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 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 and ownership type on capital structure and firm performance.

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

1. Introduction

In this paper we use firm efficiency as a measure of (inverse) agency costs to 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). 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 and ownership type on both capital structure and firm performance.

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 that 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 and ownership type 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 debt can lead to an increase in total agency costs.

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: (1) using X-efficiency as opposed to 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 empirical evidence on the relationship between ownership structure, capital structure and firm efficiency.[2]

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

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[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] 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., 1998, 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 Faccio and Lang, 2002).

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:[3] Does higher leverage lead to better firm performance? Would different ownership structures have an effect on 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? To what extent our results are driven by certain types of owners – e.g. family vs. non-family firms?

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.

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 (Berle and Means, 1932; Jensen and Meckling, 1976; Shleifer and Vishny, 1986). While there is a relatively large literature on the effects of ownership on firm performance (see for example, Morck et al., 1988; McConnell and

[3] 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 La Porta et al., 1998). 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.

Servaes, 1990; Himmelberg et al., 1999), the relationship between ownership structure and capital structure remains largely unexplored.[4] 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 often appears to be contradictory. In part these conflicting results arise from difficulties empirical researchers face in obtaining direct measures of the magnitude of agency costs that are not confounded by factors that are beyond the control of management (Berger and Bonaccorsi di Patti, 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 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. 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." Thus high debt ratios 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

[4] Recent international studies in this area include Brailsford et al. (2002) for Australian firms, Short et al. (2002) for UK firms, and King and Santor (2008) for Canadian firms.

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 insiders tend to underperform. 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 which in turn would lowers agency costs. Thus the '*convergence-of interest hypothesis* predicts that larger insider ownership stakes should lead to better firm performance. In contrast Demsetz (1983) and Fama and Jensen (1983) point out that a rise in insider share-ownership stakes may also have adverse ‘*entrenchment*’ effects in reconciling agency conflicts and these effects can lead to an increase in managerial opportunism at the expense of outside investors.

While Demsetz (1983) argues that ownership structure should not have any effects on firm performance, Stulz (1988) and Morck et al. (1988) predict that the combined effects of incentive alignment and entrenchment will give rise to a concave relationship between insider share ownership and firm performance. Shleifer and Vishny (1986, 1997) show that large external equity holders can mitigate agency conflicts because of their strong incentives to monitor and discipline management. Whether firm value would indeed be maximized in the presence of large controlling shareholders depends on the entrenchment effect (Claessens et al., 2002; Villalonga and Amit, 2006). Family firms are a special class of large shareholders with unique incentive structures. For example, concerns over family and firm reputation and firm survival would tend to mitigate the agency costs of outside debt and outside equity (Demsetz and Lehn, 1985; Anderson et al., 2003) although controlling family shareholders may still expropriate minority shareholders (Claessens et al., 2002; Villalonga and Amit, 2006). The empirical findings of Maury (2006) suggest that large controlling family ownership in Western Europe appears to benefit rather than harm minority shareholders.

Large institutional investors may not, on the other hand, have incentives to monitor management (Villalonga and Amit, 2006) and they may even coerce with management (McConnell and Servaes, 1990; Claessens et al., 2002). Shleifer and Vishny (1986) and La Porta et al. (2002) 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 capital markets where they also classify Continental Europe. 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; Kang and

Shivadasani, 1995; Claessens et al., 2002). There is also empirical evidence (e.g. Anderson and Reeb, 2003a; Villalonga and Amit, 2006; Maury, 2006; King and Santor, 2008) indicating that family firms especially those with large personal owners tend to outperform non-family firms. Other studies (e.g. Morck et al., 1988; McConnell and Servaes, 1995; Davies et al., 2005) document a non-monotonic relationship between ownership structure and firm performance. On the other hand, Demsetz and Lehn (1985), Himmelberg et al. (1999) and Demsetz and Villalonga (2001) report no significant relationships between ownership concentration and firm performance. Mahrt-Smith (2005) concludes that it will be difficult to predict the effect of ownership structure 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 blockholders have strong incentives to reduce managerial opportunism (Shleifer and Vishny, 1986) and they may prefer to use debt as a governance mechanism to control management's consumption of perquisites (Grossman and Hart, 1982). If external blockholders monitor management effectively, managers may not be able to adjust debt to their own interests as freely as if such investors did not exist (Brailsford et al., 2002). In that case firms with large external blockholdings are likely to have higher debt ratios at least up to the point where the risk of bankruptcy may induce them to lower debt. Family firms may also use higher debt levels to the extent that they are perceived to be less risky by debtholders (Anderson et al., 2003).

Friend and Lang (1988) report a positive association between large external ownership and debt. The same authors find a negative relation between leverage and insider share ownership in line with the view that managerial blockholders choose lower debt to protect their non-diversifiable human capital and wealth invested in the firm. Brailsford et al. (2002) also report a positive relation between external blockholders and debt. However they find that the relationship between managerial share ownership and leverage is non-linear. At low levels of managerial ownership, agency conflicts necessitate the use of more debt but as managers become entrenched at high levels of managerial ownership they seek to reduce their risks and they use less debt. Anderson and Reeb (2003b) find that insider ownership by managers or families has no effect on leverage while King and Santor (2008) report that both family and financially controlled firms carry more debt in their capital structure.

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 relative to the performance of their best performing peers. 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 $x = (x_1, . . . , x_N) \in R_+^N$ to produce M outputs denoted by $y = (y_1, . . . , y_M) \in R_+^M$.[5] Technology may be characterised by a technology set *T*, which is the set of all feasible input-output combinations, i.e.

$$T = \{(x, y) : x \text{ can produce } y\},\ x \in R_+^N . \qquad (1)$$

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 characterizes

[5] In the empirical section of the paper we restrict ourselves to a specification with two inputs (capital and labour) producing a single output.

[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.

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 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, i.e. the path of the projection of the observed data to the frontier of technology. The directional technology distance function is defined as:

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

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. In this paper we choose $g = (\bar{x}, \bar{y})$ which implies that output(s) may be increased by $\vec{D}_T(x, y; \bar{x}, \bar{y}) \cdot \bar{y}$ and inputs decreased by $\vec{D}_T(x, y; \bar{x}, \bar{y}) \cdot \bar{x}$ for a firm to eliminate all technical inefficiency relative to its best performing peers.

The directional distance function can be estimated non-parametrically using DEA – a mathematical programming enveloping technique - under a VRS (variable returns to scale) technology as follows:

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

subject to:

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

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

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

The intensity variables (λ_k) form combinations of inputs and outputs from the observed set of inputs and outputs of the firms in the sample, one for each activity or observation (*k*) of data. These are nonnegative variables whose solution value may be interpreted as the extent to which an activity is involved in frontier production. Thus at each segment of the piecewise frontier DEA identifies a peer group of best practice reference firms (i.e. those with non-zero λ_k) for each firm being evaluated. Each firm (*k*) can produce no more output using no less input than a linear combination of all the firms' inputs and outputs in the sample. Therefore the technology is constructed from the data (x_k, y_k) by forming the tightest convex cone that includes all data hence the descriptive title data envelopment analysis. 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 outweigh 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, all else equal, enable firms to fine tune their optimal capital structure.

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's efficiency measure[7]; *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. This is consistent with a tax argument (Modigliani and Miller, 1963); a leverage signalling argument (Ross, 1977); and a cash flow argument (Jensen, 1986). However, the possibility exists that at sufficiently high leverage levels, the effect of leverage on efficiency may be negative.[8] 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 $\alpha_2<0$.

[7] In the empirical part of the paper efficiency is measured as $1/(1+\vec{D}_T)$ where $\vec{D}_T$ is the value of the directional distance function obtained from (3) above. This has the advantage of restricting the efficiency measures in the 0 to 1 range and hence facilitates comparisons with more conventional – e.g. Shephard type - efficiency measures where a fully efficient firm has a score of 1.

[8] 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).

The variables included in Z_1 control for firm characteristics. More specifically, we assume that profitability, ownership type and structure, size, asset structure and growth opportunities are likely to influence firm efficiency.[9]

Profitability (*PR*) is measured by the ratio of profits (EBIT) to total assets. 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.

Tangibility (*TANG*) is measured as the ratio of fixed tangible assets divided by the total assets of the firm. Tangibles are easily monitored and provide good collateral and thus they tend to mitigate agency conflicts (Himmelberg et al., 1999). As in Himmelberg et al. (1999) we allow for nonlinearities in the effect of asset structure on firm performance by including the square of the tangibles to assets ratio.

Intangibility (*INTG*) is measured by the ratio of intangible assets to the firm's equity. This variable may be considered as an indicator of future growth opportunities (see Titman and Wessels, 1988) but its effect on firm performance is generally ambiguous especially if these opportunities are the result of excessive risk-taking behavior given the size of equity (see Myers, 1977; Stiglitz and Weiss, 1981).

Sales growth (*GROWTH*) – this variable can also serve as a proxy for growth prospects and investment opportunities. It is likely to have a positive effect on firm performance (see Claessens et al., 2002; Maury, 2006; King and Santor, 2008).

Firm size (*SIZE*) is measured by the natural log of the firm's sales. The effect of this variable on efficiency is likely to be positive as larger firms are expected to use better technology, be more diversified and better managed. Larger firms may also enjoy economies of scale in monitoring top management (Himmelberg et al., 1999). However a negative effect may be observed in situations where there is loss of control resulting from inefficient hierarchical structures in the management of the company (see Williamson, 1967). Larger firms also tend to incur larger monitoring costs which may offset the benefits of economic of scale stated above. Thus as in Himmelberg et

[9] 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).

al. (1999) we allow for nonlinearities in the effect of firm size on performance by including the square of the natural log of sales in the firm performance equation.

We consider both the effects of ownership concentration and ownership type on firm performance. We measure ownership concentration (*OWNC*) by the percentage of shares held by those classified as large shareholders. We allow the effect of ownership to vary in a piecewise linear form (see Morck et al., 1988) across different segments of ownership concentration by introducing dummy variables (Independence Indicators) defined over three different ranges of ownership holdings: low concentration (*OWN1*) with no shareholder holding more than a 25 percent stake in the company; intermediate concentration (*OWN2*) with the largest shareholder(s) holding between 25 and 50 percent; and high concentration (*OWN3*) representing equity holdings in excess of 50 percent. Hence the ownership structure variable (*OWNER*) used in the model is the product of '*OWNC*' times '*OWN*'.

To the extent that large or block owners are more capable of monitoring and aligning management to their objectives ownership concentration would be expected to have a positive effect of firm performance (see Jensen and Meckling, 1976; Shleifer and Vishny, 1986; Short, 1994; Jirapon and Gleason 2007). But increased ownership may adversely affect performance because it raises the firm's cost of capital due to decreased market liquidity or decreased diversification opportunities (Fama and Jensen, 1983). Morck et al. (1988) argue 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. These predictions are corroborated by McConnell and Servaes (1995) who report that ownership has a positive effect on performance for low growth firms but an insignificant albeit positive effect 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 ownership structure should not have any significant effect on firm performance. This view is supported by the empirical findings reported in Demsetz and Lehn (1985) and Demsetz and Villalonga (2001).

We control for the effect of ownership type by dividing ultimate owners into three groups: (1) firms owned by families or related individuals (Family); (2) firms owned by financial institutions – banks, mutual funds and insurance companies (Financial); and firms with other types of ownership (Other). Small firms are more likely to be family controlled and their owners are likely to be involved in the management of the company while financial companies are more likely to be widely held with no owner involvement in the company's management. Since family ownership reduces the classic owner-manager conflict, agency theory would predict a positive effect of family ownership on firm performance (Morck et al., 1988; Anderson and Reeb, 2003a; Villalonga and Amit, 2006). This effect may be offset in situations where family managed firms forego the opportunity to hire professional managers that may be able to run the business more efficiently.

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:

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

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 profitability, asset structure, size, growth opportunities, and ownership structure and type.

There are conflicting theoretical predictions on the effects of profitability on leverage (see Harris and Raviv, 1991; Rajan and Zingales, 1995; 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 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 more profitable firms are more likely to finance their growth by retained earnings whereas less profitable firms will use more debt financing. Generally most empirical studies report a negative relationship between profitability and leverage although this association may be complicated by the presence of strong investment opportunities (see Booth et al., 2001).

The tangibility of the firm's assets can serve as a proxy for the agency costs of debt and the costs of financial distress (Myers, 1977; Harris and Raviv, 1990; Booth et al., 2001). Firms with more tangible assets have in general greater ability to secure debt as these assets can be used as collateral (Jensen and Meckling, 1976; Scott, 1977). Thus asset tangibility is expected to have a positive effect on leverage (Titman and Wessels, 1988). The use of collateral as a device to lower agency costs associated with debt may play an even more important role in countries like France where creditor protection is relatively weak in comparison to other developed countries (see La Porta et al., 1998).

The degree of asset intangibility measured by the ratio of intangible assets to total assets can serve as both a proxy for growth opportunities and as a source of collateral. Growth opportunities are generally associated with an increase in the agency costs of debt and are thus expected to have a negative effect on leverage (see Myers, 1977). To the extent that intangibles may be perceived by lenders as providing some form of security they will have a positive effect on leverage. The overall effect of intangibles on leverage is likely to be negative; especially for firms that have greater opportunities to expropriate bondholder wealth by substituting safer assets for riskier assets (see Booth et al., 2001; Anderson et al., 2003).

Sales growth can also be considered as another indicator of future growth opportunities. Low growth firms will have less opportunities to substitute low risk for high risk (high return) investments; hence they should incur lower agency costs of debt and should be able to carry more debt in their capital structure. High growth firms on the other hand may face a more intense debt overhang problem of the type described by Jensen and Meckling (1976) and Myers (1977). As a result we would expect that leverage will be negatively related with growth (see Titman and Wessels 1988; Lang et al., 1996). But if recontracting costs are kept low the underinvestment incentives are much smaller (see Booth et al., 2001). And if growth opportunities are viewed as an indicator of a successful business the effect of growth on leverage may be positive. It is also possible that owners of smaller private especially closely held companies may be fearful to lose control or are unable to issue new equity (see Giannetti, 2003) and thus opt to fund growth opportunities with leverage. This will reinforce the positive effect of growth opportunities on leverage.

The effect of size on leverage is expected to be positive. As larger firms are more diversified and tend to fail less often than smaller ones, we would expect that they have better access to credit and are able to sustain more debt (Friend and Lang, 1988).

Ownership structure may have a positive or a negative effect on the amount of debt held in the firm's capital structure. Firms where shareholders rights are weak are expected to carry more debt in their capital structure as these firms are expected to incur higher agency costs (Jirapon and Gleason 2007). Because of their long-term commitments to the firm, family owned firms have stronger incentives to mitigate agency conflicts with debt claimants and as a result face lower costs of debt financing (Anderson et al., 2003). Thus family firms may carry more debt in their capital structure. On the other hand diversified shareholders have incentives to expropriate debtholder wealth by investing in risky projects (Jensen and Meckling, 1976) in which case we would expect debt holders to require a higher return. Similarly, when leverage is high the risk of bankruptcy increases which may then induce firms to lower debt. For example, an increase in insider ownership may push firms to reduce leverage in order to decrease the firm's default risk (Friend and Lang, 1988).

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 performance 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 measure firm efficiency using the directional distance function. We choose to estimate the directional distance function using deterministic 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.

Table 1 gives the descriptive statistics of the firms in the sample for 2005. The data 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 cross-section model. On average firms in the chemicals industry are much larger and more capital intensive than firms in the computers and textiles industries.[10] Firms in the computers and R&D industry have higher intangibles to

[10] We collect data for firms with at least five employees. The majority of these firms are small (defined as those with 5-50 employees), followed by medium-sized firms (those with 51-500 employees). In particular, 60% of the firms in Chemicals are small, 32% are medium-sized and 8% are large firms (more than 500 employees). In Computers and R&D, 85% of the firms are small, 13% are medium and 2% are large. In Textiles, 75% of the firms are small, 23% are medium and 2% are large.

assets ratios and carry on average more debt in their capital structure. Profitability appears to be much higher on average in the textiles industry but its distribution is highly skewed – note that the median chemicals firm is more profitable than the median textiles firm. While ownership is quite concentrated across all industries, firms in the computers and R&D industry appear to have the least concentrated 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. We observe that family ownership is highest in the textiles industry and comparatively low in the chemicals industry.

Firms in the computers industry appear to be closer on average to the technological frontier compared to those in the chemicals and textiles industries. We do not find any significant differences in efficiency performance over time (i.e. from 2002 to 2005) – there appears to be a slight improvement in performance for firms in the chemicals industry and a slight decline on average for firms in the textiles industry.

Table 2 shows how efficiency varies across Quartiles 1 through 4 of the leverage and profitability distributions; across family vs. non-family firms; and across firms with dispersed (<25%) vs. more concentrated (>25%) ownership. Firms in the top quartile of the leverage distribution are more efficient and more profitable on average. The effect of ownership concentration on efficiency is ambiguous across industries. We find that efficiency is higher for more concentrated ownership structures in the computers and R&D industry and for less (<25%) ownership shares in the chemicals and textiles industries. There is a however a large difference in efficiency performance for different types of ownership: we find that family firms are significantly more efficient than non-family firms.[11] This is an interesting finding as

[11] As in Claessens et al. (2002) and Anderson and Reeb (2003) we do not separate family ownership from family management and we do not expect this distinction to be important in view of the type of companies (mainly smaller firms) that we consider. Faccio and Lang (2002) report that about two-thirds of French family controlled firms have top managers from the controlling family and this ratio is expected to be much higher for unlisted firms. Similarly we do not expect a significant wedge between ownership and control for the type of firms we consider and hence we do not control for mechanisms that may be used to enhance control. Such mechanisms (e.g. cross-holdings, dual class shares) are rare in France (see Faccio and Lang, 2002) or are used infrequently (e.g. pyramidal structures) especially by smaller family firms.

Table 2 also shows that family firms carry on average less debt in their capital structure than non-family firms. As Anderson et al. (2003) point out family monitoring and control may result in better operating performance for family firms and this may also mitigate the owner-manager agency conflicts. Firms with dispersed ownership are also less leveraged than firms with more concentrated equity ownership**.**

We turn next to empirically assess the relationship between leverage and efficiency as well as 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.[12]

An explicitly account of the dynamics in the relationship between efficiency and leverage would thus help solve the identification problem while rendering a structure that is more robust to simultaneity bias problems. Based on this we have proceeded to estimate the agency cost and leverage equations using both static and dynamic model

[12] Given the stability of ownership patterns that we observe in our sample and the type of firms, typically small unlisted companies, we treat ownership as an exogenous variable rather than the endogenous outcome of 'competitive selection' as advocated by Demsetz (1983). This is contrary to the results of Demsetz and Lehn (1985), Himmelberg et al. (1999) and Demsetz and Villalonga (2001) for large publicly traded U.S. firms but consistent with the stable ownership structures of Continental European firms and in particular smaller companies that comprise the bulk of the firms in our sample.

specifications.[13] 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 obtained from different models or estimation techniques appear to be quite robust, particularly in relation to assessing 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 simultaneity problems. Parsimonious forms of these equations were obtained by applying a standard general to specific methodology starting with models that used variables with up to three year lags.

Table 3 reports the estimates of the firm performance equation. We report both cross-section results (Panel A) and panel estimates with random effects (Panel B). The results show that leverage has a significant effect on efficiency. This effect is positive at the mean of leverage for each industry and it remains positive over the entire relevant range of leverage values. Thus we find support for the *agency cost hypothesis* 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 traditional (chemicals and textiles) industries. This finding provides 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. The finding that debt is more important for firm performance for industries with less growth opportunities is also consistent with the theoretical predictions of Jensen (1986) and Stulz (1990) (see also Booth et al., 2001).

Asset tangibility has a negative effect on firm performance at low fixed tangibles to total assets ratios while this effect is positive at high tangibles to asset ratios. A possible explanation for this finding is that a high proportion of hard tangible assets would reduce the extent of the firm's growth opportunities and as a result the agency

[13] Given the limited number of time periods for which data is available we focus on cross-section rather than panel model estimates. This ensures sufficient dynamic conditioning of the firm performance 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). For completeness, we present panel estimates for the firm performance model.

costs of managerial discretion (see Booth et al., 2001). The effect of size on performance is mostly significant for firms in the chemicals industry. This effect is non-monotonic, i.e. size has a positive effect on performance for smaller firms but a negative effect for larger firms. The growth effect is insignificant across all industries in the cross-section regressions while the effect of intangibles on firm performance is negative and significant only for firms in the chemicals industry. Past profitability has a positive and significant effect for all industries. The effect of ownership concentration on firm performance is positive and significant across different ownership concentration ratios in the chemicals industry. This effect is estimated to be stronger for firms with lower (<25%) ownership concentration. On the other hand low ownership concentration has a negative effect on firm performance for firms in the computers industry. This effect is not significant for firms with higher ownership concentration in this industry.[14] There is also no evidence that ownership concentration has a significant effect on performance for firms in the textiles industry. Arguably the absence of a statistically significant relationship between ownership structure and efficiency for textiles and in part for firms in computers and R&D supports the view expressed by Demsetz (1983) (see also Demsetz and Villalonga, 2001) whereby different types of ownership may exacerbate agency problems, but they also yield compensating advantages that ameliorate these problems. The negative estimates for financial and other types of ownership indicate that family owned firms - the omitted category – perform better on average.

Table 4 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 high 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. However there is no evidence to suggest that the franchise-value effect outweights the efficiency-risk effect even for the most highly levered firms. We find that in general firms with more concentrated ownership carry more debt in their capital structure. For mid- to high-leveraged firms in the computers

[14] 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.

and R&D industry we find that low ownership concentration has a negative effect on leverage. Consistent with pecking order theory, profitability has a negative effect on leverage for all industries on average and also across different capital structures. The effect of profitability appears to be stronger for firms with higher debt. We also find that a higher proportion of tangible assets are more important in increasing debt capacity for the smaller typically riskier firms in the textiles industry. The effect of intangible assets is negative in chemicals, positive in textiles and generally not significant for firms in computers and R&D. The growth rate of sales has a positive effect on leverage on average (OLS estimates) for firms in chemicals as wells as for low to medium leveraged firms across all industries. The owners of these firms appear to opt for debt finance for reasons we have described earlier on. Finally, we find no evidence that ownership type has a significant effect on leverage decisions for firms across all industries.

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 on firm performance as well as the reverse causality relationship while controlling for the effects of ownership structure and ownership type. We find support for the core prediction of the Jensen and Meckling (1976) *agency cost hypothesis* in that higher leverage is associated with improved efficiency over the entire range of observed data. We also find some evidence in support of the hypothesis that firms with more concentrated ownership face lower agency mainly for firms in the chemicals industry. Moreover, we find that on average family firms outperform non-family firms.

We have also investigated the reverse causality relationship from efficiency to leverage in terms of 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 in the low to high ranges of the leverage distribution supporting the *efficiency-risk hypothesis.* We also find that more concentrated ownership is generally associated with more debt in the capital structure. However we find no evidence that ownership type has an effect on leverage choices.

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)	17855.81	63789.21	2363.00	4413.77	21226.04	997.00	2568.00	6491.76	976.00
Labour (L)	166.24	467.06	37.00	55.95	235.44	15.00	51.09	94.16	23.00
Revenue	69714.61	258236.50	8338.50	8245.26	35689.20	1816.00	9283.36	21864.07	3129.00
Profit	5973.86	51290.61	213.00	395.53	5338.94	75.00	432.97	3192.63	71.00
Intangibles	3771.61	38017.68	38.50	643.29	5595.82	11.00	252.55	1299.80	15.00
Tangibles	10101.60	37225.20	719.00	341.01	2888.03	35.00	711.32	2186.38	137.50
Total Assets	66863.22	416953.10	5621.00	7134.45	44318.08	1092.00	6407.74	19825.20	1879.50
Total Debt	33239.00	191354.70	2928.50	4175.51	20492.68	679.00	3271.51	8747.22	867.50
Efficiency_05	0.82	0.24	0.94	0.87	0.17	0.93	0.78	0.22	0.86
Efficiency_04	0.81	0.24	0.92	0.86	0.16	0.92	0.79	0.20	0.86
Efficiency_03	0.81	0.23	0.91	0.87	0.16	0.93	0.80	0.19	0.87
Y/L	94.89	209.82	65.05	78.78	130.61	64.14	51.43	36.71	41.95
K/L	47.76	123.25	20.07	7.11	83.32	2.06	11.95	25.70	5.42
PR	0.07	0.13	0.06	0.08	0.26	0.05	0.15	0.05	0.05
INTG	0.04	0.10	0.01	0.08	0.14	0.01	0.05	0.10	0.01
TANG	0.70	3.58	0.32	0.23	3.88	0.08	0.37	2.36	0.15
LEV	0.58	0.26	0.56	0.69	0.42	0.65	0.56	0.30	0.54
Growth	0.07	0.30	0.05	0.14	0.34	0.09	0.02	0.30	0.00
OWN1	0.04	0.19	0.00	0.12	0.32	0.00	0.05	0.22	0.00
OWN2	0.24	0.43	0.00	0.24	0.43	0.00	0.22	0.42	0.00
OWN3	0.72	0.45	1.00	0.64	0.48	1.00	0.73	0.45	1.00
OWNC	0.76	0.27	0.90	0.65	0.30	0.52	0.68	0.27	0.51
Family	0.35	0.48	0.00	0.56	0.50	1.00	0.61	0.49	1.00
Other	0.56	0.50	1.00	0.37	0.48	0.00	0.30	0.49	0.00
Financial	0.09	0.29	0.00	0.07	0.36	0.00	0.09	0.28	0.00
Obs	1188			3253			1705		

Notes:

Output (Y) = value-added
Labour (L) = number of employees
Y/L = labor productivity
K/L = capital intensity
PR = Profit to assets ratio
INTG = Intangibles to total assets ratio
TANG = Tangibles to equity ratio
LEV = Debt to assets ratio
Efficiency = 1/(1+distance function value)
Growth = sales growth
OWN3 denotes high > 50% ownership concentration.
OWN2 denotes intermediate > 25% but < 50% ownership concentration.
OWN1 denotes low < 25% ownership concentration.
OWNC = percentage of largest shareholders(s) equity ownership

Table 2: Efficiency and Leverage Statistics

Panel A	**Chemicals**			
Efficiency				
@	LEV_Q1	LEV_Q2	LEV_Q3	LEV_Q4
Mean	0.81	0.81	0.81	0.84
Std. Dev.	0.25	0.24	0.24	0.21
Obs	297	297	297	297
@	PR_Q1	PR_Q2	PR_Q3	PR_Q4
Mean	0.82	0.82	0.80	0.83
Std. Dev.	0.22	0.23	0.26	0.23
Obs	297	297	297	297
@	Family	Non_Family	Own<25%	Own>25%
Mean	0.95	0.75	0.88	0.82
Std. Dev.	0.10	0.26	0.24	0.24
Obs	412	776	51	1137
Leverage				
@	Family	Non_Family	Own<25%	Own>25%
Mean	0.56	0.59	0.53	0.58
Std. Dev.	0.23	0.27	0.26	0.26
Obs	412	776	51	1137

Panel B	**Computers**			
Efficiency				
@	LEV_Q1	LEV_Q2	LEV_Q3	LEV_Q4
Mean	0.86	0.86	0.87	0.87
Std. Dev.	0.16	0.17	0.16	0.17
Obs	814	812	813	814
@	PR_Q1	PR_Q2	PR_Q3	PR_Q4
Mean	0.85	0.86	0.87	0.88
Std. Dev.	0.18	0.18	0.16	0.14
Obs	814	812	813	814
@	Family	Non_Family	Own<25%	Own>25%
Mean	0.91	0.80	0.84	0.87
Std. Dev.	0.10	0.21	0.15	0.17
Obs	1806	1447	256	2997
Leverage				
@	Family	Non_Family	Own<25%	Own>25%
Mean	0.65	0.74	0.60	0.70
Std. Dev.	0.31	0.52	0.25	0.43
Obs	1806	1447	256	2997

Panel C **Textiles**

Efficiency

	LEV_Q1	LEV_Q2	LEV_Q3	LEV_Q4
Mean	0.80	0.78	0.80	0.82
Std. Dev.	0.19	0.22	0.20	0.21
Obs	426	426	427	426
	PR_Q1	PR_Q2	PR_Q3	PR_Q4
Mean	0.77	0.80	0.77	0.83
Std. Dev.	0.22	0.21	0.23	0.19
Obs	426	426	427	426
	Family	Non_Family	Own<25%	Own>25%
Mean	0.87	0.69	0.85	0.80
Std. Dev.	0.14	0.25	0.16	0.21
Obs	1046	659	58	1647

Leverage

	Family	Non_Family	Own<25%	Own>25%
Mean	0.54	0.58	0.56	0.56
Std. Dev.	0.27	0.35	0.29	0.30
Obs	1046	659	58	1647

Notes:

This table shows how efficiency varies across (a) Quartiles 1 (Q1) through 4 (Q4) of the leverage (LEV) and profitability (PR) distributions; (b) family vs. non-family firms; and (c) firms with dispersed (<25%) vs. more concentrated (>25%) ownership (Own). It also shows how leverage varies across (a) family vs. non-family firms; and (b) firms with dispersed (<25%) vs. more concentrated (>25%) equity ownership**.**

Table 3: The Firm Performance Model

Panel A: Cross-Section Estimates
Dependent Variable: Efficiency

	Chemicals		Computers		Textiles	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
PR	0.0910	2.356	0.0345	3.070	0.1101	2.305
Owner1	0.0009	2.478	-0.0007	-2.040	-0.0002	-0.559
Owner2	0.0004	1.950	0.0000	0.209	-0.0001	-0.688
Owner3	0.0004	2.611	0.0000	0.485	-0.0001	-0.848
LOGR_04	0.1469	3.800	0.0140	0.303	0.0654	0.822
LOGR_04-Squared	-0.0128	-6.158	-0.0071	-2.437	-0.0109	-2.263
Growth	0.0089	0.766	-0.0018	-0.195	0.0022	0.155
LEV	0.0716	3.981	0.0423	4.237	0.0769	3.399
LEV-Squared	-0.0002	0.908	-0.0036	-2.951	-0.0175	-3.629
Industrial	-0.0148	-1.959	-0.0099	-2.043	-0.0261	-3.599
Financial	0.0042	0.272	-0.0107	-1.172	-0.0172	-1.318
INTG	-0.0015	-3.672	0.0004	0.952	-0.0003	-0.428
TANG	-0.9508	-13.795	-1.5487	-11.932	-1.4275	-21.812
TANG-Squared	0.8516	8.211	2.2679	5.794	1.3937	12.016
Constant	0.6541	3.913	1.2220	6.724	1.0967	3.330
R-squared	0.792		0.653		0.738	
Adjusted R-squared	0.789		0.650		0.735	

Notes:

Least Squares estimates with Heteroskedasticity-Consistent Standard Errors

The dependent variable is the firm efficiency score in 2005 computed as 1/(1+distance function value)

LEV = debt to assets average ratio for 2003 and 2004
PR = profit to assets average ratio for 2003 and 2004
TANG = tangibles to assets ratio in 2004
INTG = intangibles to equity ratio in 2004
GROWTH = sales growth average for 2003 and 2004
Owner1 = Own1*Ownc
Owner2 = Own2*Ownc
Ownwr3 = Own3*Ownc
(OWN1 is a dummy variable that denotes low < 25% ownership concentration; OWN2 denotes intermediate > 25% but < 50% ownership concentration; OWN3 denotes high > 50% ownership concentration; and OWNC = percentage of largest shareholder equity ownership)
Family; Financial; Other are ownership type dummies.

Panel B: Panel Estimates 2002-2005

Dependent Variable: Efficiency

	Chemicals		Computers		Textiles	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
PR_1	0.0443	2.23	0.0216	3.44	0.0637	2.24
Owner1	0.0008	2.69	-0.0004	-1.75	-0.0002	-0.51
Owner2	0.0005	2.23	0.0001	0.7	-0.0001	-0.78
Owner3	0.0003	2.5	0.0000	0.21	-0.0002	-1.53
LOGR	0.1578	5.5	0.0208	0.5	0.0443	0.72
LOGR-Squared	-0.0131	-8.59	-0.0072	-2.76	-0.0091	-2.41
Growth	0.0159	2.64	0.0179	4.01	0.0499	5.67
LEV_1	0.0898	4.12	0.0330	4.81	0.1144	5.96
LEV_1-Squared	-0.0203	-2.11	-0.0026	-3.27	-0.0488	-3.88
Industrial	-0.0177	-2.02	-0.0079	-2.15	-0.0438	-5.42
Financial	0.0079	0.57	-0.0068	-0.84	-0.0399	-3.02
INTG	-0.0003	-1.55	0.0001	0.48	0.0003	0.76
TANG	-0.8150	-14.43	-1.5829	-15.06	-0.3271	-15.91
TANG-Squared	0.6847	8.57	2.2904	7.25	0.1148	9.25
Constant	0.5664	4.44	1.1901	7.15	1.0718	4.3
R-squared	0.802		0.694		0.688	

Notes:

Random-effects GLS regression estimates with Huber-White robust standard errors.

The dependent variable is the firm efficiency score computed as 1/(1+distance function value)

LEV_1 = debt to assets average ratio (2-year average) with one year lag.
PR_1 = profit to assets ratio (2-year average) with one year lag.
TANG = Tangibles to assets ratio
INTG = Intangibles to equity ratio
Owner1 = Own1*Ownc
Owner2 = Own2*Ownc
Ownwr3 = Own3*Ownc
(OWN1 is a dummy variable denoting low < 25% ownership concentration; OWN2 denotes intermediate > 25% but < 50% ownership concentration; OWN3 denotes high > 50% ownership concentration; and OWNC = percentage of largest shareholder equity ownership)
Family; Financial; Other are ownership type dummies.

Table 4: 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**	
Efficiency_04	0.1840	3.24	0.1794	1.59	0.1675	2.24	0.1710	2.81
PR	-0.8481	-10.01	-0.4359	-3.03	-0.5932	-5.73	-0.6693	-6.61
owner1	0.0004	0.36	-0.0002	-0.08	0.0003	0.14	0.0007	0.37
owner2	0.0003	0.47	0.0004	0.33	0.0008	0.9	0.0002	0.25
owner3	0.0007	2.15	0.0003	0.46	0.0008	1.67	0.0006	1.52
LogR_04	0.0169	2.00	0.0246	1.49	0.0255	2.23	0.0193	1.84
Growth	0.0870	3.01	0.1681	3.47	0.1597	3.07	0.1137	2.38
Other	-0.0060	-0.27	-0.0112	-0.28	-0.0065	-0.18	0.0141	0.53
Financial	-0.0006	-0.02	0.0114	0.24	-0.0213	-0.43	0.0400	0.84
Intg	-0.1870	-2.84	-0.0584	-0.62	-0.1807	-2.14	-0.2557	-2.35
tang	0.0071	2.61	0.0077	0.48	0.0067	0.38	0.0180	0.98
Const	0.2697	2.26	-0.0922	-0.39	-0.0050	-0.03	0.1279	0.87
R-sq	0.23		0.06		0.09		0.11	
	q40		**q50**		**Q60**		**q70**	
Efficiency_04	0.1533	2.38	0.1833	2.48	0.1920	2.49	0.1840	2.48
PR	-0.7481	-9.24	-0.7727	-8.65	-0.8450	-8.48	-0.8328	-7.84
owner1	0.0017	1.19	0.0012	0.97	0.0004	0.28	0.0000	0.02
owner2	0.0002	0.28	0.0004	0.5	0.0000	0.04	0.0006	0.76
owner3	0.0005	1.3	0.0008	1.88	0.0006	1.27	0.0007	1.75
LogR_04	0.0128	1.09	0.0179	1.37	0.0164	1.29	0.0184	1.63
Growth	0.1088	2.74	0.0753	2.4	0.0598	1.61	0.0469	1.21
Other	-0.0073	-0.29	-0.0164	-0.53	-0.0170	-0.55	-0.0025	-0.1
Financial	0.0249	0.64	0.0138	0.39	0.0033	0.08	0.0232	0.67
Intg	-0.1846	-2.05	-0.1867	-1.97	-0.1968	-1.97	-0.2392	-1.98
tang	0.0157	0.87	0.0143	0.86	0.0191	1.37	0.0250	2.09
Const	0.2817	1.89	0.2452	1.49	0.3292	2.01	0.3521	2.25
R-sq	0.13		0.14		0.15		0.15	
	q80		**q90**					
Efficiency_04	0.2518	2.87	0.2405	2.82				
PR	-0.8662	-8.16	-0.8782	-7.48				
owner1	0.0008	0.34	0.0006	0.21				
owner2	0.0006	0.84	-0.0003	-0.22				
owner3	0.0009	2.63	0.0007	1.13				
LogR_04	0.0212	1.57	0.0117	1.02				
growth	0.0491	1.15	0.0383	1.02				
Other	-0.0057	-0.19	0.0087	0.23				
financial	-0.0121	-0.34	0.0162	0.32				
intg	-0.2308	-1.89	-0.2120	-1.51				
tang	0.0189	2.03	0.0066	1.13				
const	0.3170	1.65	0.5175	3.01				
R-sq	0.15		0.17					

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

	Coeff	t-stat	coeff	t-stat	Coeff	t-stat	coeff	t-stat
	OLS		**q10**		**q20**		**q30**	
Efficiency_04	0.2826	3.57	0.0605	0.69	0.1527	1.9	0.2011	3.62
PR	-0.8969	-5.67	-0.1009	-1.88	-0.3116	-4.07	-0.4551	-5.36
owner1	0.0002	0.18	-0.0014	-1.32	-0.0014	-1.4	-0.0025	-2.72
owner2	0.0016	2.96	0.0005	0.61	-0.0002	-0.2	0.0001	0.15
owner3	0.0025	6.07	0.0007	1.76	0.0008	2.2	0.0006	2.24
LogR_04	0.0076	0.72	0.0067	0.46	0.0148	1.53	0.0259	3.32
Growth	-0.0436	-0.88	0.1003	2.34	0.1326	4.38	0.1240	4.49
Other	0.0154	0.80	0.0184	0.68	-0.0025	-0.12	0.0056	0.34
Financial	0.0214	0.37	0.0006	0.01	-0.0355	-1.11	-0.0228	-1.05
intg	-0.0607	-0.65	-0.1289	-1.83	0.0010	0.01	-0.0316	-0.55
tang	0.0060	1.40	0.0241	1.15	0.0184	0.79	0.0254	1.09
Const	0.2927	2.22	0.2077	1.21	0.2047	1.6	0.1658	1.68
R-sq	0.216		0.04		0.05		0.07	
	q40		**q50**		**q60**		**q70**	
Efficiency_04	0.2254	4.93	0.2088	3.02	0.1824	3.14	0.1478	2.91
PR	-0.5643	-7.86	-0.6829	-9.9	-0.7415	-10.65	-0.8827	-11.42
owner1	-0.0020	-2.31	-0.0018	-2.3	-0.0016	-2.07	-0.0017	-2.55
owner2	0.0000	0.11	0.0004	0.81	0.0008	1.99	0.0009	2.06
owner3	0.0005	2.07	0.0008	3.69	0.0009	4.15	0.0009	4.44
LogR_04	0.0266	3.96	0.0200	2.54	0.0153	2.14	0.0046	0.6
Growth	0.0970	3.86	0.0746	3.25	0.0492	1.63	0.0430	1.35
Other	0.0236	1.56	0.0237	1.59	0.0323	2.01	0.0399	2.5
Financial	-0.0150	-0.76	-0.0178	-0.98	-0.0159	-0.82	-0.0243	-0.96
intg	-0.0552	-0.98	-0.0586	-1.02	-0.0443	-0.74	-0.0805	-1.29
tang	0.0224	1.01	0.0189	0.97	0.0201	1.14	0.0110	0.82
Const	0.2032	2.4	0.3158	2.69	0.4170	4.08	0.5974	6.07
R-sq	0.09		0.11		0.13		0.15	
	q80		**q90**					
Efficiency_04	0.1679	4.05	0.1728	2.12				
PR	-0.9862	-13	-1.2494	-11				
owner1	-0.0019	-1.8	0.0006	0.25				
owner2	0.0010	2.95	0.0007	1.07				
owner3	0.0011	5.13	0.0015	3.45				
LogR_04	0.0027	0.36	-0.0105	-0.85				
growth	0.0351	1.26	0.0631	1.12				
Other	0.0418	2.42	0.0487	1.64				
financial	0.0148	0.43	-0.0068	-0.21				
intg	-0.0767	-1.7	-0.1195	-1.45				
tang	0.0059	0.74	0.0018	0.38				
const	0.6470	7.26	0.8442	5.32				
R-sq	0.17		0.21					

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

	Coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat
	OLS		**q10**		**q20**		**q30**	
Efficiency_04	0.1769	2.62	-0.0083	-0.12	0.0799	0.91	0.1644	2.12
PR	-0.8684	-6.84	-0.2242	-2.32	-0.3101	-3.65	-0.4527	-5.3
owner1	0.0001	0.10	0.0001	0.08	0.0003	0.36	0.0000	-0.03
owner2	0.0008	1.52	0.0017	2.79	0.0007	0.87	0.0014	2.06
owner3	0.0006	1.91	0.0005	1.22	0.0003	0.63	0.0007	2.04
LogR_04	0.0225	2.45	0.0042	0.34	0.0242	1.57	0.0273	2.25
Growth	0.0366	0.83	0.1037	1.61	0.1082	1.83	0.0882	1.65
Other	0.0296	1.53	0.0075	0.28	0.0081	0.28	0.0170	0.85
Financial	-0.0144	-0.48	0.0229	0.62	-0.0335	-0.9	-0.0079	-0.27
intg	0.1812	2.00	0.1346	0.93	0.1590	0.99	0.3047	2.06
tang	0.0350	4.75	0.0378	2.78	0.0393	2.13	0.0511	2.65
Const	0.1907	1.59	0.1594	1.12	0.0460	0.25	-0.0052	-0.03
R-sq	0.21		0.06		0.06		0.09	
	q40		**q50**		**q60**		**q70**	
Efficiency_04	0.2295	3.08	0.2506	4.08	0.2944	4.54	0.2720	3.89
PR	-0.4777	-4.42	-0.5458	-4.67	-0.6024	-5.53	-0.7375	-6.9
owner1	-0.0003	-0.28	-0.0007	-0.43	-0.0010	-0.5	0.0025	1.24
owner2	0.0011	1.52	0.0009	1.33	0.0008	1.29	0.0006	1.06
owner3	0.0007	1.77	0.0007	1.89	0.0007	1.81	0.0008	2.16
LogR_04	0.0327	2.59	0.0315	2.54	0.0296	2.58	0.0284	2.75
growth	0.0876	1.36	0.1094	1.87	0.0735	1.27	0.0933	1.82
Other	0.0164	0.57	0.0127	0.5	0.0237	1.11	0.0185	0.85
financial	-0.0107	-0.32	-0.0271	-0.95	-0.0404	-1.4	-0.0332	-0.95
intg	0.2458	1.84	0.2280	2.02	0.1660	1.53	0.1080	0.93
tang	0.0587	3.08	0.0659	3.46	0.0698	4.34	0.0576	3.87
const	-0.0360	-0.23	0.0201	0.14	0.0591	0.42	0.1534	1.13
R-sq	0.09	3.08	0.11		0.12		0.14	
	q80		**q90**					
Efficiency_04	0.3018	3.55	0.2824	2.8				
PR	-0.7730	-5.82	-1.0169	-5.52				
owner1	0.0018	1.18	0.0010	0.78				
owner2	0.0008	1.37	0.0004	0.41				
owner3	0.0008	2.46	0.0004	0.78				
LogR_04	0.0284	2.3	0.0242	1.34				
growth	0.0334	0.82	0.0364	0.55				
Other	0.0293	1.36	0.0579	1.8				
financial	0.0038	0.11	0.0089	0.24				
intg	0.0946	0.65	0.2669	1.69				
tang	0.0513	3.62	0.0296	2.12				
const	0.1810	1.14	0.3561	1.59				
R-sq	0.16		0.19					

Notes:

Least Squares estimates with heteroskedasticity-consistent standard errors and simultaneous quantile regression estimates with bootstrap standard errors.

The dependent variable (LEV) is the debt to assets ratio in 2005.

Efficiency_04 = firm efficiency score in 2004 computed as 1/(1+distance function value)
PR = average profit to assets ratio for 2003 and 2004
tang = tangibles to equity ratio in 2004
intg = intangibles to assets ratio in 2004
Owner1 = Own1*Ownc
Owner2 = Own2*Ownc
Owner3 = Own3*Ownc
Family; Financial; Other are ownership type dummies.