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Abstract

The use of aggregate data and failure to consider all possible alternatives to bank loans have been the main sources of criticism of empirical bank lending channel analyses. Although in the recent literature firm aggregates have replaced macro aggregates, existence of a differential impact of monetary policy across firms is an issue still open to empirical confirmation. Aggregates ignore firm heterogeneity and implicitly assume, in the case of size subaggregates, that the only difference between small and large firms is their access to capital markets. This paper represents an attempts to improve the empirical analysis of the narrow credit channel by estimating the effect of monetary policy on the debt mix using a panel of individual firms, controlling for firm specific heterogeneity. Using a data set of 12,909 Spanish firms provided by the Central Balance Sheet Office of the Bank of Spain, the estimates obtained support the existence of a bank lending channel during the 1983-1996 period. Monetary contractions during the period reduced the supply of bank loans relative to nonbank loans as evidenced by the significantly negative effect of an increase in the intervention rate on the financing mix of all firms. Furthermore, a differential impact of monetary policy is observed across firms according to their access to public capital markets, proxied by various variables, including employee size.

1. Introduction

This paper addresses one of the main criticisms of the empirical credit channel literature. Despite the clear microeconomic foundations of the existence of an additional channel for the transmission of monetary policy (see for example Bernanke and Gertler, 1989), all evidence, thus far, stems from aggregate analysis. Initially tests relied on aggregate correlations or aggregate predictive power comparisons (King, 1986, Romer and Romer, 1990, Bernanke and Blinder, 1988, 1992 and Ramey, 1993). More recently, studies have addressed the differences in financing patterns across firms by contrasting the effects of monetary policy on firm subtotals classified according to size (Gertler and Gilchrist (1994), Oliner and Rudebusch (1995)). For skeptics of the credit channel, however, this division between classes of borrowers, large and small, is not an adequate representation of the information asymmetry models underlying the credit channel since not only is the classification between small and large ad hoc, but also considerable firm heterogeneity as well as possible feedbacks amongst firms are masked in these subaggregates.

The results presented here show that at the firm level the credit channel continues to operate. It operates for all firms in the data base constructed by the Central Balance Sheet Office of the Bank of Spain (CBBE) and a differential effect is clearly distinguished between firms with and without access to capital markets. Whereas the usual identifying assumption behind subgroup comparisons is that, in the absence of credit market imperfections, small and large firms' response to a monetary contraction are identical, and that the only factor distinguishing them is the degree to which they face credit constraints (i.e. firms are small and large by accident), the use of firm level data allows other differences between large and small firms to be taken into account explicitly. By allowing for firm heterogeneity, including technological diversity, a differential response to monetary policy can

be more clearly imputed to financial differences. In addition by using individual data, firms are permitted to transit between constrained and unconstrained states across time. Thus a differential reaction between firms can be more confidently used as evidence of an operative lending channel.

The main limitation of using firm level data is its periodicity. The CBBE data, as the Compustat data, is available only on an annual basis.[1] This may encumber the task at hand, however, given that the effects of monetary policy shocks have been shown to persist for periods of up to four years, especially during the 1982-1995 period (Estrada, Hernando and Vallés, 1997), its effects should still be captured with annual data.

After a brief literature review, the framework used in this paper to assess the existence of a credit channel mechanism in Spain shall be presented, followed by results and conclusions.

2. Theory

The narrow credit channel is centered around the special nature of banks. Although several factors have led to a decline in the special nature of bank loans (i.e. securitization of bank loans, reduction of monitoring and information costs and the increase of nonbank intermediaries)[2], banks still play a special role. In the aggregate, bank loans still represent approximately 45% of total credit in Spain and 33% in the US. In addition, evidence presented by Sharpe (1990), Rajan (1992), and Petersen and Rajan (1992) show many households and firms appearing to be bank dependent.

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[1] Quarterly data encompassing around 600 firms representing a narrower rage of activities, sizes and ownerships, is available only since 1990 whereas the annual data encompasses some 6,000 firms starting in 1983.

[2] Attachment of derivatives to the securities of a firm, for example, can improve the supply and dissemination of information about the firm and lead to still more funding opportunities, reducing

According to this channel, monetary policy affects aggregate activity not only through interest rates but also by reducing the availability of credit to bank dependent firms. This channel is viable only under two conditions. First, the intermediary sector must not be able to completely insulate its lending activities from shocks to reserves. Banks must not be able to compensate the reduction in demand deposits by either raising loanable funds not subject to reserve requirements or selling off assets. Romer and Romer (1990) have argued that this condition does not hold since banks are able to avoid a fall in their liabilities by raising other loanable funds not subject to reserve requirements. The second condition requires borrowers to be unable to fully insulate their spending when faced with a tightening of the credit supply.

If the lending view is correct, monetary policy can have important effects on investment and aggregate activity without altering open market rates. In this manner, the scant interest rate sensitivity of aggregate investment in Spain would be at least partially explained. In addition, an important implication of the narrow credit channel is that monetary policy should have a disproportionate impact on borrowers with limited access to capital markets, all else equal. In other words, monetary policy may have undesired distributional consequences.

The main evidence supporting the existence of a narrow credit channel in the US stems from Kashyap, Stein and Wilcox (1993) and Gertler and Gilchrist (1993). Kashyap, Stein and Wilcox look at the relative movements in bank loans and commercial paper after monetary shocks. They find that shifts in monetary policy alter the mix of loans and commercial paper and that these induced shifts in the mix appear to affect investment. However, when Oliner and Rudebusch (1995) repeat the analysis comparing the effect of monetary policy on the debt mix of small and large firms, accounting for movements in all types of debt finance (not

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the importance of the credit channel.

only short term debt), they find that monetary shocks do not change the composition of bank and nonbank debt for either large or small firms. Instead they find that all types of credit are redirected from small to large firms in response to a monetary contraction. Gertler and Gilchrist, on the other hand, found that small firms contracted substantially relative to large firms after tight money and they attempted to show that mainly financial factors were at work.

Hernando (1998) used an approach similar to KSW using Spanish aggregate data and found that tight monetary policy had a negative effect on the debt mix (bank loans as percentage of bank loans and commercial paper), yet this effect was no longer significant once the period of credit constraints was taken into account. The author also found that the relative price of bank loans increased after tight monetary policy, even after controlling for the credit constraints.

3. Empirical Framework

The fact that two conditions operating on different agents are necessary for the bank lending channel to operate implies that evidence from bank balance sheets is inconclusive. The movement of bank and nonbank loans on firms' balance sheets after a monetary policy shock must also be compared. The key assumption behind this analysis is that the usual interest rate channel reduces firms' demand for bank loans and other debt to an equal degree. Thus a decline of bank loans relative to other debt outstanding can be taken as evidence of a reduction in bank loan supply.

The basic intuition behind this test of the lending channel can be formalized in a simple model (KSW, 1993) that will allow the introduction of firm specific characteristics. Given a predetermined external funds requirement, the firm selects the optimal mix of bank (B) and nonbank (N) debt to minimize its cost of

debt finance. Assuming a price clearing mechanism in the debt market[3], firms face a given interest r_b on bank loans and r_n on nonbank loans. In addition to this direct interest cost, firms perceive a benefit from maintaining close bank ties (R) and this benefit in turn depends on the share of bank loans. For a given amount of total debt, the benefit rises with the bank loan share subject to diminishing returns. Several theories, supported by empirical evidence, explain why firms may prefer to finance themselves at least partially with higher rate bank loans. Given the higher degree of monitoring, firms may be able to obtain bank funds, for example, even when adverse selection problems would make it difficult to raise funds in the public market.

The firm's choice problem is

$$\begin{aligned} &\text{Min } C = r_b B + r_n N - R \qquad (1)\\ &\text{s.t.} \quad B + N = D \\ &\qquad R = f(B/D) * D \end{aligned}$$

where f is an increasing concave function ($f' > 0$ and $f'' < 0$), D represents total debt and R the "relationship" benefit the firm derives from bank borrowing. The first order conditions for B and N imply:

$$r_b - r_n = f'(B/D) \qquad (2)$$

Because f' is positive, the interest rate spread $r_b - r_n$ must be greater than zero for (2) to hold. This equation implies that any shock (e.g. monetary policy) that disturbs the relative cost of bank and nonbank loans will be reflected in a shift of the firm's financing mix. If a tightening of monetary policy reduces the supply of bank loans relative to nonbank loans, the spread of r_b over r_n would widen, causing the optimal debt mix to fall. If, on the contrary, a monetary contraction

[3] The true price of bank loans however is imperfectly observable in part due to the widespread

had no effect on relative loan supplies, both the spread $r_b - r_n$ and the debt mix would be unchanged.

Using data for the Spanish economy, Hernando (1998) found that increases of the intervention rate lead to a widening of the bank loan - commercial paper rate spread. However, tests based on the response of the spread to changes in monetary policy are not conclusive in and of themselves for two reasons. First, as mentioned previously, the true bank loan rate is difficult to measure accurately. Second, the spread can be affected by factors other than increases in the intervention rate such as increasing default probabilities during recessions. Tests based on firms' financing choices, which do not require measurement of bank loan rates, are therefore a perfect complement to the spread tests when attempting to determine the response of bank loan supplies to changes in monetary policy.

Availability of firm level data allows the above specification to be enriched with firm level characteristics. In particular, the relationship benefit the firm derives from bank borrowing will depend of the firm's possible access to public capital markets. Oliner and Rudebusch (1995) tried to approximate these differences by estimating the response on different firm samples. The approach here will be to take into account specific firm characteristics that are traditionally considered to determine a firms access to capital markets - i.e. size, ties with financial conglomerates and partial foreign ownership. R would then be given by $R_{it} = f(B/D)_{it} * D_{it} * Z_{it}$ where Z_{it} is a vector of firm characteristics which may determine its access to public capital markets and which may vary over time. Letting MP denote the stance of monetary policy and differentiating the first order condition with respect to MP yields

$$d(B/D)_{it} / d MP_t = d(r_b - r_n) / d MP_t * [f''(B/D)_{it} * Z_{it}]^{-1} \quad (3)$$

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use of nonprice rationing.

Equation (3) shows that the optimal debt mix, B/D, moves inversely with the spread between the interest rates on bank loans and nonbank debt. Only if a monetary contraction reduces the supply of bank loans relative to nonbank loans, leading to a widening of the spread $r_b - r_{nb}$ would the optimal debt mix fall in response. The presence of Z_{it} in (3) captures the possible existence of a differential impact of monetary policy, an issue still open to empirical confirmation.

The econometric model that results from the above framework and which is the basis of the results presented next is

$$(B/D)_{it} = \beta_0 + \beta_1 MP_t + \beta_2 MP_t * Z_{it} + \gamma_i + \varepsilon_{it} \qquad (4)$$

where γ_i are firm fixed effects which shall be included to control for firm specific factors such as technological differences that may affect the optimal debt mix independently from monetary policy. As an indicator of the stance of monetary policy the intervention rate set by the Bank of Spain is used. The variables used as proxies for firm characteristics which may affect the access to public capital markets are size, measured according to the number of employees, partial foreign or financial intermediary ownership, registration in the stock exchange, dividend distribution, and use of commercial paper.

4. Empirical Evidence

4.1. Data

The firm-level data in this study were obtained from the Central Balance Sheet Office of the Bank of Spain. The initial data base included 18,814 firms over the 1983-1996 period. The main advantage of using this data base is that it contains detailed annual income and balance sheet information for non-financial firms in a wide range of sectors. Aside from its periodicity, the main limitation of the

CBBE database is the relative weight of large-sized firms, public sector companies, electric utilities and, in general, firms with a large volume of fixed assets.[4]

4.2. Selection Criteria

Only firms with positive total debt, sales and workers and at least two consecutive observations are included in the sample used for estimation. This reduces the number of firm-years from 91,119 in the original sample to 67,216. The total amount of firms is reduced by close to 30% to 12,909. Table 1 lists the number of firms per year and describes the balance of the panel. Slightly over 40% of the firms have a maximum of three consecutive observations. Only 11% of the firms have more than 10 observations, thus although T is large, for the majority of the firms, the time series dimension is rather small.

Rather than concentrating only on manufacturing firms, as most previous work on large and small firms has done, the sample contains firms in all nonfinancial sectors. Table 2 presents the sectoral decomposition of the data. Total manufacturing represents close to 50% of the sample and its gross value added is approximately 38% of the total national manufacturing value added. However, other sectors also have high individual sample representation - trade (23%), real estate (8%) and construction (6%), although these represent a lower percentage of the sectoral gross value added.[5]

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[4] In 1994, 77% of the sample's gross value added originated in 434 firms with more than 500 workers. In the same year, 37% of the sample's gross valued added corresponded to 392 publicly owned firms and 83% of total workers were permanent.

[5]

Sector	Sample Coverage of Sectoral Gross Value Added (1993)
Extraction Industries	29.2%
Manufacturing	37.8%
Food, Beverage&Tobacco	28.1%
Petroleum	51.7%
Chemical	55.7%
Other Fabricated Metals	35.0%
Electronics	44.1%
Automobiles	80.8%
Other	21.8%
Prod. and Dist. of Elect., Gas and Water	98.5%

The CBBE disaggregates debt into financial intermediary loans (banks and savings institutions), bonds and other tradeable assets, and other nonbank debt. Bank debt and all other nonbank debt are, in turn, split by maturity into short term debt (which has an original maturity of one year or less) and long term debt. The CBBE also provides data on trade credit, accounts payable and account receivable. Accounts payable are an important form of short-term debt. In 1996 trade debt represented 28% of all credit received by nonfinancial firms (Hernández and Hernando, 1998). Consequently one of the measures of debt mix utilized includes accounts payable. Unfortunately, however, the identity of the lender of trade debt is unknown. It would have been interesting to determine whether, in response to tight monetary policy, firms not affected by the decrease of bank loans act as intermediaries extending trade credit to the most affected firms.

Before examining the response of bank and nonbank debt mix to monetary shocks, it is useful to describe the composition of debt both for the total sample and across different size percentiles. Table 3 summarizes the average composition of debt across different size categories for the 1983 - 1996 period. Bank loans represent over 60% of total debt for the complete sample and across all size categories, with the exception of firms with real sales in the first quartile. Furthermore short term bank loans dominate for both small and medium sized firms, regardless of the size measure. On average bonds represent 22% of total loans. However, for small and medium firms they represent only 6.5% and 10% respectively. When firms are grouped according to the value of real sales, the percentage of bonds varies less and non-monotonically across the different categories. The remaining debt, composed mainly of loans with other firms and

Construction	12.4%
Trade	14.2%
Transp. and Communication	58.2%
Other	23.2%

trade debt acquired from providers of fixed assets, amounts on average to 16% of total debt. This percentage however decreases with size, both measured in terms of employees and of real sales. Overall small and medium sized firms are much more dependent on short term debt than large firms. Total debt for the first two categories is roughly split in half between long and short term while the ratio for large firms is approximately 1 to 4 (0.28).

The bottom part of Table 3 summarizes the various mix variables. Two sets of debt ratios are calculated for both the short and long run. The first measure (DBR2) is simply the ratio of short-term bank debt to the sum of this debt plus bonds and other short term debt. The second measure (DBR4) allows an even wider range of substitutions between bank and nonbank finance by including trade debt in the denominator. The inclusion of trade debt in the mix variable is justified by its relative importance as a source of short term credit and by the belief that it functions as an important substitute for short term bank loans.[6] Given that substitutions between bank and nonbank debt may involve substitutions across maturities, two additional mix variables are constructed adding the long term equivalents of the mix components. In this manner, DBR1 is the ratio of total bank debt to the sum of this debt plus total bonds and total other debt. Finally, DBR3 adds trade debt to the denominator of DBR1.

Table 4 presents the average of the different financing mix variables for all sectors in the sample. For the ratios not including trade debt (DBR1 and DBR2), the manufacturing sector has the highest proportion of bank loans whereas the services sector has the lowest. Including trade debt varies the relation between sectors, with the agricultural and services having the highest levels of DBR3, due to relatively low values of trade debt. As expected, the manufacturing industry has the lowest values of DBR3 and DBR4.

[6] Meltzer (1960), Gertler and Gilchrist (1993) and Oliner and Rudebusch (1995).

4.3. Variation Across Time

Figure 1 shows the mean debt mix over the 1983-1996 period for three firm size categories and the total (Table 5). The two main debt ratios, DBR1 and DBR2, together with the number of firms are represented in each graph. Once again one observes a very similar behavior between the different debt mix variables of small and medium firms across time, although throughout the nineties the debt ratios of the medium sized firms declined up to 10 percentage point with respect to those of the small firms. The debt ratios of the largest firms, on the other hand, have shown a continuous decline over the fourteen year period with a narrowing of the gap between the short term and total debt ratios, as the percentage of short term bank loans decreased. Consistently, across all categories as well as for the total, a sharp decline in all debt ratios is observed in 1991. This steep fall may be the reflection of the 1989-1990 credit crunch since it is also observed in the debt mix constructed using aggregate data (Hernando, 1998).

5. Monetary Policy and the Debt Mix

This section examines the movements in different mix variables to assess whether monetary policy directly constrains the supply of bank lending. As a measure of the monetary policy, the intervention rate is used (Figure 2). To preview the results, an increase in the intervention rate is found to negatively affect all debt ratios and is specially significant for the broader definitions. In addition, the effect on large firms can be clearly differentiated from that on small and medium sized firms, the effect on the former ones being positive and significant. These findings confirm previous results by Hernando (1998) and provide additional information as to the distributional effects of the bank lending channel of monetary policy.

Table 6 presents the results of estimating a simplified version of (4) which does

not include the interaction terms. All estimates presented use data in first differences in order to eliminate firm fixed effects. In addition all regressions include dummy variables for the years 1989-1991 in order to control for the credit crunch episode between July 1989 and December 1990, with its effects possibly continuing to be reflected in the 1991 balance sheets. [7]

Under a bank lending channel the various measures of mix are expected to decline in response to a monetary contraction. As shown in Table 6 both DBR2 and the broader measure DBR1 decline after an increase in the intervention rate, yet the decline is significant only for the ratio which includes short and long term debt. The marginal significance levels of the monetary policy coefficients for DBR2 and DBR1 are 0.65 and 0.00 respectively. This differential impact exemplifies how misleading conclusions may be reached when narrow measures of the finance mix are used. Oliner and Rudebusch (1995, 1996) emphasize the possibility that evidence in favor of the bank credit channel may be found using a narrow definition when in fact the actual mix of bank and nonbank debt does not change. The results presented above indicate that the opposite situation may also occur - utilizing a very narrow definition of total debt which does not include the most relevant bank substitutes can also lead to misleading results. In the CBBE sample, bank loans represent 100% of total short term loans for nearly 76% of the observations and for an additional 6% of the observations they represent over 90% of total short term loans, leaving small room for manoeuver when faced with a monetary contraction unless substitution across maturities is allowed.

Columns 3 and 4 of Table 6 show the effect of a monetary tightening on the debt mix when trade debt is included as a possible alternative to bank loans. Differences would support the theory originally proposed by Meltzer that trade debt extended by large firms could buffer any fall in bank lending to small firms.

[7] Figure 1 shows the gradual decline of the bank debt ratios until 1991, more pronounced for the largest firms, with a sharp drop this last year. The dummy variable for 1991 avoids capturing this effect in the interest rate coefficient.

Adding trade debt to the financing mix variable defined using both short and long term debt does not modify the previous results. This is not the case however for the mix defined only using short term debt. Whereas DBR2 is unresponsive to changes in monetary policy, once trade debt is included, the response to a monetary tightening is negative and significant. Once again the dangers of using very narrow definitions of the debt mix are made evident. Firms appear to try to offset reductions in short term bank loans with increases in trade debt, clearly indicating a reduction in bank loans supply rather than loan demand. This result is consistent with Hernández and Hernando (1998) which found trade credit to increase during recessions, periods typically associated with greater difficulty in obtaining external funds.[8,9]

In the definition of bank loans the Central Balance Office includes commercial credit lines. Given the special nature of these credit lines, the above results are reproduced excluding this portion of bank loans for the subsample of firms and years (1992-1996) for which this information is available. The conclusions extracted from Table 6 are unaffected, in fact, the coefficient on the monetary

[8] The authors however do not find any effect of monetary policy on the amount of trade debt made available by firms. They attribute this result to annual periodicity of the data as well as to limitations of the monetary policy indicators used (intervention rate and monetary conditions indicator). A better indicator would have been intervention rate innovations.

[9] Inclusion of a lag of the monetary policy variable does not modify the previous results and itself is not significant, except in the case of the mix variables including trade debt. When the lagged change in the intervention rate is included the sign of the current change is reversed for both DBR3 and DBR4 and the effect of the lagged change is negative. The coefficients are significant only for the short term financing mix (DBR4). This result is in part due to the change in the sample composition when firms with less than four observations are eliminated. In the complete sample 22% of the observations correspond to medium sized firms and 7% to large firms. When only firms with more than four observations are used the percentage of medium and large firms increase to 25% and 9% respectively. The increase is especially evident during the initial years. In 1985 and 1986 for example the percentage of medium size firms increases by nearly ten percentage point and the percentage of large increases by over 50 percent.

policy variable increases in absolute value and is significant both for DBR1 and DBR2.[10]

Taking first differences of equation (4) results in the following regression model

$$\Delta(B/D)_{it} = \beta_0 (\Delta MP_t) + \beta_1 (MP_t * Z_{it} - MP_{t-1} * Z_{it-1}) + V_{it}$$

where $V_{it} = \varepsilon_{it} - \varepsilon_{it-1}$. Note that the second expression on the right includes both changes in monetary policy and in the vector of firm characteristics. This term can be rewritten as $\Delta MP_t * Z_{it} + MP_{t-1} * \Delta Z_{it}$ which permits a clearer interpretation of the differential effects of monetary policy on firms with varying degrees of access to capital markets and on firms whose degree of access changes from one period to the next. Tables 7 and 8 present the results of estimating the above equation for different indicators of capital market access without restricting the coefficients on the terms of the decomposition to be equal.

Table 7 presents the results using as proxies for access to capital markets dummy variables for the different size categories defined by the Central Balance Sheet Office.[11] Once again the results are consistent with the existence of a bank credit channel. The effect of a monetary tightening is significantly negative for the small firms across all financing mix definitions, with the largest decline being observed for DBR1 and the smallest for DBR2. The effect on medium and large firms is clearly smaller although its size varies according to the definition of the debt mix. For the medium sized firms, all debt ratios decline in response to a monetary tightening, except DBR2 in which case a monetary tightening has no impact on the percentage of short term bank loans. The small difference between small and

[10] dbr1* = -.0439 - .0058 inter. Number of observations: 23,147
(.0011)
dbr2* = -.0589 - .00751 inter. Number of observations: 19,199
(.0013)

[11] Size1: Total Workers < 100
Size2: 100 ≤ Total Workers<500

medium firms arises from the positive and significant effect of the second component of the interaction term which captures the change in the size of the firms. The effect of monetary policy on the largest firms, on the other hand, is markedly different - not only does an increase in the intervention rate have a positive effect on the debt ratio of these firms, but also the effect of monetary policy on firms increasing in size is positive for both the total and short term debt mix variables. The same pattern is observed when trade debt is included in the debt ratio, although the increase in the ratio of bank to nonbank funds due to a monetary tightening is larger for these. In sum, the effect of monetary policy on the financing mix of firms is clearly different amongst small and large firms. This suggest that banks appear to prefer channeling their funds to their "best" clients when tightening of monetary policy leads to a decrease of loanable funds.

Given that the size variable may not be the best proxy for access to capital markets, the above analysis is repeated using different indicators of the availability to firms of alternative sources of funds. The different proxies used in Table 8 are partial foreign or financial intermediary ownership, registration in the stock exchange, dividend distribution, and use of commercial paper. As will be mentioned later, some of these, as well as size face possible endogeneity problems. A final estimation includes a distinction between public and non-public sector firms where the former are not expected to be affected by a monetary tightening. The impact of monetary tightening is reestimated taking into account the different characteristics individually and including the 1989-1991 dummy variables in all cases.

The main conclusion extracted from an overview of Table 8 is that although a monetary tightening continues to have a significantly negative impact on all debt ratios except DBR2, yet the differential impact across firms is not present for all indicators of capital access. In particular, firms with ties to financial

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Size3: Total Workers≥500

intermediaries (KFin) or firms with ties to foreign firms (KExt) do not respond differently to firms with none of these ties. As can be seen in the first panel of Table 8, only the short term bank ratio (DBR2) responds positively to an increase in the intervention rate when firms are partially owned by financial intermediaries. The short term debt ratio of firms without such ownership does not respond to a monetary tightening. The same pattern is observed for firms with foreign capital (Panel B) although the significance level of the coefficient on the interaction term is slighter lower. Panel C presents the results comparing firms quoted on the stock exchange to the rest. Monetary policy has a significantly negative effect on the debt ratios of firms not quoted on the stock exchange while the effect on firms with access to capital markets, as proxied by quotation on the stock exchange, is positive and significant. Those firms with the lowest information asymmetry problems obtain a higher percentage of bank loans during periods of monetary tightening. This result is consistent with the existence of a credit channel. Note also that these firms correspond almost entirely to the "large" firms in the previous table.[12]

The next two panels use as proxies for access to capital markets the use by firms of commercial paper (PAG) and the distribution of dividends (DIV). These two indicators are probably the most prone to endogeneity problems given that the availability of bank loans probably conditions the use of commercial paper and the distribution of dividends. In Panel D, the effect of monetary policy on the debt ratio of firms that do not use commercial paper is largely nonsignificant yet it is significantly positive when trade debt is included in the short term ratio (DBR4). These results are clearly different from all previous ones. Furthermore, it appears that the effect of high interest rates on firms that become commercial paper users is to reduce the debt ratios. In addition to possible endogeneity, a problem with this indicator is that commercial paper data is available only for a subsample of firms and years which precludes its inclusion in the debt ratios as a possible

[12] The average total personnel for firms quoted on the stock market is 2,157 while for those not

alternative to bank loans. Results in Panel E indicate that for firms which do not distribute dividends, a tightening of monetary policy has a significantly negative effect on the various debt ratios. In addition, high interest rates further reduce the percentage of bank loans for firms who change their dividend distribution status.

Finally, Panel F compares the effect of monetary policy on public and nonpublic firms. The second row coefficients show that, as expected, debt ratios of public firms are not affected by monetary tightening. However high interest rates lead to an increase in the proportion of bank loans for firms which become public, a result not surprising if public sector firms are considered to have less informational asymmetry problems. If this comparison is done by estimating the simple regression (4), without interaction terms, on two different subsamples, public and nonpublic, the monetary policy coefficient is negative for both subsamples yet it is significant only for the nonpublic firms for DBR1 and DBR4. For the short term debt ratio DBR2 monetary policy has no effect in either case. For DBR3 on the other hand the monetary policy coefficient is significantly negative for both types of firms.

The use of different proxies for the access to capital markets other than size, which has been much criticized, did not produce in this case any new and different conclusions. Size defined by the number of workers appears to be a good proxy for greater availability of funds for firms in the CBBE with the added benefit of being the proxy least prone to endogeneity problems.[13] Table 9 presents estimates of the effects of the different proxies on the debt ratios when all are taken into account simultaneously. The only significant dummy variables are those that indicate the use of commercial paper and dividend distribution. In both cases, the effect on the percentage of bank loans is negative and significant.

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quoted the average is 209.

[13] Theoretically, the number of employees is determined by the firm's production function and available technology. Thus, whether or not a firm obtains a bank loan is more likely to directly affect its need for foreign capital or flotation on the stock market than the number of employees. A firm's financial viability may also affect plant size but this effect is less direct.

5.1. Other Determinants of Financial Mix

When a matrix of additional explanatory variables X_{it} is included in the simple regression model (4) without interaction terms as an alternative way to control for specific firm determinants of the optimal debt mix, the negative effect on the debt ratios of an increase in the intervention rate continues to hold. As seen in the first column of Table 10, the monetary policy coefficient is significant and negative in a least squares estimate. The additional variables included are the percentage of fixed asset (INMAC) as a proxy for net worth, the percentage of liquid assets (LIQAS) as a proxy for debt alternatives and dummy variables for financial intermediary capital (DKFIN), foreign ownership (DKEXT) and quotation on the stock market (COTIZ). Of these additional variables only the first two are significant and have the expected sign. A firm with a higher net worth has less information asymmetry problems and thus can more easily obtain funds in capital markets. On the other hand a higher percentage of liquid assets represents a source of alternative funds since these assets can be easily converted to cash. The estimated coefficients however may be severely biased due to the presence of autocorrelated residuals. A possible solution is to instrument the two balance sheet variables, ΔINMAC and ΔLIQAS, in order to ensure independence of the residuals. In the second column, the results are shown for the IV estimates of the same equation using the levels of INMAC and LIQAS lagged two periods as instruments. Results are largely unchanged. The coefficient on the change of the intervention rate remains the same, while the coefficients on the balance sheet variables change only slightly. These results should be reassuring as to the correct interpretation of the interest rate coefficient.

6. Conclusions

Previous shortcomings of empirical work on the bank lending channel have been slowly overcome, yet the evidence continues to be inconclusive and skeptics still abound. The latest unresolved shortcoming refers to the interpretation of results based on firm data aggregates. Kashyap, Stein and Wilcox (1993) resolved the initial identification problem by estimating the impact of monetary policy on the ratio of bank to nonbank debt under the assumption that the traditional interest channel equally affects the demand for bank and nonbank loans. Oliner and Rudebusch (1995) raised the issue of possible misinterpretation of aggregate results due to firm heterogeneity. A reduction of the aggregate debt mix is consistent with either an operative lending channel or with a transfer of all funds away from small firms towards large firms, less dependent on bank loans. Their results support the latter interpretation. The criticism directed at Kashyap, Stein and Wilcox, however, can also be applied to the Oliner and Rudebusch evidence since by constructing aggregates for small and large firms the authors are not taking into account other types of firm heterogeneity and, moreover, they implicitly assume that the only difference between small and large firms is their access to capital markets.

This paper represents an attempt to improve the empirical analysis of the narrow credit channel by controlling for firm specific heterogeneity when estimating the effect of monetary policy on the debt mix using a panel of individual firms.

Using a data set of 12,909 Spanish firms provided by the Central Balance Sheet Office of the Bank of Spain, the estimates obtained are strongly supportive of the existence of a bank lending channel during the 1983-1996 period. Monetary contractions during the period reduced the supply of bank loans relative to nonbank loans as evidenced by the significantly negative effect of an increase in

the intervention rate on the financing mix of all firms. Furthermore, a differential impact of monetary policy is observed across firms according to their access to public capital markets, proxied by employee size. For small and medium sized firms, a monetary contraction leads to a decrease of the percentage of bank loans, yet for large firms the opposite occurs - large firms increase their relative bank financing in response to a tighter monetary policy. This suggests, as predicted by the informational asymmetry theory behind the credit channel, that banks appear to prefer channeling their funds to their "best" clients when tightening of monetary policy leads to a decrease of loanable funds.

The use of different proxies for the access to capital markets besides size, much used and widely criticized in the literature, did not produce any new and different conclusions. Size defined by the number of workers appeared to be a good proxy for greater availability of funds for firms in the CBBE with the added benefit of being the proxy least prone to endogeneity problems.

Table 1 Structure of the Panel

Year	Number of Firms
1983	2199
1984	3147
1985	3843
1986	4743
1987	5508
1988	5559
1989	5412
1990	5178
1991	5147
1992	5310
1993	5469
1994	5776
1995	5709
1996	4216

Balance of the Panel

No. of Time Series Observ.	No. of Firms	No. Observ.	%
2	3392	6784	10.09
3	2309	6927	10.31
4	1569	6276	9.34
5	1180	5900	8.78
6	952	5712	8.50
7	626	4382	6.52
8	526	4208	6.26
9	435	3915	5.82
10	461	4610	6.86
11	368	4048	6.02
12	266	3192	4.75
13	288	3744	5.57
14	537	7518	11.18
Total	12909	67216	100.00

Table 2 Sectoral Composition

Sector	Description	No. Observ.	Percentage
1	Fuel Mineral Extraction	310	0.46
2	Other Mineral Extraction	362	0.54
3	Food, Beverages and Tobacco	6335	9.42
4	Petroleum	108	0.16
5	Chemical Industry	3957	5.89
6	Other Mineral Industries	2563	3.81
7	Fabricated Metals	2520	3.75
8	Nonelectric Machinery	2795	4.16
9	Electric Machinery and Electr.	2237	3.33
10	Automobiles	1749	2.60
11	Apparel and Textile	3468	5.16
12	Leather and Footwear	950	1.41
13	Lumber	940	1.40
14	Paper and Printing	2491	3.71
15	Rubber and Plastics	1607	2.39
16	Other Manufacturing	1684	2.51
17	Electricity Prod. and Distrib.	772	1.15
18	Water Production and Distrib.	526	0.78
19	Construction	3750	5.58
20	Trade	15583	23.18
21	Transport and Communications	3262	4.85
22	Agriculture	990	1.47
23	Fishery	318	0.47
24	Hotel and Catering	1525	2.27
25	Real Estate	5353	7.96
26	Other Services	1061	1.58
Total		67216	100.00

Table 3 Composition of Total Debt - Average 1983 - 1996

Millions of 1986 Pesetas	Total	Personnel Size 1/			Real Sale Quartiles			
		Small	Medium	Large	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Total Debt	2074.98	265.15	1339.79	22063.96	232.43	222.47	444.54	7400.06
Accounts Payable	523.12	97.94	497.44	4778.32	16.33	55.75	147.11	1873.16
Total Bank Debt 2/	1297.59	180.84	883.09	13514.57	101.66	135.88	323.46	4629.12
Short Term	428.79	96.76	458.1	3603.89	32.97	59.26	156.69	1466.18
Long Term	868.8	84.08	424.99	9910.68	68.69	76.62	166.77	3162.94
Bonds	452.64	17.2	161.11	5605.59	40.22	32.65	45.57	1692.03
Short Term	97.23	3.75	24.74	1233.1	8.26	8.94	3.87	367.82
Long Term	355.41	13.45	136.37	4372.49	31.96	23.71	41.7	1324.21
Other Debt	324.74	67.10	295.58	2943.79	90.53	53.93	75.51	1078.92
Short Term	112.61	27.08	129.45	902.50	47.19	28.49	31.84	342.89
Long Term	212.13	40.02	166.13	2041.29	43.34	25.44	43.67	736.03
Total Short Term Debt	638.63	127.59	612.29	5739.49	88.42	96.69	192.40	2176.89
Total Long Term Debt	1436.34	137.55	727.49	16324.46	143.99	125.77	252.14	5223.18
Debt Ratios 3/								
Short Term								
DBR2	0.889	0.902	0.882	0.802	0.868	0.916	0.915	0.859
DBR4	0.405	0.401	0.284	0.391	0.417	0.403	0.412	0.387
Long Term								
DBR1	0.800	0.811	0.792	0.715	0.767	0.826	0.829	0.779
DBR3	0.463	0.464	0.462	0.454	0.500	0.462	0.455	0.433
Number of Observations	67216	47779	14575	4862	16802	16806	16803	16805

1/ Small: Total Workers < 100; Medium: 100 ≤ Total Workers < 500; Large: Total Workers ≥ 500.

2/ Bank Debt includes loans from both banks and S&Ls.

3/ DBR1= Total Bank Debt/ Total Debt

DBR2= Total Short Term Bank Debt/ Total Short Term Debt

DBR3= Total Bank Debt/ Total Debt + Trade Debt

DBR4= Total Short Term Bank Debt / Total Short Term Debt + Trade Debt

Table 4 Sectoral Debt Ratios 1983 - 1996

Sector		DBR1	DBR2	DBR3	DBR4
1	Fuel Mineral Extraction	0.7168	0.8238	0.5555	0.4679
2	Other Mineral Extraction	0.7777	0.8497	0.5263	0.4619
Extraction Industries		**0.7473**	**0.8368**	**0.5409**	**0.4649**
3	Food, Beverages and Tobacco	0.8127	0.8967	0.4730	0.4009
4	Petroleum	0.5488	0.6571	0.3263	0.2549
5	Chemical Industry	0.7858	0.8838	0.4011	0.3671
6	Other Mineral Industries	0.8230	0.9168	0.4968	0.4547
7	Fabricated Metals	0.8436	0.9287	0.4846	0.4326
8	Nonelectric Machinery	0.8583	0.9455	0.4430	0.4082
9	Electric Machinery and Electr.	0.8323	0.9133	0.4533	0.4237
10	Automobiles	0.8167	0.8967	0.4309	0.3905
11	Apparel and Textile	0.8892	0.9465	0.5263	0.4926
12	Leather and Footwear	0.8942	0.9402	0.4694	0.4427
13	Lumber	0.8756	0.9385	0.5065	0.4382
14	Paper and Printing	0.8319	0.9238	0.4654	0.4027
15	Rubber and Plastics	0.8467	0.9294	0.4916	0.4534
16	Other Manufacturing	0.8598	0.9269	0.4842	0.4344
Manuf. Industries Excluding Petroleum		**0.8438**	**0.9221**	**0.4712**	**0.4263**
17	Electricity Prod. and Distrib.	0.5251	0.6019	0.4223	0.2563
18	Water Production and Distrib.	0.6176	0.8449	0.4642	0.2963
19	Construction	0.8277	0.8903	0.4429	0.3721
20	Trade	0.8261	0.9025	0.3815	0.3336
21	Transport and Communications	0.7058	0.8205	0.5745	0.5078
22	Agriculture	0.8041	0.8859	0.5623	0.4607
23	Fishery	0.7841	0.8668	0.6140	0.4256
Agriculture and Fishery		**0.7941**	**0.8764**	**0.5881**	**0.4432**
24	Hotel and Catering	0.7237	0.7758	0.5599	0.3630
25	Real Estate	0.6508	0.7777	0.5305	0.5011
26	Other Services	0.7059	0.8084	0.5616	0.4960
Services		0.6935	0.7873	0.5507	0.4534

Table 5 Debt Ratios - Yearly Average

Year	No. ofObs.	DBR1	DBR2	DBR3	DBR4
1983	2199	0.7872	0.9474	0.4654	0.4020
1984	3147	0.8296	0.9561	0.5013	0.4680
1985	3843	0.8343	0.9564	0.4899	0.4501
1986	4743	0.8384	0.9546	0.4798	0.4361
1987	5508	0.8273	0.9448	0.4648	0.4216
1988	5559	0.8276	0.9333	0.4553	0.4021
1989	5412	0.8232	0.9283	0.4569	0.3984
1990	5178	0.8181	0.9107	0.4607	0.4028
1991	5147	0.7487	0.7852	0.4426	0.3859
1992	5310	0.7651	0.8420	0.4607	0.4079
1993	5469	0.7744	0.8447	0.4612	0.3997
1994	5776	0.7874	0.8532	0.4579	0.3815
1995	5709	0.7830	0.8505	0.4573	0.3773
1996	4216	0.7673	0.8398	0.4445	0.3667

Table 6 Effect of Monetary Policy on Debt Mix

(standard errors in parenthesis)

	DBR1	DBR2	DBR3	DBR4
Intervention Rate	-0.0030 **	-0.0002	-0.0020 **	-0.0020 **
	(0.0005)	(0.0005)	(0.0004)	(0.0005)
D89	0.0074 *	-0.0064	0.0133 **	0.0135 **
	(0.0040)	(0.0040)	(0.0030)	(0.0040)
D90	0.0040	-0.0095 **	0.0112 **	0.0135 **
	(0.0038)	(0.0037)	(0.0030)	(0.0036)
D91	-0.0510 **	-0.0860 **	-0.0016	-0.0025
	(0.0030)	(0.0036)	(0.0030)	(0.0036)
Adj. R^2	0.0040	0.0120	0.0006	0.0005
RMSE	0.2404	0.2065	0.2068	0.2235
No. of Observations	54307	0.45388	54307	52150

All regressions were estimated using ordinary least squares on first differences for the period 1984-1996. D89-D91 are dummy variables for the years 1989-1991.

** 5% significance level; * 10% significance level.

Table 7 Differential Effect of Monetary Policy on Debt Mix According to Size
(standard errors in parenthesis)

	DBR1	DBR2	DBR3	DBR4
Intervention Rate	-0.0036 **	-0.0011 *	-0.0023 **	-0.0022 **
	(0.0006)	(0.0006)	(0.0005)	(0.0006)
Size2*ΔIntervention Rate	0.0004	0.0011	0.0003	-0.0005
	(0.0010)	(0.0009)	(0.0008)	(0.0009)
Intervention Rate*ΔSize2	0.0012 **	0.0010 **	0.0014 **	0.0017 **
	(0.0005)	(0.0049)	(0.0005)	(0.0005)
Size3*ΔIntervention Rate	0.0047 **	0.0054 **	0.0001	0.0036 **
	(0.0014)	(0.0013)	(0.0012)	(0.0013)
Intervention Rate*ΔSize3	0.0012	0.0021 **	0.0024 **	0.0025 **
	(0.0098)	(0.0009)	(0.0009)	(0.0005)
D89	0.0077 *	-0.0059	0.0134 **	0.0136 **
	(0.0042)	(0.0041)	(0.0036)	(0.0040)
D90	0.0043	-0.0095 **	0.0112 **	0.0135 **
	(0.0038)	(0.0037)	(0.0033)	(0.0036)
D91	-0.0514 **	-0.0862 **	-0.0015	-0.0025
	(0.0039)	(0.0037)	(0.0033)	(0.0037)
Adj. R^2	0.0044	0.0125	0.0008	0.0009
RMSE	0.2404	0.2065	0.2067	0.2235
No. of Observations	54307	45388	54307	52150

All regressions were estimated using ordinary least squares on first differences for the penod 1984-1996. Size2: 100 ≤ Total Workers < 500; Size3: Total Workers ≥ 500; D89-D91 are dummy variables for the years 1989-1991. ** 5% significance level; * 10% significance level.

Table 8 Differential Effect of Monetary Policy on Debt Mix According to Firm Characteristics

(standard errors in parenthesis)

	DBR1	DBR2	DBR3	DBR4
Panel A				
ΔIntervention Rate	-0.0031 **	-0.0004	-0.0021 **	-0.0021 **
	(0.0005)	(0.0005)	(0.0004)	(0.0005)
ΔIntervention Rate*Kfin	0.0027	0.0042 **	0.0010	0.0018
	(0.0020)	(0.0019)	(0.0017)	(0.0019)
ΔKFin*Intervention Rate	0.0012	0.0010	0.0008	0.0014 *
	(0.0009)	(0.0008)	(0.0008)	(0.0008)
No. of observations	54307	45388	54307	52150
Panel B				
ΔIntervention Rate	-0.0032 **	-0.0006	-0.0023 **	-0.0022 **
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
ΔIntervention Rate*Kext	0.0011	0.0019 *	0.0015	0.0012
	(0.0010)	(0.0010)	(0.0009)	(0.0010)
ΔKExt*Intervention Rate	-0.0003	0.0004	-0.0008 *	-0.0004
	(0.0006)	(0.0005)	(0.0005)	(0.0005)
No. of observations	54307	45388	54307	52150
Panel C				
ΔIntervention Rate	-0.0031 **	-0.0004	-0.0022 **	-0.0022 **
	(0.0005)	(0.0005)	(0.0004)	(0.0005)
ΔIntervention Rate*Cotiz	0.0076 **	0.0101 **	0.0071 **	0.0115
	(0.0030)	(0.0027)	(0.0026)	(0.0028)
ΔCotiz*Intervention Rate	-0.0009	-0.0009	-0.0097 *	-0.0018
	(0.0012)	(0.0011)	(0.0010)	(0.0011)
No. of observations	54307	45388	54307	52150
Panel D				
ΔIntervention Rate	-0.0013 *	0.0001	-0.0003	0.0013 **
	(0.0068)	(0.0006)	(0.0006)	(0.0007)
ΔIntervention Rate*Pag	0.0080	0.0037	0.0056	0.0088 *
	(0.0052)	(0.0045)	(0.0045)	(0.0049)
ΔPag*Intervention Rate	-0.0081 **	-0.0133 **	-0.0036 **	-0.0044 **
	(0.0009)	(0.0008)	(0.0008)	(0.0009)
No. of observations	34763	29191	34763	33406
Panel E				
ΔIntervention Rate	-0.0030 **	-0.0005	-0.0018 **	-0.0016 **
	(0.0006)	(0.0005)	(0.0005)	(0.0005)
ΔIntervention Rate*Div	0.0000	0.0008	-0.0010	-0.0014 *
	(0.0009)	(0.0009)	(0.0008)	(0.0009)
ΔDiv*Intervention Rate	-0.0054 **	-0.0004 *	-0.0015 **	-0 0014 **
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
No. of observations	54307	45388	54307	52150
Panel F				
ΔIntervention Rate	-0.0030 **	-0.0004	-0.0019 **	-0.0021 **
	(0.0005)	(0.0005)	(0.0004)	(0.0005)
ΔIntervention Rate*Publ	-0.0005	0.0027	-0.0017	0.0010
	(0.0017)	(0.0017)	(0.0014)	(0.0017)
ΔPubl*Intervention Rate	0.0028 **	0.0057	0.0027 **	0.0031 **
	(0.0012)	(0 0012)	(0.0011)	(0.0012)
No. of observations	54307	45388	54307	52150

All regressions were estimated using ordinary least squares on first differences, including dummy variables for the years 1989,1990 and 1991. All panels were estimated for the period 1984-1996 except panel D (data on commercial paper use is only available starting in 1991 for firms which complete the extended questionnaire, i.e. larger firms).

KFin, KExt, Cotiz, Pag, Div, Publ: dummy variables for financial intermediary capital, foreign ownership, quotation on the stock market, use of commercial paper, distribution of dividends and public ownership. ** 5% significance level; * 10% significance level.

Table 9 Access to Capital Markets and Debt Ratios
(standard errors in parenthesis)

	DBR1	DBR2	DBR3	DBR4
Δ DKFin	0.0158	0.0107	0.0165	0.0214
	(0.0132)	(0.0121)	(0.0115)	(0.0127)
Δ DKExt	0.0053	0.0124	-0.0069	0.0025
	(0.0084)	(0.0076)	(0.0073)	(0.0081)
Δ DCotiz	0.0060	0.0102	-0.0131	-0.0055
	(0.0152)	(0.0140)	(0.0132)	(0.0147)
Δ DKPubl	0.0313	0.0336 *	0.0273	0.0439 **
	(0.0209)	(0.0188)	(0.0183)	(0.0202)
Δ DPag	-0.1138 **	-0.1848 **	-0.0476 **	-0.0608 **
	(0.0125)	(0.0111)	(0.0109)	(0.0119)
Δ DDiv	-0.0069 *	-0.0008	-0.0241 **	-0.0221 **
	(0.0036)	(0.0033)	(0.0031)	(0.0034)
Adj. R^2	0.0026	0.0096	0.0024	0.0022
RMSE	0.2395	0.2063	0.2089	0.2261
No. of Observations	34763	29191	34763	33406

All regressions were estimated using ordinary least squares on first differences for the penod 1992-1996 (data on use of commercial paper is only available starting in 1991 for firms that answer the complete questionnaire, i.e. larger firms).
DKFin, DKExt, DCotiz, DPag, DDiv, DPubl: dummy variables for capital of financial intermediaries, foreign ownership, quotation on the stock market, use of commercial paper, distribution of dividends and public ownership.
** 5% significance level; * 10% significance level.

Table 10 Monetary Policy and Other Determinants of the Debt Mix

Dependent Variable : Δ DBR1

(standard errors in parenthesis)

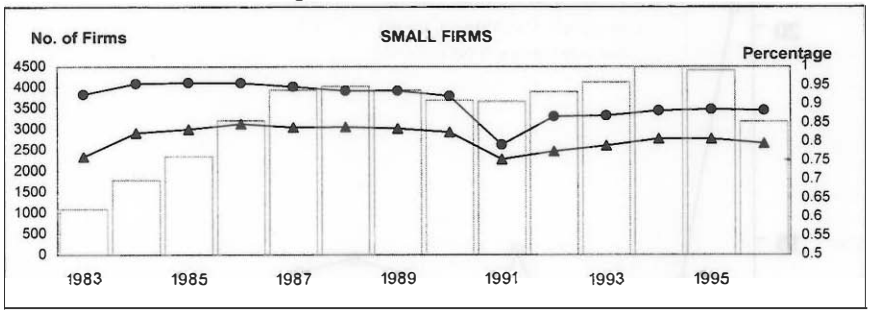
	OLS	IV
ΔIntervention Rate	-0.0014 **	-0.0013 **
	(0.0006)	(0.0007)
D89	0.0079 *	0.0054
	(0.0046)	(0.0051)
D90	0.0058	0.0048
	(0.0040)	(0.0042)
D91	-0.0489 **	-0.0493 **
	(0.0040)	(0.0045)
Δ inmac	-0.1619 **	-0.2061 *
	(0.0014)	(0.1065)
Δ liqas	-0.0967 **	-0.1947 **
	(0.0075)	(0.0527)
Δ DKfin	0.0126	-0.0083
	(0.0127)	(0.0164)
Δ DKExt	-0.0058	0.0059
	(0.0078)	(0.0085)
Δ DCotiz	-0.0050	-0.0043
	(0.0140)	(0.0145)
Adj. R^2	0.010	
RMSE	0.2308	0.2384
No. of Observations	41397	41397

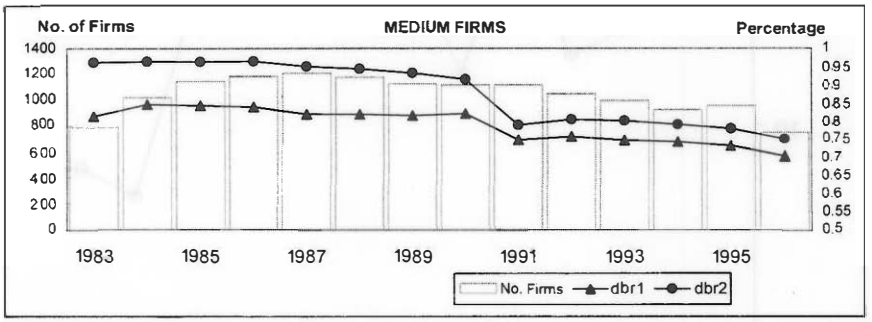
All regressions were estimated using either ordinary least squares or IV on first differences for the period 1985-1996. D89-D91 are dummy variables for the years 1989-1991.

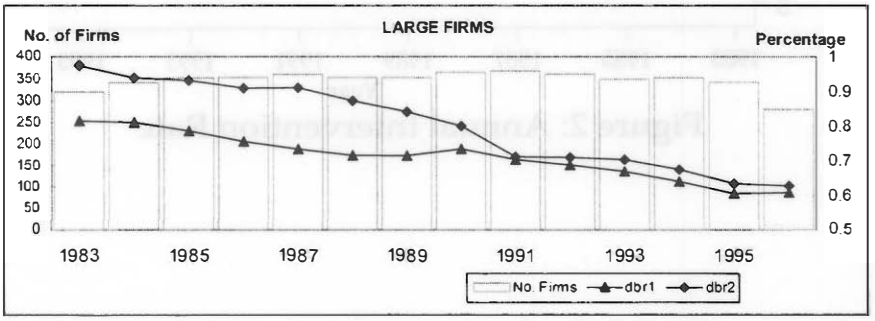
Instruments used in the IV estimates: real sales and percentage of fixed assets and liquid assets, all lagged two periods. ** 5% significance level; * 10% significance level.

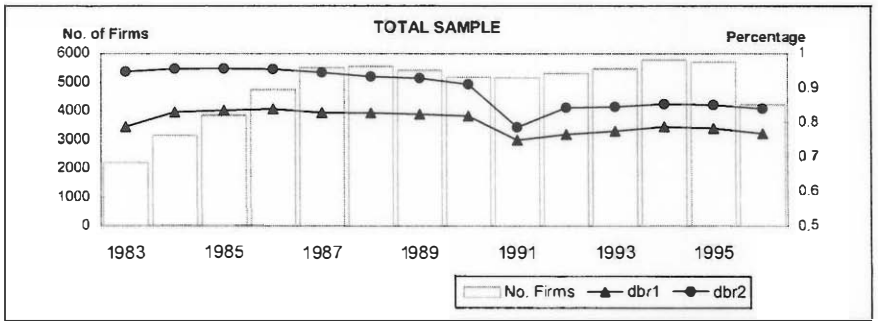
Δ inmac, Δ liqas, ΔDKfin, ΔDKExt, ΔDCotiz: first difference of percentage of fixed assets, percentage of liquid assets, and dummy variables for financial intermediary capital, foreign ownership and quotation of the stock market.

Figure 1 Annual Mean Debt Ratios









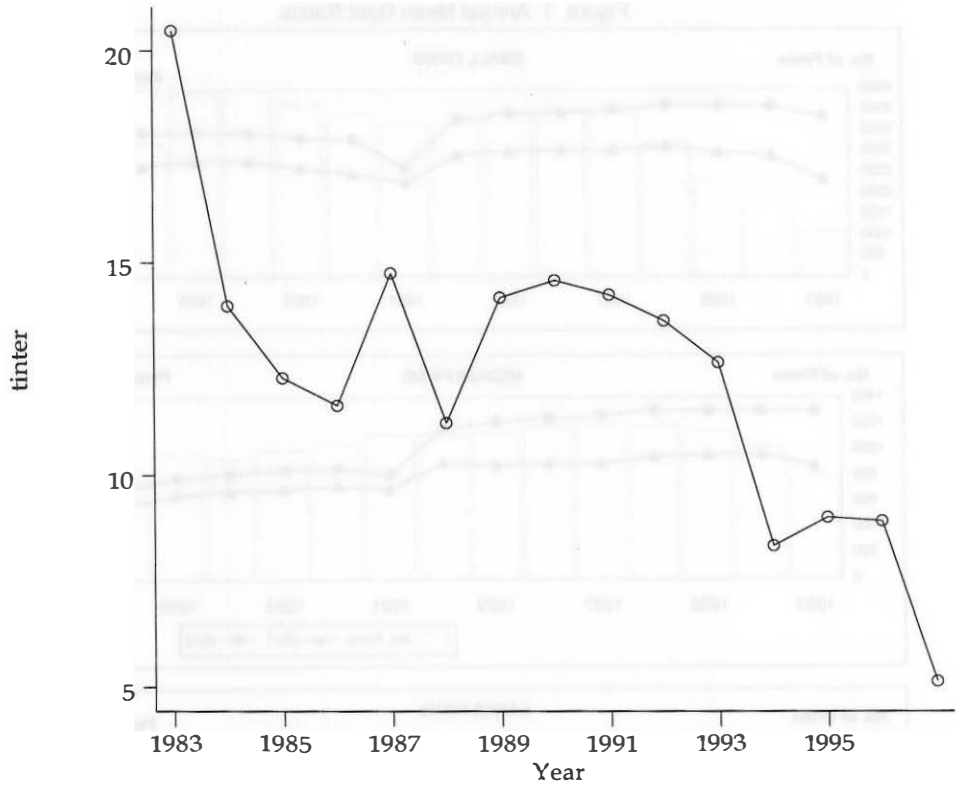


Figure 2: Annual Intervention Rate

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