# Capital structure, equity ownership and firm performance

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Abstract

This paper investigates the relationship between capital structure, ownership structure and firm performance across different industries using a sample of French manufacturing firms. We adopt productive efficiency as a measure of firm performance and model technology using the directional distance function proposed by Chambers et al. (1996). We employ non-parametric Data Envelopment Analysis (DEA) methods to empirically construct the industry's 'best practice' production frontier and measure firm efficiency as the distance from that frontier. Using these performance measures we examine if more efficient firms choose more or less debt in their capital structure. We summarize the contrasting effects of efficiency on capital structure in terms of two competing hypotheses: the *efficiency-risk* and *franchise-value* hypotheses. Using quantile regression methods we are able to test the effect of efficiency on leverage and thus the empirical validity of the two competing hypotheses across different capital structure choices. We also test the direct relationship from leverage to efficiency stipulated by the Jensen and Meckling (1976) agency cost model. Throughout this analysis we consider the role of ownership structure on capital structure and firm performance. In particular, we test the hypotheses that concentrated ownership should lead to better firm performance by lowering agency costs while dispersed equity ownership should be associated with more debt in the firm's capital structure.

Keywords: capital structure, agency costs, firm efficiency, ownership structure, DEA
JEL classification: G32, D24

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## 1. Introduction

In this paper we assess empirically the predictions of recent theories that emphasize the disciplinary role of leverage in agency conflicts and the importance of contracting and information costs in the determination of the firm's capital structure policy and on firm performance (see Jensen and Meckling, 1976; Myers, 1977; Myers and Majluf, 1984; Harris and Raviv, 1990; Walsh and Ryan, 1997). More specifically, we first assess the direct effect of leverage on firm performance as stipulated by the Jensen and Meckling (1976) agency cost model. Second, we investigate if firm efficiency has an effect on capital structure and whether this effect is similar or not across different capital structure choices. Throughout these analyses we consider explicitly the role of equity ownership structure on both capital structure and firm efficiency.

Corporate financing decisions are quite complex processes and existing theories can at best explain only certain facets of the diversity and complexity of financing choices. By demonstrating how competing hypotheses may dominate each other at different segments of the relevant data distribution we reconcile some of the empirical irregularities reported in prior studies thereby cautioning the standard practice of drawing inferences on capital structure choices based on conditional mean estimates. By using productive efficiency as opposed to financial performance indicators as our measure of (inverse) agency costs we are able to carry out tests of the agency theory that are not confounded by factors which may not be related to agency costs.

Our methodological approach is underpinned by Leibenstein (1966) who showed how different principal-agent objectives, inadequate motivation and incomplete contracts become sources of (technical) inefficiency measured by the discrepancy between maximum potential output and the firm's actual output. He termed this failure to attain the production or technological frontier as X-inefficiency. Based on this we model technology and measure performance by employing a directional distance function approach and interpret the technological frontier as a benchmark for each

firm's performance that would be realized if agency costs were minimized.[1] We then proceed to assess the extent to which leverage acts as a disciplinary device in mitigating the agency costs of outside ownership and thereby contributes to an improvement on firm performance. To properly assess the disciplinary role of leverage in agency conflicts we control for the effect of ownership structure on firm performance. We also allow for the possibility that at high levels of leverage the agency costs of outside debt may overcome those of outside equity whereby further increases in leverage can lead to an increase in total agency costs.[2]

We turn next to analyze the effects of efficiency on capital structure using two competing hypotheses. Under the *efficiency-risk hypothesis*, more efficient firms may choose higher debt to equity ratios because higher efficiency reduces the expected costs of bankruptcy and financial distress. On the other hand, under the *franchise-value hypothesis*, more efficient firms may choose lower debt to equity ratios to protect the economic rents derived from higher efficiency from the possibility of liquidation (Demsetz, 1973; Berger and Bonaccorsi di Patti, 2006).

Thus our paper contributes to the literature in four directions by: (1) using X-efficiency as opposed to standard financial indicators as a measure of firm performance to test the predictions of the agency cost hypothesis; (2) showing that X-efficiency as a proxy for (inverse) agency costs is an important determinant of capital structure choices; (3) demonstrating how competing hypotheses may dominate each other at different segments of the leverage distribution; and (4) providing new

[1] As we explain in Section 3, the directional distance function gives the maximum proportional expansion of output(s) and contraction of inputs that is feasible for a given technology thereby yielding a measure of firm efficiency relative to best practice. The directional distance function has a dual association with the profit function and thus it provides a useful performance companion when profitability is the overall goal of the firm.

[2] Previous studies either examine the effects of capital structure on performance without controlling for ownership structure (e.g., Titman and Wessels, 1988) or evaluate the effects of ownership structure on performance without controlling for capital structure (e.g., Mester, 1993; Pi and Timme, 1993; Gorton and Rosen, 1995; DeYoung et al., 2001). On the other hand, Mehran, (1995) and McConnell and Servaes (1995) examine the relationship between performance and ownership structure but consider leverage as exogenous.

empirical evidence on the relationship between ownership structure, capital structure and firm efficiency.[3]

This is to our knowledge one of the first studies to consider the association between productive efficiency, ownership structure and leverage. In a recent study Berger and Bonaccorsi di Patti (2006) examined the bi-directional relationship between capital structure and firm performance for the US banking industry using a parametric measure of profit efficiency as an indicator of (inverse) agency costs while Margaritis and Psillaki (2007) investigated a similar relationship for a sample of New Zealand small and medium sized enterprises using a technical efficiency measure derived from a non-parametric Shephard (1970) distance function. In this paper we use a directional distance function approach on a sample of French firms from three different manufacturing industries to address the following questions:[4] Does higher leverage lead to better firm performance? Would a more concentrated ownership structure lead to better firm performance? Does efficiency exert a significant effect on leverage over and above that of traditional financial measures? Are the effects of efficiency and the other determinants of corporate financing decisions similar across different capital structures? Do firms with dispersed ownership carry more debt in their capital structure?

The reminder of the paper is organized as follows. The next section discusses the relationship between firm performance, capital and ownership structure. Section 3 details the methodology used in this study to construct the 'best practice' frontier and establish the link between efficiency, capital structure and ownership structure. Section 4 describes the empirical model used to analyze the relationship between efficiency, leverage and ownership. Section 5 describes the data and reports the empirical results. Section 6 concludes the paper.

[3] Most studies up to date have focused on analyzing the financial structure-performance relationship for large firms in the US and UK. These findings may not be representative for countries with different legal and institutional settings (see Shleifer and Vishny, 1997; La Porta et al., 1999). There is relatively little evidence for Continental Europe where the legal environment is different, ownership concentration is higher and family ownership is more dominant compared to US/UK (see Pedersen and Thomsen, 2003).

[4] Civil law systems provide less investor and creditor protection than common law systems and among the civil-law systems the French system provides the least protection (see Bancel and Mittoo, 2004). As legal structures with little investor and creditor protection tend to exacerbate information asymmetries and contracting costs, a study focusing on French firms presents some interesting features for the purposes of our investigation.

## 2. Firm performance, capital structure and ownership

Conflicts of interest between owners-managers and outside shareholders as well as those between controlling and minority shareholders lie at the heart of the corporate governance literature (see Driffield et al., 2006). While there is a relatively large literature on the effects of ownership on firm performance (see for example, Morck et al. 1988; McConnell and Servaes 1990; Hermalin and Weisbach 1991; Himmelberg et al. 1999), the relationship between ownership structure and capital structure remains largely unexplored.[5] On the other hand, a voluminous literature is devoted to capital structure and its effects on corporate performance (see the surveys by Harris and Raviv (1991) and Myers (2001)). An emerging consensus that comes out of the corporate governance literature (see Mahrt-Smith, 2005) is that the interactions between capital structure and ownership structure impact on firm values. Yet theoretical arguments alone cannot unequivocally predict these relationships (see Morck et al., 1988) and the empirical evidence that we have appears to be often contradictory. In part these conflicting results arise from difficulties empirical researchers face in obtaining a 'uniform measure of firm performance, firm value or efficiency' (Driffield et al., 2006). In the remainder of this section we briefly review the literature in this area.

### *2.1 Firm performance and capital structure*

The agency cost theory is premised on the idea that the interests of the company's managers and its shareholders are not perfectly aligned. In their seminal paper Jensen and Meckling (1976) emphasized the importance of the agency costs of equity in corporate finance arising from the separation of ownership and control of firms whereby managers tend to maximize their own utility rather than the value of the firm. Agency costs can also exist from conflicts between debt and equity investors. These conflicts arise when there is a risk of default. The risk of default may create what Myers (1977) referred to as an "underinvestment" or "debt overhang" problem. In this case, debt will have a negative effect on the value of the firm.

[5] Recent studies in this area include Brailsford et al. (2002) for US firms and Driffield et al. (2006) for Asian firms.

Alternatively, there may be instances where managers have incentives to take excessive risks as part of risk shifting investment strategies (see Jensen and Meckling, 1976). This leads us to Jensen's (1986) "free cash flow theory" where as stated by Jensen (1986: p. 323) "the problem is how to motivate managers to disgorge the cash rather than investing it below the cost of capital or wasting it on organizational inefficiencies." In other words complete contracts cannot be written. Thus a higher level of leverage may be used as a disciplinary device to reduce managerial cash flow waste through the threat of liquidation (Grossman and Hart, 1982) or through pressure to generate cash flows to service debt (Jensen, 1986). In these situations, debt will have a positive effect on the value of the firm.

Building on Myers (1977) and Jensen (1986), Stulz (1990) develops a model in which debt financing is shown to mitigate overinvestment problems but aggravate the underinvestment problem. This model predicts that debt can have both a positive and a negative effect on firm performance and presumably both effects are present in all firms. According to McConnell and Servaes (1995) the common element in the models of Myers, Jensen and Stulz is their focus on the link between the firm's investment opportunity set and the effects of debt on the value of the firm. Thus a reasonable conjecture will be that for firms with few growth opportunities the positive effect of debt on firm performance will be more dominant whereas the opposite effect will apply for firms with high growth opportunities (McConnell and Servaes, 1995). But firm performance may also affect the capital structure choice (see Berger and Bonaccorsi di Patti, 2006). This reverse causality effect is in essence a feature of theories linking agency costs (Jensen and Meckling, 1976; Myers, 1977; Harris and Raviv, 1990), corporate control issues (Harris and Raviv 1988), and in particular, asymmetric information (Myers and Majluf, 1984; Myers, 1984) and taxation (DeAngelo and Masulis, 1980; Bradley et al., 1984) with the value of the firm.

### 2.2 *Ownership structure and firm performance*

The relationship between ownership structure and firm performance dates back to Berle and Means (1932) who argued that widely held corporations in the US, in which ownership of capital is dispersed among small shareholders and control is concentrated in the hands of managers tend to under-perform. Following from this,

Jensen and Meckling (1976) develop more formally the classical owner-manager agency problem. They advocate that managerial share-ownership may reduce managerial incentives to consume perquisites, expropriate shareholders' wealth or to engage in other sub-optimal activities and thus helps in aligning the interests of managers and shareholders and consequently lowers agency costs and increase firm value. Thus the *convergence-of interest hypothesis* predicts that larger managerial ownership stakes should lead to better firm performance. In contrast Demsetz (1983) and Fama and Jensen (1983) point out that a rise in the managerial share-ownership stakes may also have adverse (entrenchment) effects in reconciling agency conflicts and these can lead to an increase in managerial opportunism.

While Demesetz (1983) argues that ownership structure should not have any effects on firm performance, Morck et al. (1988) propose that in all likelihood such a relationship will exist, however it will not be invariant to the share of managerial ownership. Thus the combined effects of the *convergence-of interest* and *entrenchment hypotheses* imply that the relationship between ownership and firm performance may be positive or negative at different ranges of managerial ownership stakes (Morck et al., 1988). Shleifer and Vishny (1986) argue that equity concentration is more likely to have a positive effect on firm performance in situations where control by large equity holders may act as a substitute for legal protection in countries with weak investor protection and less developed stock markets where they also classify Continental Europe. Countering this of course is the possibility of negative entrenchment effects on firm performance associated with high managerial ownership stakes (see Fama and Jensen, 1983; Morck et al., 1988; Pedersen and Thomsen, 2003). In addition, McConnell and Servaes (1995) point out that the relation between ownership structure and firm performance will differ between low- and high-growth firms. Their conjecture is that ownership is likely to be more important for low-growth than for high-growth firms.

Several studies have confirmed the direct association between ownership concentration and firm performance (e.g. Shleifer and Vishny, 1986; Short, 1994; Gorton and Schmidt, 1996; Kang and Shivadasani, 1995; Gedajlovic and Shapiro, 1998; Thomsen and Pedersen, 2000; and Pedersen and Thomsen, 2003; Frijns et al., 2008). But as stated above increased ownership concentration can also decrease

financial performance because it raises the firm's cost of capital as a result of decreased market liquidity or decreased diversification opportunities (see Fama and Jensen, 1983). Increased ownership concentration may also lead to entrenchment effects similar to those arising from larger managerial stakes thereby leading to adverse effects on firm performance (Morck et al., 1988). Empirical evidence on non-linear relationships between ownership structure and firm performance is given by Morck et al. (1988), McConnell and Servaes (1995) and more recently by Davies et al., 2005). On the other hand, Demsetz and Lehn (1985), Himmelberg et al. (1999) and Demsetz and Villalonga (2001) find no significant relationship between ownership concentration and firm performance. Mahrt-Smith (2005) concludes that it will be difficult to predict the effect of concentrated or dispersed ownership on firm performance unless one controls for the firm's capital structure choice.

2.3 *Ownership structure and capital structure*

The relationship between ownership structure and capital structure is an important one as it underpins the link between corporate governance and firm performance. External block-holders may reduce managerial opportunism resulting in lower direct agency conflicts between management and shareholders (Shleifer and Vishny, 1986). If external block-holders monitor management effectively, managers may not be able to adjust debt to their own interests as freely as if such investors did not exist. In that case firms with large external block-holdings are likely to have higher debt ratios at least up to the point where the risk of bankruptcy may induce them to lower debt.

Managers prefer some types of owners to others, because different types have differential abilities to constrain their choices. As a consequence, managers act to maximize firm value if such ''favorite'' owners remain in charge when firm performance is good but debt features (e.g. effective debt covenants) constrain managerial choice following bad performance (Mahrt-Smith, 2005). Driffield et al. (2006) based on Brailsford et al. (2002) suggest that the relationship between managerial share ownership and leverage may be non-linear. At low levels of managerial ownership, agency conflicts decrease leading to higher debt. However, when managers hold a significant portion of a firm's equity, an increase in managerial ownership may lead to an increase in managerial opportunism and therefore may

cause lower debt. Other authors (e.g., Friend and Lang 1988, and Friend and Hasbrouck 1988) argue that an increase in managerial ownership pushes firms to reduce leverage in order to decrease default risk thereby advocating a negative relationship between managerial ownership and leverage.

## 3. Benchmarking firm performance

In this section we explain how we benchmark firm performance. To do that we rely on duality theory and the use of distance functions. Directional distance functions are alternative representations of production technology which readily model multiple input and multiple output technological relationships. They measure the maximum proportional expansion in outputs and contraction in inputs that firms would be able to achieve by eliminating all technical inefficiency. They are the primal measures; their dual measures are the more familiar value functions such as profit, cost and revenue. We interpret these inefficiencies to be the result of contracting costs, managerial slack or oversight. They differ from allocative inefficiencies which are due to the choice of a non-optimal mix of inputs and outputs.

Following Färe and Grosskopf (2004) and Färe et al. (2007) we assume that firms employ N inputs denoted by $x = (x_1, \ldots, x_N) \in R_+^N$ to produce M outputs denoted by $y = (y_1, \ldots, y_M) \in R_+^M$. Technology may be characterised by a technology set T, which is the set of all feasible input/output combinations, i.e.,

$$T = \{(x, y) : x \text{ can produce } y\}. \qquad (1)$$

The technology set is assumed to satisfy a set of reasonable axioms. Here we assume that T is a closed, convex, nonempty set with inputs and outputs which are either freely or weakly disposable.[6] To provide a measure of efficiency we use a directional technology distance function approach. This function completely characterises technology (i.e., it is equivalent to T), it is dual to the profit function and allows for adjustment of inputs and outputs simultaneously. Thus the directional distance

[6] Input weak disposability means that if all inputs increase proportionally then output will not decrease. Strong or free disposability on the other hand requires that output does not decrease if any or all feasible inputs are increased. Disposable outputs are similarly defined.

function entails an extremely flexible description of technology without restricting firms to optimize by either increasing outputs proportionately without changing inputs or by decreasing inputs proportionally for given outputs. To define it we need to specify a directional vector, denoted by $g = (g_x, g_y)$ where $g_x \in R_+^N$ and $g_y \in R_+^M$. This vector determines the direction in which technical efficiency is assessed. The directional technology distance function is defined as:

$$\vec{D}_T(x, y; g_x, g_y) = \sup\{\beta : (x - \beta g_x, y + \beta g_y \in T\}. \quad (2)$$

The directional distance function expands outputs in the direction $g_y$ and contracts inputs simultaneously in the direction $g_x$ to the frontier T. If the observed input output bundle is technically efficient, the value of the directional distance function would be zero. If the observed input output bundle is interior to technology T, the distance function is greater than zero and the firm is technically inefficient.

The directional distance function can be estimated non-parametrically using DEA under a VRS (Variable returns to scale) technology as

$$\vec{D}_T(x, y; g_x, g_y) = \max \beta \quad (3)$$

subject to:

$$\Sigma_{k=1}^{K} z_k x_{kn} \leq x_{kn} - \beta g_x, n = 1,...., N$$

$$\Sigma_{k=1}^{K} z \ y_{km} \leq y_{km} + \beta g_y, m = 1,..., M$$

$$\Sigma_{k=1}^{K} z_k = 1, z_k \geq 0, k = 1,..., K$$

The intensity variables ($z_k$) form combinations of inputs and outputs from the observed set of inputs and outputs of the firms in the sample. Each firm can produce no more outputs using no less input than a linear combination of all the firms' inputs and outputs in the sample. Constraining the intensity variables to add up to one imposes the VRS technology.

A firm's ability to achieve best practice relative to its peers will be compromised in situations where it is forced to forego valuable investment opportunities, participate in

uneconomic activities that sustain growth at the expense of profitability or being subject to other organizational inefficiencies. Following Leibenstein (1966) we use technical or X-inefficiency as a proxy for the (inverse) agency costs arising from conflicts between debt holders and equity holders or from different principal-agent objectives. These conflicts will give rise to resource misallocations and potential output will be sacrificed. The magnitude of agency costs will vary from firm to firm (see Jensen and Meckling, 1976) and thus individual firms with similar technologies can be benchmarked against their best performing peers. As in Berger and Bonaccorsi di Patti (2006) we view these best practice firms as those which minimize the agency costs of outside equity and outside debt.

In line with Jensen and Meckling (1976) we expect the effect of leverage on agency costs to be negative overall. We do however allow in our model specification for the possibility that this effect may be reversed at the point where the expected costs of financial distress outweight any gains achieved through the use of debt rather than equity in the firm's capital structure. Therefore, under the *agency cost hypothesis (H1)* higher leverage is expected to lower agency costs, reduce inefficiency and thereby lead to an improvement in firm's performance with the proviso that the direction of this relationship may switch at a point where the disciplinary effects of further increases in leverage become untenable. Since the interests of management are not necessarily aligned with those of the shareholders, controlling for ownership structure is important in carrying out tests of the agency cost hypothesis. Under the *convergence-of-interest hypothesis (H2)* more concentrated ownership should have a positive effect on firm performance. Countering this, there is the possibility that adverse (*entrenchment*) effects of increased ownership may lead to a negative effect on firm performance. Thus under the *ownership entrenchment hypothesis* (H2a) the effect of ownership concentration on firm performance may be negative.

But firm performance may also affect the choice of capital structure. Berger and Bonaccorsi di Patti (2006) stipulate that more efficient firms are more likely to earn a higher return for a given capital structure, and that higher returns can act as a buffer against portfolio risk so that more efficient firms are in a better position to substitute equity for debt in their capital structure. Hence under the *efficiency-risk hypothesis (H3)*, more efficient firms choose higher leverage ratios because higher efficiency is

expected to lower the costs of bankruptcy and financial distress. In essence, the efficiency-risk hypothesis is a spin-off of the trade-off theory of capital structure whereby differences in efficiency, other things constant, enable firms to fine tune their optimal capital structure.

However, it is also possible that firms which expect to sustain high efficiency rates into the future will choose lower debt to equity ratios in an attempt to guard the economic rents or franchise value generated by these efficiencies from the threat of liquidation (see Demsetz et al., 1996; Berger and Bonaccorsi di Patti, 2006). Thus in addition to the substitution effect, the relationship between efficiency and capital structure may also be characterized by the presence of an income effect. Under the *franchise-value hypothesis (H3a)* more efficient firms tend to hold extra equity capital and therefore, all else equal, choose lower leverage ratios to protect their future income or franchise value.

Thus the *efficiency-risk hypothesis (H3)* and the *franchise-value hypothesis (H3a)* yield opposite predictions regarding the likely effects of firm efficiency on its choice of capital structure. Although we cannot identify the separate substitution and income effects our empirical analysis is able to determine which effect dominates the other across the spectrum of different capital structure choices.

## 4. The Empirical Model

We use a two equation cross-section model to test the agency cost hypotheses (H1) and (H2/H2a) and the reverse causality hypotheses (H3 and H3a).

### *4.1 Firm Performance*

The regression equation for the firm performance model is given by:

$$EFF_i = a_0 + a_1 LEV_i + a_2 LEV_i^2 + a_3 Z_{1i} + u_i \qquad (4)$$

where *EFF* is the firm efficiency measure obtained from (3) above; *LEV* is the debt to total assets ratio; $Z_1$ is a vector of control variables; and u is a stochastic error term.

According to the *agency cost hypothesis* the effect of leverage (*LEV*) on efficiency should be positive. However, the possibility exists that at sufficiently high leverage levels, the effect of leverage on efficiency may be negative.[7] The quadratic specification in (4) is consistent with the possibility that the relationship between leverage and efficiency may not be monotonic, viz. it may switch from positive to negative at higher leverage. Leverage will have a negative effect on efficiency for values of $LEV < -\alpha_1/2\alpha_2$. A sufficient condition for the inverse U-shaped relationship between leverage and efficiency to hold is that $\alpha_2<0$.

The variables included in $Z_1$ control for firm characteristics. More specifically, we assume that profitability, asset structure, growth opportunities, size and ownership structure are likely to influence firm efficiency.[8]

Profitability (*PR*) is measured by the ratio of profits (EBIT) to total assets (e.g. Fama and French 2002, Titman and Wessels 1988). In general we expect a positive effect of (past) profitability on efficiency: *more profitable firms are generally better managed and thus are expected to be more efficient*.

Asset structure (*TAN*) is measured as the ratio of fixed tangible assets divided by the total assets of the firm (e.g. Titman and Wessels, 1988; Rajan and Zingales, 1995; Frank and Goyal, 2003). We expect a positive relationship between asset structure and efficiency: *more capital intensive firms are expected to use better technology and thus be more efficient*.

Intangibles (*INT*) are measured by the ratio of intangible assets to total assets. This variable may be considered as an indicator of future growth opportunities (see Titman and Wessels, 1988; Michaelas et al., 1999; Ozkan, 2001). We would generally expect that companies with plentiful growth opportunities will tend to adopt faster better

[7] Debt financing may also have a negative effect on firm performance for firms with plentiful growth opportunities (see Myers, 1977; Jensen, 1986; McConnell and Servaes, 1995).
[8] Most of these variables are used as determinants of firm efficiency in previous studies – see for example, Becchetti and Sierra (2003) and Berger and Bonaccorsi di Patti (2006).

technology, be better managed and thereby be more efficient: *firms with a lot of intangible assets are generally expected to be more efficient*.

Firm size (*SIZE*) is measured by the logarithm of the firm's sales. The effect of this variable on efficiency is likely to be positive as larger firms are also expected to use better technology, be more diversified and better managed. A negative effect may be observed in situations where there will be loss of control resulting from inefficient hierarchical structures in the management of the company (see Williamson, 1967). We would thus: *generally expect a positive effect of size on efficiency*.

Ownership structure is often proxied by the Ownership Indicator (OWN) representing the percentage of shares held by those classified as large shareholders (see Demsetz and Lehn, 1985; Pedersen and Thomsen, 2003). We measure the effect of ownership concentration by introducing dummy variables defined over three different ranges of ownership holdings: low (OWN3) with no owner holding more than a 25 percent stake; intermediate (OWN2) with the largest owner(s) holding between 25 and 50 percent; and high (OWN1) representing equity holdings in excess of 50 percent. In general, a positive relation between ownership concentration and firm efficiency is expected as large owners or block owners may be more capable of monitoring and aligning management to their objectives which in turn should result in higher firm values (see Jensen and Meckling, 1976; Shleifer and Vishny, 1986; Short, 1994; Jirapon and Gleason 2007). This effect is expected to be stronger in countries with weak investor protection and therefore more likely to be statistically significant (Pedersen and Thomsen, 2003). Thus our testable hypothesis is that *firms with concentrated ownership have less severe agency conflicts which in turn result in better firm performance*.

Fama and Jensen (1983) predict an opposite relationship: increased ownership decrease performance because it raises the firm's cost of capital as a result of decreased market liquidity or decreased diversification opportunities. In addition, Morck et al. (1988) advocate that concentrated ownership may be associated with a negative (entrenchment) effect on firm performance where the overall effect on firm value may be positive at low concentration but negative at high concentration levels. They also suggest that the relationship between ownership structure and firm

performance is likely to vary across industries. In line with this, McConnell and Servaes (1995) report that this relationship is positive for low growth firms but generally insgnificant albeit positive for high growth firms. Demsetz (1983) on the other hand argues that although different types of ownership may intensify agency problems, they also generate compensating advantages so that overall the ownership structure should not have any significant effect on firm performance. This view is supported by the findings reported in Demsetz and Villalonga (2001).

*4.2 The Leverage Model*

The capital structure equation relates the debt to assets ratio to our measure of efficiency as well as to a number of other factors that have commonly been identified in the literature to be correlated with leverage (see Harris and Raviv, 1991; Myers, 2001). The leverage equation is given by:

$$LEV_i = \beta_0 + \beta_1 EFF_i + \beta_2 Z_{2i} + v_i \qquad (5)$$

where $Z_2$ is a vector of factors other than efficiency that correlate with leverage and v is a stochastic error term. Under the *efficiency-risk hypothesis*, efficiency has a positive effect on leverage, i.e. $\beta_1 > 0$; whereas under the *franchise-value hypothesis*, the effect of efficiency on leverage is negative, i.e. $\beta_1 < 0$. We use quantile regression analysis to examine the capital structure choices of different subsets of firms in terms of these two conditional hypotheses. This is in line with Myers (2001) who emphasized that there is no universal theory but several useful conditional theories describing the firm's debt-equity choice. These different theories will depend on which economic aspect and firm characteristic we focus on.

The variables included in $Z_2$ control for firm characteristics that are likely to influence the choice of capital structure (see Harris and Raviv, 1991; Rajan and Zingales, 1995). They are the same variables used in the agency cost model such as size, asset structure, profitability, growth opportunities and ownership structure.

The effect of size on leverage is generally expected to be positive. As larger firms are more diversified and tend to fail less often than smaller ones, we would expect that: *size will be positively related to leverage*. However Rajan and Zingales (1995) raise the possibility that size may also be negatively correlated with leverage. They argue that size may act as a proxy for the information outside investors have and that informational asymmetries are lower for large firms which implies that large firms should be in a better position to issue informationally sensitive securities such as equity rather than debt. Thus it is plausible that: *size may also have a negative effect on leverage*.

Asset structure is generally expected to have a positive effect on leverage. The existence of asymmetric information and agency costs may induce lenders to require guarantees materialized in collateral (Myers, 1977; Scott, 1977; Harris and Raviv, 1990). For example, if a firm retains large investments in land, equipment and other tangible assets, it will normally face smaller funding costs compared to a firm that relies primarily on intangible assets. We would thus expect that: *tangibles should be positively related to debt*. A negative effect of asset structure on leverage will suggest that firms with lots of tangibles tend to rely more on internal funds generated from these assets which in turn discourages them from turning to external financing. Thus it is also possible that: *firms with more tangible assets will choose lower debt in their capital structure*.

There are conflicting theoretical predictions on the effects of profitability on leverage (see Harris and Raviv, 1991; Rajan and Zingales, 1995; Barclay and Smith, 2001; Booth et al., 2001). Myers (1984) and Myers and Majluf (1984) predict a negative relationship because they argue firms will prefer to finance new investments with internal funds rather than debt. According to their pecking order theory because of signalling and asymmetric information problems firms financing choices follow a hierarchy in which internal cash flows (retained earnings) are preferred over external funds, and debt is preferred over equity financing. Thus according to the pecking order theory: *there should be a negative relationship between past profitability and leverage*.

In contrast the trade-off and contracting cost theories predict a positive relation between profitability and leverage. For example, the trade-off theory suggests that the optimal capital structure for any particular firm will reflect the balance (at the margin) between the tax shield benefits of debt and the increasing agency and financial distress costs associated with high debt levels (Jensen and Meckling, 1976; Myers, 1977; Harris and Raviv, 1990). Similarly, Jensen (1986) argues that if the market for corporate control is effective and forces firms to pay out cash by levering up then there will be a positive correlation between profitability and leverage. Thus it is also possible that: *there will be a positive relation between profitability and leverage*.

Intangible assets can be considered as future growth opportunities (Titman and Wessels 1988; Michaelas et al., 1999; Ozkan, 2001). Following Myers (1977) the underinvestment problem becomes more intense for companies with more growth opportunities. The latter pushes creditors to reduce their supply of funds to this type of firms. Firms with expected growth opportunities would keep low leverage in order to avoid adverse selection and moral hazard costs associated with the financing of new investments with new equity capital. Thus we would generally expect: *a negative relationship between debt and growth opportunities*.

Ownership structure may have a positive or a negative effect on the amount of debt in the firm's capital structure. Firms where shareholders rights are weak are expected to carry more debt in their capital structure (Jirapon and Gleason 2007). This is consistent with agency cost theory (i.e. these firms are expected to incur higher agency costs). We would thus expect: *a positive relationship between dispersed ownership and leverage*.

But when leverage is high this increases the risk of bankruptcy which may then induce managers to lower debt. So in this case the effect will be negative (Friend and Lang 1988, and Friend and Hasbrouck 1988). For example, an increase in managerial ownership will push firms to reduce leverage in order to decrease firm's default risk. Thus it is may be the case that: *the relationship between dispersed ownership and debt is negative for highly leveraged firms*.

## 5. Empirical Results

In this section we provide answers to the questions of section 1. As we stated in the introduction we are interested in examining how capital structure choices affect firm value as well as the reverse relationship between efficiency and leverage. More precisely, we want to examine if leverage has a positive effect on efficiency and whether the reverse effect of efficiency on leverage is similar across the spectrum of different capital structures. We are also interested in assessing empirically the effects of ownership structure on capital structure and on firm performance.

As explained in Section 3, we model firm efficiency using the directional distance function. We choose to estimate the directional distance function is estimated using non-parametric frontier methods (DEA). The DEA model is constructed using a single output (value-added) and two inputs (capital and labour) technology. The labour input is measured by the total number of full-time equivalent employees and working proprietors whereas capital is measured by the firm's fixed tangible assets. We set the elements of the directional vector (g) equal to the sample averages of the input and output variables. The value of the directional distance function measures firm inefficiency. This value is zero when firms are on the frontier. Firms that do not perform as well as the benchmark firms lie inside the frontier and have efficiency scores greater than zero.

Table 1 gives the descriptive statistics of the firms in the sample for 2005. The data set comprises samples of French firms from two traditional manufacturing industries (textiles and chemicals) and a growth industry (computers and related activities and R&D). We collect data from 2002 to 2005 to allow for sufficient lagged dynamic structure to resolve the identification and endogeneity problems in the empirical specification of the model. On average firms in the chemicals industry are much larger and more capital intensive than firms in the computers and textiles industries but firms in the computer industry carry more debt in their capital structure and show higher profitability as well as (intangible) growth opportunities. Also firms in the computers industry appear to have more dispersed ownership structure. This observation is consistent with the predictions of the Mahrt-Smith (2005) model: for growth firms where long-term project discovery and development investments are

more important than short-term projects, ownership is likely to be more dispersed as managers are motivated to protect these long-term rents. Firms in the computers industry appear to be closer on average to the technological frontier compared to those in the chemicals and textiles industries. To interpret the efficiency (agency cost) results, note that the median (in terms of efficiency) chemicals firm with an efficiency score of 0.06 can increase output by 0.06*17926=1076 thousand (1.1 million) euro while reducing input use by 0.06*158=9 employees and using 0.06*9276=557 (0.5 million euro) less capital.

We turn next to empirically assess the relationship between leverage and efficiency as well as to investigate whether differences in efficiency are related to leverage controlling for the effect of ownership structure and other firm characteristics. The simultaneous equation system given by (4) and (5) above requires adequate structure to be properly identified. An obvious way to deal with the identification problem is by imposing relevant restrictions on the structural system. Undoubtedly the task of both properly identifying the system of equations for efficiency and leverage and ensuring that the conditioning variables entering these two equations are indeed exogenous is fraught with difficulty.

We have dealt with the identification and endogeneity issues in the following way. Arguably both the effect of leverage on efficiency and the reverse effect from efficiency on leverage are not expected to be instantaneous. Time lags are also likely to prevail when considering the effect of other conditioning variables on efficiency and leverage. For example, the pecking order theory states that it is past not current profitability that is envisaged to have an effect on leverage.

An explicitly account of the dynamics in the relationship between efficiency and leverage would thus help solve the identification problem while rendering a structure which is not plagued by simultaneity bias problems. Based on this we have proceeded to estimate the agency cost and leverage equations using both static and dynamic

model specifications.[9] We have estimated structural forms of these equations using instrumental variables techniques and their dynamic or reduced form specifications using OLS and quantile regressions. The results we have obtained from the different models or estimation techniques appear to be quite robust, in particular those used to assess the predictions of the *agency cost* and *efficiency* hypotheses. We only report the results obtained from estimating dynamic models for both the efficiency and leverage equations. The regressors in these equations are predetermined (lagged endogenous or exogenous) variables thereby circumventing the simultaneous bias problem. Parsimonious forms of these equations were obtained by applying a standard general to specific methodology (see Hendry, 1995) starting with models that used variables with up to three year lags.

Table 2 reports the estimates of the efficiency equation. The results show that both the linear and quadratic (lagged) leverage terms have a significant effect on efficiency. This effect is positive at the mean of leverage as well as it remains positive over the entire relevant range of leverage values. Thus we find support for the predictions of the *agency cost hypothesis* in that higher leverage is associated with improved firm performance. Based on the magnitude of estimated coefficients, we observe that the effect of debt on efficiency appears to be stronger for firms in the more traditional (chemicals and textiles) industries. This finding provides some support for the conjecture of McConnell and Servaes (1995), namely that debt has a fundamentally different role on performance between firms with few and those with many growth opportunities. In particular, more valuable low-growth firms are expected to choose more leverage in their capital structure. Tangibility has a positive effect on firm performance whereas the effect of size on performance is negative across all industries. The effect of intangibles is negative for firms in the chemicals and textiles industries but positive for computers thus emphasizing the importance of growth opportunities (positive net present value projects) on performance for firms in this industry. Past profitability has a positive and significant effect only in the computers industry. The effect of ownership concentration (OWN1) on firm performance is

[9] Given the limited number of time periods for which data is available we have opted to estimate cross-section not panel models. This ensures sufficient dynamic conditioning of the agency cost and leverage equations. In addition, it would have been difficult to apply quantile regression methods to panel data as quantiles of convolutions of random variables are highly intractable objects (see Koenker and Hallock, 2001).

positive and significant only for the chemicals industry.[10] This finding provides partial support to the conjecture of McConnell and Servaes (1995), namely that the effect of ownership on performance should be more important for low-growth rather than high-growth firms. Arguably the absence of a statistically significant relationship between ownership structure and efficiency in the computers and textiles industries supports the view expressed by Demsetz (1983) (see also Demsetz and Villalonga, 2001): although different types of ownership may exacerbate agency problems, they also yield compensating advantages that ameliorate these problems.

Table 3 reports the estimates of the leverage model. The results from the OLS and quantile regressions show that the effect of efficiency on leverage is positive and significant in the low to medium range of the leverage distribution supporting the *efficiency-risk hypothesis:* more efficient firms with relatively low levels of debt tend to choose higher debt ratios because higher efficiency lowers the expected costs of bankruptcy and financial distress. At higher leverage levels we find the income effect associated with the *franchise-value hypothesis* (i.e. more efficient but highly levered firms choose lower debt levels) offsets the substitution effect associated with the *efficiency-risk hypothesis*. However there is no evidence to suggest that the franchise-value effect outweights the efficiency-risk effect even for the most highly levered firms. For the chemicals and computers industries the effect of dispersed ownership on leverage is positive both on average (OLS estimates) as well as across different capital structures.[11] For the textiles industry the effect of dispersed ownership is different across different capital structures: positive but insignificant for low leveraged firms and (significantly) negative for high leveraged firms. The latter finding is consistent with the view that the fear of bankruptcy induces managers of highly levered firms to lower debt. This effect may also by exacerbated by a supply response. For example, in a traditional low-growth industry like textiles there is less chance that banks will extend credit to highly leveraged firms especially if the legal system provides little creditor protection. Consistent with pecking order theory, profitability has a negative effect on leverage for all industries on average and also across different capital structures. Size has a positive effect on leverage for low

[10] The effects of low ownership on firm performance were not statistically significant and have been omitted from the estimated equations reported in Table 2.
[11] The effect of concentrated ownership (OWN1) was not significant in the leverage regressions and thus it has been omitted from the results shown in Table 3.

leveraged firms. The effect of tangibles on leverage is *negative* but is generally only significant for low leveraged firms. The effect of intangible assets is generally not significant. This effect is negative for chemicals for medium leveraged firms and positive for high leveraged firms in textiles.

## 6. Conclusion

This paper investigates the relationship between efficiency, leverage and ownership structure. This analysis is conducted using directional distance functions to model the technology and obtain X-efficiency measures as the distance from the efficient frontier. We interpret these measures as a proxy for the (inverse) agency costs arising from conflicts between debt holders and equity holders or from different principal-agent objectives. Using a sample of French firms from low- and high-growth industries, we consider both the effect of leverage and ownership structure on firm performance as well as the reverse causality relationship. We find evidence supporting the theoretical predictions of the Jensen and Meckling (1976) agency cost model. Further, we test the hypothesis that concentrated ownership also lowers agency costs and that leads to better firm performance. More precisely, we find support for the core prediction of the *agency cost hypothesis* in that higher leverage is associated with improved efficiency over the entire range of observed data. We find evidence to support the hypothesis that firms with more concentrated ownership face lower agency costs only in chemicals. We find no statistically significant relationship between ownership structure and firm performance in the computers and textiles industries.

We also investigate the reverse causality relationship from efficiency to leverage and ownership structure by putting forth two competing hypotheses: the *efficiency-risk hypothesis* and the *franchise value hypothesis*. Using quantile regression analysis we show that the effect of efficiency on leverage is positive but significant only at low to mid-leverage levels. Thus our results suggest that in the upper range of the leverage distribution the income effect resulting from the economic rents generated by high efficiency offsets the substitution effect of debt for equity capital. We also found that more dispersed ownership structures are generally associated with less debt in the capital structure except for highly leveraged firms in the textiles industry.

Our methodology has gone some way in reconciling some of the empirical irregularities reported in prior studies. In particular, we have shown how competing hypotheses may dominate each other at different segments of the relevant data distribution thereby cautioning the standard practice of drawing inferences on capital structure choices using conditional mean (least squares) estimates. By using productive efficiency as opposed to financial performance indicators as our measure of (inverse) agency costs we have been able to carry out tests of the agency theory without the confounding problems that may be associated with the more traditional financial measures of firm performance. In future research it will be of interest to extend this analysis across different countries and across different industries as well as focus at different aspects of ownership structures.

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Table 1: Descriptive Statistics

| | Chemicals | | | Computers | | | Textiles | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mean | StDev | Median | Mean | StDev | Median | Mean | StDev | Median |
| Output (Y) | 17296.17 | 64660.12 | 2221.32 | 4562.10 | 26917.42 | 936.24 | 2184.99 | 6116.19 | 769.65 |
| Labour (L) | 158.49 | 444.09 | 36.00 | 57.75 | 291.23 | 15.00 | 44.21 | 86.22 | 19.00 |
| Revenue | 67838.97 | 257793.1 | 8119.38 | 9140.11 | 74512.50 | 1734.70 | 8070.34 | 22466.24 | 2311.65 |
| Profit | 5483.94 | 47798.49 | 181.58 | 427.07 | 5466.50 | 69.37 | 328.21 | 2754.82 | 48.95 |
| Solvency | 38.66 | 27.64 | 40.82 | 28.40 | 44.22 | 32.50 | 41.23 | 32.17 | 44.26 |
| Intangibles | 3438.97 | 35036.76 | 38.86 | 605.43 | 5204.28 | 10.09 | 453.91 | 6841.41 | 11.92 |
| Tangibles | 9275.78 | 34662.69 | 652.94 | 402.94 | 5499.09 | 32.35 | 637.74 | 2908.68 | 96.35 |
| Total Assets | 62276.08 | 386330.9 | 5465.28 | 7574.18 | 60315.66 | 1042.19 | 5928.07 | 24513.36 | 1398.74 |
| Total Debt | 31386.09 | 178079.8 | 2809.83 | 4455.50 | 29568.04 | 654.81 | 3020.89 | 10543.37 | 672.76 |
| Efficiency | 0.52 | 1.63 | 0.06 | 0.29 | 1.12 | 0.07 | 0.45 | 1.04 | 0.13 |
| Y/L | 94.41 | 201.84 | 64.25 | 79.67 | 125.97 | 64.07 | 50.40 | 37.18 | 40.89 |
| K/L | 45.17 | 114.45 | 19.38 | 7.02 | 77.11 | 2.05 | 11.60 | 25.14 | 5.25 |
| PR | 0.06 | 0.15 | 0.05 | 0.08 | 0.26 | 0.07 | 0.04 | 0.16 | 0.05 |
| INT | 0.05 | 0.09 | 0.01 | 0.07 | 0.15 | 0.01 | 0.05 | 0.10 | 0.01 |
| TAN | 0.19 | 0.17 | 0.14 | 0.05 | 0.07 | 0.03 | 0.12 | 0.13 | 0.07 |
| LEV | 0.58 | 0.27 | 0.56 | 0.69 | 0.50 | 0.66 | 0.57 | 0.31 | 0.55 |
| OWN1 | 0.71 | 0.45 | 1.00 | 0.47 | 0.50 | 0.00 | 0.56 | 0.50 | 1.00 |
| OWN3 | 0.04 | 0.19 | 0.00 | 0.08 | 0.27 | 0.00 | 0.04 | 0.19 | 0.00 |
| Obs | 1410 | | | 3942 | | | 2075 | | |

## Notes:

Output (Y) = vale-added
Labour (L) = number of employees
K/L = capital intensity
Solvency = solvency ratio
PR = Profit to assets ratio
INT = Intangibles to total assets ratio
TAN = Tangibles to total assets ratio
LEV = Debt to assets ratio
OWN1 denotes high > 50% ownership concentration.
OWN3 denotes low < 25% ownership concentration.

## Table 2: The Firm Performance Model

Dependent Variable: EFF05

| | **Chemicals** | | **Computers** | | **Textiles** | |
|---|---|---|---|---|---|---|
| Variable | Coefficient | t-Statistic | Coefficient | t-Statistic | Coefficient | t-Statistic |
| LEV04 | 0.087 | 3.239 | 0.011 | 1.957 | 0.032 | 2.034 |
| $.5*(LEV04)^2$ | -0.091 | -2.376 | -0.002 | -1.522 | -0.012 | -0.900 |
| PR04* | | | 0.032 | 4.329 | | |
| TAN04 | 0.532 | 19.144 | 0.724 | 34.778 | 0.599 | 14.634 |
| INT04 | -0.059 | -4.073 | 0.023 | 2.549 | -0.056 | -3.356 |
| SIZE | -0.007 | -5.770 | -0.010 | -8.129 | -0.013 | -7.038 |
| OWN1 | 0.010 | 2.001 | -0.002 | -0.702 | 0.007 | 1.354 |
| Constant | 0.081 | 6.265 | 0.119 | 11.719 | 0.144 | 8.180 |
| R-squared | **0.575** | | **0.381** | | **0.520** | |
| Adjusted R-squared | **0.573** | | **0.379** | | **0.518** | |

## Notes:

Least Squares estimates with Heteroskedasticity-Consistent Standard Errors

The dependent variable is EFF05, the firm efficiency score in 2005

LEV04 = debt to total assets ratio in 2004
PR04 = Profit to assets ratio in 2004
TAN04 = Tangibles to total assets ratio in 2004
INT04 = Intangibles to total assets ratio in 2004
OWN1 denotes high (>50%) ownership concentration

*Profitability (PR) was only significant in the computers regression.

Table 3: The Leverage Model

**Panel A** **Chemicals - OLS and Quantile Regression Estimates**

| | Coeff | t-stat | coeff | t-stat | coeff | t-stat | coeff | t-stat |
|---|---|---|---|---|---|---|---|---|
| | **OLS** | | **q10** | | **q20** | | **q30** | |
| EFF04 | 0.281 | 3.527 | 0.607 | 5.68 | 0.588 | 4.61 | 0.417 | 2.76 |
| PR04 | -0.780 | -9.057 | -0.353 | -4.01 | -0.409 | -4.87 | -0.552 | -8.63 |
| TAN04 | -0.183 | -2.699 | -0.376 | -4.71 | -0.371 | -3.2 | -0.235 | -1.81 |
| INT04 | -0.078 | -0.996 | -0.071 | -0.71 | -0.025 | -0.24 | -0.072 | -0.85 |
| SIZE | 0.002 | 0.435 | 0.006 | 1.09 | 0.011 | 1.89 | 0.008 | 1.56 |
| OWN3 | 0.281 | 4.597 | 0.458 | 2.43 | 0.384 | 2.31 | 0.312 | 2.09 |
| Constant | 0.597 | 15.496 | 0.219 | 4.07 | 0.269 | 4.83 | 0.389 | 6.49 |
| R-sq | 0.191 | | 0.056 | | 0.062 | | 0.067 | |
| | **q40** | | **q50** | | **q60** | | **q70** | |
| EFF04 | 0.230 | 2.15 | 0.177 | 1.56 | 0.163 | 1.67 | 0.062 | 0.69 |
| PR04 | -0.656 | -9.92 | -0.710 | -10.19 | -0.800 | -12.23 | -0.783 | -9.24 |
| TAN04 | -0.168 | -2.01 | -0.103 | -1.13 | -0.103 | -1.13 | -0.059 | -0.73 |
| INT04 | -0.145 | -2.02 | -0.172 | -2.21 | -0.201 | -2.56 | -0.199 | -2.5 |
| SIZE | 0.004 | 0.9 | 0.004 | 0.83 | -0.002 | -0.35 | -0.004 | -0.77 |
| OWN3 | 0.248 | 1.78 | 0.201 | 1.52 | 0.319 | 2.68 | 0.259 | 2.57 |
| Constant | 0.516 | 9.51 | 0.572 | 11 | 0.692 | 13.54 | 0.778 | 14.05 |
| R-sq | 0.080 | | 0.091 | | 0.103 | | 0.105 | |
| | **q80** | | **q90** | | | | | |
| EFF04 | 0.096 | 0.84 | 0.026 | 0.17 | | | | |
| PR04 | -0.799 | -7.96 | -0.782 | -8.33 | | | | |
| TAN04 | -0.106 | -1.16 | -0.060 | -0.49 | | | | |
| INT04 | -0.175 | -1.62 | -0.144 | -0.8 | | | | |
| SIZE | -0.006 | -1 | -0.005 | -0.65 | | | | |
| OWN3 | 0.180 | 2.23 | 0.079 | 1.24 | | | | |
| Constant | 0.865 | 16.19 | 0.961 | 12.85 | | | | |
| R-sq | 0.110 | | 0.133 | | | | | |

## Notes:

The dependent variable is LEV05, the debt to assets ratio in 2005.
EFF04 indicates the efficiency score in 2004.
TAN04 and INT04 are the 2004 tangibles and intangibles to total assets ratios, respectively.
SIZE = log (sales)
OWN3 denotes low < 25% ownership concentration.

**Panel B** **Computers - OLS and Quantile Regression Estimates**

| | Coeff | t-stat | coeff | t-stat | coeff | t-stat | coeff | t-stat |
|---|---|---|---|---|---|---|---|---|
| OLS | **OLS** | | **q10** | | **q20** | | **q30** | |
| EFF04 | 0.470 | 2.836 | 0.594 | 5.290 | 0.597 | 5.370 | 0.498 | 4.77 |
| PR04 | -0.624 | -4.331 | -0.213 | -4.430 | -0.320 | -7.090 | -0.408 | -10.75 |
| TAN04 | -0.169 | -1.069 | -0.074 | -0.550 | -0.254 | -2.910 | -0.297 | -2.53 |
| INT04 | 1.129 | 1.318 | 0.098 | 0.900 | -0.039 | -0.410 | -0.078 | -0.78 |
| SIZE | -0.015 | -1.625 | 0.011 | 1.510 | 0.015 | 2.470 | 0.019 | 2.88 |
| OWN3 | 0.102 | 3.904 | 0.050 | 2.980 | 0.057 | 4.340 | 0.067 | 4.81 |
| Constant | 0.667 | 9.267 | 0.198 | 3.380 | 0.299 | 6.940 | 0.357 | 6.61 |
| R-sq | 0.197 | | 0.043 | | 0.051 | | 0.058 | |
| | **q40** | | **q50** | | **q60** | | **q70** | |
| EFF04 | 0.419 | 3.600 | 0.275 | 2.880 | 0.246 | 2.970 | 0.173 | 1.800 |
| PR04 | -0.445 | -10.120 | -0.522 | -8.090 | -0.621 | -9.070 | -0.689 | -11.560 |
| TAN04 | -0.212 | -1.590 | -0.069 | -0.560 | -0.113 | -1.240 | -0.086 | -1.190 |
| INT04 | -0.021 | -0.310 | -0.035 | -0.580 | -0.069 | -1.080 | -0.046 | -0.750 |
| SIZE | 0.017 | 3.460 | 0.011 | 2.110 | 0.012 | 2.090 | 0.004 | 0.850 |
| OWN3 | 0.060 | 6.030 | 0.055 | 4.940 | 0.059 | 4.290 | 0.069 | 4.880 |
| Constant | 0.442 | 10.800 | 0.561 | 12.060 | 0.623 | 13.910 | 0.742 | 17.160 |
| R-sq | 0.067 | | 0.074 | | 0.083 | | 0.100 | |
| | **q80** | | **q90** | | | | | |
| EFF04 | 0.191 | 2.070 | 0.284 | 1.310 | | | | |
| PR04 | -0.773 | -12.530 | -0.858 | -7.490 | | | | |
| TAN04 | -0.174 | -2.210 | -0.275 | -1.890 | | | | |
| INT04 | -0.033 | -0.600 | -0.053 | -0.580 | | | | |
| SIZE | 0.002 | 0.530 | -0.015 | -2.040 | | | | |
| OWN3 | 0.054 | 3.910 | 0.059 | 2.430 | | | | |
| Constant | 0.829 | 23.880 | 1.066 | 16.400 | | | | |
| R-sq | 0.112 | | 0.134 | | | | | |

## Notes:

The dependent variable is LEV05, the debt to assets ratio in 2005.
EFF04 indicates the efficiency score in 2004.
TAN04 and INT04 are the 2004 tangibles and intangibles to total assets ratios, respectively.
SIZE = log (sales)
OWN3 denotes low < 25% ownership concentration.

**Panel C** **Textiles - OLS and Quantile Regression Estimates**

| | Coeff | t-stat | coeff | t-stat | coeff | t-stat | coeff | t-stat |
|---|---|---|---|---|---|---|---|---|
| | **OLS** | | **q10** | | **q20** | | **q30** | |
| EFF04 | 0.536 | 2.389 | 0.423 | 3.270 | 0.594 | 3.070 | 0.600 | 4.520 |
| PR04 | -0.506 | -2.415 | -0.206 | -1.920 | -0.280 | -3.300 | -0.282 | -6.060 |
| TAN04 | -0.171 | -1.824 | -0.061 | -0.580 | -0.236 | -1.730 | -0.170 | -1.190 |
| INT04 | 0.082 | 0.917 | 0.112 | 1.680 | 0.011 | 0.120 | 0.090 | 0.650 |
| SIZE | -0.001 | -0.155 | 0.015 | 2.030 | 0.015 | 1.790 | 0.012 | 1.500 |
| OWN3 | -0.037 | -2.051 | 0.029 | 1.170 | 0.003 | 0.110 | -0.010 | -0.420 |
| Constant | 0.539 | 7.931 | 0.069 | 1.030 | 0.184 | 2.590 | 0.268 | 4.150 |
| R-sq | 0.111 | | 0.027 | | 0.028 | | 0.041 | |
| | **q40** | | **q50** | | **q60** | | **q70** | |
| EFF04 | 0.502 | 3.720 | 0.348 | 3.440 | 0.178 | 1.270 | 0.078 | 0.590 |
| PR04 | -0.365 | -5.460 | -0.505 | -7.060 | -0.555 | -6.500 | -0.658 | -7.880 |
| TAN04 | -0.133 | -0.870 | -0.104 | -0.940 | 0.012 | 0.100 | 0.014 | 0.150 |
| INT04 | 0.163 | 1.340 | 0.103 | 0.740 | 0.165 | 1.270 | 0.061 | 0.450 |
| SIZE | 0.010 | 1.250 | -0.003 | -0.500 | -0.007 | -0.920 | -0.003 | -0.370 |
| OWN3 | -0.001 | -0.050 | -0.022 | -1.080 | -0.036 | -1.750 | -0.063 | -3.030 |
| Constant | 0.354 | 4.900 | 0.557 | 10.220 | 0.660 | 9.530 | 0.724 | 8.920 |
| R-sq | 0.044 | | 0.052 | | 0.063 | | 0.080 | |
| | **q80** | | **q90** | | | | | |
| EFF04 | 0.058 | 0.460 | 0.264 | 1.070 | | | | |
| PR04 | -0.691 | -7.510 | -0.863 | -6.520 | | | | |
| TAN04 | 0.038 | 0.460 | -0.043 | -0.410 | | | | |
| INT04 | 0.283 | 2.340 | 0.158 | 1.370 | | | | |
| SIZE | -0.006 | -0.940 | -0.021 | -2.280 | | | | |
| OWN3 | -0.058 | -2.370 | -0.075 | -2.310 | | | | |
| Constant | 0.790 | 14.010 | 1.022 | 10.460 | | | | |
| R-sq | 0.103 | | 0.130 | | | | | |

## Notes:

The dependent variable is LEV05, the debt to assets ratio in 2005.
EFF04 indicates the efficiency score in 2004.
TAN04 and INT04 are the 2004 tangibles and intangibles to total assets ratios, respectively.
SIZE = log (sales)
OWN3 denotes low < 25% ownership concentration.