dependence on bank credit for the financing of their investment projects, as well as the shallowness of the capital markets which limits their access for the capture of resources; 2) the considerable reduction of the opportunity cost of maintaining liquid assets, as a consequence of the substantial fall of interest rates during the period of study (1992-2002).

This article adopts the following structure. Next, Section 2 develops a theoretical model that depicts to what extent firms use different types of external finance in the face of changes in monetary policy, taking into account their structural financial characteristics. Section 3 develops the methodology by which we estimate the magnitude of this impact for the period 1992-2000. Section 4 presents the main empirical results, and Section 5 draws the main conclusions of the paper.

2. An explanatory model.

We develop below a theoretical model in which we analyse the extent to which firms employ different types of external finance -and varying their level of debt- in response to changes in monetary policy. The model takes into account the size, level of capitalisation, liquidity, and level of bank debt

of the firms. To undertake this, and starting with the model developed by Diamond (1991), we incorporate the market interest rate –as a measure of the opportunity cost borne by firms in obtaining finance – to analyse the implications of monetary policy for the mechanisms of transmission. We also include the role played by the different structural financial characteristics.

Let us consider a firm i, whose assets (TA) in a period of time t, are given by the sum of the liquid or current assets (LIQ), and fixed assets or capital goods (INV). Both types of rights are financed through equity (CAP) and external resources (DEB). Additionally, we assume that the value of the tangible assets held by the firm that can be offered as collateral exceeds the level of debt ($INV>DEB$).

Let us suppose that the firm decides to carry out a certain investment project which will generate a cash flow X with a probability p_j (and $1-p_j$ in the opposite case). The firm can choose to apply two different technologies (j=1, 2), where $p_2X > p_1X$, i.e. the use of technology 2 provides a higher expected return. The managers - responsible for the firm's decision making – will choose the investment project that maximises their expected utility (EU), which is given by a proportion α of the profits distributed to shareholders Π, plus the personal profits directly obtained by them, β, i.e.:

$$Max\ EU=\alpha\Pi+\beta. \tag{1}$$

The private profit obtained by the managers is zero when the decision is made to use the "good" technology (technology 2), and $B>0$, when the firm opts to apply the "bad" technology (technology 1). We assume that B is proportional to the size of the firm ($B=bA_T$) (Diamond, 1991). Finally, we establish the condition that $(p_2-p_1)X>B$, i.e. the application of the "good" technology is socially efficient.

The investment project can be financed either by using the firm's own resources, or by seeking external financing. In the second case, the firm can opt to formalise bank credits, or seek non-bank financing (issue of securities and business credit, among others). For simplicity, and given the aim of

our study, we assume that the firm chooses the second of the options indicated, requiring finance for an amount F. D would be the quantity that the firm has to repay if the project is carried out successfully. In the event that the firm does not meet its financial obligations it has acquired, it will proceed to liquidate the debt by surrendering the assets offered as collateral.

Let us suppose that, initially, the firm decides access to non-bank financing. In this case, the utility expected by the managers is given by:

$$EU_G^M = \alpha\left[p_1\left(X - D + TA - DEB\right) + \left(1 - p_2\right)\left(TA - INV\right)\right] + bTA \tag{2}$$

if they choose for the "good" technology, and:

$$EU_B^M = \alpha\left[p_2\left(X - D + TA - DEB\right) + \left(1 - p_1\right)\left(TA - INV\right)\right] \tag{3}$$

if they use the "bad" technology.

Since the managers must choose the socially efficient technology, in accordance with equations (2) and (3), it is true that:

$$\alpha\left(p_2 - p_1\right)\left(X - D + TA - DEB\right) \geq bTA \tag{4}$$

If r represents the opportunity cost incurred by the firm which corresponds to the official interest rate, the condition of maximisation of profits of the lender is given by:

$$p_2 DEB + \left(1 - p_2\right)\left(INV - DEB\right) = F\left(1 + r\right) \tag{5}$$

provided the firm incorporates the technology defined as "good".

The managers of the firm will have incentives to incorporate the "good" technology into the development of their investment project, if and only if, the following condition is satisfied (substituting (4) in (5)):

$$\frac{\alpha(p_2 - p_1)}{TA}\left(X - \frac{F + (1+r) + DEB - INV}{p_2}\right) \geq b \tag{6}$$

Otherwise, the managers of the firm will opt to apply the "bad" technology, its expected utility being equal to:

$$EU_B^{M\prime} = \alpha[p_1 X + TA - DEB - F(1+r)] + bTA \tag{7}$$

and:

$$p_1 D + (1 - p_1)(INV - DEB) = F(1+r) \tag{8}$$

would be the condition of maximisation of the lender's profits.

Banks present greater efficiency – compared to the markets- in matters relating to the control and monitoring of information on the development of investment projects. In this sense, the firm may consider that benefits from choosing bank credit, bearing a cost *m* per unit of finance obtained (Diamond, 1984). In this context, the managers of the firm will acquire the "good" technology when:

$$\frac{\alpha(p_2 - p_1)}{TA}\left[X - \frac{m(1+r)}{p_2 - p_1}\right] \geq b \tag{9}$$

The expected utility obtained by the managers being (U_G^B) and the condition of maximisation of profits by the bank will be given, respectively, by:

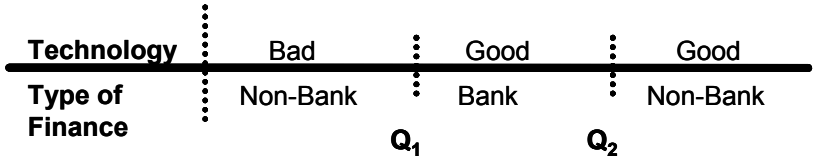
$$U_G^B = \alpha[p_2 X + TA - DEB - (F+m)(1+r)] \tag{10}$$

$$p_2 L + (1 - p_2)(INV - DEB) \tag{11}$$

Consequently, the firm will opt for non-bank finance if condition (6) is met but not condition (9); in any other case, the investment project will be financed by bank credit. Combining the results obtained from the above expressions, we have:

$$\frac{m(1+r)p_2}{(p_2-p_1)TA}+\frac{p_2 b}{\alpha(p_2-p_1)}\leq\frac{p_2 X}{TA}\leq\frac{p_2 b}{\alpha(p_2-p_1)}+\frac{F(1+r)}{TA}-\frac{INV}{TA}+\frac{DEB}{TA} \qquad (12)$$

Designating $Q_1=\frac{m(1+r)p_2}{(p_2-p_1)TA}+\frac{p_2 b}{\alpha(p_2-p_1)}$ as the lower limit of profitability, and $Q_2=\frac{p_2 b}{\alpha(p_2-p_1)}+\frac{F(1+r)}{TA}-\frac{INV}{TA}+\frac{DEB}{TA}$ as the upper limit, the decisions adopted by the firm with regard to the technology adopted and the type of finance can be summarised through the following diagraman :



i.e. for profitabilities lower than Q_1, the firm will incorporate the "bad" technology, which will be financed by non-bank resources. This source of finance will be maintained when the expected profitability exceeds Q_2, though in this case, the managers will opt to incorporate the "good" technology. When the expected unit yield of the investment is between Q_1 and Q_2, the firm will acquire the socially efficient technology by using bank credit.

Next, we will analyse the extent to which firms access the different types of finance in response to changes in monetary policy. We also study the role played by the size, the level of capitalisation, the liquidity and the bank gearing of the firm.[2] We derive expression (12), (in terms of lower and upper limit) in relation to the characteristics indicated, obtaining the following results:

a) Impact of monetary policy:

Given that $\frac{INV-DEB}{TA}$ represents the net wealth of the firm, which we will designate by W, which is a decreasing function of the interest rate ($\partial W/\partial r<0$), we have:

[2] We understand by bank gearing of a firm as the level of the firm's bank credit relative to its equity (Hoshi et al., 1993).

$$\frac{\partial Q_1}{\partial r} = \frac{mp_2}{(p_2 - p_1)TA} > 0 \tag{13}$$

$$\frac{\partial Q_2}{\partial r} = \frac{F}{TA} - \frac{\partial W}{\partial r} > 0 \tag{14}$$

The results provided by equations (13) and (14) show that firms that increase the proportion of their non-bank finance relative to that from banking institutions, will present higher levels of profitability when monetary conditions become tougher. Taking into account that variations in interest rates affect Q_1 and Q_2, it is necessary to know exactly how they are distributed in order to quantify the impact of monetary policy decisions on the structure of external finance. However, on the basis of our earlier assumptions, it seems plausible to expect that when interest rates rise, firms whose profitability is below Q_1 will replace non-bank finance by credit from financial institutions, while those whose unit profitability exceeds Q_2 will increase their financing from non-bank sources.

b) Impact of size:

$$\frac{\partial Q_1}{\partial TA} = -\frac{m(1+r)p_2}{(p_2 - p_1)TA^2} < 0 \tag{15}$$

$$\frac{\partial Q_2}{\partial TA} = \frac{INV - DEB}{TA^2} > 0 \tag{16}$$

Since profitability increases, *ceteris paribus*, with the volume of the firm's assets, the use of bank loans will decrease, *ceteris paribus*, as assets augment.

c) Impact of capitalisation:

Changes in the probability of success of the investment project may be considered as variations in the distribution of the risk of the firm. Defining (p_2-p_1) by ρ and considering that the level of capitalisation of the firm (*CAP*) is a decreasing function of ρ ($f(\rho)$, with $f'(\rho < 0)$) (Sharpe, 1991) we have:

$$\frac{\partial Q_1}{\partial \rho} = -\frac{bp_2}{\alpha \rho^2} - \frac{m(1+r)p_2}{\alpha TA \rho^2} < 0 \tag{17}$$

$$\frac{\partial Q_2}{\partial \rho} = -\frac{bp_2}{\alpha \rho^2} < 0 \tag{18}$$

The results obtained confirm that the greater solvency with which firms operates results in a reduction of bank funding.[3]

d) Impact of liquidity:

Since *TA=LIQ+INV,* substituting in (12) and deriving with respect to *LIQ*, we have:

$$\frac{\partial Q_1}{\partial LIQ} = -\frac{m(1+r)p_2}{(p_2 - p_1)LIQ^2} < 0 \tag{19}$$

$$\frac{\partial Q_2}{\partial LIQ} = -\frac{1}{LIQ} < 0 \tag{20}$$

As equations (19) and (20) show, the increase in the stock of cash and similar liquid assets by the firm reduces the use of external finance.

e) Impact of bank gearing:

The proportion of bank credit relative to own resources (*GEAR*) will have a positive impact on the level of bank credit a firm can obtain (Petersen and Rajan ,1994; Hoshi et al. 1993), i.e. $INV = g(GEAR)$, with $g'(GEAR > 0))$ [4]. Since Q_1 is not affected by this component we find that:

$$\frac{\partial Q_2}{\partial GEAR} = -\frac{g'(GEAR)}{TA} < 0 \tag{21}$$

[3] Given a uniform distribution, firms that show high profitability and/or an increased level of capitalisation may increasingly prefer bank credit. This will depend on the value adopted by Q_2, which will in turn depend on the assumptions established as to its distribution.

[4] Firms that establish long-term relationships with financial institutions enjoy benefits derived from better conditions of access to bank loans, lower loan interest rates and smaller volume of collateral required even when monetary conditions are tightened.

In this case, the advantages offered by bank credit may lead even the most profitable firms to replace market finance by bank loans in order to finance their investment projects.

3. Empirical approximation and data.

3.1. Specification and definition of variables.

The general equation to be estimated, a reduced form of the model developed above, is given by:

$$\Delta FINDEX_{nt} = \alpha_n + \sum_{j=1}^{3} \beta_j \Delta FINDEX_{n(t-j)} + \sum_{j=0}^{3} \chi_j \Delta r_{t-j} + \sum_{j=0}^{3} \delta_j \Delta ta_{n(t-j)} + \sum_{j=0}^{3} \phi_j \Delta CAP_{n(t-j)} + \sum_{j=0}^{3} \varphi_j \Delta LIQ_{n(t-j)} + \sum_{j=0}^{3} \gamma_j \Delta GEAR_{n(t-j)} + d_t + \varepsilon_{nt} \quad (22)$$

where *FINDEX* is an indicator representing the structure of external finance, as well as the debt maintained by firms; *r* is the official interest rate; *TA* the size of the firm; *CAP* the level of capitalisation; *LIQ* the level of liquidity shown by firms; *GEAR* represents the level of bank gearing of the firm at each moment of time *t*; while Δ, *d* and ε, are identified with the difference operator, the vector of dummy time variables, and in terms of error, respectively. Finally, α symbolises the specific fixed effect of each firm *i*. This term captures the deterministic trend shown by *d* for the firms in the sample. [5]

Three indicators were used to represent the external financial structure (*FINDEX*). The first, *CRED* is defined as "Bank Credit / (Bank Credit + Trade Credit)". The lower this indicator is, the higher the use of the trade credit when the firm is subject to a reduced access to bank credit following a monetary contraction (Meltzer, 1960; Nilsen 2002). The second indicator is *BANK,* which defined as the quotient between bank credit and total debt. The lower this indicator is, the higher the use of the capital markets instruments when the firm faces a reduction in the credit granted by financial

[5] With the aim of obtaining residuals from white noise, the number of lags incorporated is three. After carrying out the estimation with 1 to 6 lags, three lags minimised the residuals. Additionally, given that the variables are first-order integrated, as verified by the Augmented Dickey Fuller test (not shown), they are considered in first differences. This solves the problems derived from the possible existence of spurious correlation.

institutions, a rise in its cost or a demand for more collateral (Gertler and Gilchirst., 1994; Oliner and Rudebusch, 1995)[6]. Finally, the third indicator is *DEB*, defined as total debt as a proportion of total liabilities (Hubbard, 1998). The lower *DEB* is, the higher the use of equity as a response to a monetary contraction.

The monetary policy interest rate used -in line with the generally accepted literature (Kashyap et al., 1994; Oliner and Rudebusch, 1996) - is the inter-bank interest rate on non-transferable three month deposits. [7] In this way, given the heavy dependence of Spanish firms on bank finance (Estrada and Vallés, 1998) -the cost of which is determined by the rate incurred by intermediaries in obtaining funds- the opportunity cost borne by firms in obtaining external finance is appropriately reflected. [8]

With regard to the bank lending channel, the firms that present a greater dependence on bank finance find that monetary policy decisions are reflected with greater intensity in the composition of their balance sheet. To analyse the distributive effects of this transmission mechanism it is necessary to take into account the role played by certain specific structural characteristics of firms that may exacerbate the problems of asymmetrical information, agency costs and moral risk.

Even when size does not directly determine the possibilities of access to outside resources and their cost, this variable shows a high correlation with the factors determining risk and volatility in the returns to firms (Gertler and Gilchirst, 1994; Hubbard, 1998). Given the existence of problems of asymmetrical information, the size of the firm (*TA*) given by the logarithm of Total Assets, can be understood as a proxy of the degree of availability of information on the managerial capacity to the lenders as well as of potential business projects to be developed, and of the management's degree of control over them (Stiglitz and Weiss, 1981). Along with these, it also captures the possible presence

[6] In practice, the access to capital markets is usually only possible for large firms.
[7] We did not use the interest rate set by the Central Bank, because of the change in the public body responsible for the application of monetary policy (from the Bank of Spain to the ECB) during our period of study.
[8] The interest rate charged on firms' credit is determined, *inter alia*, by monetary policy conditions, by the market structure of the banking market, by the negotiating power of the firms, and by the existence of long-term contractual relationships between the lender and the borrower (Berger and Udell, 2002).

of problems of moral risk that arise from the emergence of barriers to control and monitoring of the investments, which are reflected in a higher external financial premium (Petersen and Rajan, 1994).

Holding liquid assets above a certain threshold limits the possibilities of obtaining outside resources, as it decreases the possibilities of transforming the portfolio of assets, as well as the net value of the firm, and therefore of the collateral that can be offered (Morellec, 2001). On the other hand, it may occur that firms that operate with a substantial cushion of liquidity are in a better situation to grant finance to the other production units in the economy and to obtain it from them, especially in a context of lower interest rates (Kim et al. 1998). The effect of liquidity is controlled through the variable *LIQ*, defined as the quotient between cash and other highly liquid assets, and total assets.

The financial structure of the firm is proxied by incorporating two additional variables, the level of capitalisation (*CAP*) defined as equity relative to total assets, and the proportion of bank credit to equity (*GEAR*). In relation to the first, the empirical evidence shows that firms will try to carry out their investment projects, relying as much as possible on their own resources, provided that they do not suffer problems of decapitalisation (Baccheta and Caminal, 2000). By including *GEAR* we capture the firm's bank debt (strictly speaking), relative to the firm's own resources (equity). Given the unavailability of alternative information, this variable also proxies the importance of firms' contractual relations with their banks (Hoshi et al. 1993).

3.2. Methodology and data.

We employ dynamic panel data to estimate equation (22). Within this technique we used the GMM estimator of Arellano and Bond (1995) and Blundell and Bond (1998), given its capacity to reduce the inaccuracies and biases of estimation -whatever the size of the sample- resulting from the inclusion of lags of the dependent variable. This estimator is based on the simultaneous estimation of two equations. The first one is the regression in differences of equation (22), while the second refers to its estimation in levels. By this method we obtain consistent and efficient estimations, provided that

the instruments employed are adequate, in the sense that the residual correlation properties of the model are considered (Hsiao, 1986). For this reason, the instruments used were, together with the dependent variable (2 to 5 lags), the vector of the rest of the explanatory variables (*r*, *TA*, *CAP*, *LIQ* and *GEAR*) with a structure of 1 to 5 lags.

We employ microeconomic data from the pan-European Amadeus database, corresponding to 15.617 Spanish firms for the period 1992-2000, giving a panel of 105.755 observations. [9,10,11] The data correspond to the consolidated statements of accounts, so as to capture the possible transfers of assets between firms that constitute a single business holding. Finally, the inter-bank interest rate on three month transferable deposits was taken from the Statistical the Bank of Spain.

In order to test the hypotheses derived from the theory of the bank lending channel, we have adopted a sequential scheme. In this sense, equation (22) is estimated at a first stage for all the firms of the sample. Subsequently, in order to show whether monetary policy measures generate distributive effects, firms are classified by size, level of capitalisation, and liquidity. In relation to the first of these criteria, the firms defined as large are those in the last quartile, while the "small" ones are those in the first quartile.[12] The same criterion was applied to classify firms in terms of their level of capitalisation or liquidity.

[9] We did not employ macroeconomic data since these may give rise to biased results on the operativity of the transmission channels of monetary policy due to: 1) simultaneity problems; 2) frictions in the capital markets; and 3) heterogeneity among the firms in the sample (Chirinko et al., 1999).

[10] This data base contains information on, *inter alia*, the structure of the balance sheet, profit and loss account, number of employees, legal nature and industry classification. The lack of data presented by these variables on the age and credit rating of the firm prevents us incorporating them into the analysis.

[11] The periodicity of the data is annual, so we must bear in mind the potencial limitations on the analysis due to the impossibility of reflecting: 1) the immediate impact of variations in interest rates on the composition of external finance; and 2) the bias in the composition of the sample, as a consequence of the predominance of large firms.

[12] The distribution of firms among the different categories has been done for each individual period, in order to reflect the dynamic nature of the data. Consequently, each firm may appear in different classifications for each year, so the number of firms in the various categories need not remain constant throughout the period considered.

Firms have also been classified according to the sector in which they carry out their activity[13]. The criterion of aggregation used was that defined by the CNAE93 statistical convention, considering subclasses of three digits[14]. Six categories were established:

- Agriculture, livestock, fisheries, hunting and forestry.
- Extractive industry, production and distribution of energy, electricity, gas and water.
- Manufacturing industry.
- Market services - shops, centres for the repair of motor vehicles, motorcycles, dedicated outlets for personal items for domestic use - transport, warehousing and communications.
- Construction.
- Education, health, social security and defence.

4. Empirical evidence.

Equation (22) was estimated for the different categories of firms defined in the previous section. The regression analysis was carried out considering the three specifications of *FINDEX* as dependent variable. Since the objective of the paper is to analyse the degree to which non-financial firms respond similarly to, or differently from, financial institutions, we estimate the long-term coefficients (η), which are given by the sum of the short term coefficients of each of the independent variables, divided by one minus the sum of the short term coefficients of the dependent variable (Chatelain et al., 2003): [15]

$$\eta = \frac{\sum_{i=0}^{3} \Phi_i}{1 - \sum_{i=1}^{3} \beta_i} \qquad (22)$$

[13] This classification allows greater homogeneization of the influence of omitted but relevant variables. It also considers the different profiles of the investment (and of its financing) across economic sectors.
[14] This is the official classification by Eurostat and INE (Spanish Statistical Office).
[15] These coefficients represent the long-term percentage change in the indicator of the composition of external finance or debt, in response to a permanente variation of 1 % of any explanatory variables (i.e.interest rates, size, degree of capitalisation, liquidity, or bank gearing of the firm).

where Φ represents χ, δ, ϕ, φ, and γ, respectively. [16]

The values obtained by the Sargan test (see Table 1) confirm the validity of the instruments used. [17] On other hand, the values corresponding to the AR1 and AR2 tests indicate that there is no second order autocorrelation. We have also employed the Hubber-White procedure, in which the standard errors are calculated on the basis of the quasi-verisimilitude function.

4.1. The impact of monetary policy measures.

Table 2 summarizes the results of the impact of monetary policy actions. A unit increase in the inter-bank interest rate results in a reduction of .0129 in *CRED* (Bank Credit / (Bank Credit + Trade Credit)). This finding seems to confirm that in the presence of imperfections in the bank credit market, firms turn to trade credit to obtain the necessary resources for their business. This evidence is in line with the results obtained for the USA by Kashyap et al. (1994) and Oliner and Rudebusch (1996). In terms of the various categories of firms identified, we observe significant differences. In relation to size, the coefficient associated with larger firms is slightly lower, in absolute value, than that corresponding to the smallest ones. The same occurs when firms are classified according to their level of liquidity. If we distinguish by sectors, we observe that firms of primary and construction activities make a larger use of trade credit when the supply of bank credit shrinks, while the impact on firms engaged in the extraction and distribution of natural resources is practically negligible.

The findings are similar when we employ *BANK* (Bank Credit/Total Debt) as dependent variable. When the price of bank loan rises, larger firms make a more intensive use of non-bank finance, due to its lower cost. In this sense, a unit increase in interest rates has led, in the long run to a fall of .0196 of *BANK*. This impact is similar for the lowest-capitalised firms (.0129), but it is greater

[16] We have not included the short term coefficients mainly because these coefficients have lower economic explanatory power and they are largely affected by strictly conjuctural factors. The exclusion of these results also simplifies the empirical evidence of the paper.

[17] The values obtained by incorporating a smaller number of instruments are characterised by the loss of significance of the long-term coefficients, as a consequence of the complex structural presented by the model (Chatelain et al., 2004).

for small firms (.03000). It is also greater for firms of the primary sector (.0214) and of manufacturing (.0214).

Finally, rises in interest rates do not seem to have generated a substantial and significant reduction in *DEB* (Total Debt/Total Liabilities). The coefficient corresponding to *r* is -.0015 for the firms classified as of low liquidity. As for the most significant differences across economic sectors, the lowest values correspond to construction (-.0011), while the highest are those of market services firms (-.0240) and those dedicated to agriculture, livestock, fishing and forestry (.0222).

4.2. The impact of specific financial structural characteristics.

Table 3 summarizes the results for the impact of firm size on firms' financial characteristics. In the case of CRED, the long-term coefficient of the variable *TA* is -.0001 for the largest firms, rising to -.0056 for their smaller counterparts. The regressions employing *BANK* and *DEB* as dependent variable find similar impacts of size. These results appear to support that size have not conferred any advantage to large firms to obtain capital market funding.

A second factor influencing firms' orientation towards bank credit has been the strength of their own capital. The availability of sufficient internal funds for the materialisation of investment projects reduces the use of external finance (Baccheta and Caminal, 2000). Our empirical evidence supports this argument. Table 4 exhibits that the coefficient corresponding to *CAP* is negative and significant, with the exception of that referring to the subsample of market services and construction firms. When the dependent variable considered is *BANK*, we observe that higher own capital has largely compensated the reduction of bank credit in the case of firms devoted to extraction, production and distribution of energy, electricity, gas and water, and manufacturing industry.

Table 5 shows that in the long run, an increase of 1 % in the relative weight of liquid assets on the balance sheet has led to a reduction of *CRED*. The magnitude of this impact is 1.7503 for the firms with a higher proportion of liquid assets. This coefficient is 1.4883 for the smaller firms. If we

distinguish by sector, the role played by the cushion of liquidity has been greater for firms devoted to construction and market services. These results show a high correlation with those obtained when the dependent variable considered is *BANK*.

Firms that show a high level of bank credit relative to equity do not suffer a reduction of the supply of bank loans in times of hardening of monetary conditions (Berger and Udell, 2002). Our findings in Table 6 (when we study the impact of *GEAR)* are in line with this argument. When we analyse the behaviour described by *BANK*, we observe that firms that enjoy higher levels of solvency have replaced bank credit with non-bank finance, even in the case of the existence of contractual relations with the banks. When we analyse the impact on *DEB*, the results suggest that the impact of *GEAR* has been greater for the highest- and lowest-capitalised firms. If we distinguish by sector, this variable has played an important role in the firms of market services activities. [18]

4.3. Analysis of robustness.

With the aim of greater robustness for our analysis we employed alternative variables, and we included additional aspects that may determine firms' financial behaviour in reaction to changes of orientation of monetary policy. [19]

First, we replaced the three month inter-bank interest rate by the deviation of the interest rate from the rate estimated through the reaction function of the Central Bank (obtained by application of the VAR methodology). The results confirm that firms tend to alter the composition of their debt when monetary conditions are tightened. The magnitude with which this occurs is slightly lower, around 1 %, probably as a consequence of the underestimation of the exogenous component of the interest rate implied by the application of this methodology (Bernanke and Mihov, 1998).

[18] We have undertaken mean differences tests for the long-term coefficients of the following subsamples: largest versus smallest firms; highest-capitalisation versus lowest-capitalisation firms; firms with high liquidity vesus those with low liquidity; and each economic activity sector versus the total sample. The results (not shown) indicate that the differences are, in general, statistically significant.
[19] The results are available on request from the authors.

Another test of robustness was to incorporate the cost of the debt in order to capture the possible influence of the relationship of the firm with the supplier of funding (i.e. how rates are set for the firm and how the rates are affected in a monetary contraction). The results indicate that in no case was it statistically significant.

Subsequently, we proceeded to include the ratio between profits before taxes and interest paid, in order to quantify the restrictions set by firms' profitability on firms' financial decisions. According to our results show that it has not appeared to have been a significant factor. When this measure is replaced by *cash flow* (defined as cash receipts minus cash payments), the results do not vary significantly. In both cases, the long-term coefficient, even when it shows the expected sign, is not statistically significant.

The inclusion of ROA (Return on Assets) or ROE (Return on Equity) does not show that profitability has significantly influenced the composition of the firms' debt. Only ROA was statistically positive when the regression analysis was carried out for the total sample, and the dependent variable was *BANK*.

Two other aspects considered were the structure of ownership and the form of company adopted. With respect to the first, the firms were classified as private and public, the latter being those that throughout the period of study presented (any kind of Central, Regional or Local) Government participation among their shareholders. Likewise, the variable was not statistically significant in any of the cases, which seems to confirm that the existence of differences in the arguments of the target function and the mechanisms for obtaining external resources have not determined the uneven degree of access to the various sources of finance. The same occurs when we introduce a qualitative variable that takes the value 1 when the firm is a PLC, 2 a limited company, 3 a cooperative and 4 for other other legal forms. In this way, the results suggest that the ownership regime has not determined the existence of differences in the access to bank credit as against other alternative sources.

Finally, we included the logarithm of GDP or the logarithm of firms' sales to capture the possible impact of the economic cycle. Only in some cases was the long-term coefficient associated with these variables significant at 10 %. For example, it was significant for small firms and for firms with a low level of liquidity when the dependent variable is *BANK*.

5. Conclusions.

In terms of the theoretical foundations of the bank lending channel, financial institutions with larger size, higher capitalisation and higher liquidity present a greater capacity to maintain their levels of their credit investments in the face of a tightening of monetary conditions. There is a body of literature that offers empirical evidence for the hypothesis of the bank lending channel both in the US and Europe. However, there is little empirical evidence on this hypothesis applied to non-financial firms in Europe.

This article has attempted to test to what extent the results (of the hypothesis of the bank lending channel) obtained for banks are maintained when the analysis is performed on non-financial firms. We have estimated –employing dynamic panel data- the impact of monetary policy actions on the composition of the external finance and the liabilities for a sample of Spanish firms during the period 1992-2000. Other financial structural characteristics such as size, capitalisation and liquidity -which may also affect the financial decisions of the firms- are also considered in the analysis.

The results obtained indicate that firms of small size, together those with a lower level of liquidity and/or lower level of solvency, have been affected, to a larger extent, by rises in interest rates as a consequence of a monetary policy action. These results confirm the fulfilment of the hypotheses of the bank lending channel (Oliner and Rudebusch, 1996), of the balance sheet channel (Kashyap, et al., 1993; Gertler and Gilchrist, 1994), and the favourable influence of long-term relationships of firms and banks (Hoshi et al., 1993). When monetary conditions are tightened, the largest firms together with those with higher capitalisation and/or higher liquidity make a larger use of non-bank funding

since they have easier access to capital markets. However, smaller firms together with those with low capital and/or low liquidity maintain their financial dependence on banks in these tightened monetary conditions.. Consequently, this empirical evidence is in support of the hypothesis that non-financial firms respond in a similar way to financial firms to changes in the orientation of the monetary policy.

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Table nº 1: Summary of regression analysis of the different models' specifications.

Sample	Dependent Variable:														
	CRED					*BANK*					*DEB*				
	Sargan Test	AR1	AR2	Number of firms	Number of observations	Sargan Test	AR1	AR2	Number of firms	Number of observations	Sargan Test	AR1	AR2	Number of firms	Number of observations
Total Sample	.212	.000	.289	15,617	82,667	.302	.000	.359	15,617	105,197	.160	.000	.276	15,617	105,729
Large Firms	.264	.000	.287	2,095	9,045	.292	.000	.327	2,095	9,813	.147	.000	.253	2,095	9,811
Small Firms	.275	.000	.290	3,496	7,471	.148	.000	.232	3,096	16,191	.288	.000	.291	3,096	16,379
High Liquidity Firms	.248	.000	.283	4,105	13,063	.222	.000	.248	4,105	16,320	.242	.000	.336	4,105	16,377
Low Liquidity Firms	.252	.000	.288	3,509	7,500	.207	.000	.369	3,520	10,197	.358	.000	.315	3,509	10,227
High Capitalization Firms	.142	.000	.301	3,266	10,761	.229	.000	.346	3,266	14,525	.212	.000	.309	3,266	14,703
Low Capitalization Firms	.159	.000	.327	2,533	5,703	.248	.000	.345	2,533	8,640	.267	.000	.300	2,533	8,639
Agriculture, Hunting and Fishery	.396	.000	.385	371	1,535	.253	.000	.396	371	2,169	.201	.000	.387	371	2,184
Extraction Industry, Energy & Water	.201	.000	.380	303	1,656	.289	.000	.201	303	2,090	.230	.000	.232	303	2,095
Manufacturing Industry	.187	.000	.393	4,602	25,258	.300	.000	.187	4,602	32,045	.204	.000	.332	4,602	32,210
Retail trade, Repairs, Domestic articles, Hotel, Restaurants, Transport and Communications	.221	.000	.289	6,834	37,027	.211	.000	.221	6,834	46,977	.206	.000	.335	6,834	47,217
Construction	.240	.000	.333	2,726	14,769	.273	.000	.240	2,726	18,738	.238	.000	.375	2,726	18,834
Other marketable services	.332	.000	.347	217	2,422	.299	.000	.332	217	3,178	.305	.000	.368	217	3,189

Estimation by GMM-system estimator using the robust two step method. Sargan test is a test of over-identifying restrictions (p-value reported), distributed as chi-squared under null validity of instruments. AR_j is a test of jth-order serial correlation in the first-difference residuals. These are both distributed as standard normal under the null hypothesis.

Table nº2: The effect of monetary policy (*r*) on the external financial structure indicator. Long-term coefficients.

	Dependent variable:		
	CRED	***BANK***	***DEB***
Total Sample	-.0129*** (.0041)	-.0196** (.0035)	-.0056** (.0026)
Large Firms	-.0209*** (.0041)	-.0016** (.0031)	-.0077** (.0027)
Small Firms	-.0294*** (.0109)	-.0300*** (.0073)	-.0063** (.0001)
High Liquidity Firms	-.0123* (.0067)	-.0143* (.0137)	-.0039* (.0013)
Low Liquidity Firms	-.0575* (.0089)	-.0131* (.0124)	-.0015* (.0001)
High Capitalization Firms	-.0166*** (.0042)	-.0067*** (.0016)	-.0027** (.0001)
Low Capitalization Firms	-.0129** (.0098)	-.0148** (.0143)	-.0228** (.0017)
Agriculture, Hunting and Fishery	-.0306*** (.0074)	-.0226*** (.0078)	-.0222** (.0009)
Extraction Industry, Energy & Water	-.0037*** (.0129)	-.0062** (.0060)	-.0039** (.0095)
Manufacturing Industry	-.0214*** (.0024)	-.0440*** (.0109)	-.0156*** (.0090)
Retail trade, Repairs, Domestic articles, Hotel, Restaurants, Transport and Communications	-.0129*** (.0041)	-.0134*** (.0014)	-.0240*** (.0011)
Construction	-.0210** (.0118)	-.0126** (.0055)	-.0011*** (.0042)
Other marketable services	-.0159*** (.0059)	-.0164** (.0045)	-.0002 (.0001)

Notes: ***/**/* denotes significance at 1, 5 and 10 % levels. Asymptotic robust standard errors reported in parentheses.

Table nº3: The effect of size (*TA*) on the external financial structure indicator. Long-term coefficients.

	Dependent variable:		
	CRED	***BANK***	***DEB***
Total Sample	-.0005***	-.0001**	-.0001**
	(.0000)	(.0001)	(.0001)
Large Firms	-.0001	-.0008**	-.0001***
	(.0003)	(.0001)	(.0008)
Small Firms	-.0056**	-.0036	-.0001**
	(.0026)	(.0004)	(.0001)
High Liquidity Firms	-.0003**	-.0004	-.0001
	(.0001)	(.0003)	(.0003)
Low Liquidity Firms	-.0003**	-.0001**	-.0001**
	(.0005)	(.0000)	(.0001)
High Capitalization Firms	-.0001**	-.0002***	-.0001**
	(.0000)	(.0000)	(.0000)
Low Capitalization Firms	-.0008**	-.0003**	-.0005**
	(.0002)	(.0000)	(.0000)
Agriculture, Hunting and Fishery	-.0003***	-.0004**	-.0002*
	(.0001)	(.0001)	(.0001)
Extraction Industry, Energy & Water	-.0002***	-.0002**	-.0005**
	(.0000)	(.0001)	(.0000)
Manufacturing Industry	-.0006***	-.0096***	-.0002**
	(.0000)	(.0000)	(.0000)
Retail trade, Repairs, Domestic articles, Hotel, Restaurants, Transport and Communications	-.0005***	-.0002***	-.0002
	(.0000)	(.0000)	(.000)
Construction	-.0001***	-.0002***	-.0001**
	(.0000)	(.0000)	(.0000)
Other marketable services	-.0001***	-.0001***	-.0003
	(.0000)	(.0000)	(.000)

Notes: ***/**/* denotes significance at 1, 5 and 10 % levels. Asymptotic robust standard errors reported in parentheses. The coefficient corresponding to *TA* is multiplied by 100.

Table nº4: The effect of capitalization level (*CAP*) on the external financial structure indicator. Long-term coefficients.

	Dependent variable:		
	CRED	***BANK***	***DEB***
Total Sample	-.0001** (.0012)	-.0049*** (.0086)	-.0201*** (.0035)
Large Firms	-.0024*** (.0006)	-.0036*** (.0008)	-.0194*** (.0002)
Small Firms	-.0036** (.0002)	-.0069*** (.0013)	-.0240*** (.0003)
High Liquidity Firms	-.0066** (.0009)	-.0060** (.0046)	-.0022*** (.0009)
Low Liquidity Firms	-.0016** (.0013)	-.0091*** (.0022)	-.0225*** (.0035)
High Capitalization Firms	-.6038** (.5907)	-.4680** (.4410)	.7173** (.0376)
Low Capitalization Firms	-.0020** (.0012)	-.0113** (.0096)	-.0024)** (.0004)
Agriculture, Hunting and Fishery	-.0107*** (.0020)	-.0043* (.0022)	-.0014*** (.0009)
Extraction Industry, Energy & Water	-.0118*** (.0033)	-.0048** (.0030)	-.0098*** (.0058)
Manufacturing Industry	-.0071*** (.0013)	-.0044** (.0020)	.0015** (.0054)
Retail trade, Repairs, Domestic articles, Hotel, Restaurants, Transport and Communications	-.0001 (-.0012)	-.0005 (.0011)	-.0047*** (.0094)
Construction	-.0028 (.0022)	-.0036 (.0011)	-.0233*** (.0094)
Other marketable services	-.0025* (.0014)	.0060 (.0012)	-.0116*** (.0010)

Notes: ***/**/* denotes significance at 1, 5 and 10 % levels. Asymptotic robust standard errors reported in parentheses.

Table nº5: The effect of liquidity level (*LIQ*) on the external financial structure indicator. Long-term coefficients.

	Dependent variable:		
	CRED	***BANK***	***DEB***
Total Sample	-.6639*** (.1555)	-.9236*** (.1658)	-.2879** (.2369)
Large Firms	-1.2149*** (.1316)	-.8447*** (.1501)	-.3108** (.0146)
Small Firms	-1.4883*** (.3810)	-1.1200*** (.1740)	-.2392** (.2860)
High Liquidity Firms	-1.7503*** (.2875)	-1.3796*** (.2537)	-.2162** (.0286)
Low Liquidity Firms	-1.3228** (.2454)	-1.4920*** (.5761)	-.5268** (.0775)
High Capitalization Firms	-.0810*** (.0115)	-.0396** (.0460)	.0725** (.0057)
Low Capitalization Firms	-.1851*** (.2795)	-.5969** (.5329)	-.5519** (.4042)
Agriculture, Hunting and Fishery	-.4463* (.3770)	-.5981** (.1587)	-.2504* (.0040)
Extraction Industry, Energy & Water	-.5106 (.5078)	-.1918 (.3035)	-.2071 (.2890)
Manufacturing Industry	-.0624*** (.2020)	-.0945 (.2913)	.0284 (.0097)
Retail trade, Repairs, Domestic articles, Hotel, Restaurants, Transport and Communications	-.6639*** (.1555)	-.4627** (.1669)	-.2917 (.0540)
Construction	-1.3415*** (.2979)	-.8374*** (.1609)	-.2783* (.1128)
Other marketable services	-.7228** (.3007)	-.3136 (.2979)	-.0437* (.0255)

Notes: ***/**/* denotes significance at 1, 5 and 10 % levels. Asymptotic robust standard errors reported in parenthesis.

Table nº6: The effect of firm´s gearing ratio (*GEAR*) on the external financial structure indicator. Long-term coefficients.

	Dependent variable:		
	CRED	***BANK***	***DEB***
Total Sample	.0076** (.0060)	.0096*** (.0159)	.0026** (.0002)
Large Firms	.0113*** (.0029)	.0116*** (.0011)	.0041* (.0000)
Small Firms	.0074*** (.0011)	.0081*** (.0020)	.0010** (.0023)
High Liquidity Firms	.3248** (.0057)	.1014*** (.0171)	.0018** (.0002)
Low Liquidity Firms	.0001*** (.0000)	.0234*** (.0076)	.0018** (.0012)
High Capitalization Firms	1.8004*** (.1323)	1.9648*** (.0740)	1.0708** (.0063)
Low Capitalization Firms	.1345*** (.0072)	.1510*** (.0129)	.2136** (.0009)
Agriculture, Hunting and Fishery	.0203* (.0239)	.0297** (.0143)	.0036* (.0002)
Extraction Industry, Energy & Water	.0189*** (.0414)	.0094*** (.0360)	.0031** (.0026)
Manufacturing Industry	.0037* (.0021)	.0050** (.0025)	.0025* (.0016)
Retail trade, Repairs, Domestic articles, Hotel, Restaurants, Transport and Communications	.0076** (.0060)	.0149** (.0043)	.0114** (.0046)
Construction	.0011** (.0046)	.0014* (.0016)	.0048* (.0094)
Other marketable services	.0378** (.0169)	.0505*** (.0162)	.0000 (.0007)

Notes: ***/**/* denotes significance at 1, 5 and 10 % levels. Asymptotic robust standard errors reported in parenthesis.