A BANK LENDING CHANNEL OF MONETARY POLICY IN SPAIN: EVIDENCE FROM BANK BALANCE SHEETS.

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Abstract: This paper focuses on the bank lending channel of monetary policy in Spain. Following the Kishan and Opiela (2000) theoretical model, I argue that if the lending view is correct, a monetary contraction should have a pronounced effect on loan supply of small banks with the least level of capitalisation. Using disaggregated data on bank balance sheets, I then test for differential bank loan supply responses to monetary policy changes, by distinguishing banks with different asset size and capital leverage ratio, to provide support for the existence of a bank lending channel of monetary policy transmission.

Keywords: bank credit channel, financial structure, monetary transmission mechanism.

JEL Classification:C23, E44, E51, G21.

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1.- INTRODUCTION

Recent investigations concerning the monetary transmission mechanism emphasise the role played by the *bank credit channel* to explain why the effects upon the macroeconomic variables of a monetary shock can be greater than those due only to the *money channel or interest rate*. In other words, following a monetary contraction aggregate expenditure is reduced for 2 main reasons: firstly, as real interest rates go up *–the interest rate channel –* expenditure on investment and durable consumer goods is reduced due to the substition effect and the income effect; and secondly, since banks are entities that finance themselves mainly with deposits subject to reserve requirements with no perfect substitutes for these, following a monetary contraction that reduces the reserve supply, the banks lower their credit supply *–the bank credit channel–*, and besides, if some borrowers are dependant upon bank financing and can not easily access other alternative sources of funding, then following a reduction in bank credit supply, their expenditure will fall, leading to a contraction in aggregate output[1].

From the point of view of the bank credit channel, a crucial factor is the behaviour of the banking sector in the transmission of the monetary impulses, namely, how the banks respond to a change in monetary policy, not only as regards their liabilities –as much through the change in the amount of bank deposits following a change in the reserve supply, as in their ability to obtain other sources of finance not subject to reserve requirements–, but also their assets –modifying their credit supply and/or their holdings of high liquidity bonds–. This new concept of the role of financial intermediaries supposes that the effects of monetary policy on production depend on the financial structure of the banks, not complying with the

[1] Both conditions were established by Bernanke and Blinder (1988).

Modigliani-Miller theorem. Thus, this channel predicts that a negative shock in bank reserves will have a greater impact on the economy if intermediate credit supply contracts, a contraction that will be greater as the banks can not access other forms of finance or because they hold limited amounts of liquid assets.

Empirical evidence contributed mainly by Kashyap and Stein (1994, 1995 and 2000) y Stein (1998) establishes that the smaller banks –with less chance of obtaining funds not subject to reserve requirements– and those with less liquidity, will reduce their credit supply by a greater amount. However, this line of investigation does not take into account the degree of capitalisation and the regulation of capital as determining factors in the banks' capacity lend funds in the form of credits. Using this new concept, Kishan and Opiela (2000) and Van den Heuvel (2001, 2002a, 2002b) establish that the response in credit supply is greater in thelower capitalised banks.

Following this last point, this paper studies in depth the role of bank capital in the monetary transmission mechanism, this being important in order to establish the operativity of the bank credit channel. In order to demonstrate the existence of the bank credit channel in Spain, the two conclusions established by Kishan and Opiela (2000) will be contrasted; namely, that credit supply reduces following a monetary contraction and, also, that the magnitude of said reduction depends on the level of capitalisation of the banks, being lower for the better capitalised entities. To achieve this, the differential effects of monetary policy on the structure of the banks' balance will be analysed, using disaggregated data on the relevant entries in the bank balance, and characterising the banking entities by size and degree of capitalisation.

The contribution of this study to the rest of the existing empirical literature concerning the situation in Spain, is to provide evidence that supports the bank credit channel, the degree of capitalisation being the most important banking characteristic in order to establish the asymmetric response of credit supply amongst the banking entities.

The rest of the paper is divided as follows: in the next section, some considerations concerning the identification –theoretically and empirically– of the bank credit channel will be discussed; section 3 will reveal what bank regulations concerning equity in Spain and the level of capitalisation of the Spanish banking system have been. And, the theoretical reference model –Kishan and Opiela (2000)– will be succinctly presented, emphasising the importance of the banks' level of capitalisation as a determinant of the credit supply response following a monetary contraction; in section 4 the variables and data used will be described, along with a discussion concerning the econometric specification used; section 5 will analyse the results obtained concerning the differential response of bank credit between the different categories of banks, and decide whether or not evidence exists in favour of the operativity of the bank credit channel in Spain; finally, the conclusions will be presented.

2.- IDENTIFICATION OF THE BANK CREDIT CHANNEL IN THE MONETARY TRANSMISSION MECHANISM.

The traditional view of the monetary policy mechanism assumes that the decisions of the central banks concerning their intervention rates cause changes in bank reserves and consequently, in market interest rates. In contrast to the money channel, the bank credit mechanism determines that monetary policy not only operates through interest rates, but also by modifying bank credit supply, increasing the effect on the macroeconomic variables.

The studies that intend to verify the degree of credit response offered by the banking entities following a monetary shock, are based on the hypotheses formulated by Bernanke and Blinder (1988), which establishes that the banks do not have perfect substitutes for either deposits nor credits in order for the bank credit channel to operate, in other words, following a monetary contraction the banks are not able to access other forms of finance that are not subject to reserves without cost, and besides, they cannot obtain sufficient liquidity through the sale of bonds being obliged to reduce their credit supply.

Those most sceptical about the operativity of this channel base this on the proposition that an action by a monetary authority, which alters the amount of reserves available, effecting the bank credit supply is rather unlikely. The justifications that underlie this criticism are as much based on natural theory as on empirical evidence. The theoretical foundation is based on the application of the Modigliani-Miller banking theorem; in other words, shocks in bank liability do not produce effects in the real behaviour of banks, namely, in credit supply. For example, Romer and Romer (1990) show this fact through the banks' capacity to compensate for a reduction in their deposits after a monetary contraction by the emission of deposit certificates leaving the amount of intermediate bank credit

unaltered. From the empirical point of view, the existing evidence –using aggregate data from the main macroeconomic and financial variables– is rather ambiguous, since the behaviour observed in aggregate credit supply following a negative monetary shock could be due as much to a reduction in credit demand on the part of economic agents –such as that determined by the interest rate channel– as a real reduction in the credit supply on the part of the banks –in this case this would indicate the existence of the bank credit channel–[2].

Both justifications however can be refuted. In the first place, Modigliani-Miller's proposition is not valid if one takes into account that financial markets are imperfect, so that if any degree of asymmetric information exists between the bank and the investors problems of adverse selection will appear, which would interfere as much in the ability of the banks to access other sources of external finance as in the decisions concerning the composition of their balances.

This first effect is analysed by Kashyap and Stein (1994) through a partial balanced model and shows that credits and deposit certificates are not perfectly substitutable since the differential between credit and certificate interest rates is affected by a reserves shocks.

As for the second one, Stein (1998) developed an adverse selection model for the banking sector and came to the following conclusions: i) those banks with greater adverse selection problems in the outside financial market would decide to maintain a larger percentage of their assets in the form of bonds (liquid assets) to the detriment of credits; ii) those banks faced with greater problems of asymmetric information in the credit market (in other words, whose credit is

[2] See, for example, the studies by Bernanke and Blinder (1992) and Kashyap, Stein and Wilcox (1993).

inelastic), following a monetary contraction will greatly reduce their credit supply, the response being inappreciable in their holdings of bonds[3].

In second place, the ambiguity associated in the use of aggregate data could be avoided by using disaggregated data, which would allow the microeconomic nature of the bank credit channel to be explored and show the two conditions established by Bernanke and Blinder (1988) –that bank credits do not have perfect substitutes for the lenders or the borrowers–, in other words, show the existence of asymmetric information problems which supposes a differential between the external and internal financing cost –*external finance premium*– as much for non finance businesses as for banking entities.

Regarding the analysis of the banks differential behaviour[4], the determination of which is the credit supply's response when faced with a monetary contraction is studied, distinguishing the banks by asset *size*, level of *liquidity* and/or degree of *capitalisation*. *Size* is seen as a *proxy* variable of the problems of adverse selection that a bank encounters, and therefore, of the ability to access other forms of finance not subject to reserve requirements; the *liquidity* level works as an buffer when faced with an adverse shock in bank reserves, and the degree of *capitalisation* is an indicator of the solvency of a bank and determines the ease with which a bank can compensate for a reduction in its deposits through other financial avenues.

[3] This result differs from that obtained in the model by Lucas and McDonald (1992), whose principal conclusion is that the "good" banks - those with high quality assets - are opposed to the "bad" banks, those that maintain more bonds in order to avoid having to go into the debt market, and in this way not have to face up to the problems of adverse selection, associated with said market.

[4] See Gertler and Hubbard (1988), Gertler and Gilchrist (1994), Kashyap, Lamont and Stein (1994) and Bernanke and Gertler (1995) as examples of studies of the behaviour of non- - financial businesses with disaggregated data, and, especially Watson (1999) for Spain.

Looking at asset *size*, Kashyap and Stein (1995) found that the credit volume of the small banks contracts much more than that of the large banks, as a consequence of the high degree of asymmetric information that they encounter ($d^2L_{it}/dM_t dA_{it}<0$[5]). However, this result could be ambiguous because this response could also be provoked by a larger reduction in credit demand, since the small banks usually have consumers, and small and medium sized businesses as their clients, whose demands are very cyclical.

Kashyap and Stein (2000) correct this problem by also taking into account the level of *liquidity* of the balances, and came up with the following results: i) the large banks can more easily access other forms of finance not subject to reserve requirements following a reduction in their deposits, as their liquidity restrictions are not as great, and, therefore, the response to their credit supply is very weak ($d^2L_{it}/dB_{it}dM_t <0$[6]); however, as the small banks usually maintain more liquid assets in order to be able to deal with a reduction in bank reserves, using them as buffers (also fulfilling this for them), then through this derivative no evidence of differential behaviour between banks would be found; ii) in order to answer the said obstacle, they take into account the interaction between both variables –*size and liquidity*– and formulate the following derivative $d^3L_{it}/dB_{it}dM_t dA_{it} >0$, showing that monetary policy has a bigger impact on credit supply in small banks with a lower liquidity ratio.

[5] L_i being the credit supply, M the monetary supply and y A_i total assets.

[6] Where B_i is the quotient between liquid bonds and total assets.

The following studies for the EU use Kashyap and Stein's methodology (2000): De Bondt (1999) finds evidence for the bank credit channel through the differential response of the smallest and least liquid banks, which reduce their credit supply following a monetary contraction by a greater degree (Spain is not included in this); Favero *et al.* (1999) obtained contrary results as to the existence of the credit channel, since in Germany and Italy the small banks expanded their credit supply following a reduction in reserves; and, finally, King (2002) did not find very convincing results, since the operativity of the bank credit channel is only evident in France and Italy, being irrelevant in Spain.

As for the degree of capitalisation, recent literature concerning credit difficulties ("*credit crunch*") have centred on analysing the effect of the level of bank capital on the growth in production and credits, since this presents a restriction on the ability of the banks to lend funds in the form of credits. Thus, recent studies concerning the monetary transmission mechanism include capital as a determining variable in bank credit response when faced with a monetary shock.

For example, Van den Heuvel (2002a) points out the operativity of the bank credit channel depends as much on the level of capitalisation as on bank regulation on equity, which have a two-fold effect: in the first place, if the banks must maintain an amount of capital as a percentage of their risk assets and if the issue of new shares is expensive for a bank (due to the problems of asymmetric information that accompany the issue of new shares), then the banks will prefer to hold more bonds not subject to this requirement rather than invest in new credits (risk assets), reducing bank finance for the expenses of consumption and investment, with the consequent effect on production; secondly, bank capital mitigates the problems of adverse selection in the market for other bank liabilities not subject to reserves, making cushioning a negative shock in reserves cheaper without changing the credit supply. This first effect is seen in those banks that are not complying with the minimum capital requirement, and the second will be seen in those banks that, complying with the minimum, maintain a high capital *ratio*.

To summarise, the magnitude of the bank credit channel will be smaller: 1) the larger the percentage of banks that do not comply with the minimum capital required, or 2) the larger the percentage of banks adequately capitalised with a high capital *ratio*[7].

The empirical evidence presented for the United States is pretty conclusive. Thakor (1996) shows that the adoption of the Basle (BIS) agreements on capital requirements in 1989 and 1992 reduces the aggregate credit supply; Kishan y Opiela (2000) found that the reduction in credit supply is lower in the larger better capitalised banks; and, finally, Van den Heuvel (2001) shows that in the federal states in the banking sector that have a low level of capitalisation, economic growth is more sensitive to changes in monetary policy.

However, for the EU and especially for Spain, certain vagueness in the results obtained appears. The work of Ehrmann *et al.* (2001) stands out, which –using the Kashyap and Stein (1995) methodology– includes capitalisation, along with size and liquidity, as variables that explain credit response when faced with a monetary contraction, and establish the existence of bank credit channel by means of the fulfilment of the following derivatives: $d^2L_{it}/dr_t dA_{it}>0$; $d^2L_{it}/dr_t dB_{it}>0$ and $d^2L_{it}/dr_t dK_{it}>0$[8]; in other words, intermediate credit supply will reduce more after a negative monetary shock in the smaller banks, or the ones with less liquidity, or in those that have a lower capital *ratio*. However, it only shows that the level of liquidity has an influence on the differential credit supply, with the exception of Spain where the variable is not said to be significant[9].

[7] Both conclusions are based on the supposition that bank capital is given, but if one consider that this responds to monetary shocks, then said conclusions could become modified. Van den Heuvel (2002a, 2002b) analysed this dynamic response through what is called *the bank capital channel.*

[8] K_i being the quotient between capital and reserves over total assets.

And, finally, for the Spanish banking system Hernando and Martínez-Pagés (2001) present ambiguous evidence, since, on one side, the banks with less liquidity respond more strongly, reducing their credit supply and, on the other hand, the better capitalised banks contract their credit more.

[9] Some justification of said results could be: i) the adoption of the hypothesis of homogeneity in the demand for credit between banks, since it is presumed that the large businesses – clients of the large banks– do not find substitutes for bank financing; ii) size appears not to be a good indicator of the problems of inverse selection and, therefore of the ability to access other forms of finance besides deposits; iii) measurement of utilised capital, (Capital + Reserves) / Assets, does not allow one to capture the risk of the bank's credit portfolio, nor does this correctly reflect the problems of asymmetric information.

3.- THE ROLE OF BANK CAPITAL IN THE CREDIT SUPPLY RESPONSE.

In this section an analysis will be made, firstly, of the recent development of the regulation of equity in Spain, and its incidence in the level of capitalisation of the Spanish banking entities. Secondly, the Kishan and Opiela (2000) model, which emphasises the importance of bank capital in the determination of the credit offer response following a monetary *shock,* will be succinctly examined, and the necessary hypotheses will be established for the bank credit channel to be operative in the transmission of monetary impulses.

3.1. Bank Regulation on equity and level of capitalisation of the Spanish banking system.

The evolution of the bank regulation on equity along with the bank capital adequacy of the banking entities in Spain has been due to the important changes that banking endured during the 80's and 90's. Mainly these were, firstly, the process of de-regularisation that brought about an increase in competition and a reduction in margins, forcing the banking entities to concede high risk credits albeit ones that attained higher benefits; and, secondly, the processes of credit non-intervention, of financial innovation and increased globalisation, propitiated a rapid technological development and the appearance of new risks –market risks, exchange risks, concentration–.

The introduction of the solvency *ratio*, being the relationship between equity and assumed risks, of credit entities began in Spain in 1985[10]. Some novelties with respect to the previous stage are: a) all risks inherent in the totality of assets –not only credit assets– with respect to which different capital requirement were set; b) the definition of equity was widened to include subordinated finance and shares; c) along with the solvency *ratio*, a *generic coefficient* was established, defined as the quotient of equity over real investment and net financial amortisation and specific provisions –not less than 5%–.

The beginning of the single banking market, on the first of January 1993, meant the adaptation of the Spanish regulations to Community guidelines. The 1992 reform introduced the following innovative elements: a) the suppression of the *generic coefficient* and the application of a *single specific coefficient* of 8%, whose denominator is the sum of the entity's assets weighted by its classification of risk –credit risk[11], negotiation portfolio risks, exchange risk and risk concentration[12]–; b) redefinition of equity: *basic resources* (*tier one*) are composed of capital, reserves and preferential shares with undetermined duration and a fixed interest rate, and *second category resources* (*tier two*), as a whole, these cannot exceed the basic resources and a 50% limit on the basic ones for subordinated financing was established.

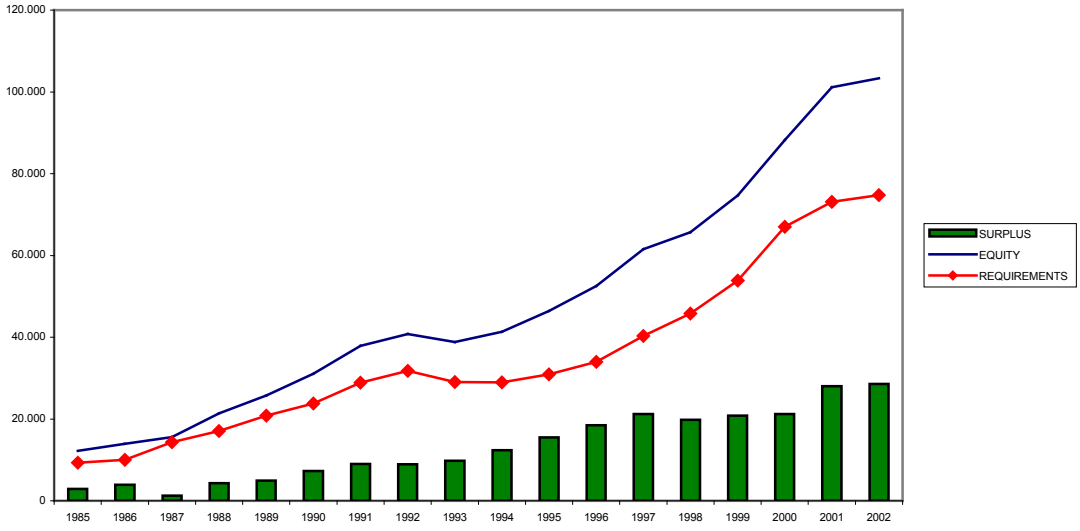
[10] Before this date the regulation of equity was based on the capital adequacy *ratio*, defined as the quotient between equity and external funds, along with a series of limitations on the concentration of risks.

[11] The main criticism of the system of weighting of the credits is that it does not take into account the "quality" of said credits, since it treats as equal those credits whose insolvency is known and presumes that these only present a potential risk.

[12] See Álvarez (2001) for a more detailed analysis of the weighting of the different risks.

The effects of the mentioned regulation can be observed through the evolution of the solvency *ratio*[13] and its components –equity and requirements– (**graphs 1 and 2**, **table 1)**. The period from 1985-2002 is characterised by a strong growth in equity and requirements, maintaining for the whole period a surplus in said resources and, consequently, a solvency *ratio* in the Spanish credit entities above the required minimum of 8%. It can be seen that following the change in the Community guidelines in 1993, the coefficient increases due to a reduction in requirements, but after 1998 it suffered a slight decrease due to a larger growth in requirements as opposed to equity as a consequence of the incorporation of new entities, of the increase in credit investment and a change in the composition of credit risk towards investments with a higher risk element.

Graph 1. Evolution of equity and requirements (Millions of €)



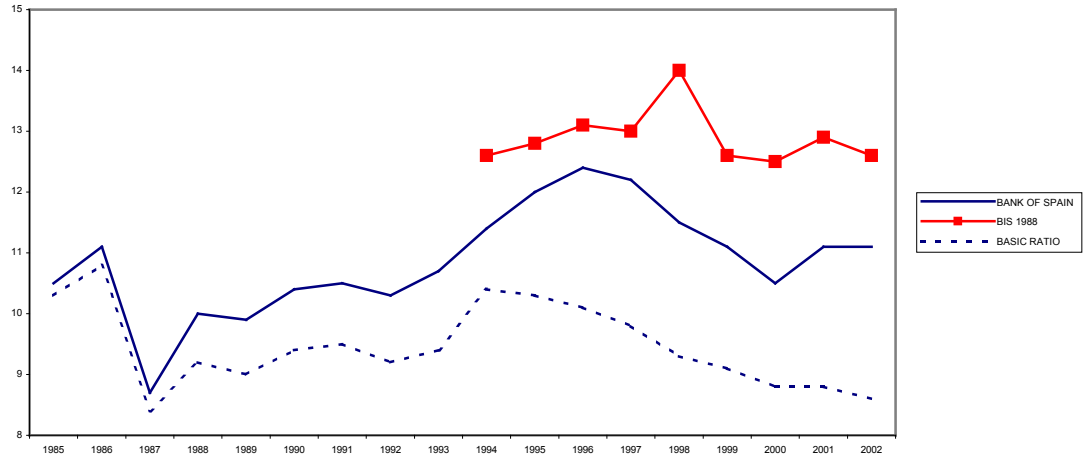
Source: Álvarez (2001) and Banco de España (2002).

[13] The solvency *ratio* is calculated by the product of the quotient between equity and capital requirement by 0,08.

Taking into account only basic resources, the *basic ratio* is more than double the required minimum of 4%, indicating that with the basic resources alone the entities more than cover the assumed risks.

If the Spanish *ratio* is compared with the average of the EU, the first is superior to the second until 1998, but looking at the *basic ratio* alone we see it is greater throughout the period. On the other hand, if instead of applying the Spanish regulation you were to use the 1988 Basilea Capital Agreement (BIS), the amount of equity belonging to the Spanish banks would have exceeded the minimum established, which indicates the greater strength of the Spanish regulation.

Graph 2. Solvency *Ratio* (%)



Fuente: Álvarez (2001) and Banco de España (2002).

Table 1. Evolution of the solvency *ratio* and its components: equity and requirements.

	1985		1986		1987		1988		1989		1990		1991		1992		1993	
	Mill. €	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%
Equity	**12.234**	**100**	**13.939**	**100**	**15.557**	**100**	**21.378**	**100**	**25.737**	**100**	**31.059**	**100**	**37.885**	**100**	**40.775**	**100**	**38.796**	**100**
Basic	*11.948*	*97,6*	*13.526*	*97,0*	*14.989*	*96,3*	*19.674*	*91,9*	*23.440*	*91,0*	*28.039*	*90,1*	*34.248*	*90,4*	*36.569*	*89,7*	*33.931*	*87,5*
Capital and reserves		97,6		97,0		96,3		91,9		91,0		90,1		90,4		89,7		87,5
Preferential shares		n.a		n.a		n.a		n.a		n.a		n.a		n.a		n.a		n.a
Second Category	*286*	*2,4*	*413*	*3,0*	*568*	*3,7*	*1.704*	*8,1*	*2.297*	*9,0*	*3.108*	*9,9*	*3.637*	*9,6*	*4.206*	*10,3*	*5.734*	*14,8*
Deductions																	*-869*	*-2,2*
Requirements	**9.319**	**100**	**10.051**	**100**	**14.313**	**100**	**17.086**	**100**	**20.817**	**100**	**23.809**	**100**	**28.900**	**100**	**31.816**	**100**	**29.004**	**100**
Credit risk		*94,1*		*93,0*		*97,1*		*94,1*		*95,1*		*95,1*		*94,4*		*94,6*		*98,1*
Market risk																		*0,0*
Exchange risk						*0,3*		*0,4*		*0,3*		*0,6*		*0,8*		*0,8*		*1,1*
Others		*5,9*		*7,0*		*8,0*		*5,6*		*4,6*		*4,3*		*4,8*		*4,7*		*0,8*
Solvency *Ratio* (%)	**10,5**		**11,1**		**8,7**		**10,0**		**9,9**		**10,4**		**10,5**		**10,3**		**10,7**	
Basic Ratio (%)	*10,3*		*10,8*		*8,4*		*9,2*		*9,0*		*9,4*		*9,5*		*9,2*		*9,4*	

Source: Álvarez (2001) y Banco de España (2002).

Table 1 (continuation). Evolution of the solvency *ratio* and its components: equity and requirements.

	1994		1995		1996		1997		1998		1999		2000		2001		2002	
	Mill. €	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%	Mill.€	%
Equity	**41.304**	**100**	**46.399**	**100**	**52.490**	**100**	**61.518**	**100**	**65.643**	**100**	**74.682**	**100**	**88.240**	**100**	**101.141**	**100**	**103.344**	**100**
Basic	*37.700*	*91,3*	*39.823*	*85,8*	*42.906*	*81,9*	*49.239*	*80,0*	*53.532*	*81,5*	*61.212*	*82,0*	*73.421*	*83,2*	*80.045*	*79,1*	*79.995*	*77,4*
Capital and reserves		91,3		85,8		81,9		80,0		69,3		66,3		65,2		61,9		61,4
Preferential shares		n.a		n.a		n.a		n.a		12,2		15,7		18,0		17,2		16,0
Second Category	*6.106*	*14,8*	*7.753*	*16,7*	*10.768*	*20,3*	*13.056*	*21,2*	*13.705*	*20,9*	*16.656*	*22,3*	*20.724*	*23,5*	*27.104*	*26,8*	*27.265*	*26,4*
Deductions	*-2.502*	*-6,1*	*-1.177*	*-2,5*	*-1.184*	*-2,3*	*-777*	*-1,2*	*-1.594*	*-2,4*	*-3.185*	*-4,3*	*-5.882*	*-6,7*	*-6.007*	*-5,9*	*-3.914*	*-3,8*
Requirements	**28.965**	**100**	**30.910**	**100**	**33.982**	**100**	**40.320**	**100**	**45.818**	**100**	**53.832**	**100**	**67.009**	**100**	**73.116**	**100**	**74.745**	**100**
Credit risk		*96,2*		*96,1*		*95,5*		*95,0*		*94,3*		*93,7*		*94,1*		*94,1*		*94,9*
Market risk		*1,8*		*2,1*		*2,2*		*2,5*		*2,9*		*3,0*		*2,5*		*2,8*		*3,0*
Exchange risk		*1,1*		*0,9*		*1,1*		*1,4*		*1,5*		*2,0*		*2,0*		*2,0*		*1,1*
Others		*0,9*		*0,9*		*1,1*		*1,1*		*1,3*		*1,3*		*1,3*		*1,1*		*1,0*
Solvency *Ratio* (%)	**11,4**		**12,0**		**12,4**		**12,2**		**11,5**		**11,1**		**10,5**		**11,1**		**11,1**	
Basic Ratio (%)	*10,4*		*10,3*		*10,1*		*9,8*		*9,3*		*9,1*		*8,8*		*8,8*		*8,6*	
EU *Ratio*(%)	**11,4**		**11,7**		**12,0**		**11,2**		**11,5**		**11,8**		**n.a**		**n.a**		**n.a**	
Basic Ratio (%)	*8,6*		*8,4*		*8,5*		*7,7*		*8,0*		*8,4*		*n.a*		*n.a*		*n.a*	
SIMULATIÓN:																		
BIS 1988 *Ratio*(%)	**12,6**		**12,8**		**13,1**		**13,0**		**14,0**		**12,6**		**12,5**		**12,9**		**12,6**	
Basic Ratio (%)	*10,7*		*10,5*		*10,3*		*10,0*		*9,8*		*9,5*		*9,1*		*9,1*		*8,7*	

Source: Álvarez (2001) and Banco de España (2002).

In **table 2** you can see the reduction in entities with a resource deficit, these represent 20.3 % of the total requirements in 1985, whilst in 2000 those not meeting the requirements are inappreciable (0.3%). Also, a re-distribution of entities from the higher interval (SR ≥ 14%) towards the central track (8% to 12%) can be observed.

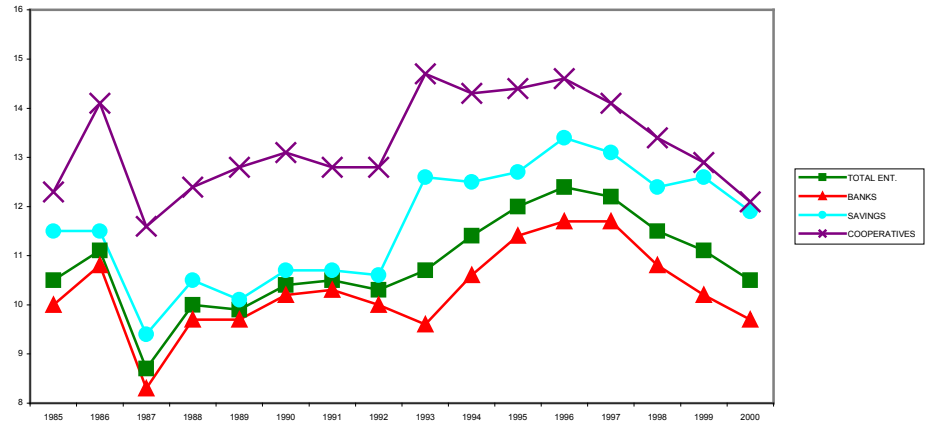
Table 2. Distribution of credit entities with regard to their Solvency *Ratio* (SR)

	1985			**1993**			**2000**		
	No. ent.	% No. ent.	% Rqmts	No. ent.	% No. ent.	% Rqmts	No. ent.	% No. ent.	% Rqmts
SR≥14%	124	41,8	17,8	192	56,3	9,8	94	40,7	3,9
12%≤SR<14%	31	10,4	6,4	41	12,0	31,7	30	13,0	13,4
10%≤SR<12%	39	13,1	29,4	45	13,2	30,2	49	21,2	19,9
8%≤SR<10%	35	11,8	26,1	44	12,9	20,0	56	24,2	62,5
SR<8%	68	22,9	20,3	19	5,6	8,3	2	0,9	0,3
Total	**297**	**100,0**	**100,0**	**341**	**100,0**	**100,0**	**231**	**100,0**	**100,0**

Source: Álvarez (2001)

Finally, distinguishing the entities by type, the highest co-efficiencies correspond to the Credit Co-operatives and the Savings Banks, 12.1% and 11.9%, respectively in 2000, whilst the banks have a *ratio* of 9.7%. Also evident is the tendency for lack of *ratio* growth for the three entities after 1996 (**graph 3**).

Graph 3. Solvency *Ratio* (%), by entity



Source: Álvarez (2001).

To conclude, what stands out is the high level of capitalisation of the Spanish banking system, well above the EU and BIS, which allows the majority of the entities to fulfil their solvency *ratio*. This fact could imply that Spanish banks, by showing themselves to be more solvent, reduce the problems of adverse selection and can more easily obtain forms of financing not subject to the reserve requirements, thus compensating for the reduction in their deposits following a monetary contraction, and allowing them to maintain their credit supply. The analysis, both theoretically and empirically, of this behaviour will be developed in the next sections.

3.2.- The role of bank capital in the credit supply response.

The relationship between bank capital, its regulation and credit supply has been studied, initially in the literature concerning credit difficulties ("*credit crunch*") and capital difficulties ("*capital crunch*"). Some studies (Peek and Rosengren (1995a, 1995b) and Thakor (1996) have shown the adequacy agreement on capital requirement reduces the credit supply at a determined moment and, also, credit supply response following an adverse shock in capital is greater for those banks subject to bank regulations concerning capital. Namely, said evidence points out that both capital and the requirements of capital are a restriction on the banks' ability to lend funds in the form of credits.

Some recent studies concerning the functioning of the bank credit channel incorporate these results (Kishan and Opiela (2000), Ehrmann *et al.* (2001), Hernando and Martínez-Pagés (2001) and Van den Heuvel (2001, 2002a, 2002b)), and they consider bank capital as a relevant factor in determining the response of the credit supply following a monetary shock.

This study is based on the Kishan and Opiela (2000) theoretical reference model – a modification of the Peek and Rosengren one (1995b)–, since it shows that, after a monetary impulse, a differential response in credit supply between banks exists, depending on their size and level of capitalisation. In this study the effects of a monetary contraction on the entry balance of a representative banking business will be analysed –on the assets side, including credits (L), bonds (B) and reserves (R), and on the liabilities side, deposits (D), other forms of finance not subject to reserves (C) and capital (K)– under the following suppositions: i) financial markets are imperfect, therefore the banks encounter problems of adverse selection when they have to resort to different ways of obtaining funds other than deposits subject to reserves; ii) banks have a certain type of monopoly as much in the market for other forms of finance –which implies that they can increase said funds by paying a higher interest rate– as in the credit market, in which they can

increase (decrease) the credits conceded, reducing (increasing) their interest rates below (above) the average market interest rate; iii) credit demand is heterogeneous between banks, being more elastic for the larger entities since a large percentage of their loans are conceded to large businesses, which can easily substitute bank financing for other means (shares, commercial paper, commercial credit, etc.)[14].

The behaviour of credit supply as a function of the type of intervention of the monetary authority, r_t, can be expressed in a very simplified manner through the following equation:

$$L_{it} = \alpha_i - \frac{\left[a_i d_i (1 - c_i)\right]}{\left[b_i + d_i\right]} r_t \qquad \textbf{[1]}$$

$$d_i = \delta(A_i), \delta' > 0; b_i = \beta(A_i, K_i), \beta_1', \beta_2' > 0$$

a_i being the elasticity of the deposit demand of the type of intervention, c_i the percentage of deposits destined for bonds, d_i the elasticity of the demand for credit with respect to the credit interest rate, and b_i the sensitiveness of the fund offer not subject to reserves with respect to their cost.

The results obtained following the application of a monetary contraction are, firstly, a reduction in credit supply ($dL_{it}/dr_t<0$), that will be more pronounced the more elastic credit demand is (higher d_i) and the less sensitive the offer of other funds not subject to reserves with respect to their interest rate is (smaller b_i), in other words, the more costly it is to obtain said funds due to the existence of greater problems of adverse selection; secondly, an increase in other funds ($dC_{it}/dr_t>0$), whose magnitude will be greater the more sensitive the offer of said

[14] Although this model does not include a restriction on capital needs to maximise benefits, which would allow the monetary authorities to make those entities that were below said requirement fulfil the minimum demanded, this is not a problem for the said model which can be applied to the Spanish banking sector since, as set out in the preceding epigraph, this shows a surplus of own resources as a whole and, by entities, a very high proportion of them fulfil the solvency *ratio* (≥8%).

funs is when faced with changes in interest rates (higher b_i); and, thirdly, the response of bonds is uncertain ($dB_{it}/dr_t > ó < 0$), since a monetary contraction will force some banks (those that have a high capital *ratio*) to sell liquid bonds in order not to alter their credit supply, but others will increase their holdings of bonds to reduced the risk to their assets, since this could be greater following a monetary contraction because the quality of credits is reduced –in the case of the small banks–, or to maintain certain compromises on credits –on the part of the large banks–.

Said responses, as seen in **equation 1** for credits, are directly related to the size and level of capitalisation of the entities, since said variables have an influence as much in the magnitude of the problems of adverse selection that appear when other forms of finance are accessed, as in the elasticity of credit demand. Therefore, the following conclusions are established: a) $d^2L_{it}/dr_tdA_{it} = d^2C_{it}/dr_tdA_{it} > ó < 0$[15], the net effect of the size of assets on the response of credits and other funds is undetermined, since, on one side, the larger banks can more easily access other forms of finance ($d^2C_{it}/dr_tdA_{it}>0$) and buffer an adverse monetary shock practically without altering their credit supply ($d^2L_{it}/dr_tdA_{it}>0$), but, on the other hand, as the larger banks face up to a more elastic demand for their credits, they will reduce their credit supply by a larger measure ($d^2L_{it}/dr_tdA_{it}<0$), maintaining a larger percentage of high risk credits and, therefore, negatively affecting access to other funds ($d^2C_{it}/dr_tdA_{it}<0$); b) $d^2L_{it}/dr_tdK_{it} = d^2C_{it}/dr_tdK_{it} >0$, in other words, the better capitalised banks will be able to more easily compensate for a reduction in their deposits by going to other sources of finance thanks to the problems of adverse selection being reduced by giving out signals of greater solvency and, therefore, the contraction in credit supply will be smaller.

[15] This lack of determination was also established by Kashyap and Stein (1995), an empirical contrast being necessary in order to determine which of the two effects prevail.

Therefore, the operativity of the bank credit channel depends upon fulfilling the following derivatives:

(i) $dL_{it}/dr_t<0$ **[2]**

(ii) $d^2L_{it}/dr_t dK_{it} >0$ **[3]**

In other words, credit supply contracts following a restrictive monetary policy, and the magnitude of said response depends inversely on the level of capitalisation of the banks.

Analogously, one can demonstrate that obtaining of other finance funds increases following a monetary contraction ($dC_{it}/dr_t>0$), and, said response is greater as the degree of capitalisation increases ($d^2C_{it}/dr_t dK_{it}>0$).

4.- CONTRASTING THE BANK CREDIT CHANNEL.

Next, a description of the data and variables used will be presented, as well as a characterisation of the balance structure of the Spanish banking system distinguishing the entities by size and level of capitalisation. After, the econometric model will be described in detail to contrast the differential response of credit supply between the banks following a monetary contraction, consistent with the results obtained by Kishan and Opiela (2000).

4.1.- Description of the data.

The data concerning the relevant balance entries is taken from the *Anuario Estadístico de la Banca Privada (AEB)* and from the *Confederación Española de Cajas de Ahorros (CECA)* for Banks and Savings Banks, respectively[16]. The original data base –132 Commercial Banks, 54 Savings Banks and 26 foreign banks– has been modified eliminating the foreign banks[17] and those entities that had fewer than 2 entries, in this way the changed data base is made up of an unbalanced panel of 168 banks (of which 51 are Savings banks), with a total of 1623 entries corresponding to the period 1992-2002 (as opposed to the 1855 entries in the original data base). With regard to the way fusions between banks are dealt with, of which there were very few during this period, these are still treated as independent entities.

[16] Generously provided by the Instituto Valenciano de Investigaciones Económicas (IVIE).

[17] Hernando and Martínez-Pagés (2001) note a contribution from H. Pill concerning the differential behaviour of the foreign banking sector in Spain following a monetary shock, which increases its credit supply since it has greater access to other sources of finance in place of deposits, compensating in this way for a fall in its deposits.

The variable selected are the following: on the assets side, credits for the private residential sector (the data base does not allow for the different types of credit to be distinguished), bank reserves (cash and deposits in central banks) and bonds (interbank deposits, bonds and other fixed income bonds); on the liabilities side, bank deposits –of which time deposits can be distinguished as they are not subject to reserve requirements–, credit entities (interbank loans), other bank liabilities that include other forms of finance not subject to reserves such as, bonds, promissory notes and other issued securities, and, finally, capital and reserves. All the variables are expressed in thousands of Euros.

Since the response of the credit supply faced with changes in monetary policy depends on the size and level of capitalisation[18], the bank entities are divided into four groups according to the size of their assets by the following percentiles: <p45 (< ≈ 1.000 millions of €), p45 – p75 (1.000 millions of € - 3.740 millions of €), p75 – p90 (3.740 millions of € - 10.000 millions of €), ≥ p90 (≥10.000 millions of €). And according to the K/A[19] *ratio,* the entities are separated into three groups: under-capitalised (K/A<8%), adequately capitalised (8%≤K/A<14%)[20] and over-capitalised (K/A≥14%)[21].

[18] Although this study emphasises the role of bank capital, the analysis to be carried out is extensible to determine the influence size has in the response to credit supply.

[19] Due to the difficulty in obtaining the solvency *ratio* for each bank, the quotient K/A has been used a *proxy* variable of solvency.

[20] Given the limitation of the number of entities in the sample, no attempt is made to differentiate between the bands from 8% to 12%, and from 12% to 14%, as in **table 2**.

[21] Although the original data base takes the Banks and Savings banks into account separately, this study does not make this distinction since more and more the differences between them is insignificant as much in the way they work as in the objectives of their businesses, the behaviour of the between large banks and the large Savings banks being similar, and between the regional banks and small Savings banks.

Table 3 shows the balance structure for each group, from which the following characteristics stand out:

(i) *According to the size of asset*: the smaller banks maintain a larger percentage of bonds and a smaller percentage of credits compared to the larger banks, also, they are more capitalised; on the other hand, the larger banks (≥p90) keep a larger percentage of other forms of finance not subject to reserves (credit entities, time deposits and other bank liabilities represent 44.9%) than the rest of the categories, and also, they represent more than 60% of the market share.

(ii) *According to the degree of capitalisation*: 60% of the entities have a ratio below 8% and make up 80% of the market share; the less capitalised banks depend more on deposits to obtain funds; the more capitalised banks maintain a larger percentage of bonds and a smaller percentage of credits compared to the others.

(iii) *According to the size of asset throughout the three capitalisation groups*: about 90% of the largest banks are under-capitalised, whilst 60% of the smallest banks have a *ratio* above 8%; the smaller banks (<p45 y p45-p75) depend less on deposits as they are better capitalised, however, only the largest ones (p75-p90 y ≥p90) and better capitalised ones (≥14%) depend less on deposits than the largest and less capitalised ones (<8%).

Table 3. Balance structure, according to size of asset and level of capitalisation: 1992-2002. (1)

	Total	**Asset size**			
		< p45	**p45–p75**	**p75–p90**	**≥ p90**
No. entities	168	76	50	25	17
Asset Mean(2)	5.134,3	377,3	2.055,3	6.126,2	33.998,3
Market Share					
Asset	100,0	3,3	11,9	17,8	67,0
Credits	100,0	3,2	12,8	18,5	65,5
Deposits	100,0	3,4	13,2	21,1	62,3
Breakdown by Assets					
Reserves	1,4	1,2	1,7	1,7	1,3
Bonds	32,6	39,5	28,8	24,7	24,2
Credits	48,4	43,4	52,0	52,2	54,2
Others	17,6	15,9	17,5	21,4	20,3
Breakdown by Liabilities					
Credit Entities	22,2	23,4	20,1	17,8	29,5
Deposits	57,0	50,4	62,5	68,4	54,1
Time	11,2	11,6	9,6	14,4	9,0
Other liabilities	3,9	1,8	6,9	2,8	6,4
Capital+reserves	13,3	20,3	7,5	7,9	6,6
Others	3,6	4,1	3,0	3,1	3,4
K/A < 0.08					
No. entities	101	29	36	21	15
Asset Mean(2)	6.797,6	622,1	2.117,2	5.912,5	31.209,3
Market Share					
Asset	79,6	2,1	8,8	14,4	54,3
Credits	82,3	2,0	9,3	15,9	55,1
Deposits	82,0	2,5	10,2	17,5	51,8
Breakdown by Assets					
Reserves	1,7	1,7	1,8	1,7	1,3
Bonds	29,2	36,3	29,1	23,8	23,4
Credits	52,0	49,2	51,1	54,8	55,5
Others	17,1	12,8	18,0	19,7	19,8
Breakdown by Liabilities					
Credit Entities	21,4	21,4	19,1	18,8	30,4
Deposits	65,4	69,1	64,6	69,9	53,7
Time	12,0	13,9	11,1	13,3	8,7
Other liabilities	4,5	1,3	7,5	2,5	6,7
Capital+reserves	6,0	5,6	6,1	6,1	6,0
Others	2,7	2,6	2,7	2,7	3,2

Table 3. (Continuation) Balance structure, according to size of asset and level of capitalisation: 1992-2002. (1)

	Total	Asset size			
		< p45	p45–p75	p75–p90	≥ p90
0.08 ≤ K/A < 0.14					
No. entities	37	21	12	3	1
Asset Mean(2)	1.774,5	358,2	1.923,5	7.351,4	12.996,4
Market Share					
Asset	7,6	0,9	2,7	2,5	1,5
Credits	8,3	1,0	3,1	2,6	1,6
Deposits	8,9	0,7	2,8	3,6	1,8
Breakdown by Assets					
Reserves	1,4	1,0	1,8	2,0	1,4
Bonds	28,7	31,2	25,9	20,4	33,5
Credits	54,3	54,0	56,1	50,1	50,7
Others	15,6	13,8	16,2	27,5	14,4
Breakdown by Liabilities					
Credit Entities	27,9	35,4	22,1	3,2	16,1
Deposits	55,9	49,4	59,8	80,1	69,4
Time	12,9	14,9	5,7	26,8	13,8
Other liabilities	2,2	1,0	4,0	2,9	3,0
Capital+reserves	10,3	10,5	10,3	9,1	8,3
Others	3,7	3,7	3,8	4,7	3,2
K/A ≥ 0.14					
No. entities	30	26	2	1	1
Asset Mean(2)	3.678,1	119,6	1.730,5	6.936,7	96.836,2
Market Share					
Asset	12,8	0,4	0,4	0,8	11,2
Credits	9,4	0,2	0,3	0,1	8,8
Deposits	9,1	0,2	0,2	0,0	8,7
Breakdown by Assets					
Reserves	0,7	0,7	0,9	0,2	1,0
Bonds	48,6	49,8	39,9	55,7	26,7
Credits	28,9	28,3	44,0	4,2	38,6
Others	21,8	21,2	15,2	39,9	33,7
Breakdown by Liabilities					
Credit Entities	18,0	16,0	26,9	41,0	28,8
Deposits	30,4	30,2	40,7	0,1	44,6
Time	6,2	6,4	5,6	0,0	8,0
Other liabilities	4,1	3,1	13,8	9,6	5,8
Capital+reserves	41,5	44,6	15,2	42,3	14,1
Others	6,0	6,1	3,4	7,0	6,7

Source: *AEB y CECA*.
(1) The calculations have been done on the averages of each entity during the period 1992-2002.
(2) In millions of Euros.

4.2.- Econometric Specification.

In order to verify the derivatives sign formulated in the previous section that show the existence of the bank credit channel in the Spanish banking system, two studies have been carried out using the following methodologies:

(i) **According to Kishan and Opiela (2000)**, banking entities are differentiated as much by their size as by their level of capitalisation, according to the categories in **table 3**, and the following econometric model has been formulated:

$$\Delta z_{it} = \lambda_i + \sum_{j=1}^{2} \alpha_j \Delta z_{it-j} + \sum_{j=0}^{1} \beta_j \Delta r_{t-j} + \sum_{j=0}^{1} \delta_j \Delta x'_{it-j} + \varepsilon_{it} \qquad \textbf{[4]}$$

where the variable z subsumes as much the logarithm of the credits as the logarithm of other forms of finance not subject to reserves, variable r is the indicator of monetary policy –the one day interest rate for interbank market non-transferrable deposits [22]–, vector x includes other balance entries, expressed as a logarithm, such as demand deposits and other forms of finance –only for credit regression –, and assets –only for the regression of other funds not subject to reserves–, λ_i is the constant that subsumes the existence of fixed effects between banks, and, finally, ε_i is the random disturbance.

The expected result of β_j has to be negative for the credit equation and lower as the degree of capitalisation increases. On the other hand, in the equation for other forms of finance, β_j has to be positive and larger according to the level of capitalisation.

[22] The use of bank reserves as an indicator of monetary policy has also been tried, but the results have never been significant.

(ii) **According to Ehrmann *et al.* (2001)**, for the total of all the entities **equation 1** can be contrasted using the following econometric specification:

$$\Delta z_{it} = \lambda_i + \sum_{j=1}^{2} \alpha_j \Delta z_{it-j} + \sum_{j=0}^{2} \beta_j \Delta r_{t-j} + \sum_{j=0}^{1} \delta_j \Delta x_{it-j} + \eta c'_{it-1} + \sum_{j=0}^{2} \mu_j c'_{it-1} \Delta r_{t-j} + \varepsilon_{it} \quad \textbf{[5]}$$

where variable z subsumes as much the credit logarithm as the logarithm of other forms of finance not subject to reserves, variable r is the indicator of monetary policy – the one day interest rate for interbank market non-transferrable deposits –, variable x is the logarithm of demand deposits, vector c includes the size (asset logarithm) and the degree of capitalisation (capital/asset), λ_i is the constant that subsumes the existence of fixed effects between banks, and, finally, ε_i is the random disturbance.

The expected result of β_j concurs with the previous specification, in other words, negative for credits and positive for other funds, whilst μ_j has to be positive in both cases with respect to capitalisation, the result being uncertain with respect to size.

In order to estimate both equations the General Moments Method (GMM) is used, suggested by Arellano and Bond (1988), with which consistent and efficient estimators can be obtained through the correct choice of instrumental variables, for which the Hansen test has been used. Also, two *dummy* variables have been used that subsume the BIS change in legislation concerning the solvency *ratio* in 1993, and the introduction of the new monetary policy regime in 1999. See the Annex for a more detailed description of the variables.

5.- RESULTS

The results of the estimation of **equation 4** by GMM –using as instrumental variables the two lags of the rate of credit growth, the rate of production growth, inflation and the degree of capitalisation, and the present and past growth value in bank reserves–, of the effects of monetary policy on the rate of variation of credits and other forms of finance separated by asset category and level of capitalisation, are presented in **tables 4** y **5**, respectively.

Taking the degree of capitalisation into account, the negative effect of an increase in interest rates on the credit supply for all the groups can be seen, this being less in absolute value as the capitalisation *ratio* increases, however, this is only significant for the under-capitalised banks.

With respect to the size of asset, the expected result is only obtained for the smaller banks (below the percentile 45) a 10% of signification. For the entities which make up the group between percentile 45 and 90, the effect is positive and significant, which could be because a large percentage of their clients are made up of large businesses, with whom they establish medium and long term financial compromises, which they are obliged to fulfil even if monetary policy is unfavourable. This kind of client relationship has traditionally been given by banks of a certain size more than Savings banks, more oriented to domestic economies and small and medium sized businesses, hence said result, since it is the banks who predominate in number between percentile 45 and 90.

Therefore, only the smallest least capitalised banks contract their credit supply following a negative monetary shock, and, given that these represent 80% of the market share, a reduction in aggregate credit supply can be observed, amplifying the effects on the macroeconomic variables.

As for the effects on other forms of finance, the results are not so conclusive. On one side, the well capitalised banks ($0.08 \leq K/A < 0.14$) and the over-capitalised ones ($K/A \geq 0.14$) do increase their holdings of other funds not subject to reserves following a monetary contraction, however, the response is significant only for the latter, indicting that these banks encounter fewer problems of adverse selection in said market, as obtaining said funds is less costly for them and, thus, they can maintain their credit supply unaltered. This fact would explain the previous result whereby the credit supply of these entities does not vary following changes in interest rates.

However, with regard to the size of asset, the results are contrary to those expected, since the response is positive for the smallest banks, and negative and significant for the largest ones. So, it does not appear to be evident that the size of asset is a good *proxy* variable of the of the banks' ability to access the market for other sources of finance.

Table 4. Effects of monetary policy on the rate of credit growth, according to equation 4.

	According to the level of capitalisation			
Variable	**K/A<0.08**[(a)]	**0.08≤K/A<0.14**[(a)]	**K/A≥0.14**[(a)]	
Δ *r*	**-0.030**[***]	-0.028	-0.004	
	(*0.005*)	(*0.373*)	(*0.959*)	
Δ deposits	0.210[***]	0.656[***]	0.808[***]	
	(*0.005*)	(*0.000*)	(*0.000*)	
Δ others funds	0.43[***]	0.422	0.418[***]	
	(*0.000*)	(*0.254*)	(*0.015*)	
R^2 Adj.	0.113	0.260	0.537	
Test Hansen	3.293	0.766	1.758	
	(*0.856*)	(*0.997*)	(*0.987*)	
	According to size of asset			
Variable	**< P45**[(b)]	**P45 - P75**[(c)]	**P75 - P90**[(b)]	**≥ P90**[(a)]
Δ *r*	**-0.035**[*]	**0.029**[**]	**0.057**[**]	-0.006
	(*0.081*)	(*0.028*)	(*0.029*)	(*0.695*)
Δ deposits	0.650[***]	0.938[***]	-0.985[**]	0.291[**]
	(*0.000*)	(*0.000*)	(*0.013*)	(*0.037*)
Δ others funds	0.323[**]	0.285	1.049[***]	0.888[***]
	(*0.021*)	(*0.260*)	(*0.000*)	(*0.000*)
R^2 Adj.	0.085	0.742	0.638	0.413
Test Hansen	0.685	0.372	2.708	0.102
	(*0.995*)	(*0.946*)	(*0.745*)	(*0.999*)

Note: The values in brackets are levels of probability. [*]=Significant to 10%; [**]=significant to 5%, [***]= significant to 1%.

[(a)] Only the present rate of growth of the independent variables is subsumed.

[(b)] Only the rate of growth for the previous period of the independent variables is subsumed.

[(c)] The growth rate for the previous period for interest rates, and the present growth rate for the rest of the variables is included.

Table 5. Effects of monetary policy on the growth rate of other sources of finance, according to equation 4.

	According to level of capitalisation		
Variable	**K/A<0.08**[(c)]	**0.08≤K/A<0.14**[(a)]	**K/A≥0.14**[(a)]
Δ *r*	**-0.027**[**]	0.027	**0.186**[**]
	(*0.025*)	(*0.259*)	(*0.018*)
Δ asset	0.616[**]	0.865[*]	0.153[*]
	(*0.014*)	(*0.053*)	(*0.100*)
R^2 Adj.	0.129	0.526	0.300
Test Hansen	1.714	0.789	6.971
	(*0.974*)	(*0.999*)	(*0.539*)

	According to size of asset			
Variable	**< P45**[(b)]	**P45 - P75**[(a)]	**P75 - P90**[(c)]	**≥ P90**[(a)]
Δ *r*	0.044	**0.029**[**]	**-0.016**[*]	**-0.017**[*]
	(*0.215*)	(*0.025*)	(*0.059*)	(*0. 056*)
Δ asset	0.607	1.557[***]	0.981[***]	1.314[***]
	(*0.190*)	(*0.000*)	(*0.004*)	(*0.000*)
R^2 Adj.	0.165	0.587	0.424	0.814
Test Hansen	1.575	0.965	0.244	0.103
	(*0.979*)	(*0.995*)	(*0.999*)	(*0.999*)

Note: The values in brackets are levels of probability. [*]=Significant to 10%; [**]=significant to 5%, [***]= significant to 1%.

[(a)] Only the present rate of growth of the independent variables is subsumed.

[(c)] The growth rate for the present period for interest rates, and the growth rate for the previous period for the rest of the variables is included.

[(c)] The growth rate for the previous period for interest rates is included and the present growth rate for the rest of the variables.

The **equation 5** estimation (**tables 6** and **7**) – the instrumental variables used are: the two lags in the rate of credit growth, the present and past value of the growth in production, inflation, the second and third lag of the degree of capitalisation, and the present value and two lags in the growth in bank reserves–, shows evidence that corroborates the previous results, showing that the bank credit channel exists, and that there is a differential response between the banking entities based on their capitalisation, size and liquidity[23].

It is important to emphasis that credit supply will contract following an increase in interest rates when bank characteristics are taken into account separately, but when several characteristics are included the response is only significant for capitalisation and size.

Besides, as the parameter sign that subsumes the interaction of every characteristic with interest rates is positive and significant for every case, this shows the existence of the credit channel, since the magnitude of the response of credit supply following a change in monetary policy is lower the more capitalised the banks are, the larger they are, and the larger the percentage of liquid assets they have is. Therefore, it is evident that a differential behaviour exists between banks in function of their level of capitalisation, size and degree of liquidity. It is worth noting that the characteristic that most influences this heterogeneous response is capitalisation, since it is significant to 1%, and the parameter is greater.

[23] Although the analysis of the influence of the degree of liquidity on credit supply is not an objective of this paper, it is included in this estimation to verify the results obtained by Ehrmann *et al.* (2001).

Table 6. Effects of monetary policy on credit growth rate, including the size and level of capitalisation of the banks, according to equation 5.

	Characteristics[(a)]			
Variable	**Capitalisation**	**Size**	**Liquidity**	**Capitalisation Size**
Δr[(b)]	**-0.124****	**-0.040***	**-0.030***	**-0.121***
	(*0.017*)	(*0.097*)	(*0.054*)	(*0.062*)
charac1*Δr	**1.347*****	**0.605****	**0.719****	**1.288***
	(*0.008*)	(*0.032*)	(*0.029*)	(*0.100*)
charac2*Δr				0.041
				(*0.912*)
R^2 Adj.	0.286	0.2880	0.366	0.297
Test Hansen	0.757	0.994	0.787	0.752
	(*0.998*)	(*0.963*)	(*0.997*)	(*0.979*)

Note: The values in brackets are levels of probability. *=Significant to 10%; **=significant to 5%, ***= significant to 1%.
[(a)] Includes a lag for these variables.
[(b)] Subsumes the second lag of the increase in interest rates.

Finally, regarding the holdings of other forms of finance, these do increase following a monetary contraction when only the level of capitalisation is taken into account, but this response is greater for the less well capitalised banks. This result being contrary to the one obtained in **table 5**.

Table 7. Effects of monetary policy on the growth rates of other forms of finance, including banks size and level of capitalisation, and according to equation 5.

	Characteristics[(a)]		
Variable	**Capitalisation**	**Size**	**Capitalisation Size**
Δr	**0.099*****	0.016	**0.107*****
	(*0.003*)	(*0.455*)	(*0.002*)
charac1*Δr	**-0.724****	-0.127	**-0.703***
	(*0.014*)	(*0.597*)	(*0.052*)
charac2*Δr			-0.196
			(*0.600*)
R^2 Adj.	0.013	0.423	0.054
Test Hansen	3.658	3.773	3.422
	(*0.886*)	(*0.877*)	(*0.843*)

Note: The values in brackets are levels of probability. *=Significant to 10%; **=significant to 5%, ***= significant to 1%.

[(a)] Only subsumes the current value of the variables.

6.- CONCLUSIONS

Determining the role of bank credit in the transmission of monetary impulses is fundamental in order for the monetary authorities to correctly predict the effects of their actions on the relevant macroeconomic variables. Whilst the theoretical argument of said role leaves no room for doubt, the empirical evidence presented is not so conclusive.

From the theoretical point of view, the importance of credit supply has been justified as seen by the Modigliani-Miller theorem not being fulfilled, since given the imperfection in financial markets and the existence of asymmetric information between banks and investors, problems of adverse selection appear, interfering as much in the capacity of the bank to access other external sources of finance as in the decisions concerning credit supply (Kashyap and Stein (1994) and Stein (1998).

From the empirical point of view, the ambiguity associated with using aggregated data has been avoided by using disaggregated data concerning the structure of the banks' balance, allowing the problems of asymmetric information and adverse selection to be captured. Regarding the size of the banks and the level of liquidity as *proxy* variables of said problems; it has been shown that the smaller banks with less liquidity reduce their credit supply more following a monetary contraction (Kashyap and Stein (1995, 2000) and De Bondt (1999). However, the studies applied to the Spanish situation do not offer favourable results for the bank credit channel (Ehrmann *et al.* (2001), Hernando and Martínez-Pagés (2001) and King (2002).

In order to demonstrate the existence of the bank credit channel in Spain, this study, following the Kishan and Opiela methodology (2000), has analysed the

importance of the level of the level of capitalisation of the banks as the most relevant in order to indicate a bank's solvency, and as a consequence, the ability to compensate for a reduction in deposits through other forms of financing.

To this effect, through GMM and for a sample of 168 banks, the two results obtained by Kishan and Opiela (2000) in order to determine the functioning of the bank credit channel have been contrasted, namely, that credit supply reduces following a monetary contraction and, also, the magnitude of said reduction depends inversely on the level of capitalisation of the banks, being smaller for the better capitalised entities. To achieve this, two different econometric specifications have been used: in the first one, the banking entities have been separated into three groups according to the level of capitalisation, and in the second one, other variables such as the size of assets and the degree of liquidity have been introduced for all the entities, also showing that the smaller entities with less liquidity contract their credit supply more following an increase in interest rates.

While the evidence in favour of the bank credit channel is conclusive, the same does not occur with a comparison of the response of other forms of finance following a monetary shock, since only the better capitalised banks increase their holdings of these sources, the effect of size on the access to said market being irrelevant.

However, to corroborate these results, future investigations should include other indicators, such as a default index or the solvency *ratio*, before the quotient between capital and asset in order to correctly capture the problems of adverse selection that the Spanish banking entities face, and, thus, determine its impact on credit supply.

APPENDIX

DESCRIPTION OF THE VARIABLES

Capital: capital, reserves, issue premium and subordinate debt.

Capitalisation: quotient between capital and the total asset, in real terms.

Credits: credits for the private residential sector.

Deposits: demand and time deposits for the private residential sector.

Liquidity: quotient between bonds and the total asset, in real terms.

Bonds: interbank deposits, bonds and other fixed income bonds.

Other funds of financing: interbank loans, time deposits, and y other bank liabilities (bonds, promissory notes and other issued securities).

Bank reserves: cash and deposits in central banks.

Monetary shock: the first difference of the one day interest rate for interbank market non-transferrable deposits.

Size: logarithm of the total asset.

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