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Do Financial Factors Affect the Capital-Labour Ratio? Evidence from UK Firm-Level Data

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Abstract

This paper investigates the nexus between financial factors and the capital-labour ratio using a rich firm-level data set. It is common in the literature to examine the impact of financial constraints on hiring and firing decisions separately from their impact on decisions related to investment in physical capital. We argue that as long as firms use both inputs in production and there is some substitutability between them, the two decisions need to be jointly analyzed. When we differentiate across firms that are more or less financially constrained, we find that the former group exhibits higher sensitivities of the capital-labour ratio to firm-specific characteristics, compared to the latter.

JEL classification: E22, D92, E44

Key words: Financial constraints, Firm-specific characteristics, Capital-Labour ratio

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1 Introduction

A large number of theoretical and empirical studies have shown that the firm's financial position is important for its fixed investment and employment decisions under imperfect financial markets (see Hubbard (1998) and Bond and Reenen (2006), for surveys). Recent evidence from the UK reveals that financial constraints and firms' real activity are indeed interrelated (von Kalckreuth (2006)).[1] Benito and Hernando (2007) present evidence that firms' corporate and real decisions (fixed investment, employment, inventories) are influenced by balance sheet and financial pressure. Overall, empirical studies of firm investment and employment strongly suggest that changes in net worth and consequently in firms'real decisions (investment, employment) arise from information problems in financial markets.

Under certain assumptions (to the extent that labour is a quasi-fixed factor or there is a lag between labour input and production), firms may need to raise funds externally to finance labour input. As a result, fluctuations in net worth can lead to accelerator effects on employment demand in ways similar to their effect on fixed investment. There is some evidence of net worth effects (using measures of leverage as a proxy) on employment demand. One type of evidence finds negative effects of leverage and debt service on employment, holding constant other determinants of labour demand (Cantor (1990), Nickell and Nicolitsas (1999), Benito and Hernando (forthcoming)). Another type of evidence finds that highly leveraged firms, all else equal, appear to be less prone to hoard labour than less leveraged firms (Sharpe (1994)).

Empirical findings from the fixed investment literature are more controversial and in particular the issue of whether a positive and statistically significant relationship between investment and cash flow can be seen as an indicator of financing constraints. Fazzari et al. (1988) (henceforth FHP, 1988) use *a priori* measures of financial constraints and find that the sensitivity of investment to cash flow is particularly large for firms that have trouble raising external funds (i.e financially constrained firms that face high agency costs). A significant challenge to FHP's (1988) conclusions came with Kaplan and Zingales (1997). They argue that there is no theoretical basis for this relationship and present empirical evidence that less financially constrained firms (firms with a low agency cost) exhibit significantly greater investment-cash flow sensitivities compared to the more

[1] Following Basu and Guariglia (2002), von Kalckreuth does not rely on a comparison of cash flow sensitivities, instead he focuses on the dynamics of adjustment.

constrained firms. An attempt to shed some light on the debate comes from Tirole (2006) who develops a simple model of credit rationing and uses it to illustrate the role of net worth. He concludes that unless one has more precise information about the actual heterogeneity of firms, it is difficult to predict how the sensitivity of investment to cash flow varies with an *a priori* measure of financial constraints.

Our motivation stems from simple theoretical considerations. We argue that as long as firms use both inputs in production (capital and labour) and there is some substitutability between them, the two decisions need to be jointly studied. Consider the following example. Under the assumption of constant returns to scale (CRS), suppose that two firms (firm 1 and firm 2, that differ in their ability to raise external finance) experience a permanent increase in the demand for their product. Firm 1, which is less likely to be financially constrained, operates at full capacity and expands both inputs by using both external finance and internal funds. With that in our mind we should expect the firm-level capital-labour ratio (K/L) to remain constant. On the other extreme, firm 2, which is more likely to be financially constrained, might not be able to borrow the funds for the capital investment and might satisfy partially the demand by hiring more labour (constrained firms by definition can not invest optimally in capital, due to the lumpiness and cost of capital). For the latter firm we should anticipate a decline in the K/L ratio. A study that considers the effects of financial factors on both investment and hiring decisions would be able to make the above distinction. In other words, how more and less constrained firms allocate their funds on capital and on labour to reach a target K/L ratio when decisions on both inputs have to be taken simultaneously rather than independently.

Motivated by such issues, this paper examines how the K/L ratio should respond to fluctuations in net worth for firms that are more or less likely to face financial constraints. The literature has largely neglected the impact of capital market imperfections on the K/L ratio. A rare point of reference is Garmaise (forthcoming), who shows that financially restricted firms will have lower K/L ratios because informed employees provide more efficient financing than uninformed capital suppliers.[2] Yet, this approach does not tell us *how* sensitive the K/L ratio is to firm-specific characteristics, nor *how* capital market imperfections can affect firms' decisions on the K/L ratio. In examining diagrammatically a rich financial dataset of UK manufacturing firms for the period

[2] In his paper owner's characteristics, indices for the bank concentration and rejections of owner's loan applications are considered as proxies for financial constraints.

1994-2004 we show that small firms (more likely to be constrained) face a lower K/L ratio in contrast with large firms (less likely to be constrained). Figure 1 illustrates the relevance of firm-level heterogeneity to the understanding of the firm's decisions on the capital-labour ratio. We observe that the K/L ratio evolves differently between firm classes, with large firms exhibiting consistently higher values across years compared to the small group of firms. In the main part we present empirical evidence that the financial position of firms, drives the heterogeneous K/L ratio among different firm classes.

In this paper we add to the literature in several important ways. First, we examine the relationship between the K/L ratio and firm-specific indicators. Financial status is a vague term for describing firms' net worth and a number of balance sheet indicators have been used in the literature as measures of financial healthiness (see Benito (2005); Benito and Hernando (2007)). We estimate the responsiveness of the K/L ratio to variations in firm-specific characteristics, such as cash flow, leverage and collateral.

Second, the focus of attention is on the investigation of the behaviour of constrained and unconstrained firms regarding their decisions on the K/L ratio. Given that a firm's choice to use capital and labour may reflect its financial position, financial factors become a central element. Hence, it is of particular interest to examine the sensitivity of the K/L ratio to firm-specific characteristics for more and less constrained firms.

Third, this study explores the impact of firm-specific interest rates on the K/L ratio. A number of recent studies (for example, Benito and Whitley (2003); von Kalckreuth (2003); Mojon et al. (2002)) have employed a firm-specific interest rate (implicit interest rate) to analyze the effects of a change in "monetary policy" on firms' behaviour (fixed investment, employment, inventories). According to the theory of the financial accelerator (Bernanke et al. (1999)), the interest paid by firms with weak balance sheets should react more to monetary policy shocks than the interest paid by firms with strong balance sheets.

Finally, a unique feature of this paper is the large panel of financial data on UK firms, extracted from the FAME database, most of which are unquoted on the stock market. Having access to financial variables for unquoted firms provides a unique opportunity to test the financing constraints hypothesis. This is because unquoted firms are more likely to be characterized by adverse financial attributes such as a short track record, poor solvency, and low real assets compared to the quoted firms, which are typically large, financially healthy, long-established companies with good credit ratings. To our knowledge, this is the first study to present evidence of a link between the capital-labour ratio and firm-specific characteristics under the presence of capital market imperfections.

The remainder of the paper is laid out as follows. Section 2 illustrates a preliminary data analysis and presents our classification schemes. In section 3 we present our baseline specifications and our econometric methodology. In section 4 we discuss the estimation results while in section 5, some robustness tests are presented. Section 6 concludes.

2 Data Analysis and Classification Schemes

This section presents a descriptive and graphical analysis of the data along with the sample separation criteria. The data are presented in primarily graphical form to illustrate variation in the cross-sectional distributions of outcomes and how these have varied over time. This provides a precursor to the more formal analysis of how the capital-labour ratio, of different firm classes, responds to financial constraints.

2.1 Data Description and Graphical Analysis

We construct our data set from the profit and loss and balance sheet data gathered by Bureau Van Dijk Electronic Publishing in the FAME database. The FAME database provides information on 2.8 million companies, 1.9 million of which are in a detailed format, over the period 1994-2004.[3] Although detailed information are available for large firms, based on firms accounting thresholds refereed in the section 248 of the UK Companies Act 1985, small and medium enterprises (SMEs) do not report detailed accounts. For medium-sized companies there is no requirement to disclose turnover details, while for small-sized companies only an abridged balance sheet is required.

In contrast to earlier US and UK studies that employ datasets made up of quoted firms, we use a rich financial data which comprises mainly non-publicly traded firms. Our database includes

[3] A maximum of 10 years of complete data history can be downloaded at once. Our data were downloaded early in 2005: the coverage period is therefore 1994-2004. It has to be noted that three types of access to the FAME dataset are available: type C gives access to all firms in the database; type B gives access to the top 322846 firms, and type A to the top 139901 firms. Only the latter access type was available to us for this particular project.

a majority of firms which are not traded on the stock market or which are quoted on alternative exchanges such as the Alternative Investment Market (AIM) and the Off-Exchange (OFEX) market.[4] This is an appealing characteristic of the data as it allows our measures of capital market imperfections to display a wide degree of variation across observations in our sample. Having data on private as well as public companies is particularly valuable in our case, as the private companies are generally the smallest, youngest, and most bank dependent firms. They are therefore more likely than public companies to face financing constraints.[5] Table 1 presents the share of quoted and unquoted firms in the sample. We find that 96.78 percent of firms operate in the private sector, and only a small fraction of firms are publicly traded (1.2 percent).

Our sample is limited only to firms that operate in the manufacturing industry. We exclude all firms in service sectors in order to avoid the likelihood of a severe measurement error of firms'capital stock. We provide information on financial accounts and ratios for 17,350 UK manufacturing firms for the years 1994-2004. Further, we use the STAN database as our source for data on industry level, alongside with FAME, to construct the user cost of capital. STAN is maintained by the Economic Analysis and Statistics Division of OECD's Directorate for Science, under the auspices of the Statistical Working Party of OECD's Committee on Industry and Business Environment. We extract information on investment and output at the industry level for all firms operating in the manufacturing sector.

Our sample includes 17,350 manufacturing firms and is representative of the aggregate economy along a number of dimensions. Figure 2 compares the aggregate percentage change of the number of employees for the firms in our panel with the corresponding percentage change for the OECD entire manufacturing sector. The two series are highly correlated and exhibit similar variation across time. Figure 3 compares the aggregate percentage change of firms' investment in our sample with the corresponding statistic for all manufacturing firms in OECD. The two measures paint a similar picture of the state of investment over time. Clearly evident is the sharp decline in investment between 1997 to 2000. Investment in our sample bottomed out at a very low level in 1999 and 2000 and then rose noticeably. The OECD investment line reached its lowest level in 2002 and ran-up in 2003.

[4] Unlike in the US, where only quoted firms are required to file their quarterly or annual accounts, UK firms have to disclose their accounts even if they are not traded on the stock market.

[5] Datasets that include only quoted firms, and therefore relatively large firms, are likely to be less informative to determine whether a firm is financially constrained or not.

Next, we impose the restriction that the firm has at least 3 consecutive time-series observations per company, with the number of years of observations on each firm varying between 4 and 11. This produces an unbalanced sample of manufacturing companies. By allowing for both entry and exit the use of an unbalanced panel partially mitigates potential selection and survivor bias. Finally, to control for the potential influence of outliers, observations in the variables that have very large dispersion are excluded. Hence, we start our empirical analysis with 14,700 firms.[6]

The epicenter of this paper is firms' financial decisions on the K/L ratio. An important element is the discussion of the capital stock and the number of employees which are used to construct the K/L ratio. Firms' simultaneous decisions on capital and on labour, and the substitutability of the two inputs create a motive to consider their evolution across time. Thus, it is of particular importance to show that any changes in the K/L ratio are not driven by changes in either capital stock (K) or the number of employees (L). We first depict K and L variations over our sample period. Comparing Figures 4 and 5, we notice that both capital and labour follow the same pattern across time. They both exhibit an increasing trend, although capital is rising at a higher pace during the mid to late 90's. In other words, these figures tell us that both capital and labour change over time providing therefore justification for their joint examination.

We then consider the mean of leverage, collateral and cash flow for more or less constrained firms using size as a sorting device. Leverage, which is defined as the ratio of total liabilities to firm's real total assets, is higher for small firms throughout our sample (Figure 6). This implies that high levels of existing debt are associated with a worse balance sheet situation, which would increase moral hazard and adverse selection problems, and lead to the inability of firms to obtain external finance at a reasonable cost. Moving to cash flow (Figure 7), it is clear that small firms have a higher cash flow position in contrast to large firms. This may indicate that financially constrained firms feel the pressure to maintain a positive cash flow cushion under capital market imperfections. The ratio of tangible assets over firm's total assets (collateral ratio) for small and large firms is presented in Figure 8. We observe that the level of collateral is consistently higher for large firms compared to the small ones. It follows that large firms can pledge more tangible assets as collateral and therefore might find it easier to access capital markets.

[6] Even though we start with a large sample, the construction of the perpetual inventory formula used to proxy for the replacement value of capital stock leads to a substantial loss of observations. We check the robustness of this issue in section 5.

A very similar picture emerges by looking at the descriptive statistics in Table 2. In examining the financial variables we find that the differences between more or less financially constrained firms are statistically significant in all cases.

2.2 Sample Separation Criteria

To depict responses of firms to capital market imperfections, we first have to partition them according to whether they are more or less likely to face financial constraints. Following the bulk of the literature we create three different measures of financial constraints, these are size, age and bank dependency. We use the 75 percent cut-off value[7] and we allow firms to switch across firm categories over time.[8]

Our first separation scheme is based on firm's real total assets. We generate a dummy variable, $SMALL_{it}$, which is equal to 1 if firm *i's* real assets are in the bottom 75 percent of the distribution of the real assets of all firms operating to the same industry as firm i in year t, and equal to 0 otherwise. Gertler and Gilchrist (1994) used this variable as a proxy for capital market access for firms in the manufacturing sector.[9] Small firms are more vulnerable to capital market imperfections and thus more likely to be financially constrained.

In the second scheme, firms are classified according to their age in order to measure the importance of a track record. An old established firm is more likely to have access in the capital market compared to a young and growing firm. Hence, it is more likely young firms to face problems of asymmetric information.[10] Therefore, we create the dummy $YOUNG_{it}$, which is equal to 1 if age for firm i is in the bottom 75 percent of the distribution of the age of all firms operating to the same industry as firm i in year t, and equal to 0 otherwise.

The last scheme is an indicator of the firm's bank-dependence, called the mix. It is defined as the ratio of the firm's short-term debt to its total debt and it was introduced by Kashyap et al. (1993).[11] The mix refers to access to market finance versus bank finance, where the majority of

[7] Greenaway et al. (2007) utilize the FAME database and partition firms to more or less financially constrained using the 75 percent cut-off value.

[8] For this reason, our empirical analysis will focus on firm-years rather than simply firms. See Kaplan and Zingales (1997), and Guariglia (1999) for a similar approach.

[9] Bougheas et al. (2006) and Guariglia and Mateut (2006) based their group classification on the firm's real total assets.

[10] This classification criterion has been employed in the past by a number of researchers (Devereux and Schiantarelli (1990); Carpenter et al. (1994) and Gertler and Gilchrist (1994)).

[11] Oliner and Rudebusch (1996) used a closely related variable (short term debt / total short term debt) in their test for the presence of a bank lending channel of transmission of monetary policy and subsequently

short term debt is bank finance. It attempts to measure the extent to which a firm has to finance itself short term rather than long term and is therefore related to its access to long term finance. The higher the mix, the more bank-dependent a firm is. Thus, it is more likely this firm to be characterized as a constrained firm. We create a dummy $MBANK_{it}$, which is equal to 1 if firm i's mix is in the top 75 percent of the distribution of the mixes of all firms belonging to the same industry as firm i in year t, and equal to 0 otherwise.

3 Methodology

This section describes the empirical approach and presents the baseline models. To examine the sensitivity of the K/L ratio to firm-specific characteristics we estimate the following static linear model.

$$y_{it} = X_{it}\beta + F_{it}\gamma + e_{it} \tag{3.1}$$

where $i = 1, 2, \ldots, N$ refers to a cross-section of firms, $t = 1, 2, \ldots, T$ refers to time period. y_{it} and X_{it} are the dependent variable and the vector of non financial explanatory variables for the firm i and year t, respectively. The dependent variable is the log of capital-labour ratio $(K/L)_{it}$, where K is the replacement value of firm's capital and L is the number of employees. The vector of non financial variables consists of $PRICE_{it}$, the log of real price - the ratio of industry variable user cost of capital to firm level wages[12] - and $SALES_{it}$, the log of real sales.[13] F_{it} denotes the vector of financial variables for the firm i and year t. e_{it} is the error term made up of five components: ψ_i is a firm-specific component, ψ_t is a time-specific component accounting for business cycle effects, ψ_j is an industry-specific component accounting for industry dynamics, ψ_{jt} is an industry specific component which varies across time and accounts for industry-specific shifts across the time period, lastly ϵ_{it} is an idiosyncratic component.[14] We control for ψ_i by estimating our equations in first-differences, for ψ_t by including time dummies, for ψ_j by including industry dummies and for ψ_{jt}

used by Guariglia and Mateut (2006).

[12] Although firm wages are affected by employee skills, we are unable to use this information since the FAME dataset has only information on the total employee remuneration.

[13] Nickell and Nicolitsas (1999) use a standard labour demand model, supplemented with a financial variable and a control for firm output namely the log of real sales

[14] Firms are allocated to one of the following nine industrial groups: food, drink and tobacco; textiles, clothing, leather and footwear; chemicals and man made fibres; other minerals and mineral products; metal and metal goods; electrical and instrument engineering; motor vehicles and parts, other transport equipment; mechanical engineering; and others (Blundell et al. (1992)).

by including time dummies interacted with industry dummies in all our specifications.

To explore the sensitivity of firms' K/L ratio stemming from the interaction between imperfect capital markets and firm-specific characteristics, we employ a set of dummy variables.

$$y_{it} = X_{it}\beta + F_{it}\gamma D_{it} + e_{it} \tag{3.2}$$

The dummy vector (D_{it}) is interacted with the vector of financial variables (F_{it}) in our baseline specification. The dummy vector consists of three different binary variables reflecting size, age and bank dependency.

In this paper we employ the First-Differenced GMM approach (see Arellano and Bond (1991)) which considers both the endogeneity bias and the unobserved heterogeneity problems.[15] This technique takes unobserved firm heterogeneity into account by estimating the equation in first-differences, and controls for possible endogeneity problems by using the model variables lagged two or more periods as instruments. To evaluate whether the model is correctly specified we use the Sargan/Hansen (J) test and the *m2* test statistic. The J statistic is the test for overidentifying restrictions, which, under the null of instrument validity, is asymptotically distributed as a chi-square with degrees of freedom equal to the number of instruments less the number of parameters. The *m2* test is asymptotically distributed as a standard normal under the null of no second order autocorrelation of the residuals in the first-differenced equation, and provides a further test on the specification of the model and on the legitimacy of variables dated t-2 as instruments in the differenced equation.

The set of financial variables that we incorporate in our models is in line with the existing empirical literature. More precisely, we define $COLLATERAL_{it}$ as the ratio of tangible assets to total assets. An extensive body of the literature points out the importance of collateral for debt finance. Firms can raise external finance by pledging the underlying productive assets as collateral. Assets that are more tangible, sustain in fact more external financing because tangibility increases the value that can be recaptured by creditors in case of borrower's default. If the firm reneges on its debt, creditors will seize those assets (Carpenter and Petersen (2002); Almeida et al. (2004)). We should expect collateral to be a significant indicator for constrained firms' K/L ratio.

We also employ $LEVERAGE_{it}$ defined as the ratio of total liabilities to total assets, as a mea-

[15] The choice of the First-Differenced GMM over the System-GMM is explained in section 5.

sure of firms' indebtness. We aim at producing a comprehensive measure of the overall "tightness" of the firm's balance sheet (Sharpe (1994); Guariglia (1999); Vermeulen (2002)). We might expect that highly leveraged firms i.e the financially vulnerable firms that face high agency costs and high levels of capital constraints, to present a more sensitive K/L ratio.

Finally we include $CASHFLOW_{it}$, defined as the sum of after tax profit and depreciation normalized by the total assets of the company. Earlier studies show that the activities of more constrained firms depend on the internal funds such as cash flow (Fazzari et al. (1988); Benito and Hernando (2007)). Recent evidence suggest that only financially constrained firms should display a propensity to save cash (Almeida et al. (2004)). In this paper, we might expect cash flow to be less significant for financially unconstrained firms' K/L ratio. But on the other extreme, constrained firms should be eager to retain cash flow thus, implying its significance on firms' decisions on the K/L ratio.

4 Results

4.1 The nexus between Firm-Specific Characteristics and the K/L ratio

Benito (2005) and Benito and Hernando (2007) stress the importance of firm-specific indicators on fixed investment decisions, inventory investment, and employment. Taking into consideration earlier evidence, we seek to test whether firm-specific characteristics are important determinants of the K/L ratio for UK firms.

Results are presented in Table 3.[16] The coefficient on the control variables have the expected sign. Both *PRICE* (the ratio of factor prices) and *SALES* have a negative and highly significant effect on the dependent variable, implying that a 1 percent increase in price and sales results in a 0.558 percent and 0.531 percent decrease in the capital-labour ratio respectively.

Turning to the analysis of the financial variables, the results indicate a significant effect of the covariates on the K/L ratio. In particular, the coefficient on *CASH FLOW* exerts a negative and significant impact on the K/L ratio. This would be the case if firms were considered as relatively more constrained.[17] The coefficient on *LEVERAGE* is negative suggesting that an increase in

[16] All standard errors are robust to cluster (industry) correlation. Given that we have repeated observations on firms, clustering allows the observations to be independent between firms, but not necessarily within firms.

[17] This result could be attributed to the fact that the majority of firms included in the dataset are unquoted, which are more likely to be financially constrained. We elaborate on the issue of the interaction between cash flow and constraints in the next section.

firm's debt limit affects negatively the K/L ratio. Finally, *COLLATERAL* exhibits a positive and highly significant coefficient stressing the importance of the ratio of tangible assets to total assets to support borrowing.

Our instrument set includes collateral, leverage, cash flow and sales all lagged two and three times. The J statistic has a significance of 0.161 and the *m2* statistic shows no sign of second order serial correlation of the residual. Both tests suggest that the instruments are valid and that there is no sign of mis-specification in the model. The results obtained from this specification are of particular importance in shaping the view that firm-specific characteristics such as leverage, collateral and cash flow are important determinants of the K/L ratio.

4.2 Capital Market Imperfections and the K/L ratio

In this section, motivated by the existing investment and employment literature we consider the effects of financial factors on both investment and hiring decisions by investigating how more or less financially constrained firms allocate their funds when decisions on capital and on labour have to be taken simultaneously. In particular, we examine whether more financially constrained firms are likely to face a higher sensitivity of the K/L ratio to firm-specific indicators, compared to their less constrained counterparts.

To examine our main hypotheses we follow the established empirical financing constrains literature and divide firms to more and less constrained using different classification criteria such as size, age and bank dependency. The results are remarkably consistent across these categories and document that constrained firms exhibit greater sensitivities to the K/L ratio.[18]

Table 4 reports the results from the interaction between firm type dummies and financial variables as reported in equation (2).

To start with, a key result concerns the negative and significant impact of *CASH FLOW* on the K/L ratio. The coefficients on cash flow are negative and statistically significant only for the group of constrained firms, indicating a negative correlation between cash flow and the K/L ratio. When a firm faces difficulties in obtaining external finance its employment should be more sensitive to the availability of its internal funds. Constrained firms can not invest optimally in capital due to some technological impediment to adjusting capital quickly (this will be the case if capital investment

[18] We split firms to more or less financially constrained using the 75 percent cut-off value. We have explored the robustness of this finding using an alternative benchmark level, namely 50 percent. This has left our main results largely unchanged. Results are available upon request.

is lumpy as suggested in the investment literature) thus the firm will satisfy demand using labour more intensively.[19] For unconstrained firms the coefficients are insignificant and quantitatively unimportant implying that the cash flow-K/L ratio correlation is zero.

Next, we observe negative coefficients on *LEVERAGE* which are significant for constrained firms but they are insignificant for their unconstrained counterparts. This result is consistent with the view that higher levels of debt may deter creditors from offering further credit for firms that are vulnerable, meaning a limited access on external finance for constrained firms. It is a stylized fact that firms have to raise external finance in order to finance their investment projects. However, when a firm is highly indebted it's extremely difficult and expensive to obtain outside finance. Thus the higher the debt burden, the higher is the cost of external finance. Cantor (1990) and Calomiris et al. (1994) show that increases in leverage at the firm level are associated with increased volatility in capital expenditures. In other words, highly leveraged firms are more likely to face a more sensitive K/L ratio.

Turning to *COLLATERAL*, the estimated coefficients are positive and significant for both constrained and unconstrained firms. These results are in line with Berger and Udell's (1990) findings that collateral is an important factor, reducing the riskiness of a loan by giving the financial institution a claim on a tangible asset. Although the coefficients are mainly higher for constrained firms, they are not significantly different from each other suggesting that the effects of the collateral are the same across different group of firms.

The instrument set includes the interaction of collateral, leverage and cash flow with the size, age and bank dependency dummies, and sales, all lagged two and three times. Overall, the J and *m2* tests do not indicate any problems with the specification of the model and the choice of the instruments.

Summarizing our results, we find that the K/L ratio presents a higher response to fluctua-

[19] Anecdotal evidence in Spaliara (2007) suggests that the sign of cash flow varies with the industry under consideration. Cash flow has a positive impact on the K/L ratio for the constrained group of firms operating in industries with low elasticity of substitution. These are electrical and instrument engineering; motor vehicles and parts, other transport equipment; mechanical engineering. Due to their high technology profile, firms retain cash flow as a buffer stock to invest mainly on capital. However, a sign reversal is observed for constrained firms in industries with high elasticity of substitution i.e food, drink and tobacco; textiles, clothing, leather and footwear; chemicals and man made fibres; and miscellaneous industries. This result may be attributed to the fact that the above industries are, on average, low technology with a labour intensive character. The majority of firms in our sample operate in high elasticity industries and this might influence the negative sign of cash flow observed in table 4.

tions in firm-specific characteristics for firms that are more likely to face financial constraints. In particular, equation (2) estimates provide us with evidence that firms facing a different degree of credit constraints exhibit a heterogeneous K/L ratio. In other words, small, young and more bank dependent firms exhibit greater sensitivities to the capital-labour ratio.

4.3 Interest Burden and the K/L ratio

A firm-specific estimate of the cost of debt (or firm-specific interest rate) has recently been employed by a number of studies (see Benito and Whitley (2003), Benito (2005), Benito and Young (2007), Benito and Hernando (2007, forthcoming),von Kalckreuth (2003), Mojon et al. (2002)). They present evidence that firms' real and financial decisions are influenced through the implicit interest rate. Their findings support the notion that debt-servicing costs affect not only investment expenditures but also employment and inventory spending.

Our aim is to exploit heterogeneity at the firm level in order to consider the financial-accelerator hypothesis, that deteriorations in financial health increase the cost of finance, and hence to show that the K/L ratio of financially constrained firms is affected more severe. Interest burden (*ID*) is incorporated in our model as an indicator for the implicit interest rate and is defined as the ratio of interest payments to total debt.[20] Although this indicator is not controlled exogenously by the Bank of England (it is endogenous in the sense that it reflects the financial conditions of firms as well as the interest rate), it does provide evidence about the extent of the asymmetric information problem in the financial transactions given firm heterogeneity (Bougheas et al. (2006)).

In column 1 of Table 5 we present the estimates of the augmented -by the interest burden-equation (1). The coefficients on the explanatory variables retain their statistical significance. The coefficient on interest burden is negative and highly significant: interest burden clearly has information about differences in payment obligations among firms embedded in it. Next, we report the results from the interactions between firm type dummies and the interest burden. The coefficients associated with the interacted interest burden show strong evidence that the K/L ratio of constrained firms is more sensitive compared to their unconstrained counterparts. This may be due to increases in the cost of finance for the former category.

The instrument set includes the interaction of interest burden with the firm type dummies, and

[20] Note that we construct the user cost of capital using the base rate instead of the firm-specific interest rate. This is because we seek to link directly the implicit interest rate with the K/L ratio rather than appraise the sensitivity of the K/L ratio to changes in the user cost of capital.

collateral, leverage and cash flow and sales, all lagged two and three times. Moreover, the results support the validity of the instruments and the absence of the second-order serial correlation.

5 Robustness Checks

In this section we provide a series of robustness analysis of our results. Firstly, we examine whether our results remain persistent when we employ a dynamic estimation. Secondly, to test the robustness of the cash flow results, we regress the specification excluding the distressed firms. Finally, we replace capital stock with fixed assets.

5.1 Dynamic Estimation

The rationale for estimating our models in a dynamic panel data setting, can be attributed to the time lags that we should expect capital adjustment to be subject to. Given the speed and the time of capital and labour adjustment, we estimate our models employing a dynamic approach.

All our variables retain their significance in most of the cases while the results support the validity of the instruments and the absence of second-order serial correlation. In Table 6 we present the estimated results of equations (1) and (2). The main findings from the Dynamic First-Differenced GMM estimations are in line with those reported in section 4.[21] It is confirmed that firm-specific characteristics such as leverage, collateral and cash flow are important determinants of the K/L ratio. Moreover, when we make the distinction between more or less financially constrained firms we show that the former group of firms exhibits higher sensitivities of the K/L ratio to cash flow and leverage. The coefficients on collateral are not significantly different across firm

[21] A recently developed model is the System-GMM, an augmented version of First-Differenced GMM outlined in Arellano and Bover (1995) and fully developed in Blundell and Bond (1998). The system-GMM controls for fixed effects with the estimator being an extension of the GMM estimator of Arellano and Bond (1991) and estimates equations in levels as well as in first-differences. Estimating the levels equations with a lagged difference term as an instrument offers significant gains, countering the bias associated with weak instruments (Blundell and Bond (1998)). System-GMM performs better than First-Differenced GMM with the latter being seriously biased in small samples when the instruments are weak. A way to detect whether the First-Differenced GMM estimator is affected by the finite sample biases is to compare the estimate of the coefficient on the lagged dependent variable obtained from the latter estimator with those obtained form the OLS and the WG estimators. As the OLS estimate is upward biased, whereas the WG estimate is downward biased, one would expect a consistent estimate of the coefficient on the laggged dependent variable to lie in between these two estimates. If we find that the estimate obtained using the First-Differenced GMM estimator lies close or below the WG estimated, then the GMM estimate is downward biased as well (see Bond et al. (2001)). After estimating equation (1) using the OLS, the WG and the First-Differenced GMM estimators, we find that the GMM coefficient lies between the OLS and the WG estimates. We can conclude that the First-Differenced GMM estimates are unlikely to be subject to serious finite sample biases, thus, we opt for estimating the model using the First-Differenced GMM.

types. Also, we find that the capital-labour ratio is more sensitive to the implicit interest rate for constrained firms confirming that financial accelerator phenomena play an important role in the transmission mechanism of monetary policy for the UK. The estimates of the augmented-by the interest burden- equation (1) and (2) are not reported for brevity, but are available upon request.

5.2 Positive Cash-Flow observations and the K/L ratio

Evidence from our econometric estimations suggest that cash flow has a negative effect on the capital-labour ratio for more constrained firms. To examine whether our findings on cash flow-K/L ratio relationship are driven by the fact that a firm is in sufficiently bad shape, we follow Allayannis and Mozumbar's (2004) technique. They investigate the role of negative cash flow observations on investment decisions estimating investment models including positive cash flow observations and all the cash flow observations interchangeably.[22]

We present these results in Table 7. All test are modifications of the estimated model in table 4. The coefficients associated with the cash flow variable are now much higher for more constrained firms. This finding reveals that the cash flow results for constrained firms obtained in Table 4, are not affected by the inclusion of distressed firms (proxied by negative cash flow). In fact, they strongly support the importance of cash flow for more constrained firms in connection to the capital-labour ratio.

5.3 An Alternative Measure of Capital Stock

Since part of our analysis depends on the capital-labour ratio, it is important to check whether our results hinge on how finely we construct capital. Up to this point we have used replacement value of capital stock as the firm's capital. However, the use of the perpetual inventory formula leads to a substantial loss of observations in our sample.

Taking into consideration the peculiarity of the replacement value of capital stock, we replace this variable with the fixed assets. Following Mackay and Phillips (2005) we define fixed assets as the sum of tangible assets, intangible assets, and investment and other fixed assets. After re-estimating equations (1), (2) and the augmented - by the interest burden- equations we show in Table 8 that results remain largely unchanged compared with those obtained using the replacement value

[22] Distressed firms, as proxied by negative cash flow observations, exhibit lower investment-cash flow sensitivities than non-distressed firms (Allayannis and Mozumdar (2004)).

of capital stock as our preferred capital variable (the interest burden results are available upon request). Thus, these findings provide assurance that our main results are robust to the use of replacement value of capital stock.

6 Conclusions

In this paper we use a large panel of financial data on UK firms, of which 99 percent are not quoted on the stock market, to examine how the K/L ratio should respond to fluctuations in net worth for firms that are more or less likely to face financial constraints. Further, we focus on the direct effect of the firm level implicit interest rate on the K/L ratio for more and less financially constrained firms. Using data on unquoted firms has provided us with a unique opportunity to construct measures of financial constraints displaying a wide degree of variation across observations.

This paper is motivated by the fact that relatively little attention has been devoted to the sensitivity of the K/L ratio to financial factors which is somewhat surprising given that changes in labour demand and fixed investment arise, to some extend, due to information problems in financial markets. We consider the effects of financial factors on both investment and hiring decisions in order to examine how more and less constrained firms allocate their funds on capital and on labour when decisions on both inputs have to be taken simultaneously.

The paper has found evidence that firms' net worth and the K/L ratio are interrelated. According to our results the K/L ratio turns to be more responsive to changes in firm-specific indicators. Further, when firms are classified on the basis of their different characteristics we show that financially constrained firms face a greater sensitivity of the capital-labour ratio in contrast with the unconstrained firms. We provide evidence that changes in the firms-specific interest rates result a severe impact on the K/L ratio for the constrained group of firms, due to increases in the cost of finance. Our results are robust to estimating our empirical models employing a Dynamic First-Differenced GMM approach, to excluding distressed firms from our sample and to replacing capital stock with fixed assets. The results strongly suggest that, financial market imperfections is the most important consideration in shaping the sensitivity of the K/L ratio across different firm classes.

A Variable Construction

A.1 Firm-Level Variables

- *Replacement Value of Capital Stock* (K): It is constructed using the traditional perpetual inventory method Blundell et al. (1992). We use tangible fixed assets as the historic value of the capital stock. We assume that replacement cost and historic cost are the same in the first year of data for each firms. The perpetual inventory formula is calculated as follows

$$K_{t+1} = (1-\delta)K_t[\frac{P_{t+1}}{P_t}] + I_{t+1}$$

  where δ is the depreciation rate, which we assume to be constant and equal to 5.5% for all firms, P_t is the price of investment goods and I_t is the investment.

- *Employment* (L): Employment is given by the total number of employees.
- *Total Real Sales* (Sales): Is the log of total company sales, deflated by the GDP deflator.
- *Cash-Flow*: Is defined as the sum of after tax profit and depreciation normalized on total assets of the company, deflated by the GDP deflator.
- *Leverage*: Is the ratio of total liabilities to real total assets.
- *Collateral*: Is defined as the ratio of tangible assets to real total assets.
- *Mix*: Is measured as the ratio of the firm's short-term debt to its total debt.
- Age: Is defined as the firm's date of incorporation.
- *Size*: Is the firm's real total assets deflator.
- *Average company wage* (Wages): It is given by the total employee remuneration divided by the number of employees.
- *User cost of capital* (UC): Based on the contribution by Hall and Jorgenson (1967), we construct the user cost of capital following Mojon et al. (2002)

$$UC_{j,t} = [\frac{P_{I,j,t}}{P_{j,t}}]\{(1-\tau)i_t[\frac{D_j}{D_j+E_j}] + b_t[\frac{E_j}{D_j+E_j}] + \delta_j - (1-\delta_j)[\frac{\Delta P_{I,j,t}}{P_{I,t}}]\}$$

  where j indicates the number of industries in the manufacturing sector and t the time period. P_I,j,t and $P_{j,t}$ are the industry specific prices of investment goods and output. τ is the highest marginal tax rate on corporate profits, i_t is the base rate (we prefer to use the base rate rather than a firm specific interest rate), b_t are yields on benchmark public sector bonds of around 10 years maturity, δ_j is the average depreciation rate in the particular industry. $D_j/D_j + E_j$ and $E_j/D_j + E_j$ are respectively the average percentage of debt finance and equity finance in the particular industry. $(1-\tau)i_t[D_j/(D_j + E_j)] + b_t[E_j/(D_j + E_j)]$ is the industry-specific required rate of return on capital and $(1-\delta)[\frac{\Delta P_{I,j,t}}{P_{I,t}}]$ the capital gain on the fraction of capital left over after depreciation.

- *Price*: Is the user cost of capital divided by the average company wage.
- *Interest Burden* (ID): Is the ratio of interest payments to total debt, deflated by the GDP deflator.
- *Deflators*: The capital stock and fixed assets are deflated using the implicit price deflator for gross fixed capital formation. Other variables are deflated using the aggregate GDP deflator.
- *Outliers*: We trim 0.5 percent of observations both from above and the below to remove the outliers for our main variables.

A.2 Industry-Level Variables

Price of Investment Goods ($P_{I,j,t}$): It is defined as the gross fixed capital formation.

Price of Output ($P_{j,t}$): It is given by the industry- specific output.

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Table 1: Share of unquoted and quoted firms in the sample

Company Type	Number of Observations	Percent
Guarantee	207	0.13
NotcompaniesAct	9	0.01
PrivateLimited	141,788	96.78
PublicQuotedOFEX	25	0.01
Public, AIM	107	0.07
Public, NotQuoted	3,750	2.43
Public, Quoted	66	0.04
Unlimited	796	0.52
Total	146,748	100

Notes: The table presents the share of quoted and unquoted firms in the sample. Some quoted firms are publicly traded on alternative exchanges such as the AIM and the OFEX market.

Table 2: Descriptive Statistics

	ALL FIRMS	SMALL=0	SMALL=1	Diff.	YOUNG=0	YOUNG=1	Diff.	MBANK=0	MBANK=1	Diff.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$(K/L)_{it}$	0.292	0.420	0.223	0.000	0.296	0.289	0.394	0.353	0.280	0.000
	(0.522)	(0.627)	(0.214)		(0.588)	(0.491)		(0.495)	(0.526)	
$Price_{it}$	2.036	2.142	2.085	0.120	2.110	2.104	0.896	1.973	2.125	0.003
	(1.457)	(6.235)	(3.714)		(4.592)	(4.872)		(1.746)	(5.081)	
$Sales_{it}$	189.771	377.75	74.698	0.000	275.302	171.751	0.000	225.545	195.689	0.000
	(347.757)	(542.558)	(89.812)		(463.898)	(347.580)		(395.494)	(382.970)	
$CashFlow_{it}$	0.113	0.089	0.121	0.000	0.098	0.118	0.000	0.097	0.115	0.000
	(0.171)	(0.128)	(0.184)		(0.138)	(0.182)		(0.150)	(0.174)	
$Leverage_{it}$	15.759	11.341	17.159	0.000	12.558	16.747	0.000	12.176	16.227	0.000
	(14.373)	(9.853)	(15.287)		(10.745)	(15.204)		(9.939)	(14.820)	
$Collateral_{it}$	26.515	27.250	26.209	0.000	28.019	25.948	0.000	33.730	25.358	0.000
	(17.440)	(17.182)	(17.505)		(16.927)	(17.566)		(17.823)	(17.100)	
ID_{it}	0.093	0.069	0.101	0.000	0.085	0.094	0.000	0.081	0.095	0.000
	(0.210)	(0.199)	(0.211)		(0.199)	(0.211)		(0.161)	(0.220)	

Notes: The table presents sample means. Standard deviations are reported in parentheses. The p-value of a test of the equality of means is reported. The subscript i indexes firms, and the subscript t, time, where $t = 1994\text{-}2004$. $SMALL_{it}$ is equal to 1 for firms in the bottom 75% of their real assets distribution in year t, and 0, otherwise. $YOUNG_{it}$ is equal to 1 for firms in the lower 75% of their age distribution in year t, and 0, otherwise. $MBANK_{it}$ is equal to 1 for firms in the top 75% of their mix distribution in year t, and 0, otherwise. $(K/L)_{it}$: Capital over labour in log, $Price_{it}$: User cost of capital to firm-level wages in log, $Leverage_{it}$: Total liabilities to real total assets, $Collateral_{it}$: Tangible assets to real total assets, $CashFlow_{it}$: Sum of after tax profit and depreciation on real total assets, $Sales_{it}$: Log of total sales, ID_{it}: Interest payments to total debt.

Table 3: Firm-Specific Characteristics and the K/L ratio

	GMM
$Price_{it}$	-0.558***
	(8.36)
$Sales_{it}$	-0.531***
	(4.10)
$CashFlow_{it}$	-0.255**
	(2.09)
$Leverage_{it}$	-0.100***
	(5.53)
$Collateral_{it}$	0.036***
	(4.93)
$JStatistic$	0.161
$m2$	0.137
$Instruments$	t-2; t-3

Notes: Dependent variable is log(capital/labour). All specifications were estimated using the GMM first-differenced specification. The figures reported in parentheses are t-statistics in absolute values. * significant at 10%; ** significant at 5%; *** significant at 1%. Time dummies and time dummies interacted with industry dummies were included in all specifications. Numbers of firms and of observations are 2819 and 10305, respectively. m2 is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributes as N(0,1) under the null of no serial correlation. The J statistic is a test of the overidentifying restrictions, distributes as chi-square under the null of instrument validity. Also see notes to Table 2.

Table 4: Capital Market Imperfections and the K/L ratio

	SIZE	AGE	BANK DEP.
	GMM	GMM	GMM
	(1)	(2)	(3)
$Price_{it}$	-0.596***	-0.555***	-0.581***
	(10.9)	(9.87)	(11.8)
$Sales_{it}$	-0.608***	-0.513***	-0.583***
	(6.10)	(5.12)	(7.62)
$CashFlow_{it} * Constrained_{it}$	-0.194*	-0.353***	-0.186**
	(1.90)	(3.32)	(2.26)
$CashFlow_{it} * (1 - Constrained)_{it}$	0.108	0.039	-0.168
	(0.35)	(0.36)	(0.62)
$Leverage_{it} * Constrained_{it}$	-0.212***	-0.127**	-0.101*
	(3.53)	(2.01)	(1.95)
$Leverage_{it} * (1 - Constrained)_{it}$	-0.090	0.139	-0.038
	(1.42)	(1.63)	(0.50)
$Collateral_{it} * Constrained_{it}$	0.029***	0.038***	0.033***
	(7.52)	(5.84)	(6.46)
$Collateral_{it} * (1 - Constrained)_{it}$	0.026***	0.018***	0.028***
	(8.49)	(2.81)	(4.44)
$JStatistic$	0.089	0.115	0.590
$m2$	0.099	0.155	0.236
$Instruments$	t-2; t-3	t-2; t-3	t-2; t-3
F-test of equality (collateral)	0.423	0.002	0.144

Notes: Dependent variable is log(capital/labour). All specifications were estimated using the GMM first-differenced specification. The figures reported in parentheses are t-statistics in absolute values. * significant at 10%; ** significant at 5%; *** significant at 1%. Time dummies and time dummies interacted with industry dummies were included in all specifications. Constrained is a dummy variable that represents $SMALL_{it}$, $YOUNG_{it}$, $MBANK_{it}$. Numbers of firms and of observations are 2819 and 10305, respectively. m2 is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributes as N(0,1) under the null of no serial correlation. The J statistic is a test of the overidentifying restrictions, distributes as chi-square under the null of instrument validity. Also see notes to Table 2.

Table 5: Interest Burden and the K/L ratio

	ALL FIRM-YEARS	SIZE	AGE	BANK DEP.
	GMM	GMM	GMM	GMM
	(1)	(2)	(3)	(4)
$Price_{it}$	-0.563***	-0.597***	-0.596***	-0.586***
	(7.69)	(8.18)	(8.15)	(7.89)
$Sales_{it}$	-0.588***	-0.669***	-0.657***	-0.638***
	(6.29)	(6.71)	(7.18)	(7.17)
$CashFlow_{it}$	-0.358***	-0.301***	-0.305***	-0.305***
	(3.51)	(2.84)	(3.16)	(3.07)
$Leverage_{it}$	-0.086***	-0.090***	-0.092***	-0.090***
	(3.26)	(3.33)	(3.38)	(3.39)
$Collateral_{it}$	0.025***	0.025***	0.025***	0.025***
	(5.65)	(5.55)	(5.76)	(5.90)
ID_{it}	-0.196***			
	(5.98)			
$ID_{it} * Constrained_{it}$		-0.199***	-0.214***	-0.169***
		(4.98)	(4.94)	(5.97)
$ID_{it} * (1 - Constrained)_{it}$		0.276	0.162	-0.023
		(1.10)	(1.49)	(0.073)
$JStatistic$	0.052	0.047	0.076	0.057
$m2$	0.372	0.259	0.307	0.350
$Instruments$	t-2; t-3	t-2; t-3	t-2; t-3	t-2; t-3

Notes: Dependent variable is log(capital/labour). All specifications were estimated using the GMM first-differenced specification. The figures reported in parentheses are t-statistics in absolute values. * significant at 10%; ** significant at 5%; *** significant at 1%. Time dummies and time dummies interacted with industry dummies were included in all specifications. Numbers of firms and of observations are 1550 and 4950, respectively. m2 is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributes as N(0,1) under the null of no serial correlation. The J statistic is a test of the overidentifying restrictions, distributes as chi-square under the null of instrument validity. Also see notes to Table 2 and 4.

Table 6: Robustness: Dynamic Estimation of Capital Market Imperfections and the K/L ratio

	ALL FIRM-YEARS	SIZE	AGE	BANK DEP.
	GMM	GMM	GMM	GMM
	(1)	(2)	(3)	(4)
$(K/L)_{it-1}$	0.180***	0.198***	0.200***	0.215***
	(8.79)	(9.03)	(9.72)	(9.51)
$Price_{it}$	-0.689***	-0.736***	-0.762***	-0.745***
	(-11.1)	(-13.9)	(-14.6)	(-13.5)
$Sales_{it}$	-0.684***	-0.784***	-0.840***	-0.811***
	(-6.96)	(-10.3)	(-10.7)	(-10.0)
$CashFlow_{it}$	-0.917***			
	(-3.34)			
$CashFlow_{it} * Constrained_{it}$		-0.769***	-0.692***	-0.558**
		(-3.10)	(-3.16)	(-2.17)
$CashFlow_{it} * (1 - Constrained)_{it}$		-0.590	0.362	-0.456
		(-1.60)	(1.34)	(-1.53)
$Leverage_{it}$	-0.079***			
	(-3.90)			
$Leverage_{it} * Constrained_{it}$		-0.095**	-0.074***	-0.076*
		(-2.03)	(-2.69)	(-1.94)
$Leverage_{it} * (1 - Constrained)_{it}$		-0.030	-0.025	-0.054
		(-0.56)	(-1.54)	(-0.93)
$Collateral_{it}$	0.038***			
	(8.41)			
$Collateral_{it} * Constrained_{it}$		0.022***	0.027***	0.024***
		(3.67)	(5.33)	(5.56)
$Collateral_{it} * (1 - Constrained)_{it}$		0.028***	0.030***	0.024***
		(5.29)	(5.84)	(4.81)
$JStatistic$	0.065	0.084	0.082	0.134
$m2$	0.095	0.111	0.129	0.175
$Instruments$	t-2; t-3	t-2; t-3	t-2; t-3	t-2; t-3
F-test of equality (collateral)		0.037	0.636	0.873

Notes: Dependent variable is log(capital/labour). All specifications were estimated using a Dynamic GMM first-differenced specification. The figures reported in parentheses are t-statistics in absolute values. * significant at 10%; ** significant at 5%; *** significant at 1%. Time dummies and time dummies interacted with industry dummies were included in all specifications. Numbers of firms and of observations are 2360 and 8314, respectively. m2 is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributes as N(0,1) under the null of no serial correlation. The J statistic is a test of the overidentifying restrictions, distributes as chi-square under the null of instrument validity. Also see Notes to Table 2 and 4.

Table 7: Robustness: Positive Cash Flow Observations

	SIZE	AGE	BANK DEP.
	GMM	GMM	GMM
	(1)	(2)	(3)
$Price_{it}$	-0.532***	-0.567***	-0.609***
	(8.13)	(9.25)	(10.3)
$Sales_{it}$	-0.503***	-0.554***	-0.659***
	(4.90)	(6.29)	(7.33)
$CashFlow_{it} * Constrained_{it}$	-0.540***	-0.738***	-0.456***
	(5.22)	(6.63)	(3.94)
$CashFlow_{it} * (1 - Constrained)_{it}$	0.015	-0.045	-0.252
	(0.042)	(0.26)	(1.30)
$Leverage_{it} * Constrained_{it}$	-0.220***	-0.070**	-0.113***
	(5.90)	(2.34)	(5.49)
$Leverage_{it} * (1 - Constrained)_{it}$	-0.195***	0.143	-0.084*
	(4.37)	(1.58)	(1.78)
$Collateral_{it} * Constrained_{it}$	0.019***	0.033***	0.027***
	(5.02)	(5.18)	(5.27)
$Collateral_{it} * (1 - Constrained)_{it}$	0.020***	0.022***	0.023***
	(7.78)	(3.20)	(4.39)
$JStatistic$	0.094	0.368	0.131
$m2$	0.320	0.416	0.452
$Instruments$	t-2; t-3	t-2; t-3	t-2; t-3

Notes: Dependent variable is log(capital/labour). All specifications were estimated using the GMM first-differenced specification. The figures reported in parentheses are t-statistics in absolute values. * significant at 10%; ** significant at 5%; *** significant at 1%. Time dummies and time dummies interacted with industry dummies were included in all specifications. Numbers of firms and of observations are 2455 and 7824, respectively. Negative cash flow observations were excluded from our sample. m2 is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributes as N(0,1) under the null of no serial correlation. The J statistic is a test of the overidentifying restrictions, distributes as chi-square under the null of instrument validity. Also see notes to Table 2 and 4.

Table 8: Robustness: Fixed Assets - An alternative capital variable

	ALL FIRM-YEARS	SIZE	AGE	BANK DEP.
	GMM	GMM	GMM	GMM
	(1)	(2)	(3)	(4)
$Price_{it}$	-0.499***	-0.534***	-0.529***	-0.485***
	(7.05)	(10.4)	(12.7)	(9.57)
$Sales_{it}$	-0.398***	-0.563***	-0.550***	-0.451***
	(2.74)	(5.28)	(6.48)	(4.26)
$CashFlow_{it}$	-1.760***			
	(3.50)			
$CashFlow_{it} * Constrained_{it}$		-0.140*	-0.204**	-0.238**
		(1.76)	(2.53)	(2.42)
$CashFlow_{it} * (1 - Constrained)_{it}$		-0.473	-0.082	-0.433
		(1.02)	(0.87)	(1.00)
$Leverage_{it}$	-0.057***			
	(3.19)			
$Leverage_{it} * Constrained_{it}$		-0.302***	-0.146***	-0.135***
		(5.20)	(3.12)	(2.74)
$Leverage_{it} * (1 - Constrained)_{it}$		-0.196***	-0.025	-0.083
		(2.67)	(0.41)	(0.98)
$Collateral_{it}$	0.011**			
	(2.47)			
$Collateral_{it} * Constrained_{it}$		0.023***	0.027***	0.024***
		(3.89)	(4.73)	(4.50)
$Collateral_{it} * (1 - Constrained)_{it}$		0.024***	0.018***	0.023***
		(5.69)	(3.33)	(3.46)
JStatistic	0.126	0.092	0.418	0.848
m2	0.042	0.031	0.053	0.051
Instruments	t-2; t-3	t-2; t-3	t-2; t-3	t-2; t-3

Notes: Dependent variable is log(capital/labour). All specifications were estimated using a GMM first-differenced specification. The figures reported in parentheses are t-statistics in absolute values. * significant at 10%; ** significant at 5%; *** significant at 1%. Time dummies and time dummies interacted with industry dummies were included in all specifications.Numbers of firms and of observations are 7907 and 32138, respectively. m2 is a test for second-order serial correlation in the first-differenced residuals, asymptotically distributes as N(0,1) under the null of no serial correlation. The J statistic is a test of the overidentifying restrictions, distributes as chi-square under the null of instrument validity. Also see Notes to Table 2 and 4.

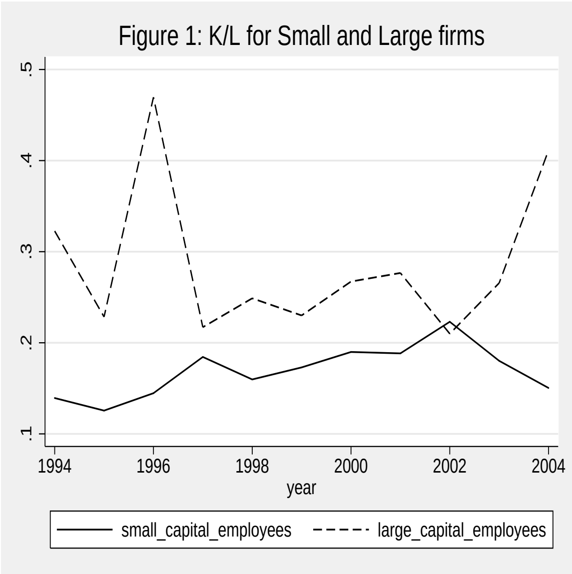

Figure 1: K/L for Small and Large firms

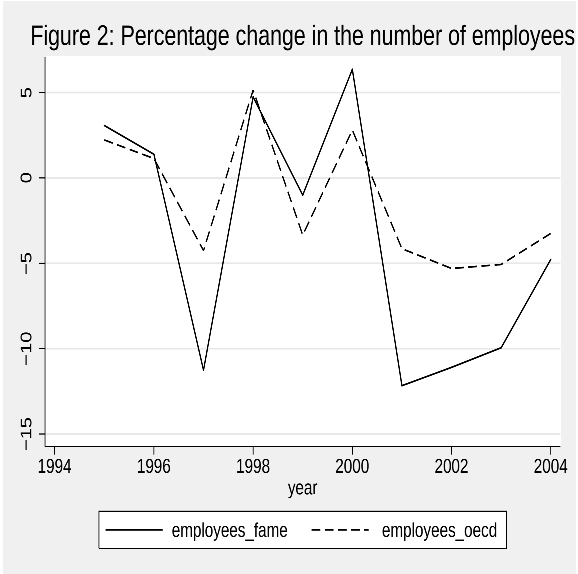

Figure 2: Percentage change in the number of employees

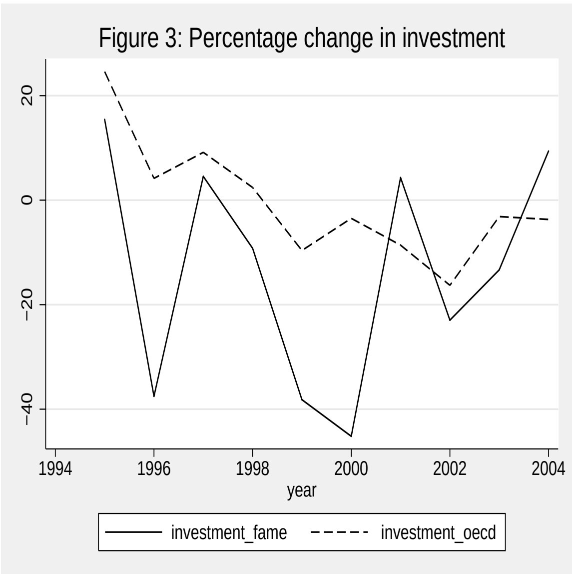

Figure 3: Percentage change in investment

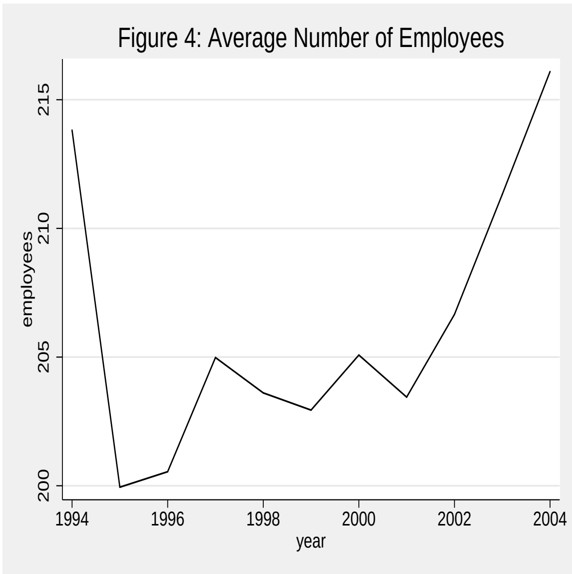

Figure 4: Average Number of Employees

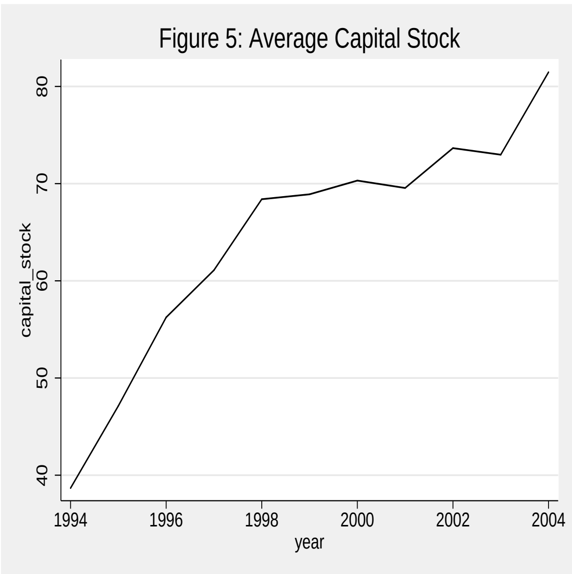

Figure 5: Average Capital Stock

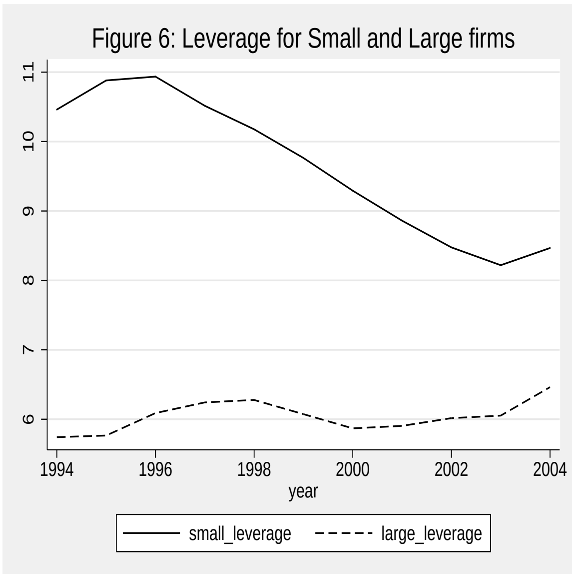

Figure 6: Leverage for Small and Large firms

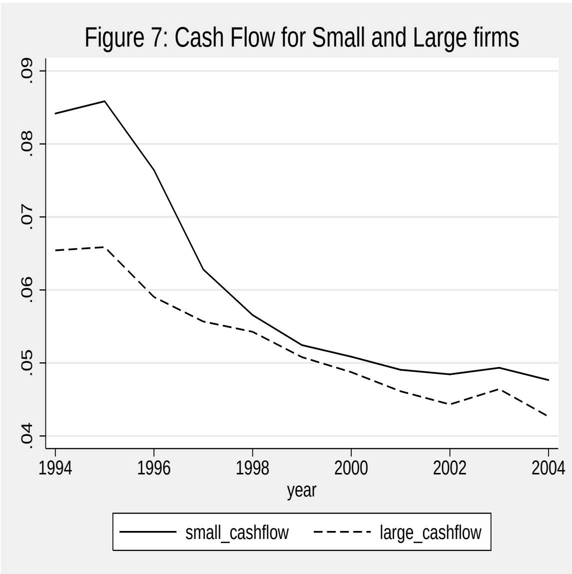
Figure 7: Cash Flow for Small and Large firms
.04
.05
.06
.07
.08
.09
1994
1996
1998
2000
2002
2004
year
small_cashflow
large_cashflow

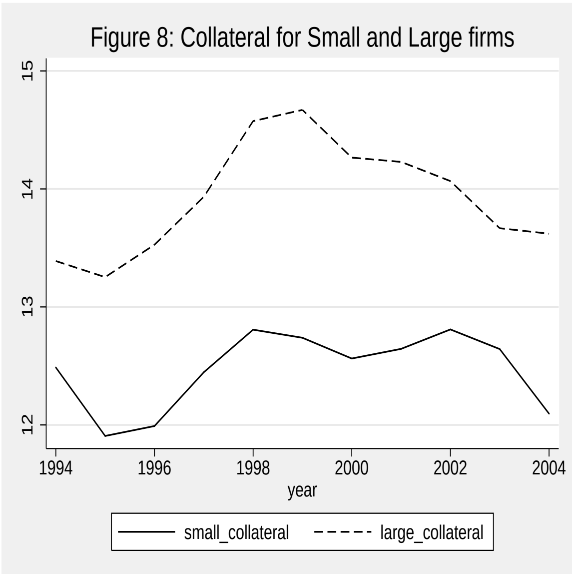
Figure 8: Collateral for Small and Large firms
12
13
14
15
1994
1996
1998
2000
2002
2004
year
small_collateral
large_collateral