Determinants of SMEs growth: Empirical evidence from Greece.

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A dissertation submitted in partial fulfillment of the requirements for the degree of Master of Science in Applied Economics & Data Analysis

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Master of Science in

"Applied Economics and Data Analysis"

September 2017

University of Patras, Department of Economics

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The present dissertation entitled

"Determinants of SMEs growth: Empirical evidence from Greece"

was submitted by **Eleni Vasakou, Sid 1018012** , in partial fulfillment of the requirements for the degree of Master of Science in *"Applied Economics & Data Analysis"* at the University of Patras and was approved by the Dissertation Committee Members.

I would like to dedicate my dissertation to my family.

Acknowledgments

I would first like to thank my dissertation supervisor, Associate Professor Dimitris Tzelepis, for his excellent cooperation and his continuous support and guidance throughout the dissertation stages. Without his support and knowledge, the validation survey could not have been successfully conducted.

I would also like to thank all the professors of the Master Program for providing me with their valuable knowledge and the skills needed for my master's studies.

Finally, I must express my very profound gratitude to my parents and to my sister for providing me with support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them. Thank you.

Summary

This paper aims to examine factors that have contributed to the growth rate of manufacturing SMEs. Based on a panel data of 4,082 manufacturing SMEs in Greece over the period 2008-2014, this study concentrates mainly on the relationship between firm size, age, profitability, debt and firm growth. Results show that there is a negative relationship between previous size and firm growth which means that Gibrat's Law is rejected in the case of Greek manufacturing SMEs. We also find that there is a negative relationship between age and firm growth. Finally, results indicate that profitability has a positive impact on firm growth while there is a negative relationship between debt and firm growth in the case of manufacturing SMEs in Greece.

Keywords: Firm growth, Firm size, Firm age, Manufacturing sector, SMEs, Greece, Panel data

Περίληψη

Στόχος της παρούσας διπλωματικής εργασίας είναι να εξετάσουμε τους προσδιοριστικούς παράγοντες που συμβάλλουν στο ρυθμό ανάπτυξης των μικρομεσαίων επιχειρήσεων του κλάδου της μεταποίησης. Χρησιμοποιώντας διαστρωματικά στοιχεία χρονολογικών σειρών από 4,082 μικρομεσαίες επιχειρήσεις στην Ελλάδα για την χρονική περίοδο 2008-2014, επικεντρωνόμαστε κυρίως στη σχέση μεταξύ μεγέθους, ηλικίας, κερδοφορίας, χρηματοοικονομικής μόχλευσης και ρυθμού ανάπτυξης των επιχειρήσεων. Σύμφωνα με τα αποτελέσματά μας, υπάρχει αρνητική σχέση μεταξύ του μεγέθους και του ρυθμού ανάπτυξης των επιχειρήσεων το οποίο μας οδηγεί στην απόρριψη του νόμου του Gibrat στην περίπτωση των ελληνικών ΜΜΕ στον κλάδο της μεταποίησης. Επίσης, υπάρχει αρνητική σχέση μεταξύ της ηλικίας και του ρυθμού ανάπτυξης των επιχειρήσεων. Τέλος, η κερδοφορία έχει θετική επιρροή στο ρυθμό ανάπτυξης ενώ υπάρχει αρνητική σχέση μεταξύ του χρέους και του ρυθμού ανάπτυξης των ΜΜΕ στον εξεταζόμενο κλάδο.

Λέξεις κλειδιά: Ρυθμός ανάπτυξης επιχειρήσεων, Μέγεθος επιχειρήσεων, Ηλικία επιχειρήσεων, Κλάδος μεταποίησης, Μικρομεσαίες επιχειρήσεις, Ελλάδα, Panel data

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Chapter 1

Introduction

Small and medium sized firms are the backbone of all economies and are a key source of economic growth and flexibility not only in advanced industrialized economies, but also in emerging and developing countries. Small and medium sized enterprises are very important for an economy as they contribute to job creation, technological progress and production growth.

There is an extensive literature on firm growth which begins with Gibrat's "Law" which has attracted wide interest over the past decades. According to this law, firm growth does not depend on previous size but it is a random process. However, according to Sutton (1997), Gibrat's law is more likely to be confirmed only in large firms, with a low possibility of confirming this law in smaller ones.

Additionaly, various authors conclude that the youngest firms show higher growth rates in comparison to older ones. This happens because younger firms' goal is to attain the minimum efficient size (MES) in order to assure their survival. Once they reach this size, they have a tendency to reduce their growth rates (Jovanovic 1982; Fariñas and Moreno 1997).

Alchian (1950) presented the Growth of the Fitter theory. As stated in this theory, fitter firms grow and survive, but less active firms lose their market share and exit as a result of poor performance. Moreover, in accordance with the financing constraint hypothesis, retained profits can be used by firms in order to make

investments, while it is difficult for firms with low profitability to grow even if they have high possibilities to grow. This is in accordance with the pecking-order theory, as managers prefer internal finance to external capital.

Financial liquidity is very significant for SMEs as it helps them to organise their assets in a more productive way. In addition, financial liquidity helps SMEs to adopt quickly and easily to the unexpected changes of the market in which they operate. It is difficult for small enterpises to aquire external finance. Nevertheless, when SMEs are in debt, they tend to manage their resources more efficiently as they need to pay-off their obligations as soon as possible (Baker and Nelson 2005). On the contrary, Lang et al. (1996) show that there is a negative relationship between leverage and future growth at the firm level.

The importance of SMEs is grossly underrated. In 2014, 99.9% of Greek entrerprises are defined as SMEs, according to a survey of the Hellenic Confederation of Professionals, Craftsmen and Merchants (GSEVEE), corresponding to a total number of 531.059 SMEs. Specifically, 96.7% of them are defined as very small entrerprises, 2.8% are defined as small enterprises, 0.4% as medium-sized enterprises and only 0.1% as large enterprises. In comparison to the EU average, SMEs and specifically micro-firms are greater in number and more significant to the economy of Greece (European Commission, 2016b).

Innovation and technology progress depend to a large extend on the maufacturing sector. Furthermore, manufacturing growth supports jobs which do not belong to the manufacturing sector. Importantly, SMEs are usually financially constrained thus they are more sensitive to macroeconomic changes (Bryson et al., 2015). All of the above justify our attention on small and medium-sized enterprises in the manufacturing sector.

In this study, we focus on some internal factors of SMEs growth in the Greek manufacturing sector. As determinants of SME growth we consider: (1) size; (2) age; (3) return on sales as a measure of profitability and (4) debt as a measure of external financing. Thus, our approach in this study is to regress firm growth not

only on the traditional determinants of size and age but also on profitability and financial leverage.

Moreover, panel data methodology is used in order to control for firm heterogeneity and reduce collinearity among the variables that are examined. By using this method we are able to eliminate the possible biases that may arise in our estimations due to correlation between the explanatory variables and unobservable individual effects included in our model. Specifically, we use the fixed effects regression model to analyse an unbalanced panel data of 4,082 manufacturing SMEs in Greece over the period 2008-2014. One of the most desirable features of the fixed-effects model is the inclusion of firm and time-specific effects in the growth model in order to capture any unobservable effects. Another desirable feature of the fixed-effects model is that it may provide a means for controlling for omitted variable bias.

The empirical evidence obtained in this study lets us conclude that: (1) there is a negative and statistically significant relationship between previous size and firm growth; (2) there is a negative and statistically significant relationship between age and firm growth; (3) there is a positive and statistically significant relationship between profitability and firm growth and (4) there is a negative and statistically significant relationship between debt and firm growth.

After this introduction, the paper is organised as follows: Chapter 2 reports recent information about the manufacturing SMEs in Greece; Chapter 3 presents a review of the literature on the relationship between determinants and growth as well as research hypotheses are formulated; Chapter 4 presents the summary statistics, the model specification and estimation method used; The empirical findings are reported and discussed in Chapter 5, while Chapter 6 concludes.

Chapter 2

Manufacturing sector in Greece

SMEs are very important to the Greek economy. SMEs in Greece generate almost three quarters of added value and about 90% of employment compared to an average of 60% of added value and two thirds of employment in the EU (European Commission, 2016a).

Greek SMEs were extremely affected by the financial crisis and have not recovered completely yet. In 2015, added value was 35% below its 2008 value and employment was 23% below its 2008 value. Nevertheless, this period of decline has become stagnant recently. Added value remained unchanged in 2014 and 2015 while the negative trend for SME employment ceased in 2015 (European Commission, 2016a). In the three following graphs (2.1, 2.2 and 2.3) we can see the decline in the number of Greek SMEs, th decline in the number of persons employed as well as the decline in value added during 2008 - 2015.

Despite these facts, the signs of a near-term recovery are still limited. On the one hand, micro firms which dominate the Greek economy, are expected to have a fall in added value of 2% and a stable employment in the next few years. On the other hand, the added value and employment of medium-sized firms, are expected to increase at rates of 2% and 3% respectively.

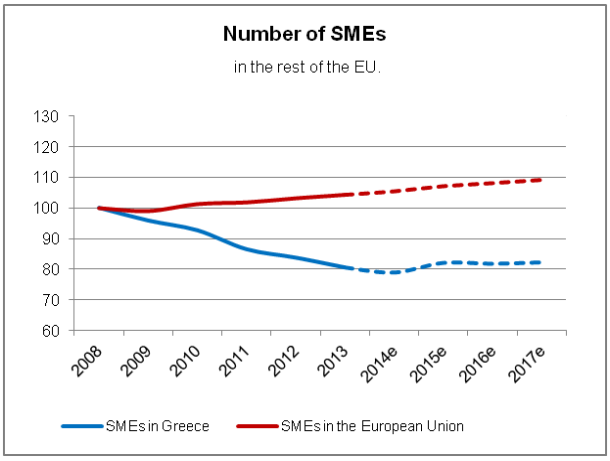

Figure 2.1: Number of SMEs during 2008 - 2015

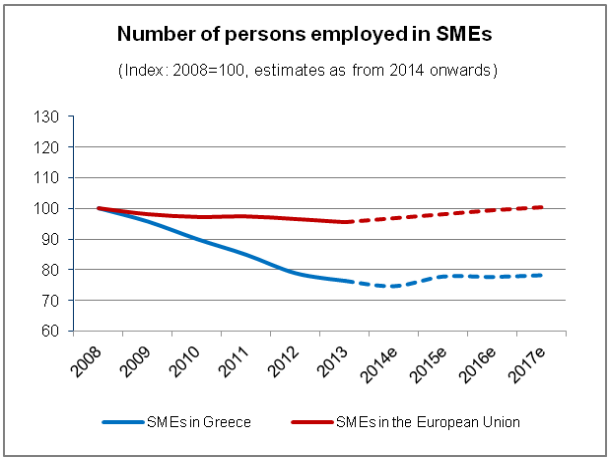

Figure 2.2: Number of persons employed in SMEs during 2008 - 2015

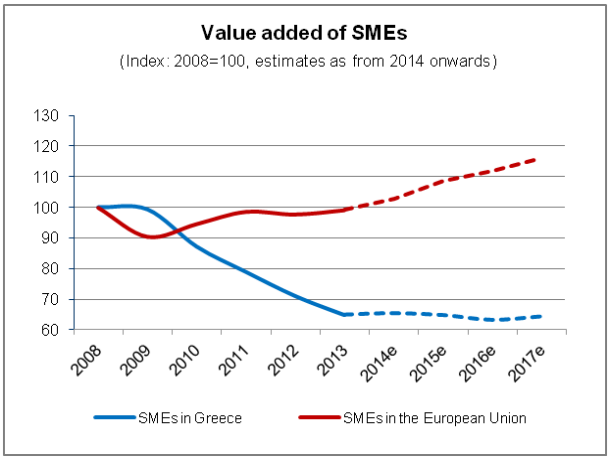

Figure 2.3: Value added of SMEs during 2008 - 2015

In the context of the manufacturing sector, economic crisis had a strong impact on SMEs. To be more exact, added value fell by 41% and employment fell by 32% between 2008 and 2015. However, SMEs in the pharmaceutical sector had a better performance in comparison to other manufacturing sectors. Specifically, added value in 2015 was only 10% below the level of 2008. This fact shows that the pharmaceutical sector is one of the most important and robust Greek sectors. The pharmaceutical sector has made significant investments in research & development and in fixed assets over the past few years. The following pie charts (2.4, 2.5 and 2.6) present the number of SMEs as a percentage of total number of enterprises, the number of people employed as a percentage of total number in enterprises and value added as a percentage of total number by enterprises in the manufacturing sector in 2015.

According to European Commision's SBA Fact Sheet (2016a), entrepreneurship performance in Greece is in line with the EU average. However, the nature of entrepreneurship in Greece is quite different from the nature of entrepreneurship in the rest of the EU. Specifically, the motivation for setting up a new enterprise is quite different in Greece than in most Member States. In the rest of the EU opportunity seems to be the most significant motivation for entrepreneurs, whilst in Greece entrepreneurs have started a business because of necessity.

For Greek SMEs, access to finance is very uncertain due to the re-capitalisation of banks along with the capital control measures. Unfortunately, bank lending to SMEs is still limited, thus it is more difficult for Greek firms to make new investments. Government has made an effort to deal with these difficulties by borrowing from the European Investment Bank (EIB) so that Greek commercial banks in turn can lend to SMEs.

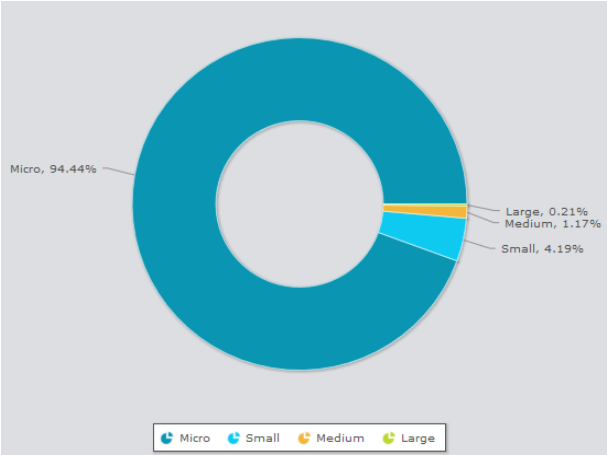

Figure 2.4: Number of SMEs in the manufacturing sector in 2015

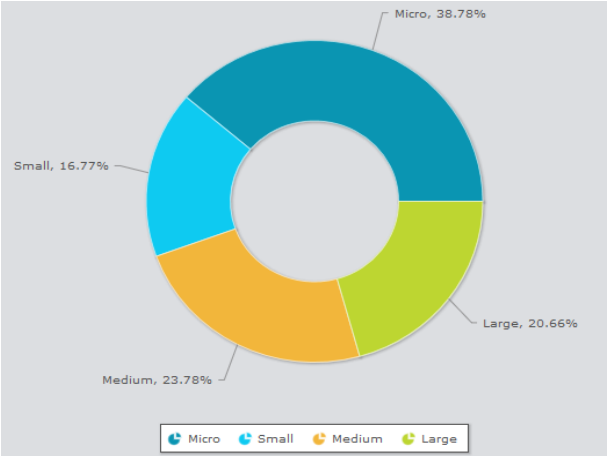

Figure 2.5: Number of persons employed in manufacturing SMEs in 2015

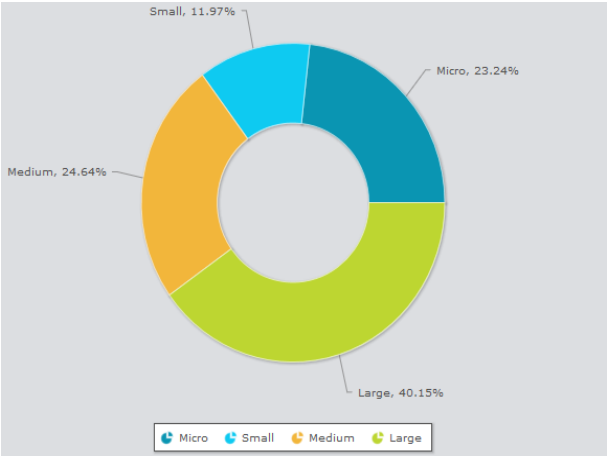

Figure 2.6: Value added of manufacturing SMEs in 2015

Finally, table 2.1 below presents the industry sectors in the 2-digit National Classification of Economic Activities (NACE) sectors 15-37.

Table 2.1. *Industry sectors*

2-digit	Industry
15	Food products and beverages
17	Textiles
18,19	Wearing apparel; leather and leather products
20	Wood and wood products
21	Pulp, paper and paper products
22	Publishing and printing, reproduction of recorded media
24	Chemicals and chemical products
25	Rubber and plastic products
26	Other non-metallic mineral products
27	Basic metals
28	Fabricated metal products except machinery and equipment
29	Machinery and equipment
30,32	Office machinery and computers; radio, television and communication equipment and apparatus
31	Electrical machinery and apparatus
33	Medical, precision and optical instruments, watches and clocks
34	Motor vehicles, trailers and semi-trailers
35	Other transport equipment
36,37,23,16	Manufacturing n.e.c.; coke, refined petroleum products and nuclear fuel; tobacco products

Chapter 3

Literature review

3.1 Determinants of firm growth

3.1.1 Size

The well-known Gibrat's law of proportionate growth has drawn a lot of attention of many economists over the past decades. In our days, Gibrat's "Law of Proportionate Effect" is considered to be a benchmark model for a wide range of scientific studies on industrial sectors. According to Gibrat (1931), the growth rate of a firm can be expressed as a random variable which is not dependent of its current size and its past growth history. Consequently, the relationship between growth in the present period and size in the previous period is not statistically significant. According to the author, large and small firms are equally likely to have a certain growth rate over time, thus small firms do not necessarily have higher growth rates than larger ones.

The early studies concentrated mainly on large enterprises, probably because of data availability. Many papers analysing UK manufacturing firms showed a tendency for larger firms to have higher growth rates (Hart 1962; Samuels 1965; Prais 1974; Singh and Whittington 1975).

Nevertheless, various other studies with more up-to-date databases have found that small firms, on average, seem to grow faster in comparison to larger firms

and this result is called "mean-reversion". Studies focusing on small businesses have also found a negative relationship between firm size and expected growth for example Segarra and Callejón (2002) as well as Calvo (2006) for Spanish manufacturing, Yasuda (2005) for Japanese manufacturing firms, Wagner (1992) and Almus (2000) for German manufacturing and finally McPherson (1996) for African micro firms.

While most of the empirical studies on Gibrat's law have focused only on the manufacturing sector, some other studies have focused on the services sector as well. The empirical results are often very similar as the relationship between size and expected growth rate in is negative too (Variyam and Kraybill 1992; Johnson et al. 1999).

Many researchers conclude that Gibrat's law holds for enterprises above a certain size threshold. Mowery (1983), analyses a sample which consists of small firms and another sample whisch consists of large firms. Gibrat's law is holds in the second sample with the large firms, while in the first sample mean-reversion is noticed. According to Bigsten and Gebreeyesus (2007), there is a negative relationship between size in the previous period and growth in a sample of Ethiopian manufacturing firms, while size is not dependent of growth for the larger enterprises. More specifically, their results show that there is an inverse relationship between size and growth until the firm reaches an efficient size of 400 workers.

Sutton (1997) concludes that the firm's need to reach a minimum scale of efficiency that allows survival affects the relationship between growth in the present period and previous size. According to the author, small firms have not yet attained a minimum scale of efficiency that allows them to survive, so they tend to have higher growth rates and a certain degree of continuity until they reach a size that allows survival. In most cases, large firms have already attained a minimum scale of efficiency that allows survival. Thus, for large firms the possibility of a relationship between growth in the present period and previous size is less. Therefore, Gibrat's law is less likely to be confirmed in small firms, while there is

a greater likelihood to confirm Gibrat's law in large firms. Moreover, John Sutton refers to the negative dependence of growth on size as a "statistical regularity" in his survey of Gibrats law (Sutton 1997).

Lotti et al. (2009) examine a sample of Italian new firms and conclude that smaller firms grow faster at the start of their life-cycle but as time passes it is difficult to reject the independence between size and growth. Becchetti and Trovato (2002) for Italian manufacturing firms and Geroski and Gugler (2004) for large European firms conclude that the growth of large firms is independent of their size, while by including smaller firms in the research a dependence of growth on size is observed.

Audretsch et al. (2004) support that there are higher possibilities for growth in the case of small enterprises, in comparison to larger ones, because they are at sub-optimal size. Thus, small firms have a higher possibility for growth and their growth rate diminishes as size increases.

3.1.2 Age

The relationship between age and firm growth has received a lot of attention in empirical work. It is assumed that older firms are less able to adapt to environmental changes. Older firms may not observe new business opportunities because they lack of entrepreneurial spark. Older firms usually stick to what they know best and they become distanced from any kind of improvement. Fizaine (1968) supported, for French firms, that age has a negative effect on the growth of firms and that growth rates decreases with age.

Dunne et al. (1989) agree with Fizaine's findings and support, for US firms, that the expected growth rate decreases with age. According to many studies, age is observed to have a negative effect on firm growth – see among others Evans (1987) for US manufacturing firms, Liu et al. (1999) for Taiwanese electronics plants, Geroski and Gugler (2004) for large European companies, and Yasuda (2005) for Japanese manufacturing firms.

The main purpose of a firm, according to Jovanovic (1982), at the start of its life cycle is to attain a minimum scale of efficiency which helps the firm to survive in its operating market. Therefore, in order to reach an efficient size, a firm needs to achieve rather high rates of growth during the first years of its existence and the firm's need decreases as it reaches that efficient size.

Various authors suggest that the relationship between age and growth may vary depending over the distribution of the age. Barron et al. (1994) conclude, for New York Credit Unions, that older firms grow faster than adolescent ones, but eventually the youngest firms are the ones that present the fastest growth. Bigsten and Gebreeyesus (2007) conclude, for manufacturing firms in Ethiopia, that there is an inverse relationship between age and growth only in the first few years after they enter the market, then it stays constant for most of the age group until the relationship starts to be positive beyond a specific age.

Fariñas and Moreno (1997) conclude that the youngest firms experience higher growth rates because their most important objective is to attain a size which is required for their survival. These authors also support that firms have a tendency to reduce their growth rate once they attain their survival.

Lotti et al. (2009) support, for Italian SMEs, that there is a negative and statistically significant relationship between growth and age at the initial stages of the SME life cycle and that this relationship is not statistically significant when SMEs reach later stages of their life cycle.

Given that young SMEs main goal is to reach a minimum efficient size that allows them to survive in their markets, SMEs growth is expected to be greater in the years right after market entry, while their growth decreases as they come closer to this size (MES). The relationship between age and growth for later stages of the SME life cycle is expected to be less important, because growth will depend more on strategic decisions than on the need to reach an efficient size, due to the fact that many firms have attained a size for their survival.

3.1.3 Profitability

Profitability is an important variable which not only has an effect on enterprises and shareholders but also it effects the attractiveness of investments. Profitability has an effect on both the performance of various sectors and the whole economic system (Peneder 2009).

Moreover, profitability is the final result of macroeconomic conditions, sector specific conditions, investment and R&D, management, taxation rules and corporate governance. Profitability is a measure of a firm's efficiency as it shows how well firms convert revenues into income which can be transferred to owners and shareholders. Less profitable firms are usually taken over by more profitable firms or find themselves out of the markets (Peneder 2009).

Profitability as well as firm growth have received a lot of attention in the literature. It is fact that profits can lead to the expansion of a firm. It is generally believed that firm growth and profit rates are related to each other (Goddard et al. 2004). Alchian (1950) presented the Growth of the Fitter theory. As stated in this theory, fitter firms grow and survive, but less active firms lose their market share and exit as a result of poor performance. Therefore, if profit rates reflect the degree of fitness, it is possible to predict that profitable firms will grow.

In accordance with the financing constraint hypothesis, retained profits can be used by firms in order to make investments, while it is difficult for firms with low profitability to grow even if they have high possibilities of growth. In addition, according to the pecking-order theory, managers prefer internal finance to external finance. Firms prefer internal finance to external finance for their investments as a result of asymmetric information between the investors and the firm (Myers and Majluf, 1984). An increase in retained earnings leads to an increase in investment and therefore this leads to greater expansion. That explains why profit is an important source of finance for expansion. Many authors conclude that there is a positive relationship between profit and firm growth (Goddard et al. 2004; Jang and Park 2011).

3.1.4 External financing

Fagiolo and Luzzi (2006) conclude that financial liquidity is very significant for SMEs. In fact, SMEs can organise their financial resources in a more efficient way due to financial liquidity and as a result SMEs can adjust with ease to rapid changes that may occur in the markets that they operate. Nevertheless, Fazzari et al. (1988) conclude that because of market imperfections, it is difficult for SMEs to obtain external finance and as a result SMEs' growth is dependent particularly on internal financing. Small and medium-sized firms are less likely to have access to impersonal centralized debt markets. Specifically, during periods of tight credit, small and medium-sized borrowers are often denied loans in favour of better-quality borrowers (Fazzari et al. 1988).

As far as debt is concerned, Baker and Nelson (2005) conclude that SMEs have a tendency to organise their financial assets in a more productive way as they need to pay off the debt as soon as they can. Thus, when in debt, SMEs tend to manage their resources efficiently, meaning that debt may have a positive impact on firm growth. Meyer (1998) states SMEs can take advantage of their growth opportunities when they obtain loans on favourable conditions, especially in cases where internal financing is not adequate.

On the contrary, the optimal capital structure theory indicates that the negative effect on leverage on growth enhances firm value because the leverage prevents managers from taking on poor projects (Jensen 1986; Stulz 1990). Opler and Titman (1994) and Billett et al. (2007) empirically found that sales growth is lower in firms with higher leverage. Therefore, the influence of debt leverage on growth could be negative.

Lang et al. (1996) show that there is a negative relationship between leverage and future growth at the firm level. This negative relationship holds for firms with a low Tobin's q ratio, firms whose growth opportunities are not recognised by the capital markets or firms with insufficiently valuable growth potential to offset the effects of their debt overhang to finance positive net present valued

projects. Another factor that causes this negative relationship is the managements information about future growth opportunities.

3.1.5 Other determinants of firm growth

Previously, we investigated some of the determinants of firm growth. Here, we look at other factors that also have an influence on growth rates.

Innovation.

One of the most important determinants of firm growth is innovation. Innovation plays a significant role in a country's economy as it causes a great deal of structural change. New techniques and new products replace the older ones. Innovation, through a more efficient use of inputs, can lead to the production of higher level of output. Firms are interested in the influence of innovation on turnover growth while policy makers and economists are more interested in the employment growth. According to Carden et al. (2005), innovation is what firms need most in order to increase their growth rates. Hay and Kamshad (1994) support for SMEs that innovation is one of the most commonly accepted strategies in order to expand.

Generally, it is quite difficult to observe the impact of innovation on firm growth on the grounds that it takes a lot of time for a firm to transform innovation into economic performance. Moreover, it is difficult and very expensive for a firm to transform a new idea into a successful manufacturing procedure and finally into a commercial success. In the context of steel and petroleum sectors, Mansfield (1962) concludes that successful innovators grew faster particularly if they were small in the beginning. Scherer (1965) concludes, for large US firms, that patents are positively related to sales growth. In the context of large UK firms, Geroski and Machin (1992) support that innovative firms grow faster and are more profitable than non-innovative ones.

Many authors conlude that there is a positive and statistically significant relationship between R&D and firm growth (Geroski and Toker, 1996; Roper, 1997;

Freel, 2000; Del Monte and Papagni, 2003).

However, not all of the previous studies were able to find a positive relationship between innovation and firm growth. Some authors conclude that there is no significant relationship between innovation and sales growth (Geroski et al., 1997; Bottazzi et al., 2001). Finally, Freel and Robson (2004) find that there is a negative relationship between innovation and sales growth in the context of small manufacturing firm in England. This negative relationship is due to the ambiguous and expensive nature of innovation.

However, various authors state that innovation has no significant impact on firm growth but it has a significant positive impact on growth only for the fastest-growing firms. Concequently, for firms which face rapid decline, any attempt at innovation would deteriorate this decline (Goedhuys and Sleuwaegen, 2008; Coad and Rao, 2008).

R&D expenditure is considered to be a barrier to entry for competitors in markets, because in many cases it represents significant sunk costs (Montgomery, 1994; Sutton, 1998). The barriers to entry may cause higher rates of growth in the firms that already exist in the market. Therefore, less competition helps the existing firms to have higher investment opportunities, and thus higher growth rates.

Generally, R&D has the following positive impacts on SME growth: (1) more abilities to diversify activities (Montgomery, 1994; Deloof, 2003; Rogers, 2004); (2) more flexibility in their organizational skills, which helps SMEs to adapt to changes in the markets that they operate (Rogers, 2004); (3) more capabilities to establish networks with other firms (Rogers, 2004; Rickne, 2006) (4) higher export capacity, and thus less risk in their business activities (Beise-Zee and Rammer, 2006) and finally (5) more capabilities to operate in technologically intensive markets (Johns, 1987; Hölzl, 2009; Stam and Wennberg, 2009). On the other hand, some authors claim that R&D expenditure can lead to the restriction of SME growth: (2) It is more difficult for SMEs to hire trained and experienced person-

nel. As a result, it is more difficult for SMEs to handle R&D activities (Freel, 2003; Tanabe and Watanabe, 2005). (1) SMEs need a learning process in order to use R&D expenditure in a more efficient way, which can take considerable time. Consequently, this means diminished growth in SMEs that are not yet experienced in handling R&D activities (Müller and Zimmermann, 2009).

Internal finance

According to Reid (2003), financing restrictions can affect SMEs' growth strategies to a large extent. In fact, compared to larger firms, it is more difficult for SMEs to have access to external financing due to the higher information asymmetry in the relationships with creditors. Indeed, SMEs can change the composition of their assets more easily (Pettit and Singer, 1985) as well as SMEs have higher probability of failure to repay (Ang, 1992; Müller and Zimmermann, 2009).

Labour productivity

Rogers (2004) states that the smaller size of SMEs allows them to be more flexible in their activities in comparison to large firms. For the author, this organizational flexibility can create a climate which can be more favourable to higher labour productivity. Mateev and Anastasov (2010) conclude that labour productivity is a determinant which induces SME growth. Majumder (2004) states that the effects of knowledge and experience are crucial factors for the efficiency of the labour productivity factor which in turn has a positive impact on firm growth.

Entrepreneur's characteristics

Human capital is a significant determinant of firm growth. Education may help entrepreneurs to take advantage of any opportunity that appears in their business environment. Almus (2002) concludes, for Germany firms, that there is a positive relationship between human capital (e.g. university degree or master degree) and

growth. On the contrary, Robson and Bennett (2000) do not find any significant relationship between education and profitability growth or employment growth in the context of UK small enterprises.

There are many studies that have shown interest on the education level of the firm founders in developing countries as well. In the context of five African nations, McPherson (1996) concludes that human capital has a significant and positive effect on small firm growth. Moreover, Robson and Obeng (2008) conclude, for small firms in Ghana, that the more educated entrepreneurs are likely to face fewer barriers to growth.

Besides human capital, the gender of the entrepreneur has an influence on the growth of firms too. Various authors state that firms which are directed by female entrepreneurs tend to grow at slower rates (Catley and Hamilton 1998; McPherson 1996; Coad and Tamvada 2008). This happens due to the fact that women are less ambitious in comparison with men (Robson and Obeng 2008). Another possible reason is that women do not take risks easily due to the fact that they mostly depend on their business for their household income (Mead and Liedholm 1998). Finally, women entrepreneurs seem to be less involved in making money (Cromie 1987).

Legal status

Lgal status also appears to be a factor which is associated with growth rates. According to Harhoff et al. (1998), enterprises with limited liability tend to have higher rates of growth than other enterprises. Unfortunately, this kind of firms have higher possibilities of failing and thus exiting the market. In addition, Stiglitz and Weiss (1981) conclude that firms with limited liability makes managers to follow plans which gives a combination of higher expected returns and higher possibility of bankruptcy.

Capital intensity

Capital intensity is also a significant determinant of firm growth. Firms with more intensive use of capital (for example fuel, electricity, water and telephone services) seem to grow faster than other firms (Sleuwaegen and Goedhuys 2002). Moreover, smaller enterprises in capital-intensive sectors grow much faster than larger enterprises while in labour-intensive enterprises, the gap between growth of small and large firms is smaller (Nickerson and Wright 2007).

Macroeconomic factors

Business cycle is undoubtedly one significant macroeconomic factor that affects firm growth. Various authors have discussed how firm growth changes over the business cycle. According to Higson et al. (2004), macroeconomic variations have an impact on firm growth. Moreover, Hardwick and Adams (2002) conclude that larger firms grow faster during periods of decline and recoveries, while smaller firms grow faster during booms.

Another significant macroeconomic factor that affects firm growth is the region in which the firm is established. It is supported that small firms grow faster in urban areas than in rural areas (McPherson 1996). Moreover, firms which are established in industrialized areas grow faster than other firms as a result of the easier access to recourses (Sleuwaegen and Goedhuys 2002).

Beck et al. (2005) conclude that firms in fast-growing, larger and richer economies tend to have higher growth opportunities. This means that there is a significant and positive relationship between GDP growth rate and firm growth.

According to previous studies, many variables are related to firm growth which are statistically significant, it still remains difficult to be accurate about a firm's future growth rate.

3.2 Hypotheses

Following evidence from both theoretical and empirical literatures, in this study we test the following hypotheses:

- H1: There is a negative relationship between previous size and firm growth.
- H2: There is a negative relationship between age and firm growth.
- H3: There is a positive relationship between profitability and firm growth.
- H4: There is a positive relationship between debt and firm growth.

Chapter 4

Data description and estimation method

4.1 Database

This study uses data from the Imentor database (www.imentor.gr), which is an online business information service of Hellastat, covering the period 2008-2014. This database provides a coverage of all Greek firms, including large firms (>250 employees), medium sized firms (<250 employees), small firms (<50 employees) as well as micro-sized firms (<10 employees). Micro sized firms are rarely included in past performance studies (Reid, 2007).

We select SMEs based on the European Union recommendation. According to this recommendation, a firm is considered small and medium-sized when it has: (1) fewer than 250 employees and (2) total assets under 43 million euros or (3) business turnover under 50 million euros. Table 4.1 presents the SMEs definition according to the European Union recommendation (European Commission, 2016c).

In this study, we focus on manufacturing SMEs. All monetary values were transformed into the prices in 2008 fiscal year by using the Consumer Price Index (CPI) provided by the Hellenic Statistical Authority. Dataset was cleaned by dropping firms which had only one year of observation, firms with non-consecutive

observations and firms with missing data that could not be calculated. Outliers have been eliminated by winsorizing the variables at the 1st and the 99th percentile. After this procedure, the result was an unbalanced panel of 4,082 firms and 22,311 observations.

Table 4.1. *SMEs definition*

Company category	Staff headcount	Turnover or	Balance sheet total
Medium-sized	< 250	$\leq$ € 50 m	$\leq$ € 43 m
Small	< 50	$\leq$ € 10 m	$\leq$ € 10 m
Micro	< 10	$\leq$ € 2 m	$\leq$ € 2 m

4.2 Variables

Table 4.2 presents the variables used in this study, together with their corresponding measure. As dependent variable, we consider SME growth, given by the rate of sales growth. As independent variables we consider: size, age, ros as a measure of profitability and leverage (or debt) as a measure of external financing.

Table 4.2. *Definition of variables.*

Variable	Definition
GROWTH	Difference between logarithm to sales in current period and logarithm to sales in previous period
SIZE	Logarithm to sales
AGE	Logarithm of number of years of firm's life
ROS	Ratio of net income to net sales
LEV	Ratio of total liabilities to total assets

4.3 Summary statistics

Table 4.3 provides a breakdown of the sample by size class and reveals right skewness in the distribution, with proportionately more micro-sized and small firms than medium sized firms in the manufacturing sector. Micro and small firms accounted for 82% of firms in 2008 and about 80% in 2014 in our sample.

Table 4.3. *Firm distribution by size class*

	2008	2014
Micro & small (up to 49 employees)	2,952	2,205
Medium-sized (50-249 employees)	644	520
Total	3,596	2,725

In table 4.4, we present the correlation matrix between the variables used in this study. When the correlation of the coefficients the explanatory variables are above 30%, the problem of collinearity between those variables is particularly relevant according to Aivazian et al. (2005). According to the correlation matrix, we find that the all correlation coefficients between explanatory variables of growth are below 30%. There is a low level correlation among the variables used in this study, thus we consider that multicollinearity is unlikely to be a problem in our model.

Table 4.5 shows the summary statistics of the variables used in this study for manufacturing SMEs in Greece. For each variable we report the number of observations, mean, median, standard deviation, minimum and maximum. In this table we notice some interesting results. Firstly, the average sales of the sampled manufacturing firms is 4,586,166 euros. Additionally, the average growth rate in sales is -1.57%, which appears to correspond to the recent economic crisis in Greece. The variable age ranges from 1 up to 116 years old and the average age of the firms is about 20 years old. Furthermore, leverage which depicts the debt

of the manufacturing sector is about 56% which is quite high, while the average ros which depicts the profitability of the sector is about -4.26%.

Table 4.4. *Correlation matrix.*

Variables	GROWTH	SIZE	AGE	ROS	LEV
GROWTH	1.0000				
SIZE	-0.0997*	1.0000			
AGE	-0.1370*	0.1132*	1.0000		
ROS	-0.1071*	0.2796*	-0.0419*	1.0000	
LEV	-0.0151*	0.1741*	-0.1262*	-0.1380*	1.0000

*Significance at 5% level.

Table 4.5. *Summary statistics*

Variables	Obs	mean	sd	min	max
GROWTH	22311	-.0157284	.4066461	-.768311	2.55503
SIZE	22311	14.55751	1.348243	10.70593	17.33627
AGE	22311	2.737695	.6652235	0	4.744932
ROS	22311	-.0426764	.2716519	-1.643081	.3443748
LEV	22311	.5600462	.2659678	.0365528	1.285034
ageinyears	22902	19.62776	12.296	1	116
netsales	22902	4586166	7100078	27.35	82700000

4.4 Estimation method and model specification

The structure of our dataset allows us to use a panel data methodology for our empirical research. A panel data set (or longitudinal data) has both a cross-sectional and a time series dimension, where all cross section units are observed during the whole time period. Additionally, panel data methodology can control firm heterogeneity and reduce collinearity among the variables that are examined. This type of analysis enables us to eliminate the potential biases in the resulting estimates due to correlation between the explanatory variables and unobservable individual effects included in the model.

There are two basic static panel data models: (1) fixed effects model and (2) random effects model. Fixed effects assumes that the individual specific effect is correlated with the independent variables. Unfortunately, the effects of time-invariant variables that are measured cannot be estimated by using fixed effects. In the random effects model, the individual-specific effect is a random variable that is uncorrelated with the independent variables. The main advantage of this model is that it can estimate coefficients for explanatory variables that are constant over time.

The desirable feature of the FE model is the inclusion of firm and time-specific effects in the growth model to capture unobservable effects, such as managerial differences and policy changes. This means that fixed effect models may provide a means for controlling for omitted variable bias. The equation for fixed effects model is:

$$Y_{it} = \beta_1 X_{it} + ... + \beta_k X_{kt} + \alpha_i + e_{it} \tag{4.1}$$

where:

Y_{it} represents the dependent variable where i=entity and t=time

X_{it} represents the independent variables

$\beta_{i...k}$ is the coefficient for the independent variables

α_i (i=1...n) is the unknown intercept for each entity (n entity-specific intercepts)

e_{it} is the error term

On the other hand, one of the advantages of an RE model is that time-invariant regressors can be included in the model specification. This means that by using the random effect model we are able to examine the coefficients of the explanatory variables that are constant over time. The equation for random effects model is:

$$Y_{it} = \beta_1 X_{it} + ... + \beta_k X_{kt} + \alpha_i + u_{it} + \epsilon_{it} \tag{4.2}$$

where:

u_{it} is the between entity error

ϵ_{it} is the within entity error

In panel data analysis (the analysis of data over time), the Hausman (1978) test can help you to choose between fixed effects model and random effects model. The null hypothesis is that the random effects model is preferred. The alternate hypothesis is that the fixed effects model is preferred. Specifically, the Hausman test searches if there is a correlation between the unique errors and the regressors in the model. The null hypothesis is that there is no correlation between the two. If p-value is less than 0.05, then the null hypothesis is rejected.

We tested for the following hypotheses: H_0: random effects model vs H_1: fixed effects model. According to our results p-value is less than 0.05, thus H_0 is rejected. Concequently, the fixed effects model is preferred in our analysis.

Therefore, we estimate the following regression equation to analyze the determinants of firm growth:

$$GROWTH_{it} = \beta_0 + \beta_1 SIZE_{it-1} + \beta_2 AGE_{it-1} + \beta_5 ROS_{it-1}$$

$$+ \beta_6 LEV_{it-1} + \sum_{i=1}^{N} \beta_i D_i + \alpha_i + \epsilon_{it} \tag{4.3}$$

where β_0, β_1,...,β_6 are parameters to be estimated, α_i (i=1...n) is the unknown intercept for each entity, and ϵ_{it} is the disturbance error. The variables $SIZE_{it-1}$ and AGE_{it-1}, represent firm $i's$ size and age in period $t-1$, respectively. In our analysis, variables take a time-lag in order to clarify the causality relationship (Honjo and Harada, 2006).

$GROWTH_{it}$ is the growth of firm i at time t, measured in terms of sales. Generally, there are different approaches to measure firm growth such as turnover

growth, employment growth, productivity growth and total assets growth. In this study, we focus on sales growth (or turnover growth). Sales growth is the difference between logarithm to sales in current period and logarithm to sales in previous period.

$$GROWTH_{it} = ln(\frac{Sales_{it}}{Sales_{it-1}}) \tag{4.4}$$

Firm size ($SIZE_{it-1}$) is measured by sales in logarithmic terms in previous period. If Gibrat's law holds, this simple hypothesis confirms that the firm size is uncorrelated with firm growth. In addition, a squared size term is also included in an extra regression analysis, in order to take account of the possible non-linear relationship between initial firm size and growth and to avoid biased estimates which result from misspecification error (Bigsten and Gebreeyesus 2007).

AGE_{it-1} is measured in years from the birth of the firm to the time of the survey and is in logarithmic terms. In addition, an extra regression analysis is presented, by including also a squared age term in the model, in order to take account of the possible non-linear relationship between firm age and growth and to avoid biased estimates which result from misspecification error.

The return on sales ratio (or net profit margin) in previous period is also included in the growth regression (ROS_{it-1}), which represents the profitability of the firms. This measure shows how much profit is being produced per euro of sales. An increasing ROS means that a firm is more efficient, whereas a decreasing ROS implies imminent financial difficulties. We measure return on sales as the net profit (net income) to net sales.

$$ROS_{it-1} = \frac{Net\ Profit_{it-1}}{Sales_{it-1}} \tag{4.5}$$

LEV_{it-1} represents the leverage of the firms in the previous period. Leverage refers to the amount of debt used to finance assets. The higher the degree of leverage, the higher the financial risk. Leverage is measured by the total liabilities to total assets ratio.

$$LEV_{it-1} = \frac{Total\ Liabilities_{it-1}}{Total\ Assets_{it-1}} \tag{4.6}$$

Finally, we include year dummy variables to control the differences due to macro-economic conditions.

Chapter 5

Empirical findings

According to table 5.1, our results confirm most of our hypotheses. The estimation coefficient of the size variable is negative and statistically significant at the 1% level. Therefore, smaller firms experience higher sales growth, which is consistent with most of the recent empirical works. Concequently, the hypothesis of independence between firm size and firm growth, known as Gibrat's law, is rejected. Based on these results, we can accept the previously formulated hypothesis H1.

The relationship between age and growth in Greek manufacturing SMEs is found to be negative and statistically significant at 1% level. Therefore, younger firms experience high sales growth. Based on these results, we can accept the previously formulated hypothesis H2.

The relationship between profitability and growth in Greek SMEs is found to be positive and statistically significant at 1% level. The magnitude of the coefficient is not very high though. Based on these results, we can accept the previously formulated hypothesis H3. Our study results provide evidence that profitable firms grow faster, which is in accordance with previous studies.

The estimation coefficient of leverage is negative and statistically significant at the 1% level. Based on these results, we cannot accept the previously formulated hypothesis H4. The results indicate that high leveraged firms have a slow growth rate. Moreover, the leverage variable is negative while the profitability variable is

positive. Our findings suggest that SMEs facing credit restrictions not only rely on internal investment sources for growth but also that SMEs use their own profits to pay off their debts and its charges.

Table 5.1. *Fixed-effects regression (I).*

GROWTH	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
SIZE	-.3757452	.0063731	-58.96	0.000	-.3882371	-.3632534
AGE	-.0951947	.023496	-4.05	0.000	-.1412491	-.0491403
ROS	.0358845	.0147273	2.44	0.009	.0070175	.0647515
LEV	-.1033596	.0253118	-4.08	0.000	-.152973	-.0537461
Year						
2009	-.1664762	.008418	-19.78	0.000	-.1829762	-.1499762
2010	-.167869	.0092059	-18.23	0.000	-.1859134	-.1498246
2011	-.2205974	.0102378	-21.55	0.000	-.2406644	-.2005304
2012	-.2955851	.0115293	-25.64	0.000	-.3181837	-.2729865
2013	-.2391815	.0129369	-18.49	0.000	-.2645391	-.2138239
2014	-.2203993	.0142468	-15.47	0.000	-.2483243	-.1924742
Cons	5.957109	.1030079	57.83	0.000	5.755204	6.159015
					Obs	22,311
					Groups	4,082
					F(10,18219)	565.84
					Prob>F	0.0000

In addition, an extra regression analysis is presented, by including also a squared size term and a squared age term, in order to take account of the possible non-linear relationship between size and growth as well as age and growth, and also to avoid biased estimates which result from misspecification error (Bigsten and Gebreeyesus 2007). Therefore, we also estimate the following regression equation to analyze the determinants of firm growth:

$$GROWTH_{it} = \beta_0 + \beta_1 SIZE_{it-1} + \beta_2 AGE_{it-1} + \beta_1 SIZE^2_{it-1} + \beta_2 AGE^2_{it-1} +$$

$$\beta_5 ROS_{it-1} + \beta_6 LEV_{it-1} + \sum_{i=1}^{N} \beta_i D_i + \alpha_i + \epsilon_{it} \quad (5.1)$$

Table 5.2. *Fixed-effects regression (II).*

GROWTH	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
SIZE	-.7394794	.060083	-9.31	0.000	-.8572478	-.621711
AGE	-.2338257	.0544873	-4.29	0.000	-.340626	-.1270253
$SIZE^2$	.0130758	.0021487	6.09	0.000	.0088641	.0172876
AGE^2	.0644263	.0234093	2.75	0.006	.0185419	.1103106
ROS	.0516752	.0149344	3.46	0.001	.0224024	.080948
LEV	-.0939125	.0253206	-3.71	0.000	-.1435432	-.0442819
Year						
2009	-.1361772	.0164309	-8.29	0.000	-.1683827	-.1039716
2010	-.1384974	.0195289	-7.09	0.000	-.1767751	-.1002197
2011	-.1990664	.0226482	-8.79	0.000	-.2434581	-.1546747
2012	-.278905	.025833	-10.80	0.000	-.329539	-.2282709
2013	-.22965	.0290003	-7.92	0.000	-.2864922	-.1728079
2014	-.22832	.028000	-6.80	0.000	-.274622	-.1728079
Cons	9.161134	.3831513	9.91	0.000	8.410136	9.912132
					Obs	22,311
					Groups	4,082
					F(12,18217)	476.67
					Prob>F	0.0000

According to table 5.2, the size-growth relationship was found to be non-linear as indicated by the positive and significant coefficient on the squared size term. This means that we observe a convex firm-size growth relationship during the period examined.

Finally, the age-growth relationship was found to be non-linear as indicated by the positive and significant coefficient on the squared age term. This means that we observe a convex firm-age growth relationship for the Greek manufacturing SMEs during the period examined.

Chapter 6

Conclusion

Based on a sample of 4,082 Greek manufacturing SMEs and by using the fixed-effects method, our approach in this study was to regress firm growth not only on the traditional determinants of size and age but also on profitability and leverage.

Firstly, the empirical evidence obtained lets us conclude that there is a negative and statistically significant relationship between previous size and firm growth. Thus, the Gibrat's law is rejected in the case of the manufacturing SMEs in Greece for the examined period. Smaller firms experience higher sales growth, which is consistent with recent previous studies. Moreover, by adding a squared size term in the model, the size-growth relationship was found to be non-linear. Thus, we observe a convex firm size-growth relationship during the period examined.

Secondly, we conclude that there is a negative and statistically significant relationship between age and firm growth. Younger firms experience higher sales growth, which is consistent with most of the recent empirical works. The empirical evidence that we obtained confirms the arguments presented by Jovanovic (1982) and Fariñas and Moreno (1997), that in the first years of the life-cyle, SMEs main goal is to reach an efficient size which allows their survival in the market that they operate. Once survival is attained, firms tend to redusce their rate of growth. Moreover, by adding a squared age term in the model, the age-growth relationship was found to be non-linear. This means that we observe a convex

firm age-growth relationship across the period examined.

Thirdly, we conclude that there is a positive and statistically significant relationship between profitability and firm growth. The empirical evidence that we obtained confirms the arguments presented by Alchian (1950) that if profit rates reflect the degree of fitness, it is possible to predict that profitable firms will grow.

Fourthly, we find that there is a negative and statistically significant relationship between debt and firm growth. In our study, the results indicate that high leveraged firms have a slower growth rate and SMEs facing credit restrictions rely on internal investment sources for growth.

Compared to large firms, SMEs have more difficulty in accessing external financing. The empirical evidence lets us suggest that policies of financial support should be directed especially to young manufacturing SMEs, so that SMEs can take advantage of good growth opportunities in situations when internal finance is not sufficient.

For future research, we suggest studying the R&D intensity, labour productivity and entrepreneural characteristics as determinant factors of growth. Also, as a suggestion for future research, we suggest studying macroeconomic factors of growth for manufacturing SMEs in Greece.

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