

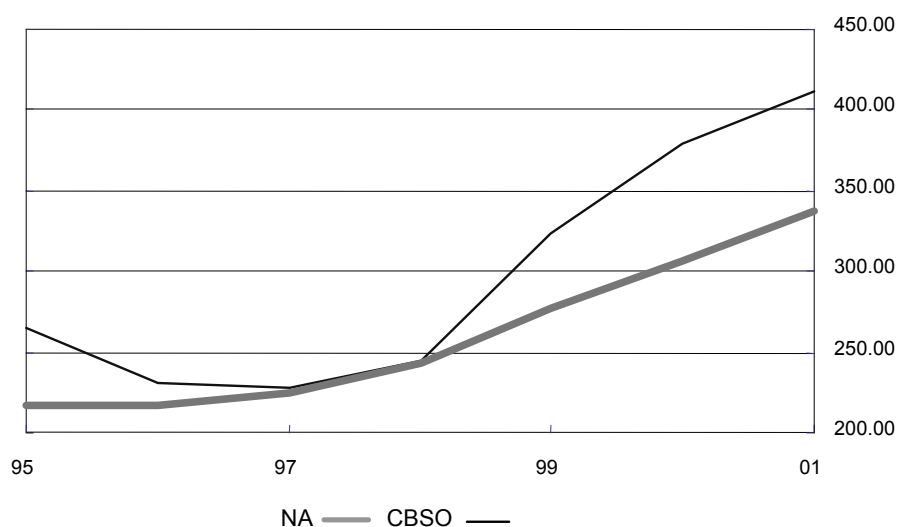
# The impact of financial variables on firms' real decisions: evidence from Spanish firm-level data

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## 1. Introduction

The financial position of the corporate sector may influence the performance of the real economy and the stability of the financial system through its contribution to aggregate demand and its links to the banking system and capital markets. This paper analyses some measures of firms' financial health and assesses their impact on some real decisions of firms, bearing in mind that basing the assessment of the financial position of companies on an analysis of aggregate sectoral indices may, while being informative, occasionally cover up some vulnerabilities that only a study at a greater level of detail can reveal. In this sense, the implications for the financial strength of the Spanish corporate sector of the increasing debt ratios observed at an aggregate level (Graph 1) may differ depending on the distribution of indebtedness across firms. Therefore, in this paper the emphasis is placed on the analysis of disaggregated data on such financial indicators. For this purpose, itemised data from a sample of the non-financial firms reporting to the Bank of Spain Central Balance Sheet Data Office Annual Database for the period 1985-2001 are used.

Graph 1  
Debt over gross revenue



Note: NA: National Accounts; CBSO: Central Balance Sheet Data Office.

Adjustment by companies to changes in the financial pressure they face (for instance, as a result of a monetary policy shift) can potentially involve a wide range of activities, with the most prominent

<sup>1</sup> This paper represents a follow-up of previous joint work with Andrew Benito, to whom we are very grateful. We also thank Juan Ayuso, Roberto Blanco, Jorge Martínez-Pagés, Fernando Restoy, Javier Vallés and participants in the BIS meeting and in the seminar held at the Bank of Spain for helpful comments, and the Central Balance Sheet Data Office of the Bank of Spain for providing the data. The views expressed are those of the authors and should not be attributed to the Bank of Spain.

relating to their investment decisions, human resources policies and financial policies. Benito and Hernando (2002) examine, making use of microeconomic methods (panel techniques), the sensitivity of a number of aspects of corporate behaviour (namely, investment in physical capital, employment, inventories and dividend policies) to changes in financial pressure. In this paper, using a similar methodological framework, we conduct a more in-depth study of the response of fixed investment and employment to a relatively broad set of indicators that are usually considered to characterise the financial position of firms. Among these, we include variables providing information on corporate profitability, financial burden and indebtedness (or leverage).

Additionally, we evaluate whether the impact of the financial position on business decisions is non-linear. In particular, our conjecture is that this relationship becomes relatively more intense when financial pressure exceeds a certain threshold. Furthermore, we analyse whether the relevant threshold differs depending on the real decision considered.

Finally, in the light of the estimated impacts of the different financial variables on firms' real decisions, we construct a composite indicator of financial pressure as a weighted average of these variables. Again, we investigate to what extent the weights attached to the different financial proxies differ for employment and for fixed investment.

The remainder of the paper is organised as follows. Section 2 provides a preliminary look at the descriptive information of the cross-sectional distribution of financial variables offering an overall assessment of financial pressure experienced by the Spanish corporate sector over the 1985-2001 period. Section 3 describes the baseline specifications for fixed investment and employment, summarises the estimation method and presents the basic estimation results. Section 4 analyses whether the impact of the financial position on corporate decisions becomes relatively more intense when financial tightness exceeds a certain threshold, whilst Section 5 constructs composite indicators of financial pressure, in the light of the estimated impacts of the different financial variables on firms' real decisions. Section 6 concludes.

## **2. The financial position of the Spanish corporate sector: a preliminary look at firm-level data**

The financial performance and financing decisions of firms as well as their responses to financial pressure are important to both a country's macroeconomic conditions and the stability of its financial system. Thus, for instance, excessive indebtedness may adversely affect investment spending or, in the face of an unexpected shock, prompt sharp portfolio switching. However, from the standpoint of identifying the risks to macroeconomic and financial stability, it should be borne in mind that the fragility of certain firms need not be offset by the soundness of others. Accordingly, the use of aggregate indicators to assess the financial position of the corporate sector and its impact on real activity may be inadequate and thus a study at a greater level of detail may be required. Indeed, the behaviour of the companies that are most exposed financially is, for these purposes, as relevant (if not more so) as the average behaviour of the sector. Against this background, the purpose of this section is twofold. First, we attempt to provide an overall picture of the financial position of Spanish non-financial companies and its evolution over the period considered. Second, we try to assess to what extent the real behaviour - more precisely, the demand for factors of production - of the more financially vulnerable firms differs from that of firms with an average financial position.

The data employed are derived from an annual survey of non-financial firms conducted by the Central Balance Sheet Data Office of the Bank of Spain (Bank of Spain (2002)). This is a large-scale survey used extensively by the Bank in forming its assessment of the Spanish corporate sector. In terms of gross value added, the survey respondents jointly represent around 35% of the total gross value added of the non-financial corporate sector in Spain, and the pattern of evolution of the aggregate values for the main variables used here (employment, investment) is quite similar to that observed in the whole economy. This paper employs data for the period 1985-2001, for which the coverage of the survey has been relatively stable. Data are only used when there are at least five consecutive time-series observations per company. This produces an unbalanced sample of 7,547 non-financial companies and 70,625 observations with between five and 17 annual observations per company (see Data appendix).

Table 1 presents median values for the different variables used in our analysis for subsample periods.<sup>2</sup> The most important aggregate variation observed in (pro)cyclical variables such as fixed investment and cash flow reflects the recession in Spain, the trough of which was experienced in 1993. Also clear from Table 1 is the declining debt service burden apparent in the late 1990s. A median value for the interest debt burden term *idb*, of 0.216 and 0.214 for 1989-92 and 1993-96, respectively, compares to a figure of 0.100 for 1997-2001. This reduction primarily reflects reductions in nominal interest rates and the entry of Spain into the European monetary union.<sup>3</sup>

Table 1  
Sample medians

		1985-88	1989-92	1993-96	1997-2001	1985-2001
<i>I/K</i>	Investment rate	0.118	0.103	0.076	0.111	0.100
<i>N</i>	Employment	65	47	35	37	43
<i>Y</i>	Real sales (1995 prices)	7,580.6	5,525.9	4,213.9	4,357.3	5,088.8
$\Delta y$	Sales growth	0.038	-0.007	0.013	0.041	0.021
$\Delta w$	Wage growth	0.012	0.022	0.004	0.005	0.010
<i>B/A</i>	Debt	0.301	0.247	0.269	0.249	0.263
$(B - m)/A$	Net indebtedness	0.207	0.164	0.173	0.140	0.168
<i>B/GR</i>	Debt over gross revenue	1.500	1.424	1.645	1.489	1.514
<i>idb</i>	Interest debt burden	0.188	0.216	0.214	0.100	0.167
<i>tdb</i>	Total debt burden	1.052	1.037	1.013	0.714	0.944
<i>GR/A</i>	Gross revenue	0.216	0.188	0.162	0.168	0.179
<i>CF/A</i>	Cash flow	0.130	0.105	0.095	0.115	0.110
<i>pd</i>	Probability of default	0.007	0.009	0.012	0.007	0.009
Observations		12,444	18,294	19,448	20,439	70,625

Note: See Data appendix for definitions.

This section presents, in primarily graphical form, preliminary data analysis of the sample of Spanish non-financial firms. This analysis first illustrates variation in the cross-sectional distributions of financial and real variables and how these distributions have varied over time. Then, a comparison is made of the behaviour of investment and labour demand for various sets of firms defined in terms of their financial position, using alternative indicators to proxy the degree of financial tightness of the companies.

First, we consider a narrow definition of the debt service burden that is defined as the ratio of interest payments on debt to the company's gross revenue (interest debt burden). The cross-sectional distribution of this variable and how it varies over time is shown in Graph 2.1. Different percentiles (ie the 25th, 50th, 75th and 90th) in the cross-sectional distribution in each year are displayed. The experience of the median company (the 50th percentile) is indicative of the typical Spanish company in each year, whilst the higher percentiles indicate the experience of those companies facing more intense financial pressure. Consider the median company (the 50th percentile) first. Its interest

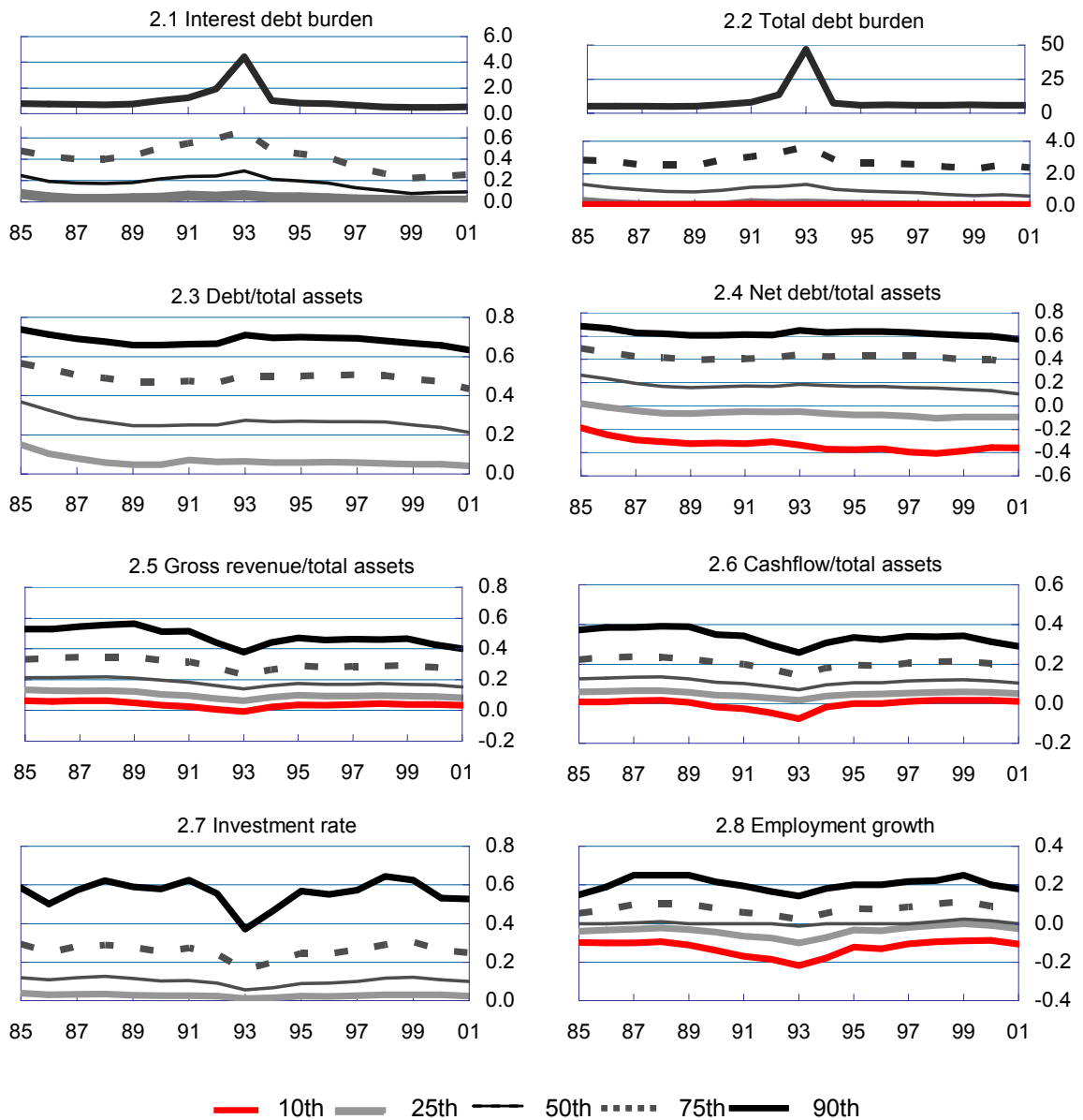
<sup>2</sup> See Data appendix for more precise definitions of the variables used in the paper.

<sup>3</sup> Nominal short-term interest rates in Spain were in the range of 12-16% (annual averages) in the period from 1985 to 1990, from which point they were reduced steadily to reach 4% by 2000, with Spain being one of the economies adopting the euro on 1 January 1999.

payments relative to gross operating profit fell during the mid-1980s but then began to increase at the end of the 1980s before again declining as growth resumed following the recession of the early 1990s. Variation in this ratio reflects a combination of variation in interest rates, company profitability and indebtedness. The variable peaked in 1993, from which point it has declined steadily. An important finding from Graph 2.1 is that as interest rates have fallen from the mid-1990s, the implied reduction in financial pressure has been felt throughout the cross-sectional distribution of firms in Spain and, indeed, is strongest for the more financially vulnerable. At the 75th percentile of the distribution, the interest debt burden fell from 0.66 in 1993 to 0.25 in 2001. This is a positive development for financial stability associated with the corporate sector in Spain. It also contrasts with the experience during the recession, at its deepest in 1993, when the financial pressure on the most vulnerable companies increased relative to the more typical companies suggesting that aggregate data on debt burdens at the time understated the vulnerability of the most fragile companies and hence of the system as a whole.

Graph 2

**Percentiles of distributions of financial variables**



A very similar pattern emerges when considering a broader measure of the debt service burden as a proportion of gross revenue that includes not only interest payments but also the stock of short-term debt. As can be seen from Graph 2.2, where the cross-sectional distribution of the total debt burden is displayed, the highest variation in this ratio is experienced by the most vulnerable companies, ie those in the upper decile of this distribution.

The cross-sectional distribution of corporate indebtedness, defined as the ratio of total outstanding debt to total assets, is illustrated in Graph 2.3. Similarly, Graph 2.4 depicts the cross-sectional distribution of net indebtedness. Both graphs show a remarkable stability in the cross-sectional distribution of indebtedness of firms. It should be noted that stability in the company-level cross-sectional distribution can be consistent with aggregate movements in a variable and in variation for individual companies. For instance, the aggregate data corresponding to those in Graph 2.4 indicate an increase in indebtedness from 32.4% in 1997 to 38.6% by 2001. This is explained by large firms increasing their debt levels. The stability of the cross-sectional distribution of indebtedness among Spanish firms also contrasts with findings for UK quoted firms, where a marked increase in dispersion in recent years has been found (Benito and Vlieghe (2000)).

Graphs 2.5 and 2.6 illustrate two measures of profitability: gross revenue and cash flow, in both cases divided by total assets. Two key observations arise from these graphs. First, profitability is clearly procyclical as we would expect. At the median, gross revenue (cash flow) over total assets declined from 21.9% (13.5%) in 1988 to 13.9% (7.1%) in 1993, from which point it has since recovered steadily, reaching 15.2% (10.3%) in 2001. Second, the experience of the median firm understates variation at the upper tail of the cross-sectional distribution, and in the case of the cash flow measure also at the lower tail. For financial stability issues it is the lower tail that is more relevant and here (ie at the 10th percentile) cash flow over total assets fell from 1.7% in 1988 to -7.5% in 1993.

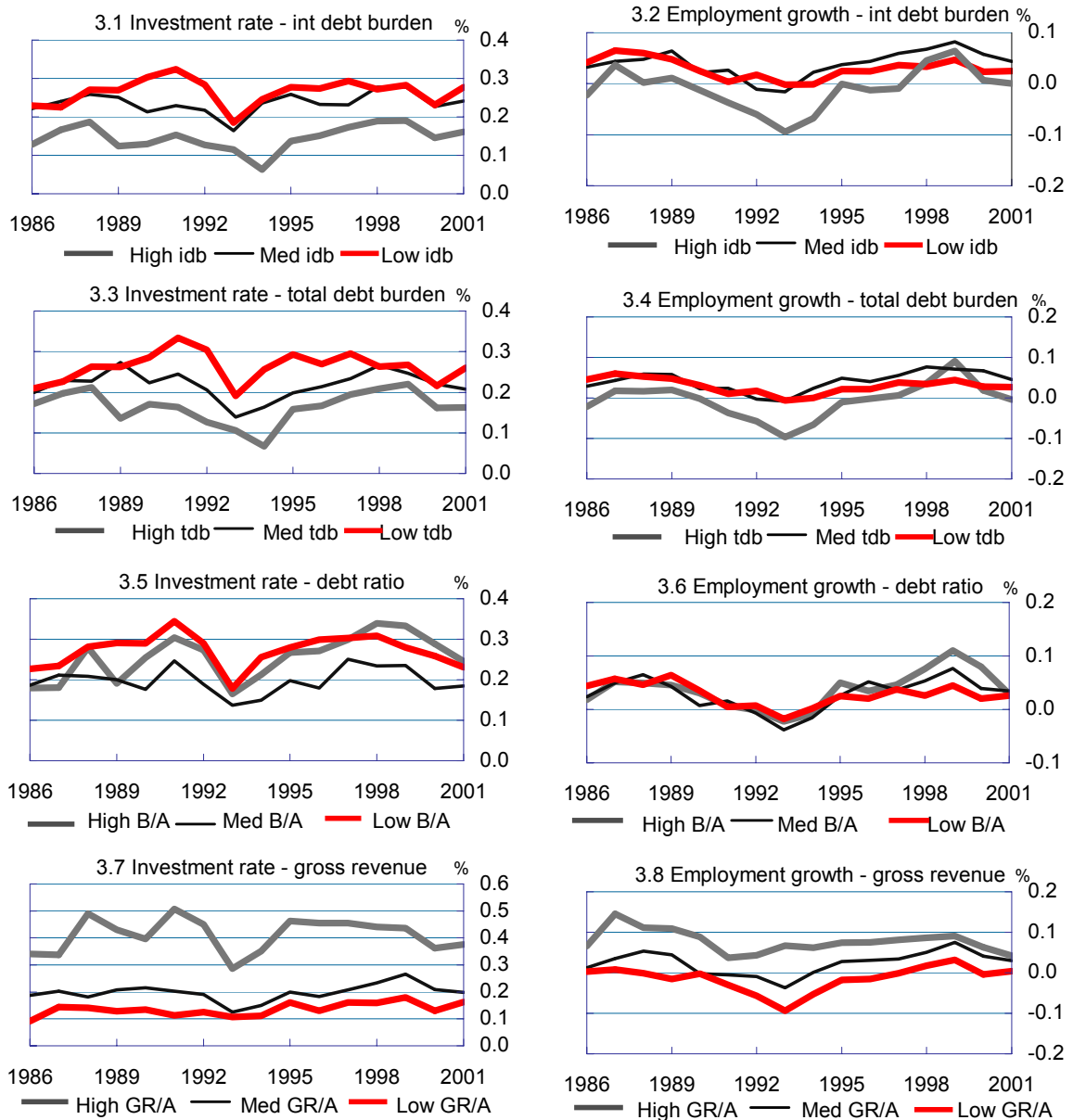
The cross-sectional distributions of fixed investment and employment growth are also considered, in Graphs 2.7 and 2.8, respectively. Investment is procyclical as expected. In particular, it declines in the recession of 1993 and especially so at the top of the cross-sectional distribution, namely at the 90th percentile. Employment growth at the median firm varies relatively little during the sample period, but becomes negative for the only time during the period in 1993. This disguises more significant variation at both the upper and lower tails of the distribution, which show even stronger declines in the recession of 1993 coinciding with increases in the financial pressure of borrowing costs, as shown above.

This descriptive analysis has shown that there is substantial cross-sectional variation in the distribution of Spanish firms for each of the variables examined. To the extent that real behaviour differs across companies facing different degrees of financial pressure, the assessment of the financial position of the corporate sector should ideally adopt a disaggregated perspective. To emphasise the relevance of this issue, in what follows we illustrate how investment in physical capital and labour demand differ across companies with different financial positions. For this purpose, Graph 3 compares the average level of both real variables in different corporate groupings defined on the basis of their financial position, proxied by alternative indicators. Each panel of the graph presents the average value of a real variable (the investment rate or the growth rate of employment) for the firms belonging to three different deciles of the distribution defined in terms of a financial indicator (the interest debt burden, the total debt burden, the debt ratio or gross revenue over total assets). The median decile (that including the firms between percentiles 45 and 55) can be regarded as representative of the behaviour of a firm in an average financial position. Analogously, the top (bottom) decile includes the 10% of firms with the highest (lowest) value of the corresponding financial indicator.

First, Graphs 3.1 and 3.2 compare the behaviour of firms facing different degrees of financial pressure, this being proxied by means of a measure of the relative burden of debt (or, in other words, of the firms' capacity to meet interest payments), ie our interest debt burden (*idb*) variable, which is defined as the ratio of interest payments to gross revenue. This variable, being the net result of changes in interest rates, in corporate profitability and in corporate debt, is a relevant indicator of the financial pressure firms may be facing. In Graphs 3.1 and 3.2, no marked differences in demand for factors of production are observed between the firms with lowest financial pressure and those with average financial pressure. However, firms with a higher financial burden in relation to their capacity to generate funds from operations have substantially lower investment and employment growth rates. Moreover, in the case of employment, this difference seems more marked in recessionary phases.

Graph 3

**Financial position and level of activity**



According to Graphs 3.3 and 3.4, similar conclusions can be drawn when the comparison is established in terms of our total debt burden variable (*tdb*). Thus, those companies facing a higher total financial burden display substantially lower investment and employment growth rates. Differences are less marked between the firms with the lowest total financial burden and those subject to average financial pressure, especially in the case of employment growth.

Interestingly, the pattern of results changes when the level of indebtedness is used as the indicator of financial tightness. Thus, in Graph 3.5, the observed relationship between the investment rate and the debt ratio is not monotonic. Similarly, no significant differences in employment growth are observed among the three deciles considered (Graph 3.6). This absence of a clear relationship between the debt level and the level of activity at the company level may be interpreted as the consequence of two opposite effects. On the one hand, firms with high indebtedness may experience difficulties in gaining access to additional credit to finance new investment projects, but on the other hand, those companies with higher levels of investment and employment growth are those that have been successful in attracting external funds to take advantage of their growth opportunities.

Finally, Graphs 3.7 and 3.8 show a clear link between the level of profitability and the demand for factors of production. Firms with higher levels of gross revenue over total assets have substantially higher investment and employment growth rates.

Overall, the evidence in this section suggests: first, that there is a substantial dispersion in the distribution of Spanish firms in terms of several indicators of the degree of financial tightness they face; second, that financial position affects business activity; and third, that this impact is not linear and becomes relatively more intense when financial pressure exceeds a certain threshold.

### 3. The impact of financial variables on firms' real decisions

The estimation analysis in this section considers the responsiveness of fixed investment and employment to changes in the financial conditions facing a company, proxied by a set of financial variables. These variables include indicators providing information on corporate profitability, indebtedness (or leverage) and relative burden of debt and try to capture the degree of financial pressure firms may be facing. More precisely, the financial variables considered are: two measures of the debt service burden,  $tdb$  and  $idb$ , two measures capturing the indebtedness of the company,  $(B/A)$  and  $((B-m)/A)$ , and two measures of corporate profitability,  $(GR/A)$  and  $(CF/A)$ . Finally, we also consider an indicator of the probability of default that has been constructed using the estimated coefficients of a probit model for the probability of default estimated by Benito et al (2003) for a similar sample of Spanish non-financial firms.

#### 3.1 Baseline specifications

The model estimated for fixed investment is an error correction model which specifies a target level for the capital stock and allows for flexible specification of short-run investment dynamics, in which we add different financial indicators as potential explanatory variables. The error correction model is standard in the investment literature. As is emphasised in Bond et al (1999), this type of model tends to produce more reasonable parameters than more structural models, such as Q models, which may be significantly affected by measurement error.<sup>4</sup> Assuming long-run constant returns to scale, subsuming the depreciation rate into the unobserved firm-specific effects and assuming that variation in the user cost of capital can be controlled for by including both time-specific and firm-specific effects, the following specification for the investment rate can be obtained:<sup>5</sup>

$$\left(\frac{I}{K}\right)_{it} = \alpha_i + \beta_1 \left(\frac{I}{K}\right)_{it-1} + \beta_2 \Delta y_{it} + \beta_3 \Delta y_{it-1} + \beta_4 (k-y)_{it-2} + X'_{it} \gamma + \theta_t + \varepsilon_{it} \quad (1)$$

where  $i$  indexes companies  $i = 1 \dots N$  and  $t$  indexes years  $t = 1 \dots T$ .  $\Delta$  denotes a first difference,  $I/K$  is the investment rate,  $y$  is the log of real sales,  $k$  is the log of real fixed capital stock,  $\alpha_i$  are company-specific fixed effects, and  $X$  represents a vector of financial variables.  $\theta_t$  are time effects that control for macroeconomic influences on fixed investment common across companies and  $\varepsilon_{it}$  is a serially uncorrelated, but possibly heteroskedastic error term. The coefficients  $\beta_2$  and  $\beta_3$  indicate the short-run responsiveness of fixed investment to sales growth, whilst the coefficient  $\beta_4$  indicates the speed of adjustment of the capital stock towards its desired level.

The labour demand equation, derived by Nickell and Nicolitsas (1999) from a quadratic adjustment cost model which then adds financial factors, takes the following form:

$$n_{it} = \phi_i + \lambda_1 n_{it-1} + \lambda_2 k_{it} + \lambda_3 w_{it-1} + \lambda_4 \Delta w_{it} + \lambda_5 \xi_{it} + X'_{it} \eta + \Psi_t + \mu_{it} \quad (2)$$

where  $i$  indexes companies  $i = 1, 2 \dots N$  and  $t$  indexes years  $t = 1, 2 \dots T$ .  $n$  is (log) average company employment during the year,  $w$  is the (log) average real wage at the company,  $k$  denotes (log) real

<sup>4</sup> In any case, a Q model is not possible here, since most of the Spanish firms are not quoted and thus the usual Q variable cannot be constructed.

<sup>5</sup> See Bond et al (1999) or Bond et al (2003) for details on the derivation of the investment model.

fixed capital stock.  $\xi$  is a demand shock proxy which consists of the growth in log real sales, and  $\psi_t$  represent a set of common time effects (year dummies) which will control for aggregate effects including aggregate demand.<sup>6</sup>  $\mu_{it}$  is a serially uncorrelated but possibly heteroskedastic error term.

Two elements in equation (2) depart from what is considered a standard specification for labour demand. First, financial factors, represented by the regressors  $X_{it}$ , are included. Despite the extensive literature considering a potential role for financial conditions in shaping fixed investment (see Hubbard (1998)), there are few studies which allow for such a role in the context of labour demand models.<sup>7</sup> Second, the model includes a demand shock variable,  $\xi_{it}$ , following Bentolila and Saint-Paul (1992).

### 3.2 Estimation method

The estimation method consists of the GMM-System estimator proposed by Arellano and Bover (1995) and examined in detail by Blundell and Bond (1998). These models control for fixed effects with the estimator being an extension of the GMM estimator of Arellano and Bond (1991) estimating equations in levels as well as in first differences.

Apart from the bias that would arise if fixed effects were not controlled for, it is also necessary to note that most current firm-specific variables are endogenous. In order to avoid the bias associated with this endogeneity problem, we use a GMM estimator taking lags of the dependent and explanatory variables as instruments.

The use of a GMM-System estimator is justified because where there is persistence in the data such that the lagged levels of a variable are not highly correlated with the first difference, estimating the levels equations with a lagged difference term as an instrument offers significant gains, countering the bias associated with weak instruments (see Blundell and Bond (1998)). Several variables display high levels of serial correlation. The estimation method requires the absence of second-order serial correlation in the first-differenced residuals for which the test of Arellano and Bond (1991) is presented (labelled  $M_2$ ). If the underlying model's residuals are indeed white noise then first-order serial correlation should be expected in the first-differenced residuals for which we also present the test of Arellano and Bond (1991), labelled  $M_1$ . We also report the results of the Sargan test for instrument validity in the GMM-System equations.

### 3.3 Basic results

Table 2 reports estimation results for fixed investment. Column 1 reports the results of the basic specification without financial variables. We generally find insignificant levels of persistence in company-level investment, a result quite consistent with results reported by Bond et al (2003). The error correction term  $(k - y)_{it-2}$  is correctly signed and statistically significant with coefficient (robust standard error) of  $-0.175$  (0.022) implying a reasonable speed of adjustment, comparable to that obtained in similar studies. The sales growth terms are positive and significant and their magnitude is in the upper range of the values usually obtained in the literature. We find the expected first-order serial correlation in our first-differenced residuals, while there is no evidence of second-order serial correlation, the key requirement for validity of our instrumentation strategy, and the Sargan test statistics are insignificant at conventional levels.<sup>8</sup>

We then consider adding the financial variables to the basic specification. Columns 2 to 8 of Table 2 report the estimates of the basic specification augmented with one financial variable at a time. First, columns 2 and 3 add debt variables to the standard specification. The expected negative coefficient is obtained although it is only at the margin of significance (p-value = 0.15) in the case of the  $B/A_{it-1}$  term.

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<sup>6</sup> The demand shock variable is not considered in the analysis of Nickell and Nicolitsas (1999), but it was included in a similar specification by Bentolila and Saint-Paul (1992).

<sup>7</sup> Some exceptions are Nickell and Wadhvani (1991), Nickell and Nicolitsas (1999) and Ogawa (2003).

<sup>8</sup> In our preferred estimates (those reported in the tables) we selected the instrument set such that the Sargan test statistic reported was not significant at conventional levels, although these estimates proved very similar to those where the instrument set included instruments dated  $t - 2$  to  $t - 6$  in the first-differenced equation and  $t - 1$  in the levels equation.



Table 2  
Fixed investment

Basic specification augmented with one financial variable at a time

$(I/K)_{it}$	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$(I/K)_{it-1}$	-0.057 (0.099)	-0.020 (0.083)	-0.084 (0.057)	-0.094 (0.085)	-0.055 (0.085)	-0.099 (0.090)	-0.113 (0.087)	-0.079 (0.076)
$\Delta y_{it}$	0.358 (0.124)	0.365 (0.111)	0.347 (0.109)	0.329 (0.095)	0.294 (0.098)	0.312 (0.111)	0.386 (0.113)	0.293 (0.101)
$\Delta y_{it-1}$	0.334 (0.112)	0.313 (0.106)	0.379 (0.088)	0.271 (0.086)	0.260 (0.086)	0.321 (0.103)	0.290 (0.104)	0.214 (0.057)
$(k - y)_{it-2}$	-0.175 (0.022)	-0.164 (0.020)	-0.171 (0.017)	-0.168 (0.020)	-0.162 (0.020)	-0.161 (0.020)	-0.158 (0.019)	-0.163 (0.018)
$(B/A)_{it-1}$		-0.070 (0.050)						
$((B - m)/A)_{it-1}$			-0.091 (0.027)					
$idb_{it-1}$				-0.024 (0.008)				
$tdb_{it-1}$					-0.004 (0.001)			
$(GR/A)_{it-1}$						0.201 (0.097)		
$(CF/A)_{it-1}$							0.331 (0.126)	
$pd_{it-1}$								-0.537 (0.204)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$M_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_2$	0.785	0.469	0.903	0.927	0.739	0.840	0.747	0.907
Sargan	0.188	0.170	0.402	0.091	0.374	0.142	0.156	0.145
Companies	7,547	7,547	7,547	7,547	7,547	7,547	7,547	7,547
Observations	55,531	55,531	55,531	55,531	55,531	55,531	55,531	55,531

Note: Estimation by GMM-System estimator using the robust one-step method (Arellano and Bond (1998). Blundell and Bond (1998)). Sargan is a Sargan test of over-identifying restrictions (p-value reported), with a chi-square distribution under the null of instrument validity.  $M_j$  is a test of  $j$ th-order serial correlation in the first-differenced residuals (p-values reported). These are both distributed as standard normals under the null hypotheses. Asymptotic robust standard errors reported in parentheses. Instruments: in the first-differences equation, the following lagged values of the regressors:  $\Delta y$ ,  $B/A$ ,  $GR/A$ ,  $CF/A(t-4, t-5)$ ,  $(k-y)(t-5, t-6)$ ,  $(B-m)/A(t-2$  to  $t-5)$ ,  $idb$ ,  $tdb$ ,  $pd(t-3$  to  $t-5)$ ; in the levels equations, the first differences of the regressors dated as follows:  $I/K$ ,  $\Delta y$ ,  $B/A$ ,  $(B-m)/A$ ,  $idb$ ,  $tdb(t-2)$ ,  $pd(t-1)$ ,  $(k-y)$ ,  $GR/A$ ,  $CF/A(t-3)$ .

Table 3  
Fixed investment

Simultaneously including several financial variables

$(I/K)_{it}$	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$(I/K)_{it-1}$	-0.054 (0.075)	-0.101 (0.053)	-0.107 (0.079)	-0.022 (0.076)	-0.085 (0.053)	-0.076 (0.079)	-0.117 (0.057)	-0.133 (0.057)
$\Delta y_{it}$	0.316 (0.090)	0.329 (0.088)	0.302 (0.089)	0.277 (0.092)	0.296 (0.089)	0.270 (0.092)	0.292 (0.084)	0.322 (0.083)
$\Delta y_{it-1}$	0.257 (0.083)	0.336 (0.071)	0.278 (0.082)	0.245 (0.084)	0.338 (0.072)	0.285 (0.082)	0.364 (0.071)	0.357 (0.070)
$(k - y)_{it-2}$	-0.159 (0.019)	-0.167 (0.017)	-0.158 (0.018)	-0.154 (0.019)	-0.166 (0.017)	-0.155 (0.018)	-0.160 (0.017)	-0.161 (0.017)
$(B/A)_{it-1}$	-0.033 (0.048)			-0.020 (0.049)				
$((B - m)/A)_{it-1}$		-0.075 (0.027)			-0.071 (0.027)		-0.044 (0.031)	-0.046 (0.031)
$idb_{it-1}$	-0.024 (0.009)	-0.018 (0.009)	-0.017 (0.010)					-0.015 (0.009)
$tdb_{it-1}$				-0.004 (0.001)	-0.003 (0.001)	-0.003 (0.001)	-0.002 (0.001)	
$(GR/A)_{it-1}$			0.162 (0.094)			0.151 (0.094)	0.153 (0.065)	0.155 (0.065)
$(CF/A)_{it-1}$								
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$M_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_2$	0.706	0.671	0.754	0.449	0.907	0.962	0.465	0.312
Sargan	0.097	0.230	0.087	0.362	0.514	0.275	0.257	0.115
Companies	7,547	7,547	7,547	7,547	7,547	7,547	7,547	7,547
Observations	55,531	55,531	55,531	55,531	55,531	55,531	55,531	55,531

Note: See note to Table 2.

These estimates, in particular that including the net indebtedness term  $((B - m)/A)_{it-1}$ ,<sup>9</sup> suggest that a high level of debt can lead to balance sheet adjustment in the form of companies deferring or forgoing investment projects (see also Vermeulen (2002) for an industry-level study). Second, in columns 4 and 5 two indicators of the relative debt service burden are included. For both variables (the interest debt burden term  $idb_{it-1}$  in column 4 and the total debt burden  $tdb_{it-1}$  in column 5) a significantly negative and well determined effect is found. This suggests that the financial pressure of debt servicing plays an important role in influencing investment levels of firms. Third, the estimates in columns 6 and 7 include two indicators of corporate profitability. In both cases,  $(GR/A)_{it-1}$  in column 6 and  $(CF/A)_{it-1}$  in column 7, the coefficients are significantly positive, which is consistent with studies of investment for other countries. As has been extensively discussed in the literature on investment and financial constraints, the cash flow terms might be either picking up the relevance of internal finance for investment or acting as a proxy for investment opportunities. Finally, the results reported in column 8 show that the indicator for the probability of default,  $pd_{it-1}$ , displays the expected negative and statistically significant effect on investment.<sup>10</sup> As this indicator is a composite measure based on several financial indicators, each of them weighted by its influence on the probability of default, its estimated coefficient in the investment equation reflects the impact of the financial situation on corporate investment through its incidence on the probability of default.

Nevertheless, the relative importance of different financial variables in explaining the probability of default or the probability of failure might differ from their relative contribution to explaining real decisions of companies. Thus, in order to get a more precise picture of the global impact of financial conditions on corporate behaviour, it is worth directly and simultaneously including several financial indicators in the estimated equations. Thus, it is possible to ascertain which specific financial features (indebtedness, profitability, financial burden ...) are more relevant for each specific corporate decision. However, the close links between the different financial indicators imply that few indicators are likely to turn out to be simultaneously significant. As a consequence, the interpretation of the results of this exercise is not a trivial task. Table 3 reports the estimates of specifications of the investment equation, simultaneously including several financial variables. As can be seen from the tables, those variables measuring the burden of servicing debt, both  $tdb$  and  $idb$ , remain significant in all specifications and their coefficients are quite robust. As regards the indicators of indebtedness, the gross measure  $(B/A)$  is never significant. In the case of the net debt term  $((B - m)/A)$ , it retains its significance in most cases. However, a notable decline in the point estimate of its coefficient is observed when a profitability indicator is included. Finally, the coefficients for the corporate profitability terms remain significant in all specifications although their point estimate is lower whenever the net debt term is included in the specification.<sup>11</sup>

Our first set of estimation results for the employment equation is presented in Table 4. Column 1 reports the results of the basic specification without financial variables whereas columns 2 to 8 report the results obtained when a financial variable is added to the specification. These results show the importance that financial factors have in explaining labour demand. The results in columns 2 and 3 show that debt has a negative (although non-significant) impact on labour demand. However, when considering the two indicators of the relative burden of debt, both of them have a negative and highly significant impact on labour demand. The results of the estimation when an indicator of profitability is included are reported in columns 6 and 7, and show a positive and significant impact of the profitability indicator on employment demand, for a 95% confidence level. Finally, as in the case of the investment equation, a negative and significant coefficient is found for the indicator of the probability of default,  $pd_{it-1}$ .

<sup>9</sup> By including this indicator we want to analyse whether debt is important once adjusted for liquidity. An indicator of liquidity (liquid assets divided by short-term debt) turned out to be insignificant when included in both the investment and the employment equations.

<sup>10</sup> The estimate for this variable should be viewed with some caution since the reported standard errors do not take into account that it is an estimated regressor.

<sup>11</sup> Table 3 reports results for specifications including the gross revenue term  $(GR/A)$ . The pattern of results is qualitatively similar when the cash flow term  $(CF/A)$  is included instead of  $GR/A$ .

Table 4  
Employment

Basic specification augmented with one financial variable at a time

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$n_{it-1}$	0.915 (0.020)	0.924 (0.015)	0.910 (0.017)	0.943 (0.016)	0.941 (0.017)	0.930 (0.019)	0.927 (0.019)	0.920 (0.018)
$k_{it}$	0.039 (0.008)	0.037 (0.007)	0.042 (0.007)	0.030 (0.007)	0.030 (0.007)	0.031 (0.007)	0.034 (0.007)	0.041 (0.008)
$\Delta w_{it}$	-0.535 (0.118)	-0.533 (0.109)	-0.522 (0.104)	-0.416 (0.097)	-0.507 (0.101)	-0.491 (0.096)	-0.501 (0.099)	-0.462 (0.111)
$w_{it-1}$	-0.017 (0.053)	-0.023 (0.044)	-0.002 (0.048)	-0.053 (0.042)	-0.037 (0.043)	-0.024 (0.046)	-0.012 (0.046)	0.016 (0.049)
$\Delta y_{it}$	0.303 (0.047)	0.305 (0.044)	0.301 (0.044)	0.300 (0.046)	0.299 (0.044)	0.285 (0.042)	0.306 (0.043)	0.311 (0.043)
$(B/A)_{it-1}$		-0.012 (0.021)						
$((B - m)/A)_{it-1}$			-0.010 (0.013)					
$idb_{it-1}$				-0.022 (0.007)				
$tdb_{it-1}$					-0.003 (0.001)			
$(GR/A)_{it-1}$						0.085 (0.031)		
$(CF/A)_{it-1}$							0.113 (0.041)	
$pd_{it-1}$								-0.450 (0.199)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$M_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_2$	0.082	0.088	0.075	0.117	0.068	0.059	0.088	0.089
Sargan	0.443	0.242	0.444	0.471	0.647	0.339	0.362	0.298
Companies	7,547	7,547	7,547	7,547	7,547	7,547	7,547	7,547
Observations	55,531	55,531	55,531	55,531	55,531	55,531	55,531	55,531

Note: Estimation by GMM-System estimator using the robust one-step method (Arellano and Bond (1998), Blundell and Bond (1998)). Sargan is a Sargan test of over-identifying restrictions (p-value reported), with a chi-square distribution under the null of instrument validity.  $M_j$  is a test of  $j$ th-order serial correlation in the first-differenced residuals (p-values reported). These are both distributed as standard normals under the null hypotheses. Asymptotic robust standard errors reported in parentheses. Instruments: in first-differences equation, following lagged values of the regressors:  $n$ ,  $B/A$ ,  $(B - m)/A(t - 5)$ ,  $a$ ,  $\Delta y$ ,  $\Delta w(t - 5, t - 6)$ ,  $w$ ,  $GR/A$ ,  $CF/A(t - 4, t - 5)$ ,  $idb$ ,  $tdb$ ,  $pd(t - 4 \text{ to } t - 6)$ ; in the levels equations, the first differences of the regressors dated as follows:  $n$ ,  $w$ ,  $B/A$ ,  $(B - m)/A(t - 2)$ ,  $idb$ ,  $tdb$ ,  $pd$ ,  $CF/A(t - 3)$ ,  $GR/A(t - 3)$ .

Table 5 shows the results obtained when more than one financial variable is included in the estimation. As can be seen in columns 1 and 4 for debt and 2 and 5 for net indebtedness, both indicators are also non-significant when they are combined with another financial variable. In contrast, indicators of debt burden maintain their significance when they are included in the estimation with an indebtedness or profitability measure. The same applies to profitability indicators: they remain significant when they are combined with another indicator. Finally, columns 7 and 8 show that when three financial indicators are included in the regression (one for indebtedness, another for debt burden and the third one for profitability) the first is no longer significant, as was also the case when it was combined with only one additional indicator, whereas the indicators of debt burden remain significant at a 95% confidence level and the profitability terms are also significant although their point estimates are somewhat reduced.

#### 4. Non-linear effects

The evidence presented in Section 2 shows that firms with a weaker financial situation - ie those firms belonging to the decile of the distribution characterised by the highest values of alternative proxies of financial pressure - have substantially lower investment and employment growth rates. However, in general, no significant differences in demand for factors of production are observed between the firms with least financial tightness and those with an average financial pressure. This evidence suggests that the relationship between the real activity of firms and their financial position is non-linear. Moreover, it seems reasonable that there will be a more pronounced impact of this position on real activity once the financial pressure reaches a certain threshold. In this section, we provide a more formal analysis of this hypothesis. For this purpose, we estimate the investment and labour demand equations described in Section 3, but now allowing for a differential impact of financial conditions depending on the relative level of the corresponding financial indicator. As in Tables 2 and 4 we estimate the investment and employment models considering one financial indicator at a time. In each regression, we test whether the companies facing high financial pressure - ie those firms in the upper decile (or quartile) of the distribution defined in terms of the corresponding financial indicator - are more sensitive to the financial conditions. More precisely, we estimate the following specifications:

$$\left(\frac{I}{K}\right)_{it} = \alpha_i + \beta_1 \left(\frac{I}{K}\right)_{it-1} + \beta_2 \Delta y_{it} + \beta_3 \Delta y_{it-1} + \beta_4 (k - y)_{it-2} + \gamma_1 F_{it} D_{0-75}^F + \gamma_2 F_{it} D_{75-90}^F + \gamma_3 F_{it} D_{90-100}^F + \theta_t + \varepsilon_{it} \quad (3)$$

and

$$n_{it} = \phi_i + \lambda_1 n_{it-1} + \lambda_2 K_{it} + \lambda_3 w_{it-1} + \lambda_4 \Delta W_{it} + \lambda_5 \xi_{it} + \eta_1 F_{it} D_{0-75}^F + \eta_2 F_{it} D_{75-90}^F + \eta_3 F_{it} D_{90-100}^F + \psi_t + \mu_{it} \quad (4)$$

where  $D_{0-75}^F$ ,  $D_{75-90}^F$  and  $D_{90-100}^F$  are dummy variables for observations below the 75th percentile, between the 75th and 90th percentiles, and above the 90th percentile, respectively, of the distribution defined in terms of the financial variable  $F$ . When a corporate profitability measure - either ( $GR/A$ ) or ( $CF/A$ ) - is used as a financial indicator, we replace these dummies by  $D_{0-10}^F$ ,  $D_{10-25}^F$  and  $D_{25-100}^F$ , which are dummy variables for observations below the 10th percentile, between the 10th and 25th percentiles, and above the 25th percentile. In these cases, the lower the percentile, the lower the profitability, and the higher, a priori, the degree of financial tightness.

##### 4.1 Results

Table 6 reports the results obtained for investment when non-linearities are considered. As can be seen, debt is not significant in either of the groups, although the comparison of the magnitude of the coefficients for the three groups shows that it goes in the expected direction (negative coefficient and higher, in absolute value, for those companies with higher indebtedness). When we consider net indebtedness instead of debt, we obtain evidence in favour of the existence of differences in the impact of this variable on investment, depending on its magnitude: net indebtedness is irrelevant for firms with moderate levels of net indebtedness (below the 75th percentile), whereas for those firms above this threshold it has a negative and significant impact both for the group between the 75th and 90th percentiles and for the group in the upper decile.

Table 5  
**Employment**

Simultaneously including several financial variables

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
$n_{it-1}$	0.944 (0.013)	0.936 (0.015)	0.950 (0.016)	0.940 (0.013)	0.930 (0.016)	0.944 (0.015)	0.951 (0.015)	0.950 (0.015)
$k_t$	0.029 (0.006)	0.032 (0.007)	0.026 (0.007)	0.030 (0.007)	0.035 (0.007)	0.025 (0.007)	0.022 (0.007)	0.025 (0.007)
$\Delta w_{it}$	-0.435 (0.090)	-0.433 (0.086)	-0.454 (0.082)	-0.503 (0.095)	-0.500 (0.082)	-0.512 (0.078)	-0.515 (0.074)	-0.453 (0.077)
$w_{it-1}$	-0.036 (0.038)	-0.033 (0.039)	-0.048 (0.039)	-0.022 (0.038)	-0.037 (0.044)	-0.030 (0.038)	-0.024 (0.037)	-0.038 (0.037)
$\Delta y_{it}$	0.292 (0.043)	0.291 (0.043)	0.307 (0.042)	0.288 (0.041)	0.271 (0.038)	0.285 (0.036)	0.283 (0.034)	0.295 (0.039)
$(B/A)_{it-1}$	0.016 (0.024)			0.016 (0.026)				0.005 (0.027)
$((B - m)/A)_{it-1}$		0.007 (0.014)			0.021 (0.015)		0.011 (0.017)	
$idb_{it-1}$	-0.023 (0.007)	-0.022 (0.008)	-0.017 (0.008)					-0.014 (0.008)
$tdb_{it-1}$				-0.003 (0.001)		-0.003 (0.001)	-0.003 (0.001)	
$(GR/A)_{it-1}$					0.097 (0.019)	0.079 (0.019)	0.091 (0.020)	
$(CF/A)_{it-1}$			0.084 (0.044)					0.114 (0.044)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$M_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_2$	0.086	0.084	0.113	0.054	0.042	0.048	0.044	0.084
Sargan	0.201	0.400	0.525	0.191	0.416	0.425	0.365	0.230
Companies	7,547	7,547	7,547	7,547	7,547	7,547	7,547	7,547
Observations	55,531	55,531	55,531	55,531	55,531	55,531	55,531	55,531

Note: See note to Table 4.

Table 6  
Investment  
Non-linear effects

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
$(I/K)_{it-1}$	-0.089 (0.066)	-0.076 (0.069)	-0.102 (0.069)	-0.098 (0.074)	-0.114 (0.076)	-0.134 (0.075)	-0.141 (0.050)
$\Delta y_{it}$	0.293 (0.096)	0.346 (0.093)	0.356 (0.090)	0.261 (0.093)	0.344 (0.090)	0.362 (0.092)	0.284 (0.077)
$\Delta y_{it-1}$	0.245 (0.095)	0.354 (0.091)	0.339 (0.088)	0.335 (0.087)	0.356 (0.088)	0.290 (0.090)	0.361 (0.067)
$(k - y)_{it-2}$	-0.171 (0.018)	-0.166 (0.018)	-0.170 (0.018)	-0.170 (0.019)	-0.166 (0.019)	-0.159 (0.018)	-0.162 (0.016)
$(B/A)_{it-1}(<p75)$	0.072 (0.077)						
$(B/A)_{it-1>(>75; <p90)$	-0.013 (0.059)						
$(B/A)_{it-1>(>p90)$	-0.052 (0.054)						
$((B - m)/A)_{it-1}(<p75)$		-0.061 (0.047)					-0.052 (0.030) <sup>1</sup>
$((B - m)/A)_{it-1>(>p75; <p90)$		-0.147 (0.062)					-0.052 (0.030) <sup>1</sup>
$((B - m)/A)_{it-1>(>p90)$		-0.127 (0.048)					-0.052 (0.030) <sup>1</sup>
$(idb)_{it-1}(<p75)$			-0.081 (0.096)				
$(idb)_{it-1>(>p75; <p90)$			-0.100 (0.060)				
$(idb)_{it-1>(>p90)$			-0.031 (0.009)				
$(tdb)_{it-1}(<p75)$				-0.007 (0.008)			-0.004 (0.007)
$(tdb)_{it-1>(>p75; <p90)$				-0.005 (0.010)			0.011 (0.010)
$(tdb)_{it-1>(>p90)$				-0.004 (0.001)			-0.002 (0.001)
$(GR/A)_{it-1}(>p25)$					0.202 (0.101)		0.165 (0.063) <sup>1</sup>
$(GR/A)_{it-1}(>p10; <p25)$					0.662 (1.103)		0.165 (0.063) <sup>1</sup>
$(GR/A)_{it-1}(<p10)$					0.658 (0.727)		0.165 (0.063) <sup>1</sup>
$(CF/A)_{it-1}(>p25)$						0.311 (0.135)	
$(CF/A)_{it-1}(>p10; <p25)$						3.470 (2.770)	
$(CF/A)_{it-1}(<p10)$						0.890 (0.447)	
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$M_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_2$	0.978	0.988	0.756	0.812	0.643	0.486	0.201
Sargan	0.068	0.254	0.032	0.259	0.082	0.395	0.187

Note: See note to Table 2. Number of companies: 7,547. Number of observations: 55,531.

<sup>1</sup> Coefficients restricted to be equal.

When indicators of debt burden are considered, results strongly support the existence of non-linearities: both indicators are significant for firms above the 90th percentile, whereas for firms between the 75th and the 90th percentile total debt burden is found to be insignificant and interest debt burden is only at the margin of significance ( $p$ -value = 0.09). For firms below the 75th percentile, neither of these indicators has a significant impact on investment.

As for profitability indicators, a positive and significant coefficient is obtained for those firms with higher profitability (those above the 25th percentile). However, the coefficients for these variables are rather imprecisely estimated for the other two groupings. As expected, we obtain a higher coefficient for those companies in the lower tail of the distribution (a priori those facing higher financial pressure). However, this coefficient is only significant for ( $CFA$ ).

Ideally, we would like to allow for non-linearities in the effects of more than one financial variable at a time. However, when simultaneously including different financial variables in a non-linear fashion, there is a sharp drop of significance in the interaction terms. For this reason, we opted for a mixed strategy by including one financial variable in a non-linear way and the rest of the financial variables linearly. Using this approach, the results of our preferred specification are reported in the last column of Table 6. In this specification, a linear effect is allowed for gross revenue over total assets and for net debt, while total debt burden enters in a non-linear way. We find, as expected, a positive coefficient for ( $GRA$ ) and a negative one for net debt.<sup>12</sup> Finally, a negative impact of total debt burden is only found for firms that are in the upper tail of the distribution.

Results for employment are shown in Table 7, and corroborate the existence of a non-linear impact of financial variables on firms' real decisions. We find, however, some differences with respect to investment: both indicators of indebtedness and debt burden are significant for firms in the upper decile of the distribution, for a 99% confidence level, but for firms between the 75th and 90th percentile only indicators of interest debt burden have a significant impact on employment. When profitability is considered, lower and upper bounds are found to be significant and, as was also the case for investment, the coefficient estimated for the lower decile is higher than that estimated for firms with higher profitability (above the 25th percentile). As in the case of investment, we also adopted a mixed strategy in the specification of the financial variables in the employment equation. The results of our preferred specification are reported in the last column of Table 7. In this specification, a linear effect is allowed for gross revenue over total assets while total debt burden enters in a non-linear way. A positive and significant coefficient is found for the profitability term and a negative and significant one for total debt burden only for firms that are above the 90th percentile.

Overall, these results corroborate the descriptive evidence in Section 2 and point to the existence of threshold effects on the impact of financial variables on investment and employment.<sup>13</sup> The specific threshold and the different sensitivities to the financial position seem to depend on the particular financial variable considered.

## 5. Composite indicators of financial pressure

In Section 3, we obtained evidence in favour of the existence of a significant impact of financial variables on the demand for factors of production. The results in Section 4 suggest that this impact is more pronounced for the upper tail of the distributions defined in terms of the proxies for financial pressure. Now, in this section, we wish to construct synthetic indicators that summarise the non-linear influence that financing conditions have on investment and employment. Moreover, on the basis of these composite indicators we wish to assess how the impact of financial conditions has evolved over time with a special emphasis on the distribution across companies of this impact. For this purpose, we compute linear combinations of alternative sets of financial variables, where the relative weights are given by the estimated coefficients in the investment and the employment equations.

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<sup>12</sup> Profitability and net debt enter linearly in the specification, although in the table we present the coefficient for each of the three groups (which is equal for all of them) separately.

<sup>13</sup> Although the results clearly support this conclusion, it has to be mentioned that the results reported in this section are more sensitive to the set of instruments used than those obtained for the linear specifications presented in the previous section.



Table 7  
**Employment**  
 Non-linear effects

	[1]	[2]	[3]	[4]	[5]	[6]	[7]
$n_{t-1}$	0.922 (0.014)	0.905 (0.015)	0.934 (0.014)	0.931 (0.014)	0.926 (0.016)	0.940 (0.026)	0.958 (0.013)
$k_{it}$	0.035 (0.007)	0.041 (0.007)	0.033 (0.007)	0.034 (0.007)	0.032 (0.007)	0.029 (0.007)	0.019 (0.006)
$\Delta W_{it}$	-0.510 (0.092)	-0.492 (0.092)	-0.635 (0.087)	-0.550 (0.087)	-0.637 (0.080)	-0.519 (0.077)	-0.554 (0.075)
$w_{t-1}$	0.000 (0.039)	0.043 (0.041)	-0.021 (0.037)	-0.003 (0.035)	0.012 (0.040)	-0.026 (0.039)	-0.050 (0.032)
$\Delta y_{it}$	0.297 (0.038)	0.293 (0.042)	0.313 (0.041)	0.286 (0.038)	0.280 (0.038)	0.280 (0.037)	0.280 (0.035)
$(B/A)_{it-1}(<p75)$	0.032 (0.034)						
$(B/A)_{it-1}(>75; <p90)$	0.015 (0.029)						
$(B/A)_{it-1}(>p90)$	-0.042 (0.023)						
$((B - m)/A)_{it-1}(<p75)$		-0.001 (0.015)					
$((B - m)/A)_{it-1}(>p75; <p90)$		0.001 (0.025)					
$((B - m)/A)_{it-1}(>p90)$		-0.052 (0.023)					
$(idb)_{it-1}(<p75)$			-0.039 (0.051)				
$(idb)_{it-1}(>p75; <p90)$			-0.109 (0.033)				
$(idb)_{it-1}(>p90)$			-0.034 (0.005)				
$(tdb)_{it-1}(<p75)$				0.006 (0.004)			0.005 (0.005)
$(tdb)_{it-1}(>p75; <p90)$				-0.001 (0.004)			0.006 (0.005)
$(tdb)_{it-1}(>p90)$				-0.004 (0.001)			-0.003 (0.001)
$(GR/A)_{it-1}(>p25)$					0.090 (0.012)		0.085 (0.019) <sup>1</sup>
$(GR/A)_{it-1}(>p10; <p25)$					0.116 (0.060)		0.085 (0.019) <sup>1</sup>
$(GR/A)_{it-1}(<p10)$					0.304 (0.090)		0.085 (0.019) <sup>1</sup>
$(CF/A)_{it-1}(>p25)$						0.067 (0.044)	
$(CF/A)_{it-1}(>p10; <p25)$						-1.350 (1.134)	
$(CF/A)_{it-1}(<p10)$						0.549 (0.185)	
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$M_1$	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$M_2$	0.067	0.052	0.093	0.039	0.045	0.049	0.048
Sargan	0.151	0.334	0.107	0.155	0.567	0.564	0.440

Note: See note to Table 4. Number of companies: 7,547. Number of observations: 55,531.

<sup>1</sup> Coefficients restricted to be equal.

Thus, a financial conditions indicator for investment (FCII) can be defined as follows:

$$FCII_{it} = -\sum_k \hat{\gamma}^k X_{it}^k \quad (5)$$

where  $\hat{\gamma}^k$  is the estimated coefficient for financial variable  $X^k$  in the investment equation. Analogously, a financial conditions indicator for employment takes the following form:

$$FCIE_{it} = -\sum_k \hat{\eta}^k X_{it}^k \quad (6)$$

where  $\hat{\eta}^k$  is the estimated coefficient for financial variable  $X^k$  in the employment equation. These indicators measure the contributions of the financial variables in the investment and employment equations. As the sign of these contributions is changed, the higher the indicator, the tighter the financial conditions faced by companies, ie the larger the negative impact of financial conditions on investment or employment. Since we have allowed for a non-linear impact of financial variables, the differences in the indicator across firms will reflect not only differences in the financial position but also differences in the sensitivity of the real variables to this position.

Our starting point is to construct financial conditions indicators for investment and employment on the basis of the estimated coefficients of our preferred models in the previous section. In particular, our benchmark models are those in column 7 of Table 6 for fixed investment and column 7 of Table 7 for employment. Both models allow for a non-linear effect of the total debt burden  $tdb_{it-1}$ , while restricting the impact of the gross revenue term ( $GR/A$ ) to be linear. In addition, the investment model also includes a linear net debt term  $((B - m)/A)$ .

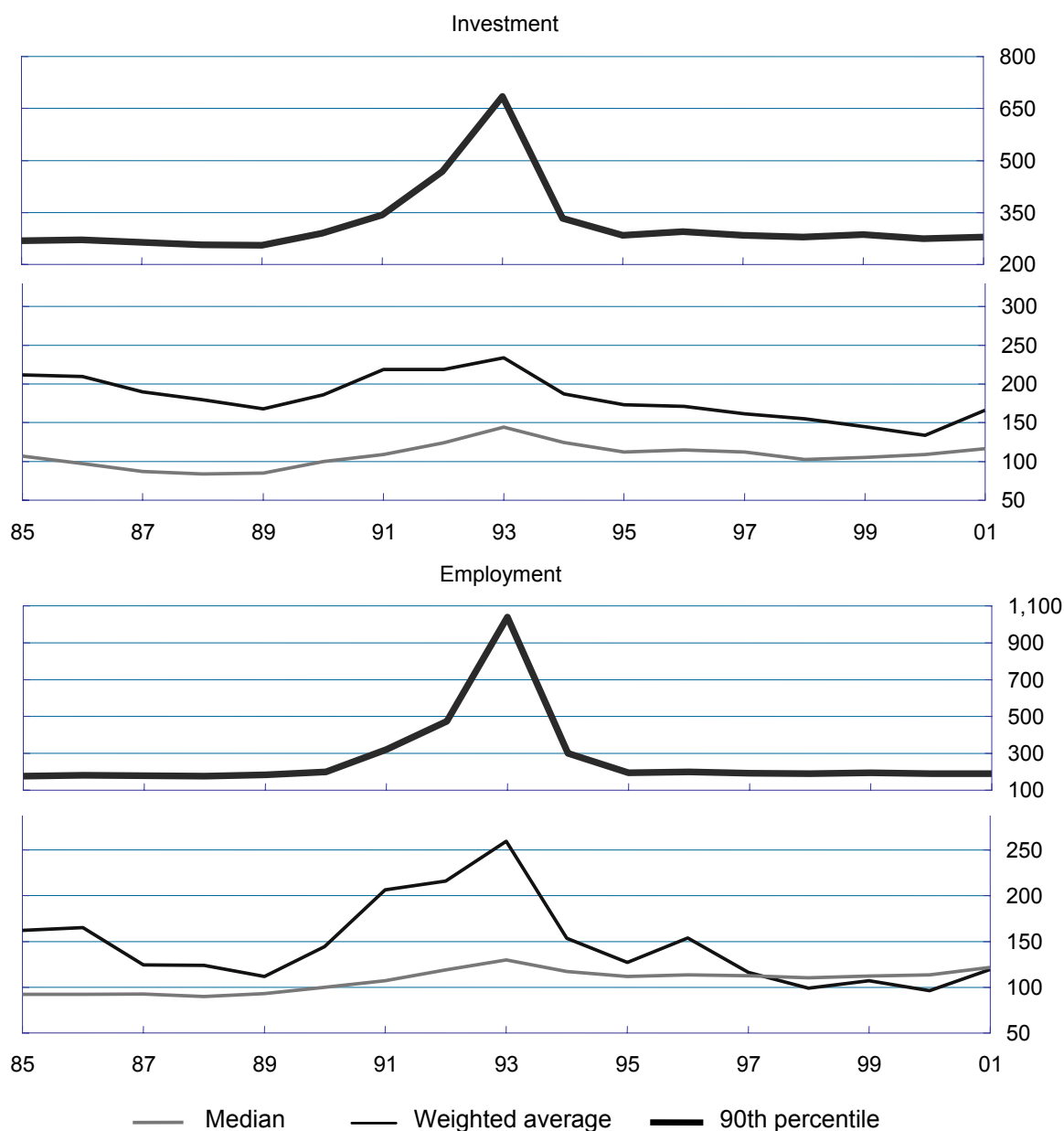
In order to ascertain the relevance of financial variables for companies in different financial positions, it is useful to focus on different percentiles of the distribution of these indicators. More precisely, we present the evolution of the median value of these indicators as representative of the average financial pressure faced by the companies in our sample. We also show the evolution of the 90th percentile, to assess the time profile of the vulnerability of the companies facing high financial pressure. Finally, we report the weighted average as an aggregate indicator of the position of the corporate sector as a whole. The weight for each firm in this indicator will be given by its contribution to total (aggregate) fixed assets, in the case of investment, or to total employment, in the case of employment. To compare the different percentiles and the weighted average of the financial indicators we normalise them by setting  $FCII_{1990}^{median} = 100$  and  $FCIE_{1990}^{median} = 100$ .

Graph 4 displays the different percentiles and the weighted average of the indicators for the impact of financing conditions on investment and employment. In the case of fixed investment (Graph 4, upper panel), the different percentiles and the weighted average display a similar countercyclical pattern. According to the median FCII, the second half of the 1980s was characterised by a relaxation of financial conditions which was mostly explained by the reduction in corporate debt in a period of high nominal interest rates and, to a lesser extent, by a certain recovery in corporate profitability. In the early 1990s, this indicator shows a tightening of financial conditions as a result of an intense deterioration of corporate profitability.<sup>14</sup> After reaching a peak in 1993, the median FCII declined continuously until 1998, owing to the reduction in the level of debt. In this period, there is also a modest improvement in corporate profitability. Finally, the median FCII displays a slight increase in the last three years of the sample owing to a slight reduction in corporate profits.

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<sup>14</sup> Interestingly, if we consider FCII's derived from models excluding measures of profitability (for instance, the models in columns 2 and 5 of Table 3), the tightening of financial conditions during the cyclical downturn of the early 1990s is less severe.

Graph 4  
**Composite indicators of the impact of financial conditions**



The comparison of the median and the weighted average FCII shows that the weighted average presents higher values for the entire period, implying that the financial position for those firms that are more relevant for investment is weaker than that of the median. Furthermore, in some periods a different evolution pattern is observed for the representative (median) firm and the weighted average. For instance, the significant tightening in financial conditions observed in 2001 for the weighted average is not so clearly seen in the median, which displays a more stable evolution in the last part of the sample.

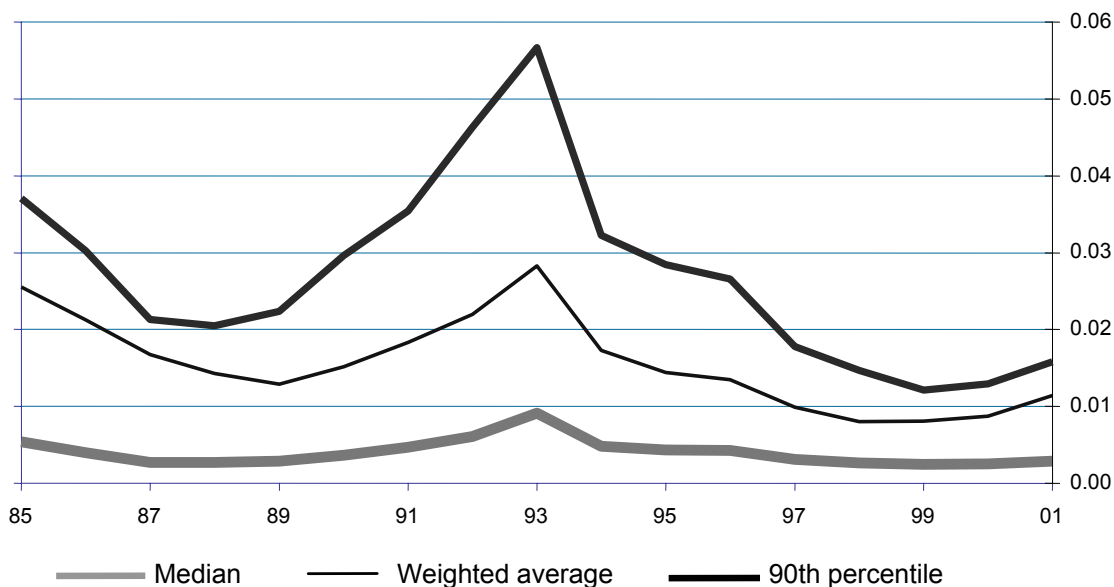
Again, the comparison of the median FCII with the higher percentiles reveals that it is in the recessions, especially in the cyclical trough of 1993, when the impact of the financing conditions on investment increased relatively more for the most vulnerable companies than for companies with an

average financial pressure.<sup>15</sup> It is also worth noting that the observed increase in the median in the last years of the sample is not observed for the firms in the upper decile of the distribution.

In the case of employment (Graph 4, lower panel), our preferred financial indicator is a weighted average of the *total debt burden* and the *gross revenue term*. As previously mentioned, a non-linear effect is allowed for the total debt burden term and the debt variables are no longer significant once additional financial indicators are included in the equation. The profile of the different percentiles of the FCIE is quite similar to that of the FCII. First, the different percentiles display a countercyclical pattern and second, this pattern is more evident in the case of the highest percentile. Again, the median indicator is not a good proxy of the position of the sector as a whole, although in this case the difference between the median and weighted average indicator diminishes in the last part of the sample. In fact, the median exceeds the weighted average in the last part of the sample period (after 1998), something that is not seen in the FCII. The tightening in financial conditions observed in 2001 for the weighted average FCII is also seen in the FCIE.

Finally, for the sake of comparison, we show in Graph 5 the indicator of financial fragility based on the model of Benito et al (2003) for the probability of default. As in the case of our indicators of the impact of financial conditions, we display the median, the 90th percentile and the weighted average. In this case, the weights are given by total assets of the firm with respect to the aggregate level of assets. The cyclical profile of the different percentiles of the distribution of this indicator is quite similar to those reported in Graph 4. The weighted average value of the indicator has a range of 0.008 to 0.028 while the 90th percentile varies between 0.012 and 0.057. There is a slight difference regarding the timing of the most recent deterioration in financial conditions. This financial stability indicator dates it to 1998, while according to our indicators it is only in 2001 that we observe a tightening in financing conditions.

Graph 5  
Financial fragility indicator



Note: The indicator of financial fragility is an indicator of the probability of default, based on Benito et al (2003). See the Data appendix for a brief description of this indicator.

<sup>15</sup> As expected, the value of the 90th percentile of the indicator based on a non-linear specification is higher, over the whole sample period, than the value of the 90th percentile of an indicator constructed with the same variables but without considering non-linearities. And, interestingly, it is in the recession when this difference is larger. For the weighted average indicator, a linear specification also yields a degree of fragility persistently lower than that reported here, including non-linearities.

Overall, this evidence shows the relevance of using firm-level data when analysing the evolution of the financial position and suggests that financing conditions do not affect all companies equally. A tightening of financial conditions will have a significantly greater effect on the real decisions of those firms with lower financial soundness. This is particularly relevant in episodes where the financial pressure on a significant number of firms breaches the threshold at which it has a more intense influence on business activity. In these episodes, indicators based on aggregate data may not reliably reflect the system's financial soundness since they do not adequately reflect the deterioration of the financial position of the more vulnerable companies.

## 6. Conclusions

This paper has aimed to assess the impact of financial conditions on firms' real decisions, using a large-scale company-level panel data set for the period 1985-2001. The analysis has focused on the behaviour of fixed investment and employment, which are conceivably two of the most important aspects of adjustment by firms in response to changes in financial conditions. Within the general topic of the relationship between financial conditions and real activity, we have addressed three specific issues: first, the assessment of the relative importance of different financial variables in explaining the real decisions of firms; second, the analysis of the non-linearity in the relationship between financial proxies and real variables; and, finally, the construction of a synthetic indicator to capture the impact of financing conditions on investment (and, alternatively, on employment).

Our results strongly indicate that financial position is important in explaining corporate decisions on fixed investment and employment. Several financial indicators turn out to be significant in the estimated equations. In particular, measures of the debt service burden (both including and excluding the stock of short-term debt) remain significant when additional financial indicators are incorporated and their coefficients are quite robust. As regards the indicators of corporate profitability, they are significant in all specifications, although their point estimates depend on the additional financial variables included in the specification. Finally, the evidence for the indicators of indebtedness is less conclusive. In the investment equation the net debt term is significant in most cases. In the employment equation, the debt terms are never significant in the linear specifications but they are significant for the upper decile of the distribution when considering non-linear specifications.

We have found evidence in favour of the hypothesis of a non-linear relationship between financial conditions and real activity. At a purely descriptive level, we have shown that the group of firms facing a higher degree of financial pressure, which we identify as those in the upper decile of the cross-sectional distribution of firms defined in terms of alternative financial indicators, have substantially lower investment and employment growth rates. The regression analysis corroborates this result: the sensitivity of investment and employment to financial conditions is substantially larger for those firms in the upper quartile (or decile) of the distribution defined in terms of the corresponding financial indicator. Moreover, in some specifications, the financial variable is not significant for the companies facing a moderate (or low) degree of financial tightness. Overall, this evidence suggests that the real impact of financial conditions is non-linear and becomes relatively more intense when financial pressure exceeds a certain threshold. As a consequence, from the standpoint of identifying the risks to macroeconomic and financial stability, the use of firm-level data seems to be particularly relevant in episodes where the financial pressure on a significant number of firms reaches levels at which it has a more pronounced influence on real activity. In these episodes, indicators based on aggregate data may not reliably reflect the system's financial soundness since they do not adequately reflect the vulnerability of the most fragile companies. In addition, the analysis of our composite indicators constructed at the firm level reveals that neither the level nor the evolution of the financial pressure experienced by the representative (median) firm is a good measure of the financial pressure faced by the corporate sector. In fact, in the last year of our sample (2001) the observed increase in our median indicators is much lower than that observed for the weighted average.

As regards the most recent data, our composite indicators for the impact of financial conditions on investment and employment remain at moderate levels, in historical terms. At an aggregate level, Spanish firms have shown an increase in debt ratios, although this has not been translated into a higher debt service burden due to the declining path of interest rates. Thus, the financial position of the corporate sector will not foreseeably represent, on average, a significant obstacle to the recovery in investment and employment. Moreover, a more disaggregated analysis shows that, in the most

recent period, the increase in debt ratios for those firms in a weaker financial position (which are, according to our results, the most sensitive to changes in their financial position) has been lower than that observed in the aggregate. Furthermore, the available information for 2003 reveals that the companies with the highest indebtedness have indeed experienced reductions in their debt ratios. Nonetheless, the high level of debt at some of these firms suggests that their scope to obtain additional external funds is now lower and that their exposure to potential shocks is higher. Additionally, our analysis has shown that financial conditions for those firms that are more relevant for investment and, to a lesser extent, for employment, are tighter than those for the median (representative) firm and therefore these companies may be more influenced by disturbances affecting their financial position.

## Data appendix

Table A1

### Number of time-series observations per company

Panel structure

No of records	5	6	7	8	9	10	11
Companies	1,268	1,109	913	658	581	379	352
No of records	12	13	14	15	16	17	Total
Companies	411	365	415	400	234	462	7,547

#### *Investment (I)*

Purchase of new fixed assets.

#### *Capital stock (K)*

Fixed assets at replacement cost (calculated by the Central Balance Sheet Data Office (CBSO) of the Bank of Spain). When introduced in real terms, *K* is deflated by the Gross Fixed Capital Formation deflator.

#### *Total assets (A)*

This is given by the sum of fixed assets at replacement cost *K* and working capital less provisions.

#### *Employment (N)*

The number of employees during the year.

#### *Real sales (S)*

Total company sales, deflated by the GDP deflator.

#### *Wages (W)*

The average company wage is given by direct employment costs (not including social security contributions) divided by the employment headcount and deflated by the GDP deflator.

#### *Gross revenue over total assets (GR/A)*

Gross operating profit plus financial revenue divided by total assets.

#### *Debt (B/A)*

Total outstanding debt divided by total assets.

#### *Debt over gross revenue (B/GR)*

Total outstanding debt divided by gross revenue, *GR*.

#### *Net debt ((B – m)/A)*

Total outstanding debt less cash and its equivalents divided by total assets.

#### *Interest debt burden (idb)*

Interest payments divided by gross revenue.

#### *Total debt burden (tdb)*

Interest payments plus short-term debt over gross revenue.

#### *Cash flow (CF/A)*

Post-tax profit plus depreciation of fixed assets divided by total assets.

#### *Probability of default (pd)*

Based on Benito et al (2003), this indicator is obtained from the estimation of a probit model which has as explanatory variables real sales, debt, interest debt burden, short-term debt without cost over total debt, profitability, liquidity, a dummy indicating if the firm pays dividends and the growth rate of gross domestic product.

For interest debt burden and total debt burden, where companies have a negative or zero value for the denominator and a positive value for the numerator the ratio is set equal to the value of the 99th percentile that year; where the numerator is zero, the ratio is set equal to zero, for any value of the denominator. Additionally, for all the variables used as regressors (except those that enter in levels), when the value is higher than the 99th percentile, it is changed for the value of this percentile.

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