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ABSTRACT

Corporate Growth and FDI: Are Multinationals Stimulating Local Industrial Development?*

The aim of this Paper is to improve our understanding of the empirical determinants of corporate growth by extending the literature to include a new group of variables related to FDI, namely the degree of foreign ownership and technology spillovers. Based on recent developments in the field, our analysis also takes into account the role of sunk costs and financial structure, while quantile regression techniques as more suitable to the data available (2640 manufacturing firms operating in Greece in the 1992-97 period) are used. Our findings highlight the role of multinationals in increasing corporate growth with varying intensity depending on industry groups and regression quantiles, and vindicate the use of new variables.

JEL Classification: F23 and L11
Keywords: corporate growth, multinational firms, quantile regression and spillovers

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Corporate growth and FDI:
Are multinationals stimulating local industrial development? [*]

I. Introduction

Multinational companies (MNCs) are increasingly thought to be important for host countries in terms of promoting local development. Markusen and Venables (1999) provide a theoretical treatment of the way in which linkages created by MNCs with domestic (supplier) firms may act as a catalyst for the development of the domestic industrial sector. Examining the related issue of spillovers originating from Foreign Direct Investment (FDI), Blomström and Kokko (1998) suggest different ways in which such spillovers may take place in host economies. MNCs bring along new technologies with public good qualities, leading to efficiency benefits for domestic firms. Higher efficiency results in increased profits which in turn may boost the growth rate of the domestic industrial sector either by causing new entry or by speeding up the growth rate of existing firms. MNCs may also contribute in paving the way (through the creation of networks) for exports to access foreign markets from the host economy, thus indirectly increasing demand for local firms. Finally, domestic firms feeling threatened by the entry of MNCs in their industries potentially leading to lower market shares, may want to strike back by becoming more efficient, a competition effect improving performance and, subsequently, promoting growth.

Spillovers stemming from MNCs have been empirically examined in the literature in terms of their effects on efficiency, performance and entry. Blomström and Sjöholm (1999), Aitken and Harrison (1999), Chhibber and Majumdar (1999), Görg and Strobl (2002), and Dimelis and Louri (2002) among others, provide empirical support to the hypotheses of technology spillovers stemming from MNCs and increasing domestic productivity, profitability and the number of new entrants. Nevertheless, potential effects on corporate growth are, to our knowledge, not yet investigated.

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It is our purpose in this paper to examine empirically the effect that MNCs have on the growth of firms in the host economy, while taking into account recent theoretical contributions on the subject. The firm growth literature has a long history of contributions that have essentially revolved around issues of the determinants and trends of industry concentration and to a lesser extent the determinants of growth *per se*, often presented as a random process. Since accumulated evidence seems to reject randomness, some effort is required to identify deterministic factors affecting the way firms develop.

Recent contributions to the explanation of firm growth include the roles of sunk costs (Cabral, 1995) and financial structure (Lang et al., 1996; Nickell et al., 1992; 1999). Testing empirically for their respective effects, when the effect of other firm attributes as well as foreign participation have already been accounted for, has also been a strong motivation for the present research along with the overall paucity of evidence on firm growth regarding Greek firms and the disputed role of MNCs in the country. Further on the novelty side, this research explores the effects of regressors in different quantiles of the conditional distribution of the dependent variable. The results point to significant and interesting differences of these effects along the conditional distribution.

In the following section, various important studies within the large literature on firm growth are reviewed and the key results are highlighted, paving the way for the empirical investigation to be undertaken. Next, in the third section descriptive statistics and the explanatory variables used are presented, whilst in the fourth section the empirical findings following ordinary-least-squares and quantile regression analysis are displayed and discussed. The final section concludes the paper.

II. Theoretical considerations and evidence on firm growth

a) Growth as a random process

There is a vast literature on firm growth that has been concentrated on a nexus that runs from the shape of the size distribution of firms and the statistical generating mechanism that is capable of producing it, to the implications of the latter on firm growth and ultimately on industry concentration. The firm size distribution is skewed: there are more small firms than there are large firms. This is portrayed in a graph of a probability density function where the probability mass is concentrated closer to the origin of the axes, i.e. corresponding to small firms, and has a long right tail that relates to larger firm sizes.

Gibrat assumed that the lognormal distribution was a good description of the observed firm size distribution and Hart and Prais (1956) suggested the variance of the logarithms of firm sizes as an index of business concentration.

Aitchison and Brown (1957, p. 22) explain in detail how a lognormal distribution of firm sizes emerges. Following their exposition, we suppose that the variate firm size is initially S_0. It becomes S_t after the t^{th} step in a process and it reaches its final value S_n after n steps. The change in the variate at the t^{th} step is a random proportion of some function of its previous value S_{t-1}, that is $S_t - S_{t-1} = \varepsilon_t \varphi(S_{t-1})$. The *law of proportionate effect* (LPE) emerges in the special case where $\varphi(S_{t-1}) = S_{t-1}$. A formal definition for the LPE is " *A variate subject to a process of change is said to obey the law of proportionate effect if the change in the variate at any step of the process is a random proportion of the previous value of the variate*" [ibid.]. This implies that $S_t - S_{t-1} = \varepsilon_t S_{t-1}$, or alternatively $\frac{S_t - S_{t-1}}{S_{t-1}} = \varepsilon_t$. Summing up both sides of the last expression for n steps in the process we get $\sum_{t=1}^{n} \frac{S_t - S_{t-1}}{S_{t-1}} = \sum_{t=1}^{n} \varepsilon_t$ which, for small time intervals and values of the percentage increment ε_t, becomes approximately $\sum_{t=1}^{n} \frac{S_t - S_{t-1}}{S_{t-1}} \approx \int_{S_0}^{S_n} \frac{1}{S} dS = \log S_n - \log S_0$. Subsequently, Steindl (1965 p.30) shows that the logarithm of firm size comes about from an additive effect of many small random variables and the logarithm of the initial size. If these random variables have identical distributions with mean μ and variance σ^2, then by the Central Limit Theorem the sum of these random variables is normally distributed with mean μt and variance $\sigma^2 t$. When $t \to \infty$, the contribution of the original size in the sum would be minuscule involving that $\log S_t \sim N[\mu t, \sigma^2 t]$. Hence S_t is log-normally distributed and in effect LPE describes a generating process for a firm size distribution that is skew, provided of course that one accepts that the actual firm size distribution is indeed lognormal.[1]

[1] Ijiri and Simon (1977) point out that a lognormal firm size distribution can be derived from a random-walk Gibrat fashion only when it is assumed that firms start the random walk at the same time. Allowing for new entrants once the process has already started destroys lognormality (ibid. p. 138). An alternative process that allows for new entry at the smallest size class leads to Yule distribution (also skew), but at the cost that it cannot hold declines in firm sizes.

The LPE, or Gibrat's law, in its strict version implies that over a period of time all firms have equal chances for the same amount of proportionate growth independently of their size at the beginning of the period. The assumptions of Gibrat's law are violated if growth rates or their variance is correlated with firm size. A weaker form of Gibrat's assumption used in Ijiri and Simon (1977) states that expected growth is independent of attained size, but only for firms in a given size class.

In the context of a linear model and in a cross section setting LPE may be expressed as

$$s_i(t) = \beta s_i(t-1) + \varepsilon_i(t) \tag{1}$$

where $s_i(t)$ and $s_i(t-1)$ denote differences from the cross-section mean of the logarithms of firm sizes in time t and t-1, and i indexes the i^{th} firm in a cross section of firms. Gibrat's law implies that $\beta = 1$. If $\beta < 1$ firms below average grow faster than those above it, whereas when $\beta > 1$ the opposite is the case. A number of authors (Friedman, 1992; Quah, 1993) have suggested that it is fallacious to believe that when $\beta < 1$ it necessarily suggests convergence. Or that over time there is a decrease in the variance of the variable of interest i.e. a trend for concentration of its values around its mean. Indeed, Hart and Prais (1956), and Hart (1995) explain why in the context of (1) $\beta < 1$ is a necessary but not a sufficient condition for decrement in the variance of firm size over time. In particular, since the variance of $s_i(t)$ is

$$V[s(t)] = \beta^2 V[s(t-1)] + \sigma^2 \tag{2}$$

and it holds that $\rho^2 = \dfrac{\beta^2 V[s(t-1)]}{V[s(t)]}$,where ρ is the correlation between s(t) and s(t-1), it follows that:

$$V[s(t)] / V[s(t-1)] = \beta^2 / \rho^2 \tag{3}$$

Since $\rho \leq 1$ and given (3), an increasing variance when $\beta < 1$ can emerge only when $\rho < \beta < 1$. When β>1 the variance always increases. In testing the relationship between firm size and growth a variant of (1) has been proposed by Evans (1987a; 1987b).

$$S(t) = [g(A(t-1), S(t-1)]^p S(t-1) e(t), \tag{4}$$

where g is some growth function, A is firm age, p is the length of period over which growth of firms is being considered and e is a lognormally distributed error term. Thus,

$$[\ln S(t) - \ln S(t-1)] / p = \ln g(A(t-1), S(t-1)) + u(t), \qquad (5)$$

where u(t) is normally distributed with zero mean and independent of A(t-1) and S(t-1).

This formulation allows for more flexible specifications of the growth function. Evans, taking a second order expansion, accounts for squared terms and interaction terms between the right hand side (RHS) variables, whereas his dependent variable is essentially an annualised change in firm sizes. The effect of firm size on growth can be assessed by taking the partial derivative $g_S = (\partial \ln g / \partial \ln S)$. A $\beta < 1$ from (1) is consistent with a negative partial derivative with respect to initial size in Evans' framework. A more direct comparison with (1) can be made if the elasticity of the end-of-period size with respect to initial size is calculated as $E_S = \frac{\partial \ln(S_t)}{\partial \ln(S_{1-1})} = 1 + pg_s$. In case S_{t-1} is not raised to any power and there are no interaction terms involving initial size in RHS, then it is easy to see that $1 + pg_s = \beta$.

b) Evidence

In applied research there have been two kinds of tests regarding the validity of Gibrat's Law. The first regards direct testing of the hypothesis that firm growth is independent of firm size, i.e. β=1. The second pertains to the validity of the assumption that the firm size distribution, although admittedly skew, is indeed lognormal. The evidence on the second sort of trial of Gibrat's Law is rather limited, since the first has always been of much more interest. Interestingly, the vast majority of empirical studies testing β=1 a priori accept that the firm size distribution is lognormal.[2]

Thus, it appears that the only discerning voices regarding the appropriateness of lognormal and similar distributions have been those of Quandt (1966) and Silberman (1967) who, using elaborate tests and econometric techniques, have concluded that these are rather a poor fit. On the other hand, Hart and Oulton (1997, p. 206) notice that the usual tests tend to reject the hypothesis of normality of the log-transformed firm sizes in

[2] This is aptly put by Ijiri and Simon (1977) who point out that "… in applying the assumptions to the logarithm of the variate, we have in effect, assumed the law of proportionate effect" (ibid. p.141)

large samples. Arguing that no theoretical distribution could fit real data exactly, they propose that *“if a particular distribution is approximately true and if it simplifies the task before us”* it should be used.

Early studies (Hart and Prais, 1956; Hart, 1962) using UK data that span from the 1850s to 1950s provide evidence in support to the operation of Gibrat’s Law. Hart in particular (ibid. p. 39) makes the point that *“ there is a large stochastic component in the forces determining the growth of firms, which makes it difficult to adopt a deterministic explanation”*. Samuels (1965), on the other hand, using data on quoted companies finds that in the 1951-1960 period large firms were growing at a faster proportional rate than small firms resulting in concentration levels that were higher than if Gibrat’s law was in operation. In the US, Simon and Bonini (1958) studied growth rates of the 500 largest firms for 1954-56 and found evidence that there is no difference in the growth rates of firms above some critical value. Hymer and Pashigian (1962), using data on the 1000 largest US firms between 1946 and 1955, found an insignificant, although positive, effect of firm size on firm growth suggesting that there had not been significant differences in growth rates of large and small firms. However, the variance of growth rates was inversely related to firm size. On these grounds Gibrat’s law was rejected. The inverse size and variance of growth relationship was attributed to the increased probability of decline and exit of small firms due to their cost disadvantages which, however, are at the same time a great motivation for small firms to try and grow faster.

Singh and Whittington (1975) explained the smaller variance of growth rates found in larger UK firm size-classes, arguing that large firms could be more diversified which in turn allows them to offset adverse growth prospects in one market by a good performance in another. The basic implication of Gibrat’s law was also rejected in this study as it was found that in almost all industries independently considered, but also when taken together, large firms were growing faster than smaller ones ($\beta>1$) over the period 1948-1960. To further explore the substance of this result the authors examined the “persistence of growth” hypothesis, that is to regress firm growth rates over 1954-1960 on firm growth rates over 1948-1954. The coefficient obtained was positive and significant although the overall variance accounted for was small, suggesting a tendency for the growth rates of individual firms to persist. In a step forward this research, incorporating past growth in the RHS of the basic growth equation, yielded that, to a great extent, the positive relationship between size and growth was due to positive serial correlation of growth rates.[3] Chesher (1979) pursued this point further and demonstrated that serial correlation in the error term may lead to inconsistent estimates of the parameter β. The extent of inconsistency is proved to be an inverse function of the length of study period, that is the longer the unit of time, the smaller the serial correlation in growth and the less unreliable the estimates obtained. Testing Chesher's framework of analysis on German firms, Wagner (1992) finds evidence of 'persistence of chance' in the sense that fast growing firms in present have also been growing faster in the past, while Armus and Nerlinger (2000) reject LPE by pointing out that small firms grow faster than large ones.

Mansfield (1962) finds that smaller firms exhibit more variable, but higher, growth rates than larger US firms. In testing a variant of LPE for firms of larger than minimum efficient size, Mansfield's results rejected the LPE, obtaining $\beta<1$ in all cases considered but for the petroleum industry in the 1945-1954 period. Mansfield made the point that restricting the testing of the relationship between firm size and growth for only surviving firms may introduce a downward bias in the estimation of β, due to exclusion of laggard small firms. Dunne and Hughes (1994) further explain that the rationale behind this is that, whereas slow growing large firms could slowly slip downwards through the firm size distribution which essentially could delay or even avoid their exit, shrinking small firms sooner than later pass the exit threshold in an industry. Including only surviving firms in a sample creates, *ceteris paribus*, a selectivity bias as surviving small firms are most probably faster growing ones. Despite the intellectual appeal of Mansfield's argument, it has been demonstrated in several studies which properly accounted for such source of bias, that obtaining $\beta<1$ was not in fact an artefact of sample selection (Hall, 1987; Evans, 1987a; b; Dunne et al, 1989; Dunne and Hughes, 1994). However, in Hall (1987) Gibrat's Law was accepted for the larger firms, whereas Evans (1987b) notices that departures from Gibrat's law decrease for larger firm sizes.

Hart and Oulton (1996) in a recent study of the relationship between firm size and growth in UK firms over 1989-1993, using an extensive and comprehensive data set, analyse in detail possible departures from Gibrat's law along the firm size distribution. In

[3] Ijiri and Simon [1977] using simulations have shown that skew firm-size distributions may be brought about

particular, using (1) and various definitions of firm size, they consistently obtain $\beta<1$ for periods that span from one to four years. If, however, variables are measured with error, ordinary least squares estimates of β would be biased downwards. This would, in turn, suggest that when $\beta<1$ in short spanned studies, this may be due to firms with transitorily small size, because of measurement error, growing faster than firms with transitorily larger size, for the same reason. Hart and Oulton account for this potential source of bias by calculating a geometric mean β and the reciprocal of a coefficient derived from the reverse of (1). This geometric mean was close to unity raising concerns for the possibility of earlier unjust rejection of Gibrat's law. However, using sequential regressions in ascending size direction, β increased from about 0.43 to 0.80, whereas in sequential regressions in descending size direction, β declined from about 1.10 to 0.86. Thus, whereas an overall regression towards the mean shows a negative relation between firm size and growth, there are significant differences of the effect of size on growth along the firm size distribution. Differences as such tend to accept Gibrat's law for large but not small firms. Farinas and Moreno (2000) using non-parametric techniques on Spanish data find a negative effect of size on firm growth robust to error-in-variables bias.[4]

Kumar (1985) investigates the relationship between firm size and growth in the UK over 1960-1976 distinguishing also growth by acquisition. His results contrast with those of Singh and Whittington (1975) in that small firms were found to be faster growing than larger ones and persistence of growth was weaker. A negative relationship between size and growth was also evident when growth by acquisition was considered. Kamshad (1994) finds a negative size growth relationship for French co-operative firms that is robust to sample selectivity. Using information on the world's largest 792 industrial firms Cantwell and Sanna-Randacio (1993) explore the positive effects of multinationality on (parent) growth and find an inverse firm-size relationship. In a theoretical setting, Sanna-Randacio (2001) assesses the impact of FDI on local firm development taking into account the technological repercussions and stresses its sector specificity. Audretsch et al. (1999) provide evidence that rejects Gibrat's law for newborn Italian manufacturing firms. Mata (1994) finds a negative relationship between size and growth of new Portuguese firms that belong to the same cohort. In contrast, Wagner's (1994) results on

even in the presence of serial correlation in firms' growth rates.

[4] To account for possible bias the authors used as regressor the average of the period instead of initial size.

new German manufacturing firm growth seem to point out that new firms small and large face the same distribution of growth probabilities. In Dunne et al (1989) research on the survival and growth of US manufacturing plants, size has been inversely related to growth of surviving plants. However, when distinction is made between plants owned by single-plant and multi-plant firms the effect of plant size turns to positive when growth of plants owned by multi-plant firms is considered. On the contrary, Variyam and Kraybill (1992) find that when the effect of other firm characteristics is held constant, the rate of growth is significantly smaller for single establishment vs. multi-establishment firms.

c) Deterministic approaches

From the above discussion we may conclude that in most of the empirical studies that set to test the validity of Gibrat's law, the evidence has been largely unfavourable at least in what relates to its strict form. It may also be evident that there has been a time evolution in the predominant sign of the effect of initial size on firm growth. Thus, in contrast to earlier studies, it has been fairly established that small firms have tended, on average, to grow faster than larger ones. The phenomenon has often been termed as 'reversion to the mean' or regression to the mean in the Galtonian sense. In a recent paper, Hart (2000) reassesses the evidence and examines its compatibility with theoretical views regarding firm growth and the shape of cost curves. Interesting conclusions underline that persistence of growth is low. In the last decades small and young firms may be growing faster due to favourable technological progress offsetting much of the comparative advantage of large firms and to favourable government policies. Foremost, "*The systematic tendency for small and younger firms to grow more quickly is the main reason why firm growth is not entirely stochastic*" (ibid. p. 229).

It is true that the unease to accept that firm growth is governed by a Gibrat process has been expressed early in the literature. If such a process were meant to be for all and not just for surviving firms, then the incidence of firm decline (negative growth) and eventually firm death would have been independent of firm size. It was soon recognised that this could not be the case (Mansfield, 1962; Singh and Whittington, 1975). Such a version of the law would have been largely incorrect, as far as a number of studies have pointed out that size and age are positively related to firm survival.

Jovanovic (1982) developed a theoretical model that could account for these deviations from LPE uncovered by empirical research. His model of "noisy" selection predicts a negative relationship between firm size and growth, and firm age and growth. The model assumes that firms are heterogeneous with respect to their true efficiencies and, consequently, cost levels. Firms learn about their true efficiencies as they operate in an industry. In a Bayesian learning process firms update, through experience, their expectations regarding the value of their efficiency. Those that make positive discoveries about their true efficiencies survive and grow, whereas the others decline and exit. Failure, but also growth rates decrease with firm size and age. An old, large operating firm is most probably one that has already made a series of positive discoveries about its true efficiency that leave less scope for further efficiency gains from learning. A negative age growth relation has been uncovered in a number of empirical studies and different country contexts (Evans, 1987b; Dunne et al, 1989 and Variyam and Kraybill, 1992 for US; Dunne and Hughes, 1994 for UK; Kamshad, 1994 for France; Farinas and Moreno, 2000 for Spain). An exception is provided by Das (1995) who studied firm growth in the computer hardware industry in India and found a positive age effect, but only when unobserved firm heterogeneity was accounted for by using firm-specific fixed effects in a panel data estimation setting. Moreover, Fotopoulos and Louri (2000) demonstrated that financial pressure does matter in affecting the hazard confronting new firms in Greek manufacturing and that firm survival may be sensitive to the economic cycle.[5]

On more theoretical grounds, Cabral (1995) developed a model that attempts to provide an explanation for the inverse firm size and growth relationship supported by the more recent wave of empirical literature. His model, underlining the role of sunk costs in building capacity and the role of growth as an insurance against exit, leads to the proposition that "*Everything else constant, new firms' expected growth rates and the degree of sunkness of investment costs are positively correlated across industries*" (ibid. p.168). Moreover, he adds that there may be some differentiation if firms are cash constrained.

In another strand of economic literature, attempts have been made to account for differences in corporate growth across firms drawing on possible effects of firms'

[5] See discussion and references therein on the determinants of firm survival.

financial structure. A central issue is whether leverage affects a firm's investment decision and ultimately its growth, given its investment opportunities.[6] It seems that there is dichotomy on the effect of leverage on investment policies. On the one hand a firm with good investment projects is assumed to be able to raise funds whatever its debt exposure is, and on the other it is argued that a large debt overhang may prevent the firm from financing positive net present value projects with external funds. Lang et al. (1996) examine the relation between leverage and growth over a 20-year period using a sample of large industrial firms. The significantly negative coefficient estimated places additional weight on the effect of leverage on firm growth, as this would be expected to be weaker for the large firms used in the analysis having access to stock markets. It is further clarified that the strong negative effect holds for firms known to have low growth opportunities (low Tobin's q), but not significantly so for firms with good growth prospects (high q).[7] Low leverage might be signalling management's private information about a firm's future growth prospects. At the other end of the spectrum in a firm with low investment opportunities, a large debt may prevent management from undertaking poor projects. Here too a negative relation between leverage and firm growth might be discerned. Opler and Titman (1994) also find that firms in the higher three deciles of leverage in their data are those with lower rates of sales growth. The issue of financial pressure and its effect on corporate behaviour has also been examined by Nickell et al. (1992) and Nickell and Nicolitsas (1999). Higher leverage increases the threat of bankruptcy and hence forces managers to raise efficiency possibly through cutting back on organisational slack. Thus, a positive effect on productivity and productivity growth is estimated with further positive repercussions in overall firm performance.

In terms of foreign ownership and its potential effects on firm growth Markusen and Venables (1999) put forward a formal analysis of how linkages of foreign with domestic supplier firms may work as a catalyst for industrial development. The initial positive effects of increased (foreign) demand on the supplier (intermediate goods producing) firms, increase their profits, thereby attracting more investment in the sector which leads to lower intermediate goods prices favouring customer (final goods producing) firms. Such (demand) spillovers may cause a subsequent increase in investment, which may be

[6] Much discussion on these issues can be found in Lang et al. (1996) and a thorough review of theories of capital structure in Harris and Raviv (1991)

expressed either in new entry or in higher growth of existing firms. In a less formal but extremely meticulous analysis Blomström and Kokko (1998) explain the possible ways in which spillover effects from multinational firms are transferred to domestic firms. The public good nature of the knowledge-based assets transferred to the host country by multinational firms is considered as the main source of technology spillovers. Appropriation of their qualities may take place through reverse engineering, (skilled) employment turnover or direct contact with local agents. Local suppliers and sub-contractors may benefit from new technology information disseminated by multinationals in order to satisfy their advanced technical standards. Such technology diffusion improves the technical efficiency of domestic firms and enhances growth. The ensuing increase in competition intensifies the effect. Finally, networks created by multinational firms following their knowledge of world markets pave the way for export increases from host countries on behalf of both foreign and domestic firms. Barrell and Pain (1993), Blomström and Sjöholm (1998), Aitken and Harrison (1999), and Dimelis and Louri (2002) provide empirical support of a positive effect of multinational ownership on productive efficiency, distinguishing between a shift due to the increased productivity of foreign firms and spillover effects derived from foreign involvement in an industry and applicable to all firms (foreign and domestic). Chhibber and Majumdar (1999) examine the effect of foreign ownership on profitability and find strong positive effects depending on the extent of property rights. Finally, in a recent paper Görg and Strobl (2002) test the Markusen and Venables (1999) model using Irish data on firm entry and confirm its findings, estimating a strong positive effect of MNCs on both net and gross entry.

Before finishing this section on deterministic explanations of firm growth, it should be stressed that proponents of 'stochastic' approaches have been careful to avoid suggesting that systematic forces have no effect on firms' growth.[8] As Steindl (1965) points out in a more general setting, since a basic tenet of econometrics is that economics deals with random processes it may seem superfluous to ask for a stochastic approach. After all most of models are deterministic in character. *"Random elements can be introduced into the formal apparatus in two ways … functional equations are set up for the distribution functions of the random variables… to explain how certain patterns of distributions*

[7] See Geroski et al. (1997) for a detailed analysis of how expectations of long-run profitability, in terms of stock market valuation, affect growth.
[8] See Audretsch et al. (1999) and references therein.

arise…[or in] *a deterministic approach, where the random elements play the subordinate role of a disturbance term introduced after everything essential has been already settled"* (ibid. p.19). Regarding the first approach it seems that there are now many stochastic models of firm growth, which can account for positively skewed distributions. Still, Sutton (1997 p. 42) argues that in constructing theoretical models: "*Most authors now claim only that the distribution will be "skew", but do not specify the extent of skewness, or the particular form which the size distribution might take"*.

III. Data and explanatory variables

a) Data

The present study makes use of a sample of 2640 Greek manufacturing firms operating in both 1992 and 1997, i.e. surviving firms. Individual firm information has been derived from the ICAP directory that collects financial data based on the accounts of all Plc. and Ltd. (i.e. large sized) firms in Greece and provides also information on employment, age and share of foreign ownership. As can be seen in Table 1 six percent (164) of our firms are foreign (partially or wholly) owned. The average domestic firm is more than six times smaller than the average foreign firm in terms of total assets, while the average domestic growth of assets in the 5-year period is smaller (1.70) than the respective foreign (2.02). About 38% of the firms in the sample are less than 10 years old, with an average age of about 17 years. Domestic firms are younger on average (16 years), while foreign firms have an average age of 23 years. The average foreign ownership share is almost 70% and the average foreign participation in terms of capital on an industry basis is 21%. Furthermore, foreign firms exhibit higher leverage and higher liquidity ratios.

______________Table 1 here_______________

An analytical framework following (1) with influences by (4) constitutes the basis for the empirical research undertaken here.[9] Firm size, the variable of interest, is measured in terms of total assets. As the firm size distribution has often been claimed as lognormal and, consequently, its logarithmic transformation as normal, it is worth exploring its properties in our sample. The mean of the log firm size in 1997 is about 13.61 with a standard deviation of 1.37 and a median value of 13.44. The relation of mean and median offers an indication of positive skewness. Indeed, the coefficient of skewness is about 0.66 (0 for normal distribution), whereas its coefficient of kurtosis is 3.63 (3 for normal distribution) indicating a rather leptokurtic distribution. Although, these deviations from normality do not appear to be severe, a Shapiro-Wilk test performed on the data confidently rejects the normality hypothesis. This may not be surprising given the discussion in Hart and Oulton (1996; 1997) presented earlier.

To help explore the firm size distribution in our data and its deviations from normality a non-parametric kernel density estimation (Silverman, 1986) is performed. To further facilitate exploration, the data on the logarithm of firm size in 1997 ($\log S_{it}$) are taken in deviation from their mean so that the resulting variable has a zero mean.[10] A kernel density estimator at value x is found as $\hat{f}(x) = \frac{1}{nh}\sum_{i}^{n} K\left[\frac{x - X_i}{h}\right]$ with kernel K that has the property $\int_{-\infty}^{\infty} K(x)dx = 1$, where *h* is bandwidth (smoothing parameter) and X_is are the values of X that fall in the same interval (bin) with width *h* around *x*.

Here $h = \frac{0.9}{n^{1/5}} m$, where $m = \min(\sqrt{\mathrm{var}[X]}, \text{interquartile range } X/1.349)$ (ibid. p. 47-48) and K is the Epanechnikov kernel. The result of this estimation appears in Figure 1, where a normal distribution that has the same mean and standard deviation, has been superimposed for comparison purposes. The log-transformation of the firm size distribution (thicker line) exhibits a right skew, and it peaks more than the corresponding normal.

________________Figure 1 here ________________

Putting concerns about the possible importance of these deviations from normality aside for a while, the analysis proceeds to some econometric investigations on the determinants of firm growth. For this purpose, a number of potential explanatory variables have been deployed.

[9] With a minor modification that includes a constant instead of taking deviations from the means of the variables involved as implied by (1).

b) Explanatory variables

Based on the growth literature reviewed in the second section, the traditional variables included are initial (1992) firm SIZE (in terms of total assets) and AGE. The new variables added by the present research to the estimation of corporate growth are of two types: industry-specific (extent of foreign involvement and level of sunk costs) and firm-specific (percentage of foreign ownership and financial structure).[11]

Subsequently, FSHARE is calculated as the share of an industry's fixed assets accounted for by firms with foreign participation and intends to pick up spillover effects stemming from multinational involvement in an industry and leading to increased growth. SUNK is defined as 1 minus the ratio of second hand machinery and equipment over total investment in machinery and equipment and provides an approximation for the extent of second hand markets for capital components. Its introduction follows Gabral's theorisation and seeks to examine whether a higher level of sunk cost at the industry level induces faster growth of firms in these industries.

At the firm level, FOWN, measures the extent of foreign ownership and is essentially a percentage of foreign participation.[12] Foreign subsidiaries are expected to be more productive than their domestic counterparts due to higher technology inputs and more efficient organization in production and distribution. They tend to operate on a lower (production and distribution) cost curve than domestic firms, hence their ability to compete successfully despite their inferior knowledge of local markets and consumer preferences. Their higher efficiency, increasing with the degree of foreign ownership, is expected to induce faster growth so as to satisfy larger parts of the market. LEVERAGE, defined by the ratio of book values of total liabilities to total assets, is expected to account for the effect of the degree of debt burden overhang at the base year 1992.[13] An

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[10] The other moments of the variable in deviation form remain the same as in $\log S_{it}$

[11] Efforts to account for the effect of firm characteristics, other than size and age, have so far accounted only for modest fractions of the variation in firm growth. In Lang et al (1996), their formulations account for between 6%-15% of the variation in firm growth, suggesting that, even if random elements are reduced, chance and unaccounted for factors remain responsible for the largest part of variation in firm growth.

[12] It was preferred to use FOWN in a 'continuous' variable fashion instead of choosing a cut-off point in foreign participation and construct a dummy variable that distinguishes between 'foreign' and 'domestic' firms. Doing the latter does not alter the interpretation of our results. To overcome the problem of taking logs of zero values of foreign participation 1 was added to all observations.

[13] Unfortunately, since the vast majority of our firms are not introduced in the Athens Stock Exchange market, it has not been feasible to calculate Tobin's q, as an index of a firm's known growth opportunities.

index of liquidity in a firm's capital structure is also employed. LIQUIDITY is defined as current assets minus inventories over total assets. It is thought that it provides some information on the extent of a firm's assets more readily available for exploiting investment opportunities, and hence its effect on firm growth is hypothesised to be positive. All our variables have been subjected to logarithmic transformation.

IV. Empirical Findings

a) OLS estimations

The results of estimating variants of (1) are presented in Table 2. The results presented have been arranged in order to avoid problems brought about by correlation between the RHS variables of the estimated equations.[14]

______________Table 2 here_______________

Column 1 of the table presents results of the standard, in the literature, equation.[15] The coefficient of initial size (β) is less than 1, implying that small firms are growing faster than larger ones, and the coefficient of age is negative, suggesting that younger firms are growing faster than older ones.[16] These results agree with those of earlier studies reviewed in the previous section. It has been argued that in large cross-section data sets, the null hypothesis seems to be more frequently rejected than in small samples.[17] As explained aptly by Deaton (1997 p.130) "*larger samples are like greater resolving power on a telescope; features that are not visible from a distance become more and more sharply delineated as the magnification is turned up*". Leamer (1978) suggests appropriate adjustments, regarding χ^2 and F tests, that account for the effect of sample size. These adjustments were adopted here to test a number of hypotheses by using appropriate Wald-χ^2 tests. First, the hypothesis that β=1 and second the hypothesis that all

[14] None of the partial correlation coefficients in the RHS exceeds 0.25. But, despite a modest sample correlation coefficient (0.23) between FSHARE and SUNK, including both of them appeared to lower their effects. Therefore, separate estimations with each one are provided.

[15] Accounting for industry heterogeneity by introducing industry dummies gets an estimated β of 0.907 and a coefficient on age of –0.106. In what follows industry dummies have not been included as far as inclusion of variables defined at the industry level was preferred and putting everything together would have resulted in perfect collinearity.

[16] Had the dependent variable been defined as $\left(\ln S_{it} - \ln S_{i,t-1}\right)/d$ the coefficient of initial size that would been obtained is –0.0164 and can be recovered from present estimation as $(\beta - 1)/d$ where d equals 5 in the present case. Other coefficients could be recovered by simply dividing those appearing in Table 2 by d.

[17] See Evans (1987a) and Hart and Oulton (1996) for a discussion of this issue in the present research context.

coefficients, other than that of SIZE and the constant, are jointly zero were rejected in all alternative specifications as shown in Table 2.

The effect of SUNK on firm growth has been found to be positive. That is, firms in industries with higher levels of sunk costs grow faster. Foremost, this result remains positive and significant, in both conventional and sample adjusted hypothesis-testing procedures, across all alternative specifications. This suggests, that having accounted for the effect of inter-industry differences in sunk costs and other firm specific attributes, small and younger firms grow faster. The rationale for this outcome may be that growth is an insurance against exit and, consequently, against incurring sunk costs, and this is especially true for smaller and younger firms. Whereas Cabral’s (1995) theoretical explorations point to the role of sunk costs essentially attempting to explain the repeated, in empirical literature, occurrence of $\beta<1$, it is apparent here that small firms grow faster than large ones even if the significant effect of sunk costs on firm growth has already been accounted for. In terms of capital structure LIQUIDITY appears to positively affect growth, whereas LEVERAGE (interpreted as a debt overhang) is found to play a negative role, in agreement with the literature that has put forward the hypothesis that financial pressure affects firm performance and growth. Finally, the existence of multinational firms is found to exert positive effects both at a firm and at an industry level. First, foreign firms are found to grow faster than domestic firms. Furthermore, the rate of growth increases the higher the foreign ownership share, FOWN, in the firm. At the same time, firms in industries with higher foreign participation, FSHARE, appear to be faster growing than the rest. Such an effect accounts for the positive spillovers stemming from foreign firms and benefiting all firms in the same industry.

It is interesting to have a look at the separate estimations of growth for foreign and domestic firms. As can be seen in Table 3, age and financial structure affect significantly only domestic firms, while the size of the effect of sunk costs more than doubles in the foreign firms group. More importantly, spillovers, as measured by the share of foreign penetration in an industry, are significant for both groups, but are about five times larger for foreign firms, showing their stronger dependence on the existence of other foreign firms in the market. It may, for example, be easier to find skilled employees if the market has already a large foreign presence, thus facilitating growth. Also, it appears that the implied negative effect of initial size on firm growth is stronger among foreign affiliates rather than domestic firms, indicating that small foreign firms grow faster than small domestic firms. An explanation may be that, as foreign firms are not restricted by financial considerations (as shown by the respective insignificant coefficients) possibly because they have access to the resources of the parent company, they can afford to grow faster than their domestic counterparts.

______________Table 3 here_______________

Another thought-provoking picture is also provided by Table 4, where our sample is divided in two different categories of subgroups mostly inspired by arguments in Cantwell and Sanna-Randacio (1993) and Sanna-Randacio (2001). Firms are split in industries which are heavy receivers of FDI, and industries which are not receiving much FDI. The growth of the high inward FDI group is the highest (1.802), while the growth of the low inward FDI group is lower (1.664). Two more sub-groups include firms in industries active in outward FDI and firms in industries not involved in outward FDI.[18] The growth of the low outward FDI group is the second highest (1.774), while that of high outward FDI group is the lowest (1.608). Apparently, firms in this group are not growing as fast as firms in the other groups, possibly because they have to divert resources to support the growth of affiliates abroad. Different responses to the explanatory variables included may be expected. The most remarkable difference is in the effect of FSHARE. As can be seen in Table 4, while FSHARE is of no significance for firms in the low inward FDI group, it is highly significant and five times larger in the high inward FDI group. Spillovers boosting local firm growth are much more important in the sectors where the presence of MNCs is more noticeable. The role of FOWN in enhancing growth varies in a similar way. The higher the extent of foreign participation the higher growth is but the effect is of smaller size and marginal significance in the low inward FDI group. In the same group financial structure is found to exercise no effect, while the effect of SUNK is reduced. In the high outward FDI group, the effects of FSHARE as well as of FOWN are not significant. In contrast, in the low outward FDI group, spillovers are significant, while the effect of FOWN is not only highly significant but also double in size. In this group financial structure has no effect on growth, while it affects significantly the firms in the high outward FDI group. The effect of SUNK varies accordingly. The emerging overall picture is that FDI effects are diversified according to different groups of industries with firms in industries with intense foreign presence benefiting the most.

______________Table 4 here_______________

b) Quantile regression estimations

Earlier studies have suggested that the growth-size relationship varies over the size distribution of firms, and that the growth process, followed by the smallest firms, differs from that of the larger firms. This has been inferred by running sequential regressions up and down the unconditional firm size distribution. Motivated by these earlier findings as well as by the findings in the data section rejecting the normality assumption of our dependent variable, the relation between firm growth and firm size is also explored using the technique of quantile regression as suggested by Koenker and Basset (1978; 1982). Non-normality of the dependent variable causes the residuals of the standard regression model to be non-Gaussian and, hence, the estimators to be inefficient or asymptotically inefficient. The need to deal with such situations led to the development of alternative 'robust' estimation techniques placing less weight on outliers.

Quantile regressions are able to characterise the entire conditional distribution of a dependent variable given a set of regressors. Whereas, the least-squares estimation measures the effect of covariates on the conditional mean of the dependent variable, quantile regression can trace this effect at various quantiles of the conditional distribution of the dependent variable providing a more complete picture of the relationship between the dependent and independent variables. The θ^{th} quantile $(0 < \theta < 1)$ of a random variable Y or of its corresponding distribution, denoted by ξ_θ, is defined as the smallest number ξ satisfying $F_Y(\xi) \geq \theta$. For continuous variable Y, its θ^{th} quantile is given as the smallest number ξ satisfying $F_Y(\xi_\theta) = \theta$. As suggested by Koenker and Bassett (1978) θ can be derived as a solution to the location model:[19]

$$\min_{\beta} \frac{1}{n}\left[\sum_{i:y_t \geq \beta\}} \theta|y_i - \beta| + \sum_{i:y_t < \beta\}} (1-\theta)|y_i - \beta|\right]$$

[18] The industries are classified following two recent papers analyzing FDI in Greece, namely Barbosa and Louri (2002) for inward FDI and Louri, Papanastassiou and Lantouris (2000) for outward FDI.
[19] Basic exposition here follows Buchinsky (1998).

The solution to this problem, $\hat{\beta}$, is the θ^{th} sample quantile of y.[20] The regression θ^{th} quantile is derived as an extension of the location model and is the solution to the minimisation problem:

$$\min_{\beta} \frac{1}{n}\left[\sum_{i:y_t \geq \mathbf{x}_i'\beta\}} \theta\left|y_i - \mathbf{x}_i'\beta\right| + \sum_{i:y_i < \mathbf{x}_i'\beta\}} (1-\theta)\left|y_i - \mathbf{x}_i'\beta\right|\right]$$

The solution vector $\hat{\beta}_\theta$ has interesting properties, including that: a) it makes the θth quantile of the residuals equal to zero, b) the estimation error vector has as many zeros as the number of RHS variables, c) it holds that $\bar{y}_t = \bar{\mathbf{x}}_t'\hat{\beta}_\theta + \bar{\varepsilon}_\theta$ where $\bar{\varepsilon}_\theta$ denotes the mean of the residuals obtained from θ^{th} quantile regression, and d) the appropriate $\hat{\beta}_\theta$ solution vector is estimated using all n observations.

Buchinsky (1998) summarises the attractions of quantile regressions. Some are of particular importance for the present research. These are: a) the quantile objective function being a weighted sum of absolute deviations makes the estimated coefficient vector robust to outlier observations, b) different solutions at various quantiles could be interpreted as differences in the response of the dependent variable to changes in the regressors taking place at various points of its conditional distribution, and c) in case of non-normal errors, quantile regressions may be more efficient than least square estimators. This last feature seems to be particularly relevant in our case.

Quantile regressions were performed at various quantiles and the results of the estimation using FSHARE as the only industry variable are presented in Table 5. Estimation is based on the last column of Table 2. A variant of Table 5 estimating the effect of SUNK is provided by Table 6. Maintaining, the basic logarithmic formulation is not a problem as far as quantile regressions are equivariant to monotonic transformations.[21] The estimated standard errors reported in Tables 5 and 6 have been derived by bootstrapping since this has been suggested as both suitable and well performing method for quantile regressions (Buchinsky, 1998). The asymptotic variance-covariance matrix was estimated by:

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[20] For an algorithm see Koenker and D'Orey (1987).
[21] This issue has been raised and clearly discussed in Mata and Machado (1996).

$$\text{Est.Var}[\beta_\theta] = \frac{1}{R-1}\sum_{r=1}^{R}(\hat{\beta}_{\theta r}^{B} - \overline{\beta}_{\theta}^{B})\,(\hat{\beta}_{\theta r}^{B} - \overline{\beta}_{\theta}^{B})'$$

where $\overline{\beta}_{\theta}^{B} = 1\big/ R\sum_{r}^{R}\hat{\beta}_{\theta r}^{B}$, R stands for the number of replications and $\hat{\beta}_{\theta r}^{B}$ is the bootstrap estimator of β_θ in the r^{th} replication. In this case, 600 replications were performed in order to derive the results presented in Tables 5 and 6. The Pseudo-R^2, a local measure of fit, is suggested by Koenker and Machado (1999) as $\text{Pseudo\_}R_\theta^2 = 1 - \hat{V}_\theta \big/ \tilde{V}_\theta$ where $\hat{V}_\theta$ and $\tilde{V}_\theta$ are the values of the objective function for the unrestricted and restricted models respectively.[22]

_____________Tables 5 and 6 here______________

The quantile-regressions results could be interpreted in the same fashion as those in Table 2, i.e. a coefficient of SIZE that is less than one implies a negative effect on firm growth (the formula suggested in fn. 16 still applies), but this time with respect to the relative regression quantile. Some interesting observations emerge from inspecting the quantile regression results. The coefficient of SIZE declines as we move from lower to upper quantiles (except for θ[0.25]). This suggests that although small firms grow faster than large firms in all quantiles, the negative effect of initial size on growth is certainly more pronounced for firms in faster tracks.[23] Also, the negative effect of AGE increases steadily from lower to upper quantiles confirming that younger firms grow faster and this effect is stronger for firms in faster tracks. A similar gradation is observed for the effect of FOWN, which increases from lower to higher quantiles of the conditional size distribution showing a stronger effect of foreign ownership for faster growing firms. In contrast the effect of LEVERAGE has been of larger negative magnitude for firms in the lowest quantile, implying that firms in the slow tracks suffer more from financial distress. The positive effect of LIQUIDITY seems to be of particular relevance for the middle quantiles and less important for the highest. Finally, the positive effect of foreign involvement at the industry level follows a similar pattern. FSHARE did not benefit the laggards or the fastest growing firms but concentrated its positive effect in the middle of

[22] 'Location model' or quantile regression on a constant only.

[23] To facilitate interpretation of the coefficient of size in quantile regressions, if the dependent variable was defined as $(\ln S_{it} - \ln S_{it-1})/d$ then the coefficients of SIZE would have been : for θ[0.10] –0.0089, for θ[0.25] –0.0063, for θ[0.50] –0.0117, for θ[0.75] –0.0177, and for θ[0.90] –0.0245, these can easily be derived from those reported in Table 5.

the distribution. A test devised by Gould (1997), testing for interquantile differences of the coefficients, was performed and accompanies the basic results in the last column of Table 5. With the notable exception of foreign ownership coefficients, and less so of LEVERAGE this tests provides that there are significant differences across quantiles for most coefficients of interest.

In Table 6 SUNK is the industry variable used and its effect is estimated as enhancing growth in an increasing way from lower to higher quantiles of the conditional size distribution. The coefficients of the other explanatory variables retain similar sizes and significance levels as in Table 5 underlining the robustness of the statistical findings.

V. Conclusions

The main aim of this research was to provide an empirical assessment of the determinants of firm growth and examine in particular the complex and often disputed role of multinationals using a large sample of Greek firms for the first time examined. The research has benefited from rich earlier literature on the subject. An effort, however, has been made to improve the existing understanding by examining some additional possibilities. Thus, this research extends previous results by accounting for the effect of the degree of foreign ownership in a firm, the extent of foreign presence in an industry creating spillovers, the existence of sunk costs, and finally leverage and liquidity. Most of our variables vindicated their selection, while estimations performed in four separate groups according to nationality (domestic/foreign) or involvement in inward and outward FDI (groups with high/low in/outward FDI) resulted in interesting, differentiated effects. A deeper understanding of how the FDI spillover mechanism affects growth was thus provided. Foremost, the effects of the new additions together with that of initial size and age were traced along the *conditional size distribution*, producing some interesting ‘snap-shots’.

Overall, the results of quantile regressions offer some reassuring support to those obtained earlier by least squares, although admittedly provide a more integrated picture of the underlying relations. Both firm size and age have a definitely negative effect on growth, more important for the faster growing firms. Foreign ownership also exerts a positive effect on growth increasing for the faster growing firms, while spillovers stemming from foreign presence in an industry have a positive effect but less significant at the tails of the conditional distribution. The same applies for the effect of liquidity. The effect of leverage has been negative but is significant only for the slow growing firms at the lower tail of the distribution.

The main implication of our findings is that firm growth is not quite random. Theory provides us with new determinants, some of which have been estimated here to exert a strong influence on firm growth. Especially, the role of multinational firms is found to be positive and increasing according to the degree of their local involvement. Further developments in the literature may include a distinction among different degrees of foreign ownership in line with the property rights assumed. A deeper understanding of the way multinationality enhances the growth process would thus be provided. Policy implications are in need of examination.

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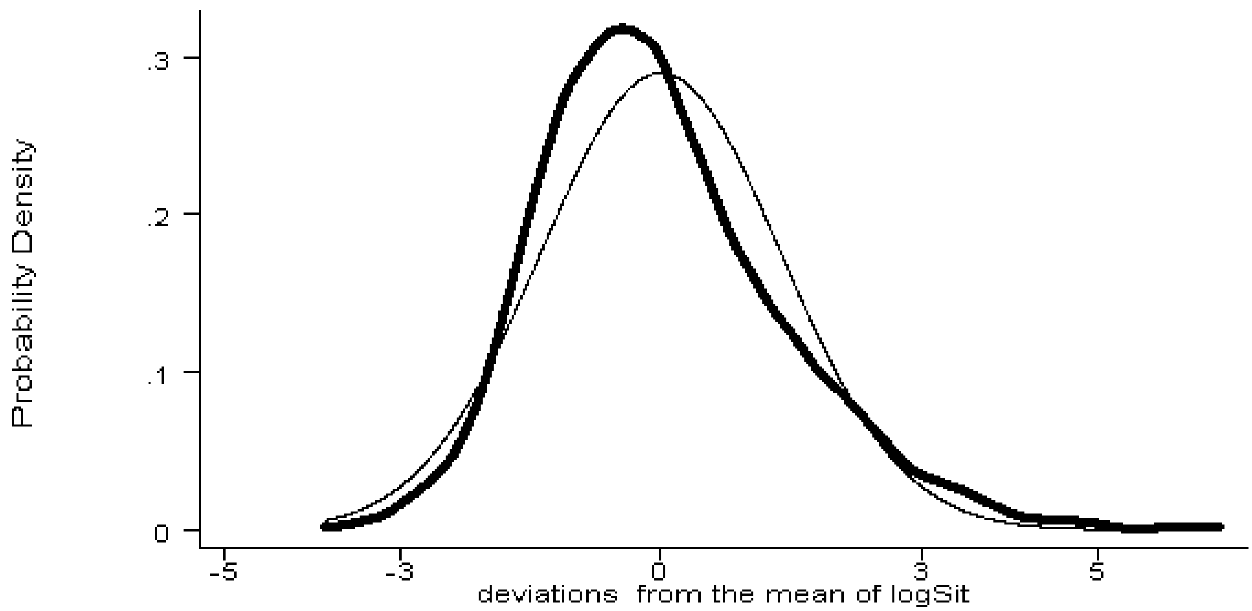

Figure 1. Epanechnikov kernel density estimate

Table 1: Sample Summary Statistics

FIRMS	All=2640		Domestic=2476		Foreign=164	
	MEAN	S.D.	MEAN	S.D.	MEAN	S.D.
SIZE 97	30.25	146.01	23.58	117.07	131.02	358.66
GROWTH	1.72	3.70	1.70	3.40	2.02	6.78
AGE	17.40	16.27	17.04	16.23	22.87	15.88
FOWN	4.32	18.71	0	0	69.26	33.77
LEVERAGE	0.38	0.19	0.56	0.27	0.65	0.57
LIQUIDITY	0.57	0.30	0.37	0.27	0.44	0.18
SUNK*	0.98	0.03	-	-	-	-
FSHARE*	0.21	0.17	-	-	-	-

*industry variables

Table 2: Ordinary Least Squares results (heteroskedasticity consistent standard errors)

	Estimated coefficients (standard errors in parentheses)					
Variables	(1)	(2)	(3)	(4)	(5)	(6)
SIZE (β)	0.918∗∗∗ (0.009)	0.917∗∗∗ (0.009)	0.906∗∗∗ (0.010)	0.905∗∗∗ (0.010)	0.909∗∗∗ (0.010)	0.908∗∗∗ (0.010)
AGE	-0.102∗∗∗ (0. 013)	-0.105∗∗∗ (0.012)	-0.104∗∗∗ (0.012)	-0.104∗∗∗ (0.013)	-0.106∗∗∗ (0.012)	-0.106∗∗∗ (0.013)
SUNK		2.155∗∗∗ (0.386)	2.060∗∗∗ (0.388)	-	2.061∗∗∗ (0.391)	-
FOWN		-	0.051∗∗∗ (0.011)	0.050∗∗∗ (0.011)	0.049∗∗∗ (0.011)	0.048∗∗∗ (0.011)
FSHARE		-	-	0.221∗∗∗ (0.082)	-	0.200∗∗∗ (0.082)
LEVERAGE		-	-	-	-0.052∗∗∗ (0.021)	-0.048∗∗ (0.022)
LIQUIDITY		-	-	-	0.047∗∗∗ (0.020)	0.046∗∗ (0.020)
CONSTANT	2.044∗∗∗ (0.124)	2.102∗∗∗ (0.124)	2.228∗∗∗ (0.130)	2.157∗∗∗ (0.131)	2.206∗∗∗ (0.132)	2.141∗∗∗ (0.133)
R^2	0.818	0.820	0.821	0.820	0.822	0.821
Wald χ^2 H_0 β=1	73.47†	75.79†	88.04†	88.44†	80.09†	80.83†
‡Joint Wald χ^2		86.57†	104.78†	88.49†	87.78†	71.97†

Leamer's adjusted for N χ^2 critical values: 7.87 (1df), 15.75 (2df), 23.63 (3df), 31.51 (4df). † rejects H_0

‡ tests of the null hypothesis that all coefficients, other than those of size and constant, are jointly zero

∗∗∗ significant at 1%, ∗∗ significant at 5%, ∗ significant at 10%

Table 3 : Domestic and Foreign Firms, O.L.S results (heteroskedasticity consistent standard errors)

Industries	Domestic Firms					Foreign Firms				
Growth	g_{DF}=1.701, s.d=3.89					g_{FF}=2.020, s.d=2.86				
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SIZE (β)	0.905***	0.905***	0.905***	0.909***	0.908***	0.895***	0.885***	0.882***	0.887***	0.885**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.036)	(0.034)	(0.036)	(0.036)	(0.037)
AGE	-0.104***	-0.107***	-0.106***	-0.109***	-0.108***	-0.031	-0.020	-0.049	-0.021	-0.051
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.054)	(0.056)	(0.057)	(0.058)	(0.059)
FSHARE	-	-	0.170**	-	0.150*	-	-	0.816***	-	0.777**
			(0.084)		(0.085)			(0.343)		(0.347)
SUNK	-	1.907***	-	1.919***	-	-	5.282***	-	5.177***	-
		(0.400)		(0.405)			(1.255)		(1.369)	
LEVERAGE	-	-	-	-0.051**	-0.048**	-	-	-	-0.081	-0.074
				(0.022)	(0.022)				(0.079)	(0.085)
LIQUIDITY	-	-	-	0.047***	0.046**	-	-	-	0.012	0.040
				(0.020)	(0.020)				(0.106)	(0.109)
CONSTANT	2.196***	2.238***	2.174***	2.216***	2.158***	2.377***	2.549***	2.398***	2.487***	2.360**
	(0.137)	(0.137)	(0.138)	(0.140)	(0.141)	(0.489)	(0.469)	(1.361)	(0.447)	(0.453)
R^2	0.798	0.800	0.798	0.801	0.799	0.838	0.845	0.845	0.846	0.845
N	2476	2476	2476	2476	2476	164	164	164	164	164

*** significant at 1%, ** significant at 5%, * significant at 10%

Table 4 : High and low inward FDI and high and low outward FDI industries. OLS results (heteroskedasticity consistent standard errors)

Industries	High IN	High IN	Low IN	Low IN	High OUT	High OUT	Low OUT	Low OUT
Growth	g_{HIN}= 1.803, s.d.= 4.53		g_{LIN}=1.664, s.d.=3.49		g_{HOUT}=1.608, s.d.=2.99		g_{LOUT}=1.774, s.d.=3.99	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SIZE (β)	0.898***	0.901***	0.908***	0.909***	0.905***	0.909***	0.906***	0.907***
	(0.016)	(0.016)	(0.014)	(0.014)	(0.017)	(0.017)	(0.013)	(0.013)
AGE	-0.104***	-0.102***	-0.110***	-0.112***	-0.109***	-0.109***	-0.104***	-0.105***
	(0.020)	(0.020)	(0.017)	(0.017)	(0.020)	(0.020)	(0.017)	(0.017)
FSHARE	0.305***	-	0.159	-	0.253*	-	0.199**	-
	(0.136)		(0.108)		(0.150)		(0.098)	
SUNK		2.592***	-	1.699***	-	2.912***	-	1.963***
		(1.064)		(0.428)		(1.121)		(0.416)
FOWN	0.058***	0.059***	0.029**	0.029**	0.028	0.025	0.058***	0.059***
	(0.016)	(0.016)	(0.015)	(0.014)	(0.022)	(-0.22)	(0.013)	(0.013)
LEVERAGE	-0.075**	-0.079*	-0.028	-0.030	-0.080***	-0.086***	-0.020	-0.023
	(0.034)	(0.033)	(0.026)	(0.026)	(0.034)	(0.034)	(0.026)	(0.026)
LIQUIDITY	0.098***	0.101**	0.017	0.015	0.092***	0.100***	0.018	0.014
	(0.028)	(0.028)	(0.027)	(0.027)	(0.032)	(0.032)	(-0.026)	(0.027)
CONSTANT	2.334***	2.386***	2.139***	2.184***	2.245***	2.284[3]	2.154***	2.234***
	(0.235)	(0.228)	(0.169)	(0.168)	(0.297)	(0.245)	(0.165)	(0.169)
R^2	0.827	0.827	0.805	0.807	0.823	0.824	0.816	0.818
N	1057	1057	1583	1583	856	856	1784	1784

∗∗∗ significant at 1%, ∗∗ significant at 5%, ∗ significant at 10%

Table 5: Quantile Regression Estimates (FSHARE) (standard errors in parentheses)

	(1) $\theta[0.10]$	(2) $\theta[0.25]$	(3) $\theta[0.50]$	(4) $\theta[0.75]$	(5) $\theta[0.90]$	Joint Test (1) $\theta[0.10]-\theta[0.25]=0$ (2) $\theta[0.25]-\theta[0.50]=0$ (3) $\theta[0.50]-\theta[0.75]=0$ (4) $q[0.75]-\theta[0.90]=0$ $F_{(4,2633)}$
SIZE(**β**)	0.954***	0.970***	0.946***	0.908***	0.871***	9.42***
	(0.014)	(0.010)	(0.010)	(0.012)	(0.016)	
AGE	-0.028*	-0.035***	-0.090***	-0.158***	-0.197***	11.42***
	(0.016)	(0.012)	(0.015)	(0.022)	(0.026)	
FOWN	0.026	0.031***	0.030***	0.033***	0.046*	0.14
	(0.019)	(0.011)	(0.010)	(0.013)	(0.026)	
LEVERAGE	-0.060***	-0.031	-0.006	-0.047	-0.037	1.93*
	(0.020)	(0.024)	(0.021)	(0.031)	(0.046)	
LIQUIDITY	-0.001	0.038**	0.066***	0.095***	0.046	2.98***
	(0.022)	(0.017)	(0.021)	(0.027)	(0.038)	
FSHARE	0.028	0.201***	0.255***	0.276**	0.191	1.17
	(0.099)	(0.075)	(0.081)	(0.105)	(0.150)	
CONSTANT	0.704***	0.792***	1.593***	2.640***	3.569***	
	(0.178)	(0.127)	(0.138)	(0.148)	(0.204)	
Pseudo R^2	0.585	0.594	0.595	0.597	0.584	

*** significant at 1%, ** significant at 5%, *significant at 10% level *

Table 6. Quantile Regression Estimates (SUNK) (standard errors in parentheses)

	(1) θ[0.10]	(2) θ [0.25]	(3) θ[0.50]	(4) θ[0.75]	(5) θ[0.90]	Joint Test (1)θ[0.10]-θ[0.25]=0 (2) θ[0.25]- θ[0.50]=0 (3) θ[0.50]- θ[0.75]=0 (4) q[0.75]- θ[0.90]=0 $F_{(4,2633)}$
SIZE(**β**)	0.955*** (0.014)	0.968*** (0.010)	0.941*** (0.011)	0.911*** (0.012)	0.877*** (0.016)	7.22***
AGE	-0.028** (0.015)	-0.038*** (0.013)	-0.091*** (0.016)	-0.152*** (0.020)	-0.205*** (0.024)	12.61***
FOWN	0.023 (0.019)	0.035*** (0.012)	0.034*** (0.011)	0.037*** (0.012)	0.045** (0.023)	0.19
LEVERAGE	-0.058*** (0.021)	-0.038* (0.024)	-0.011 (0.022)	-0.048 (0.031)	-0.043 (0.043)	1.27
LIQUIDITY	-0.001 (0.021)	0.038** (0.020)	0.077*** (0.021)	0.092*** (0.028)	0.058 (0.038)	2.97***
SUNK	0.637* (0.391)	1.494* (0.388)	2.002*** (0.450)	2.669*** (0.407)	2.917*** (0.731)	3.93***
CONSTANT	0.718*** (0.187)	0.892*** (0.124)	1.759*** (0.160)	2.682*** (0.155)	3.607*** (0.199)	
Pseudo R^2	0.585	0.595	0.596	0.599	0.586	

*** significant at 1%, ** significant at 5%, *significant at 10% level *