The Influence of Age on the Relationships between SMEs Growth and its Determinants: Empirical Evidence Using Panel Data

Abstract:

Using two sub-samples of Portuguese SMEs: 1) 495 young SMEs; and 2) 1350 old SMEs, through the two-step estimation method, we examine if age is a fundamental characteristic of the relationships established between determinants and SME growth. The multiple empirical evidence allows us to conclude that age is a determinant for the relationships formed between determinants and SME growth: 1) age and size are negatively related to growth in young SMEs, but are not relevant in explaining the growth of old SMEs; 2) cash flow and debt are of greater relative importance for growth in young SMEs than for growth in old SMEs, with R&D expenditure being of greater relative importance for growth in old SMEs than for growth in young SMEs; and 3) growth in young SMEs is found to have a continuous tendency, unlike the case of old SMEs. We also find significant differences between the determinants of survival in young SMEs and old SMEs.

Keywords: Age, Gibrat's Law, SME growth; Two-step Estimation Method.

Jel Classifications: C23, D22, G32, L26

1. Introduction

According to Gibrat (1931), firm growth does not depend on previous size, but is a random process. Therefore, the relationship between growth in the present period and size in the previous period is not statistically significant. For the author, small and large firms are equally likely to have a certain rate of growth over time, and so small firms do not necessarily have higher rates of growth than large ones. The conclusions of Gibrat (1931) became known in the literature as Gibrat's "Law".

However, Sutton (1997) concludes that the relationship between growth in the present period and previous size is affected by firms' need to obtain a minimum scale of efficiency that allows survival. For the author, given that small firms in many cases have not yet reached a minimum scale of efficiency to allow survival, there is a greater possibility of their growth process being continuous, growth in one period depending on previous size. In the context of large companies, that in most cases have already reached a minimum scale of efficiency allowing them to survive, the possibility of a relationship between growth in a given period and previous size is less. Therefore, according to Sutton (1997), Gibrat's "Law" is less likely to be confirmed in small companies, with a greater possibility of confirming Gibrat's "Law" in large ones.

Besides size, other variables have been used as determinants of firm growth, for example: 1) age (Mata, 1994; Becchetti and Trovato, 2002; Yasuda, 2005; Honjo and Harada, 2006; Calvo, 2006; Oliveira and Fortunato, 2006; Moreno and Casillas, 2007; Fotopoulos and Giotopoulos, 2010; Serrasqueiro et al., 2010); 2) R&D expenditure (Yasuda, 2005; Calvo, 2006; Hölzl, 2009; Stam and Wennberg, 2009; Martin, 2010; Serrasqueiro et al., 2010); 3) internal financing (Heshmati, 2001; Audretsch and Elston, 2002; Carpenter and Petersen, 2002; Cabral and Mata, 2003; Honjo and Harada, 2006; Oliveira and Fortunato, 2006; Moreno and Casillas, 2007; Serrasqueiro et al., 2010);

and 4) external financing (Heshmati, 2001; Becchetti and Trovato, 2002; Honjo and Harada, 2006; Serrasqueiro et al., 2010).

Lotti et al. (2009) conclude for Italian SMEs that at the initial stages of the SME life-cycle there is a negative relationship between growth in the present period and size in the previous period. However, as SME age increases, the relationship between growth in the present period and size in the previous period becomes less relevant, to the extent of being statistically insignificant in many cases. In the context of Greek SMEs, Fotopoulos and Giotopoulos (2010) conclude that Gibrat's Law does not hold true for young Greek SMEs, but does so when taking old Greek SMEs as the subject of analysis.

The conclusions of Lotti et al. (2009) and Fotopoulos and Giotopoulos (2010) are quite relevant because they show that confirmation of Gibrat's "Law" depends on SME age. The possibility of confirming Gibrat's "Law" increases with greater SME age, being less in the case of young SMEs.

This study extends the analysis of Lotti et al. (2009)[1] and Fotopoulos and Giotopoulos (2010)[2], taking besides age and size, other determinants considered relevant in the literature for SME growth, testing if the relationships between determinants and growth are of a different nature in the case of young SMEs and old SMEs. With this objective, we consider two sub-samples of Portuguese SMEs: 1) 495 young SMEs; and 2) 1350 old SMEs.

As determinants of the growth of Portuguese SMEs, besides age and size we consider: 1) R&D expenditure; 2) cash flow as a measure of internal financing; and 3) debt as a measure of external financing.

[1] Lotti et al. (2009) consider age and size as explanatory variables of SME growth.
[2] Fotopoulos and Giotopoulos (2010) consider only size as an explanatory variable of SME growth.

Methodologically, so as to deal with possible bias in the results as a consequence of the matter of survival, we use the two-step estimation method proposed by Heckman (1979). In the first phase, using all surviving and non-surviving SMEs we estimate probit regressions of survival for young SMEs and old SMEs. Afterwards, based on the probit regressions estimated, we calculate the Mill's inverse ratio. At the second stage, considering only surviving firms we estimate regressions referring to the relationships between determinants and the growth of young and old SMEs, also considering the Mill's inverse ratio as an independent variable, with the aim of solving the possible result bias arising from the matter of survival.

To estimate the regressions referring to the relationships between determinants and growth in young SMEs and old SMEs, we use different dynamic panel estimators: 1) GMM (1991); 2) GMM system (1998); and 3) LSDVC (2005). Using dynamic panel estimators allows us to estimate correctly the relationship between growth in the previous period and growth in the present period.

With regard to the literature, this study makes two important contributions: 1) in terms of methodology, it is pioneering in using simultaneously probit regressions to solve possible result bias due to the survival issue, and dynamic panel estimators to estimate relationships between determinants and SME growth; and 2) the study is pioneering in providing new empirical evidence in the study of the influence of age on the relationships formed between determinants and SME growth, considering for this purpose various determinants of SME growth normally used in the literature (age, size, R&D expenditure, internal financing, external financing).

The empirical evidence obtained in this study lets us conclude that age is fundamental in explaining the relationships between determinants and growth in young SMEs and old SMEs 1) the negative relationships between age and growth and between

size and growth are more relevant in the case of young SMEs than in old SMEs; 2) internal financing and external financing is of greater relevance for growth in young SMEs than in old SMEs; 3) R&D expenditure is more important for growth in old SMEs than for growth in young SMEs; and 4) greater persistence of growth is found in young SMEs than in old SMEs.

After this introduction, the study is divided as follows: 1) section 2 presents a review of the literature on relationships between determinants and growth, and hypotheses for investigation are formulated; 2) section 3 presents the database, variables and estimation method used; 3) section 4 presents the empirical evidence obtained; 4) section 5 discusses the results; and 5) section 6 presents the conclusions and implications of the study.

2. Determinants of Firm Growth

2.1. Age

According to Jovanovic (1982), in the first years of their life, firms have the main goal of reaching a minimum scale of efficiency that allows them to survive in the markets in which they operate. To reach an efficient size means attaining relatively high rates of growth in the first years of existence, this need diminishing as firms approach, or reach, that efficient size.

Fariñas and Moreno (1997) reinforce the conclusions of Jovanovic (1982), the authors concluding that the youngest firms present higher rates of growth because their most immediate goal is to reach a size which allows them to survive. According to these authors, once survival is attained, firms tend to reduce their rate of growth.

As for the expected relationship between age and firm growth, the conclusions of Lumpkin (1998) and Shane and Venkataraman (2000) are very relevant. The authors conclude that the youngest firms have a greater perception of risk than older companies. Greater perception of risk, together with the need to attain a minimum size of efficiency that allows survival in their markets of operation, will mean selecting highly profitable investment projects, which can contribute to young firms having relatively high rates of growth, compared to old SMEs.

Concerning the relationship between age and SME growth over their life-cycle, Lotti et al. (2009) find a negative and statistically significant relationship between age and growth in Italian SMEs at the start of their life-cycle, the relationship being statistically insignificant when SMEs reach later stages of their life-cycle.

Considering that young SMEs starting up their activity can have the main aim of reaching a minimum scale of efficiency that allows them to survive in their markets, we can expect growth to be considerable in the years immediately following market entry and to diminish as SMEs come closer to the minimum size necessary for survival. At later stages of the SME life-cycle, we can expect less of a relationship between age and growth, since growth will depend more on strategic business possibilities than on the need to attain a particular efficient size, because in many cases they have already reached a size that allows survival in their operating markets.

Based on the arguments above, we formulate the following hypothesis:

H1: The negative relationship between age and growth is of greater relative importance in young SMEs than in old SMEs.

2.2. Other Determinants

2.2.1. Size

Gibrat (1931) concludes that small and large firms are equally likely to find a particular rate of growth over time. Therefore, according to the author, small firms do not necessarily have higher growth rates than large ones. According to Gibrat (1931), some firms are "lucky" enough to find a particular growth rate over time, growing and surviving, while others do not find a sustained growth rate and do not manage to survive in their markets of operation.

However, various authors, among whom we highlight Sutton (1997), question Gibrat's "Law" (1931). Sutton (1997) concludes that the possibility of validating Gibrat's "Law" is not independent of firm size. Small firms tend to have higher rates of growth and a certain degree of continuity until they come close to, or attain, a size that allows them to survive. In this context, Barkham et al. (1996) conclude that the motivation for SME growth is essentially due to the need to reach a size that enables them to face up to the effective and potential competition in their operating markets in order to survive. The motivation for growth in large companies, according to Barkham et al. (1996), is due essentially to alterations in strategy with the aim of maximizing profits.

Audretsch et al. (2004) conclude that small firms have greater possibilities for growth, since in most cases they are at sub-optimal size, compared to the case of large companies. We can therefore expect that the smaller the size, the greater the possibility for firm growth, the rate of growth diminishing as firm size increases.

On starting their activity, we can expect SMEs to have higher levels of growth than SMEs at more advanced stages of their life-cycle, since in the first years of activity

SMEs have the main strategic concern of attaining a sufficient minimum size to allow survival. This being so, we can expect the relationship between growth in the present period and size in the previous period to be more negative in young SMEs than in old SMEs. In later stages of the SME life-cycle, we can expect the relationship between growth in the present period and size in the previous period to be less relevant. Lotti et al. (2009) find empirically that as the age of Italian SMEs increases, the relationship between growth in the present period and size in the previous period becomes less relevant. Fotopoulos and Giotopoulos (2010) find that Gibrat's Law does not hold true for young Greek SMEs, but does so when taking old Greek SMEs as the subject of analysis.

Based on the above arguments, we formulate the following hypothesis:

H2: In the case of young SMEs, Gibrat's "Law" is less likely to be confirmed than in old SMEs, the negative relationship between growth and previous size being more relevant.

2.2.2. Investigation and Development

R&D expenditure can serve as a barrier to new firms entering the market, since in many cases it represents significant sunk costs (Montgomery, 1994; Sutton, 1998). Barriers to the entry of competitors in markets characterized by high R&D expenditure can lead to high growth rates in existing firms, since less competition can enable them to have greater investment opportunities, and consequently greater growth opportunities.

The expected positive effects of R&D on SME growth can be summarized as follows: 1) more capacity to diversify activities (Montgomery, 1994; Deloof, 2003; Rogers, 2004); 2) greater export capacity, and consequently less business risk (Beise-Zee and Rammer, 2006); 3) increased capacity to establish cooperation networks with

other SMEs (Rogers, 2004; Rickne, 2006); 4) more capacity to operate in quite specific markets, namely very technologically intensive ones (Jones, 1987, Hölzl, 2009; Stam and Wennberg, 2009); and 5) great organizational flexibility, which allows SMEs to adapt to changes arising in their markets of operation (Rogers, 2004).

However, various authors state that R&D expenditure can contribute to restricting SME growth: 1) activities associated with R&D expenditure have a high level of risk, and so financing these activities, when internal finance is insufficient, may be difficult due to creditors hindering access to credit, preventing efficient use being made of growth opportunities (Yasuda, 2005; Müller and Zimmermann, 2009); 2) for SMEs to be able to use R&D expenditure efficiently, they need a learning process which can take time. This can mean diminished growth in SMEs that have not yet gained much experience in managing R&D projects (Müller and Zimmermann, 2009); 3) high investment in R&D can mean problems in managing SMEs' financial resources in the short term, leading to inefficient use being made of the good investment opportunities available, and this may contribute to diminished growth (Tanabe and Watanabe, 2005; Gomez and Vargas, 2009; Müller and Zimmermann, 2009); and 4) compared to large companies, SMEs have more difficulty in managing R&D projects, as a consequence of the difficulty in hiring qualified human resources (Freel, 2003; Tanabe and Watanabe, 2005).

From the above, we can expect old SMEs to be able to use R&D expenditure more efficiently than young SMEs, for the following reasons: 1) while young SMEs have the main motivation to grow quickly to reach a minimum size that allows them to survive in their markets, old SMEs, having reached that survival level, are mainly concerned with diversifying their activities, for which R&D can be particularly relevant; 2) older SMEs, given their greater reputation (Diamond, 1989) and less possibility of bankruptcy

(Müller and Zimmermann, 2009), are more able to obtain credit, which when internal financing is insufficient can be fundamental for financing and managing R&D projects, contributing to efficient use being made of investment opportunities in this type of SME; and 3) older SMEs have greater experience in managing R&D projects, and given their reputation, are more able to recruit qualified human resources.

Based on the above arguments, we formulate the following hypothesis:

H3: R&D expenditure is of greater relative importance for growth in old SMEs than for growth in young SMEs.

2.2.3. Internal Financing

Reid (2003) concludes that SMEs' growth strategies can be greatly affected by financing restrictions. Indeed, compared to large firms, SMEs have more difficulty in accessing external financing, as a consequence of greater information asymmetry associated with the relationships formed with creditors, due to: 1) their greater possibility of bankruptcy (Ang, 1992; Müller and Zimmermann, 2009); and 2) the greater ease in changing the composition of their assets (Pettit and Singer, 1985).

It is important to emphasize that young SMEs can be expected to have greater information asymmetry in the relationships established with creditors, compared to the case of old SMEs, given that: 1) young SMEs, due to their limited age, have less reputation than old SMEs (Diamond, 1989); 2) due to that limited age, they can change the composition of their assets more easily, which according to Pettit and Singer (1985), increases creditors' uncertainty in granting credit to this type of SME; and 3) the greater possibility of bankruptcy in young SMEs (Müller and Zimmermann, 2009), since in most cases they have not yet reached a sufficient size to allow survival, contributing to creditors hindering access to credit by young SMEs.

Cooley and Quadrini (2001) and Cabral and Mata (2003) conclude that growth in young SMEs is considerably affected by financing restrictions. In the context of Japanese SMEs, Honjo and Harada (2006) conclude that internal financing is relevant for the growth of young SMEs, but is not relevant for growth in old SMEs.

We can expect that young SMEs, given the greater difficulty in obtaining external financing, are more dependent on internal funding to finance their growth possibilities, compared to the case of old SMEs.

Based on the above arguments, we formulate the following hypothesis:

H4: Internal financing is of greater relative importance for growth in young SMEs than for growth in old SMEs.

2.2.4. External Financing

According to Fagiolo and Luzzi (2006), financial liquidity is particularly important in the context of SMEs, for this type of firm to be able to manage its financial resources efficiently, adapting more easily to rapid changes that can occur in their operating markets. However, as Fazzari et al. (1988) conclude, due to market imperfections, SMEs face particular difficulties in obtaining external financing, their growth being especially dependent on internal funding. In this context, Meyer (1998) concludes that in many cases internal funding is not sufficient for SMEs to finance all their growth opportunities. When internal financing is not sufficient, it is crucial that SMEs have access to debt on advantageous terms, so as to finance their growth without excessive stress in managing their financial resources.

Baker and Nelson (2005) and George (2005) conclude that when resorting to debt, SMEs tend to manage their financial resources efficiently, given the need to pay off the debt and its charges over a constant period. The possibility of SMEs managing their

financial resources efficiently, particularly when in debt, may mean debt has a positive effect on SME growth.

Young SMEs are more likely to go bankrupt than old SMEs (Ang, 1992; Müller and Zimmermann, 2009), and are also more able to change the composition of their assets (Pettit and Singer, 1985), and so creditors make it particularly difficult for this type of firm to access credit, compared to older SMEs. The greater difficulty to obtained credit, and consequently greater difficulty to managing financial resources, associated to greater probability of bankruptcy, may contribute to young SMEs making particularly efficient use of financial resources in general, and debt in particular, debt being especially relevant for the growth of young SMEs, compared to what may happen in old SMEs.

Based on these arguments, we formulate the following hypothesis:

H5: Debt is of greater relative importance for growth in young SMEs than for growth in old SMEs.

3. Methodology

3.1. Database

This study uses the SABI (Sistema de Balanços Ibéricos - System Analysis of Iberian Balance Sheets) database supplied by Bureau van Dijk, for the period between 1999 and 2006. We select SMEs based on the European Union recommendation L124/36 (2003/361/CE). According to this recommendation, a firm is considered small and medium-sized when it meets two of the following criteria: 1) fewer than 250 employees; 2) assets under 43 million euros; 3) business turnover under 50 million euros.

According to Arellano and Bond (1991), use of dynamic panel estimators implies that cross-sections are included in databases for at least four consecutive years, in order to be considered in the econometric analysis, namely in second order autocorrelation tests which are fundamental to confirm the robustness of the empirical results obtained. Since this study uses dynamic panel estimators, we eliminate firms that do not belong to the database for at least four consecutive years during the period 1999 – 2006.

With the objective of solving the problem of possible bias in the results, and simultaneously to have a database which is more representative of the state of Portuguese SMEs, we consider three types of SME: 1) SMEs in the market for the whole period of analysis; 2) SMEs entering the market during the period of analysis; and 3) SMEs leaving the market during the period of analysis.

Since our objective is to study the influence of age on the growth of Portuguese SMEs, we consider two sub-databases: 1) 495 young SMEs, of which 236 enter the market during the period of analysis and 36 leave the market in that period; and 2) 1350 old SMEs, of which 162 leave the market during the period of analysis. We consider as young SMEs those up to 10 years of age at the end of the analysis period[3], considering as old SMEs all those over 10 years of age at the end of that period[4].

Table 1 presents the structure of the database considered in this study.

(Insert Table 1 About Here)

In order to test the robustness of the empirical evidence obtained, namely to see if it depends on the classification criterion used, we consider an alternative criterion for classifying young and old SMEs. According to this alternative criterion, we consider as

[3] which corresponds to the year 2006.

[4] Hyytinen and Pajarinen (2004), Oliveira and Fortunato (2006), Ferrando et al. (2007) and La Rocca et al. (2009) take the same criterion for classifying young SMEs and old SMEs.

young SMEs those entering the market in the period 1999-2006, considering the remainder as old SMEs[5]. The results are presented as an appendix.

3.2. Variables

The following table presents the variables used in this study, together with their corresponding measure[6].

(Insert Table 2 About Here)

As dependent variable we consider SME growth, given by the rate of asset growth. As independent variables, we consider: 1) age; 2) size; 3) expenditure on Research and Development; 4) cash flow, as a measure of internal financing; and 5) debt, as a measure of external financing.

3.3. Estimation Method

Studying the determinants of growth in SMEs, without correcting possible sample bias as a consequence of not considering the situation of firms that left the market during the period of analysis, could lead to bias in the results obtained, due to omitting the situation of firms with survival difficulties, a situation which may be different from that of firms with good survival possibilities.

---

[5] According to the alternative criterion, we consider as young SMEs those up to 7 years old, considering as old SMEs those over 7 years old. Robb and Robinson (2009) consider as young SMEs those up to 5 years old. In this study, use of dynamic estimators, with the consequent need for SMEs to be in the sample for at least four consecutive years for validity of the second order autocorrelation tests, recommends use of an alternative criterion with a higher maximum age for classifying young SMEs. However, the alternative criterion we use is similar to the one used by Robb and Robinson (2009), since by considering as young SMEs those entering in the period 1999-2006, their maximum age is 7 years. The alternative criterion used in this study is also relatively similar to that used by Steffens et al. (2009), the authors classifying as young SMEs those up to 8 years old, and those over 8 years old as old SMEs.

[6] The variables used, and the correspondent measures used, in this study are in agreement with other studies about SME growth, for example in: Heshmati, 2001; Becchetti and Trovato, 2002; Cabral and Mata, 2003; Yasuda, 2005; Honjo and Harada, 2006; Oliveira and Fortunato, 2006; Hölzl, 2009; Stam and Wennberg, 2009; Fotopoulos and Giotopoulos, 2010; Martin, 2010; Serrasqueiro et al., 2010).

The best way to solve this problem is to use the two-step estimation method proposed by Heckman (1979). At the first stage, considering all firms, both surviving and non-surviving, we estimate a probit regression, in which the dependent variable takes the value of 1 if the firm is in the market, and the value of 0 if it has left the market. As independent variables we consider the growth determinants used.

At a second stage, when estimating regressions relating to growth determinants, we only consider surviving firms, adding the Mill's inverse ratio as another explanatory variable, in order to control for possible data bias as a consequence of survival.

The probit regression estimated in the first step allows us to calculate the additional explanatory variable, the Mill's inverse ratio, which allows for control of possible sample bias.

The probit regression to estimate, corresponding to the first step, is given by:

$$\Pr(\delta_{i,t} = 1) = \tau_0 + \kappa GROW_{i,t-1} + \sum_{K=1}^{5} \tau_K X_{K,i,t-1} + S_S + d_t + z_{i,t}\,, \qquad (1)$$

in which: $GROW_{i,t-1}$ is growth in the previous period; $X_{K,i,t-1}$ is the vector of the growth determinants K considered in this study[7]; S_S are the sector dummy variables[8]; d_t are the annual dummy variables measuring the impact of changes in the economic situation on the probability of bankruptcy; and $z_{i,t}$ is the error.

After determining the Mill's inverse ratio[9], for each observation, we consider it as an additional explanatory variable of the growth of young and old SMEs.

[7] As already mentioned, we consider as determinants of growth in young and old Portuguese SMEs: 1) age; 2) size; 3) R&D expenditure; 4) cash flow, as a measure of internal financing; and 5) debt, as a measure of external financing.

[8] We consider sector dummy variables representing the main sectors of activity: 1) primary sector (I) including agriculture and fishing; 2) secondary sector (II) including industry and construction; and 3) tertiary sector (III) including services and commerce.

[9] The inverse Mill´s ratio is the ratio between cumulative density function and the density function. The designation of inverse Mill´s ratio is due to the fact that Mill´s ratio considers the inverse of Hazard ratio

At the second stage, to estimate regressions relating to the growth determinants, we use dynamic panel estimators, namely the GMM (1991), GMM system (1998) and LSDVC (2005) estimators. Using dynamic estimators has the following advantages over traditional panel models (random effect panel models and fixed effect panel models): 1) greater control of endogeny; 2) greater control of the possible collinearity of explanatory variables; and 3) greater effectiveness in controlling effects caused by the absence of relevant independent variables for explaining the dependent variable. Besides, using dynamic estimators allows us to determine correctly, i.e. without result bias, the persistence of growth in young and old SMEs.

The regressions to estimate, using the various dynamic panel estimators, are given by the following expression:

$$GROW_{i,t} = \beta_0 + \delta GROW_{i,t-1} + \sum_{K=1}^{5} \beta_K X_{k,i,t-1} + \beta_\lambda \lambda_{i,t} + S_S + d_t + v_i + e_{i,t}, \qquad (2)$$

in which : $\lambda_{i,t}$ is the Mill's inverse ratio; v_i are non-observable individual effects; and $e_{i,t}$ is the error which has normal distribution.

Estimating equation (2) with traditional panel models, namely with random and fixed effect panel models, we would obtain biased estimates of the estimated parameters, given the existence of correlation between v_i and $GROW_{i,t-1}$, and between $e_{i,t}$ and $GROW_{i,t-1}$.

Arellano and Bond (1991) recommend estimation of equation (2) with the variables in first differences, using the lags of growth and determinants at level. From estimating equation (2) in first differences, non-observable individual effects (v_i) are eliminated,

(also known as force of mortality). For a detailed description of calculation of the inverse Mill´s ratio, see Heckman (1979).

eliminating the correlation between v_i and $GROW_{i,t-1}$. Using lags of growth and determinants creates orthogonal conditions between e_{it} and $GROW_{i,t-1}$, eliminating their correlation.

However, Blundell and Bond (1998) state that in situations of a persistent dependent variable, i.e. when high correlation is found between the dependent variable in the previous and present period, and the number of periods is not very high, the GMM (1991) estimator gives inefficient results because the instruments are weak, leading to bias in the estimated results. That bias is particularly relevant with respect to the estimated parameter measuring the relationship between the dependent variable in the previous and present periods. In situations with high persistence of the dependent variable, Blundell and Bond (1998) propose use of an alternative estimator considering a system of variables at levels and in first differences. For the variables at levels, the instruments are given in first differences. For the variables in first differences, the instruments are given in levels.

For the results obtained with the GMM (1991) and GMM system (1998) estimators to be considered robust, two conditions must be checked: 1) the restrictions created from use of the instruments have to be valid; and 2) there can be no second order autocorrelation. To test the validity of the restrictions created from use of the instruments, we use the Sargan test in the case of the GMM (1991) estimator and the Hansen test in the case of the GMM system (1998) estimator. In both cases the null hypothesis is validity of the restrictions created by use of the instruments created, the alternative hypothesis being non-validity of the restrictions created by use of the instruments. We also test for the existence of first and second autocorrelation. The null hypotheses indicate non-existence of first and second order autocorrelation, the alternative hypotheses indicating existence of first and second order autocorrelation. If

we do not reject the null hypotheses of validity of the restrictions created by the instruments and non-existence of second order autocorrelation, we conclude that the results obtained with the GMM (1991) and GMM system (1998) estimators are robust.

Bruno (2005) concludes that in situations where neither the number of cross-sections nor the number of observations is very high, given the relatively high number of instruments compared to the number of observations, this can cause bias in the results obtained using the GMM (1991) and GMM system (1998) estimators. Considering that the number of cross-sections and consequently the number of observations is not particularly high, mainly concerning young SMEs, in this study we also use the Bruno (2005) estimator, Least Squares Dummy Variable Corrected – LSDVC, in order to test the robustness of the results previously obtained using the GMM (1991) and GMM system (1998) dynamic estimators.

With the aim of testing for differences in the relationships between determinants and growth for young SMEs and old SMEs, we use the Chow test[10]. We test for possible differences for each of the determinants considered in this study, as well as the global difference for the set of determinants considered. The null hypothesis is that there are no differences in the estimated parameters regarding relationships between determinants and growth for young SMEs and old SMEs, the alternative hypothesis being the existence of differences in the estimated parameters.

[10] We also use the Chow test to test for differences in survival determinants for young SMEs and old SMEs.

4. Results

4.1. Descriptive Statistics

The following table presents the results of the descriptive statistics of the variables used in this study.

(Insert Table 3 About Here)

We find that on average, growth of young SMEs is considerably greater than that of old SMEs. That greater growth in SMEs will certainly be related to young SMEs' need to attain a minimum size of efficiency that allows them to survive in their operating markets. As for the independent variables, we find that on average: 1) young SMEs have more intensive expenditure on R&D and greater debt than old SMEs; and 2) old SMEs have greater size and have greater cash flow than young SMEs.

4.2. Analysis of Survival

The following table presents the probit regressions relating to the analysis of survival in young SMEs and old SMEs.

(Insert Table 4 About Here)

The results estimated through probit regressions let us conclude that[11]: 1) growth in the previous period, age, size, cash flow and debt contribute to increased probability of

[11] In Appendix, table A1, presents the results of the survival analysis of young SMEs and old SMEs, considering the alternative criterion for classifying young and old SMEs presented above in section 3. Methodology. The results obtained, concerning sign, magnitude, and statistical significance of the estimated parameters, are relatively similar to those presented in Table 4, which confirms the robustness of the empirical evidence obtained in this study, concerning specifically the survival analysis made.

survival in young SMEs; and 2) age, R&D expenditure and debt contribute to increased probability of survival in old SMEs.

The following table presents the results of the Chow test of possible differences in the survival determinants of young SMEs and old SMEs.

(Insert Table 5 About Here)

We see that for all survival determinants of young SMEs and old SMEs, we reject the null hypothesis of equality of estimated parameters. The results of the overall chow test confirm those differences. The empirical evidence obtained shows that: 1) growth in the previous period, age, size, cash flow and debt are of greater relative importance for the survival of young SMEs than for the survival of old SMEs; and 2) R&D expenditure is of greater relative importance for the survival of old SMEs than for that of young SMEs.

4.3. Dynamic Panel Estimators

The following table presents the regressions relating to the growth determinants of young SMEs and old SMEs, using the GMM (1991), GMM system (1998) and LSDVC (2005) estimators[12].

(Insert Table 6 About Here)

We find the results obtained with the GMM (1991) estimator, whether considering young SMEs or old SMEs as the subject of analysis, are not robust. Indeed, use of the Sargan test rejects the null hypothesis of validity of the restrictions created by the

[12] In Appendix, table A2, presents the results relating to the growth determinants of young SMEs and old SMEs considering the alternative criterion for classifying young and old SMEs previously presented in section 3. Methodology. Concerning sign, magnitude and statistical significance of the estimated parameters, the results obtained are similar to those presented in Table 6, which confirms the robustness of the empirical evidence obtained on the growth determinants of young SMEs and old SMEs.

instruments used. Therefore, we cannot interpret the empirical evidence obtained for the relationships between determinants and growth in young SMEs and old SMEs using the GMM (1991) estimator.

The results of the Hansen test, whether focusing on young SMEs or old SMEs, indicate that we cannot reject the null hypothesis of validity of the restrictions created from the instruments used. In addition, in the case of both young SMEs and old SMEs, we cannot reject the null hypothesis of absence of second order autocorrelation. Based on the results of the Hansen and second order autocorrelation tests, we can consider the results obtained with the GMM system (1998) estimator as robust and consequently suitable for interpretation.

In general, the results obtained with the LSDVC (2005) estimator corroborate those obtained with the GMM system (1998) estimator, concerning sign, magnitude and statistical significance of the estimated parameters measuring the relationships between determinants and growth in young SMEs and old SMEs, which confirms the robustness of the empirical evidence obtained.

Since the results obtained with the GMM (1991) estimator cannot be considered robust, we interpret the empirical evidence obtained with the GMM system (1998) and LSDVC (2005) estimators.

The empirical evidence obtained allows us to conclude that: 1) growth in the previous period, R&D expenditure, cash flow and debt influence growth in young SMEs positively, whereas age and size influence the growth of this type of SME negatively; and 2) R&D expenditure and cash flow influence the growth of old SMEs positively, with growth in the previous period, age, size and debt having statistically insignificant relationships with their growth.

We also find that, irrespective of focusing on young SMEs or old SMEs, the relationship between the Mill's inverse ratio and growth is negative and statistically significant. Therefore, we can conclude that the two-step estimation method proposed by Heckman (1979) was shown to be efficient in correcting the bias of the estimated parameters as a consequence of the survival issue. In fact, not considering the Mill's inverse ratio in the growth regressions of young and old SMEs would lead to overvaluing the estimated parameters measuring relationships between determinants and growth.

The following table presents the results of the tests of possible difference in the estimated parameters measuring relationships between determinants and growth in young SMEs and old SMEs.

(Insert Table 7 About Here)

The results of the Chow test indicate that, whatever the estimator used, for all determinants the null hypothesis of equality of estimated parameters is rejected. The results of the tests of the global difference confirm that age is relevant in explaining the relationships formed between determinants and SME growth. We can therefore conclude that the relationships between determinants and SME growth are different according to SMEs being young or old.

5. Discussion of the Results

We find the relationship between age and growth in young SMEs is negative and statistically significant, while the relationship between age and growth in old SMEs is negative, but not statistically significant. Based on these results, we can consider the previous formulated hypothesis H1 as valid, since the negative relationship between age

and SME growth is of greater relative importance in the case of young SMEs than in old SMEs.

The search for a minimum size of efficiency that allows SMEs to survive in their markets seems to be particularly relevant in the case of young SMEs. The empirical evidence obtained in this study corroborates the arguments presented by Jovanovic (1982) and Fariñas and Moreno (1997) that in the first years of activity, SMEs' main concern is to reach a certain size that lets them survive in their markets. In addition, the greater perception of risk in young SMEs (Lumpkin, 1998; Shane and Venkataraman, 2000) may mean choosing profitable investments in the first years of activity, those investments contributing to this type of SME recording high rates of growth.

Lotti et al. (2009), in the context of Italian SMEs, find a negative relationship between age and growth in the first years of activity, the magnitude of that relationship diminishing as age increases to the extent of being statistically insignificant when firms reach more advanced stages of their life-cycle. The evidence obtained for Portuguese SMEs corroborates that obtained by Lotti et al. (2009) for Italian SMEs. The negative relationship between age and growth in young SMEs shows that in the first years of activity Portuguese SMEs record high rates of growth, with growth diminishing as they approach the minimum scale of efficiency that allows them to survive in their markets. The fact that age is of greater relative importance for the survival of young SMEs than for the survival of old SMEs is clearly indicative of the marginal importance of one more year of age in young SMEs for them to approach, or reach, a minimum size of efficiency that allows them to survive.

The statistically insignificant relationship found between age and growth in old SMEs indicates the search for a minimum size of efficiency ceases to be a strategic concern, possibly as a consequence of having already attained that size.

We find the relationship between size and growth in young SMEs is negative and statistically significant, whereas the relationship between size and growth in old SMEs is negative but not statistically significant. Therefore, we can accept the previously formulated hypothesis H2 as valid, since in the case of young SMEs Gibrat's "Law" is less likely to be accepted as valid, the negative relationship between size and growth being of greater relative importance than in old SMEs.

On one hand, the negative relationship between size and growth in young SMEs lets us conclude that small young SMEs grow more than larger young SMEs, with no confirmation of Gibrat's "Law". On the other, the statistically insignificant relationship between size and growth in old SMEs lets us conclude that growth in old SMEs is independent of size, confirming Gibrat's "Law" in these circumstances.

Concerning the relationship between size and growth, the empirical evidence obtained corroborates that obtained for the relationship between age and growth in young and old SMEs. In fact, the negative relationship between size and growth in young SMEs indicates, as forecast by Sutton (1997) and Audretsch et al. (2004), that small SMEs have higher growth rates than larger ones, since their aim is to reach a minimum size of efficiency to allow them to survive in their markets. This objective will be particularly relevant in the case of young SMEs in the first years of activity, since in most cases they have not yet reached a size that allows them to survive. Later, as young SMEs come closer to that minimum scale of efficiency, the rate of growth diminishes.

Confirmation of Gibrat's "Law" in the case of old SMEs agrees with the conclusions of Barkham et al. (1996). As in most cases, old SMEs have already attained a minimum size of efficiency that allows them to survive, this may contribute decisively to the strategy of this type of SME shifting towards investments that aim for maximizing

profits, growth ceasing to be dependent on SME size, unlike the situation in young SMEs where strategies aim essentially for survival.

In the context of Italian SMEs, Lotti et al. (2009) find that as SME age increases, there is a greater possibility of accepting Gibrat's "Law". According to the authors, this is due to the fact that older SMEs have already got over the survival stage, growth no longer being dependent on previous size. In the case of Greek SMEs, Fotopoulos and Giotopoulos (2010) conclude that Gibrat's Law is valid for young SMEs but not for old SMEs. The empirical evidence for Portuguese SMEs corroborates the empirical evidence obtained by Lotti et al. (2009) for Italian SMEs, and by Fotopoulos and Giotopoulos (2010), for Greek SMEs, since smaller young Portuguese SMEs grow more than larger young Portuguese SMEs, this not being found when analyzing old Portuguese SMEs, i.e. or in other words, Gibrat's Law is rejected in the case of young Portuguese SMEs, but is accepted as valid in the case of old Portuguese SMEs.

We also find that greater size in young Portuguese SMEs is a determinant factor for their survival, this not happening with old Portuguese SMEs. This result shows that the size of young Portuguese SMEs is important for this type of SME to reach a minimum size of efficiency in order to survive in its operating market.

We find a positive and statistically significant relationship between R&D expenditure and growth in young SMEs and old SMEs. However, the magnitude of the positive effect of R&D on growth is greater in old SMEs than in young SMEs. The results of the Chow test confirm the differences of magnitude of the impacts of R&D on the growth of young and old SMEs. Based on this empirical evidence, we can consider the previously formulated hypothesis H3 as valid, since R&D expenditure is of greater relative importance for growth in old SMEs than for growth in young SMEs.

Just as Montgomery (1994) and Sutton (1998) conclude, since in many cases R&D expenditure represents considerable sunk costs, it can serve as a barrier to new firms entering the operating markets of young and old SMEs that invest in R&D. Less competition can allow young and old SMEs to make more efficient use of the multiple investment opportunities that arise, which can mean increased growth.

Although the empirical evidence obtained in this study lets us conclude that the benefits of R&D for SME growth: greater capacity to diversify activities (Montgomery, 1994; Deloof, 2003; Rogers, 2004); greater export capacity (Beise-Zee and Rammer, 2006); greater capacity to establish cooperation networks (Rogers, 2004; Rickne, 2006); greater capacity to operate in certain specific markets (Jones, 1987, Hölzl, 2009; Stam and Wennberg, 2009); and greater organizational flexibility (Rogers, 2004), are relevant in the case of young SMEs and old SMEs, they seem to be of greater relative importance for the growth of old SMEs than for that of young SMEs.

The fact that R&D expenditure is of greater importance for the growth of old SMEs than for growth in young SMEs may be related to: 1) the importance of R&D for diversifying old SMEs' activities, a diversification which is particularly important when SMEs have already reached the minimum size of efficiency to let them survive in their markets; 2) the greater reputation (Diamond, 1989) and less possibility of bankruptcy (Müller and Zimmermann, 2009) can allow old SMEs that are short of internal financing to obtain credit on relatively advantageous terms, which allows more efficient management of financial resources and consequently more efficient use of the multiple investment opportunities that R&D expenditure provides; and 3) greater age of SMEs can mean more experience in managing R&D projects and greater ability to take on qualified human resources. The fact that R&D expenditure contributes to a greater

probability of survival in old SMEs but is irrelevant for the probability of survival in young SMEs shows the added importance of R&D in old SMEs.

The relationship between cash flow and growth in young and old SMEs is positive and statistically significant. However, the results of the Chow test indicate the magnitude of the estimated parameters is different according to focusing on young SMEs or old SMEs, the impact of cash flow on growth being greater in young SMEs than in old SMEs. Based on this empirical evidence obtained, we can consider the previously formulated hypothesis H4 as valid, since cash flow is of greater relative importance for growth in young SMEs than for growth in old SMEs.

Internal financing is important for growth in young and old SMEs. The empirical evidence corroborates what is forecast by Reid (2003), since a shortage of internal finance can affect the growth strategies of SMEs. The greater possibility of bankruptcy in SMEs (Ang, 1992; Müller and Zimmermann, 2009), as well as the greater ease of changing the composition of their assets (Pettit and Singer, 1985), compared to the case of large companies, may mean creditors giving difficult credit terms to this type of firm, contributing to internal financing having added importance as a source to finance growth.

However, we can expect creditors to make terms of credit particularly difficult for young SMEs, compared to the terms imposed on old SMEs, since: 1) given their lesser age, they have less reputation and can more easily change the composition of their assets; and 2) younger firms are more likely to go bankrupt, since in many cases they have not yet reached a minimum scale of efficiency that allows them to survive in their markets. More restrictive credit terms imposed on young SMEs can contribute decisively to internal finance being particularly important for financing the growth of this type of firm. The empirical evidence obtained seems to corroborate the conclusions

of Cooley and Quadrini (2001) and Cabral and Mata (2003), since young SME growth can be particularly affected by financing restrictions.

The empirical evidence obtained in Portugal corroborates the empirical evidence obtained by Honjo and Harada (2006), for Japanese SMEs, since the authors also find that cash flow is of greater relative importance for growth in young Japanese SMEs than in their older counterparts.

Besides the above, cash flow is important for the probability of survival in young SMEs, but is not relevant for the probability of old SMEs surviving. The importance of internal financing for the probability of young SMEs surviving indicates its importance for the activity of this type of SME.

We find a positive and statistically significant relationship between debt and growth in young SMEs, while the relationship between debt and growth in old SMEs is not statistically significant. This being so, we can consider the previously formulated hypothesis H5 as valid, since debt is of greater relative importance for the growth of young SMEs than for that of old SMEs.

Although SMEs may be particularly dependent on internal financing, due to the added difficulties in obtaining external finance as a consequence of market imperfections (Fazzari et al., 1988), when internal financing is insufficient, debt can be fundamental for financing SME growth (Meyer, 1998). In the Portuguese case, debt is only relevant for the growth of young SMEs, being of negligible importance for growth in old SMEs.

Observing the descriptive statistics, we find that the mean debt of young SMEs is 0.72361, while the mean debt of old SMEs is 0.65023. However, after breaking total debt down into short and long-term debt, we see on one hand that the mean short-term debt of young SMEs is 0.66112, the mean short-term debt of old SMEs being 0.52849.

On the other hand, the mean long-term debt of young SMEs is 0.06249, whereas the mean long-term debt of old SMEs is 0.12174. These different values of mean debt show that when internal financing is insufficient, young SMEs are particularly dependent on short-term debt to fund their growth, while old SMEs have the possibility to turn to long-term debt for this purpose.

Due to their excessive dependence on short-term debt when internal financing is insufficient, young SMEs can be subject to situations of liquidity shortage. Although as Fagiolo and Luzzi (2006) point out, liquidity is of particular importance for SMEs to be able to manage their financial resources efficiently, it does not appear to be a sufficiently relevant problem to mean diminished growth in young SMEs.

The greater possibility of bankruptcy in young SMEs (Ang, 1992; Müller and Zimmermann, 2009), as well as the greater possibility to change the composition of their assets (Pettit and Singer, 1985), compared to the case of old SMEs, may contribute to creditors making it particularly difficult for young SMEs to access long-term debt. Young SMEs will therefore have to be especially efficient at managing their financial resources, given the requirement to pay off the debt and its charges over a short and constant period.

As Baker and Nelson (2005) and George (2005) conclude, when SMEs resort to debt they are particularly efficient at managing their financial resources. The fact that when internal finance is insufficient, young SMEs are especially dependent on short-term debt, while old SMEs are especially dependent on long-term debt, may contribute decisively to young SMEs being more efficient at managing their external financing, compared to the case of old SMEs, debt contributing positively to the growth of young SMEs, something which does not occur in old SMEs.

The fact we find debt to be of greater relative importance for the probability of young SME survival than for the probability of old SMEs surviving indicates that debt, when internal financing is insufficient, is particularly relevant for the growth and survival of young SMEs.

Honjo and Harada (2006) find that debt is not relevant in explaining the growth of young Japanese SMEs. Contrary to what is found in the case of young Japanese SMEs, debt is a relevant determinant for growth in young Portuguese SMEs.

Given the use of dynamic panel estimators, we determine the relationship between growth in the previous period and growth in the present period. The empirical evidence obtained lets us conclude there is a positive, statistically significant relationship between previous growth and present growth in young SMEs, a positive, but not statistically significant relationship being found between previous and present growth in old SMEs. This empirical evidence indicates that growth in young SMEs is a continuous process, while continuity is not found in the growth of old SMEs. We also find that growth in the previous period is important for the probability of young SME survival, but is not important for the probability of survival in old SMEs.

This empirical evidence confirms the importance of the search by young SMEs for a minimum size of efficiency that allows this type of SME to survive in the operating market. In the first periods of activity, growth over time follows a line of continuity until SMEs come close to, or reach, a minimum scale of efficiency. In later stages of their life-cycle, when SMEs have already attained a minimum size of efficiency that lets them survive in their operating markets, growth ceases to be related to previous growth and previous size.

6. Conclusion and Implications

Based on two sub-samples of Portuguese SMEs: 1) 495 young SMEs; and 2) 1350 old SMEs, using the two-step estimation method, we examine if age is a determinant factor in the relationships formed between determinants and growth in SMEs.

The empirical evidence obtained lets us conclude that age is a relevant factor in the relationships formed between determinants and growth in young SMEs and old SMEs.

Firstly, we find that greater age and size contribute to reduced growth in young SMEs. In the case of old SMEs, age and size are not found to be relevant for their growth process. In addition, we find that growth in young SMEs is a continuous process, this not being so in old SMEs. These results show that on one hand the youngest SMEs grow more than slightly older ones, and on the other, that small young SMEs grow more than larger SMEs. The youngest and smallest SMEs grow with the aim of reaching a minimum size of efficiency that allows them to survive in their operating markets, growth diminishing as they approach that size. Concerning old SMEs, which in most cases have already reached survival, age and size are not relevant for their growth, and nor does growth show a continuous process over time. The greater importance of previous growth, age and size for the activity of young SMEs, compared to the case of old SMEs, is proven by their greater relative importance for survival.

Secondly, R&D expenditure is of greater relative importance for the growth of old SMEs than for growth in young SMEs. R&D expenditure seems to be relevant for old SMEs, having reached the minimum size of efficiency, being able to diversify their activities. What is more, greater experience in managing R&D projects, as well as greater ability to recruit qualified human resources, can contribute to greater efficiency in managing R&D investment in old SMEs, compared to the case with young SMEs. The fact that R&D expenditure is more relevant for the survival of old SMEs, than for

the survival of young SMEs, reveals the greater importance of R&D expenditure for the activities of old SMEs.

Thirdly, we find that cash flow and debt are of greater relative importance for growth in young SMEs, compared to their importance for the growth of old SMEs. On one hand, the greater difficulties of young SMEs in accessing debt can mean considerable dependence on internal financing as a way to finance growth. On the other, the greater probability of bankruptcy, and consequent need to reach a minimum size of efficiency to allow survival, together with the need to pay off short-term debts over a short and constant period, can contribute to young SMEs being particularly efficient at managing outside resources, contributing to debt being particularly important for the growth of this type of SME. The fact that cash flow and debt are important for a greater probability of survival in young SMEs confirms the importance of internal and external financing for the activity of this type of SME.

The multiple empirical evidence obtained in this study lets us provide different guidelines for economic policy in general, and industrial policy in particular: 1) for young SMEs, given the importance of debt when internal financing is insufficient to finance growth, we suggest the creation of special lines of credit that would allow young SMEs to manage their financial resources efficiently, without excessive stress in paying off contracted debt. Financial support directed specifically to young SMEs would help them reach a minimum size of efficiency more easily, allowing them to survive in their markets; and 2) for old SMEs, we suggest the creation of financial support specifically aimed at R&D projects, so that this type of SME, having reached the minimum size of efficiency and consequent survival, can diversify activities and continue the growth process. In addition, it could be advantageous to create tax

incentives, namely considerable tax deductions for R&D expenditure in old SMEs, in order to encourage continuous investment by this type of firm in R&D.

Appendix: Alternative Criterion for Selecting SMEs Based on Age

Table A1: Survival Analysis – Young SMEs and Old SMEs – Alternative Criterion for Selecting SMEs Based on Age

Dependent Variable: $\Pr(\delta_{i,t} = 1)$		
Independent Variables	Young SMEs	Old SMEs
$GROW_{i,t-1}$	0.08112***	0.01134
	(0.01984)	(0.01553)
$AGE_{i,t-1}$	0.11888***	0.03736***
	(0.02369)	(0.01374)
$SIZE_{i,t-1}$	0.14979***	0.00982
	(0.03491)	(0.02832)
$R\ \&\ D_{i,t-1}$	0.06730	0.31119***
	(0.08395)	(0.11224)
$CF_{i,t-1}$	0.44647***	0.07839
	(0.12445)	(0.09203)
$LEV_{i,t-1}$	0.19909***	0.08303**
	(0.05092)	(0.04123)
$CONS$	0.03829	0.02665
	(0.05990)	(0.05293)
$PseudoR^2$	0.50483	0.37449
$Log\ \ Likelihood$	-773.44	-722.03
$Firms$	236	1609
$Observations$	1228	10825

Notes: 1. Robust Standard Deviations in parenthesis. 2. *** statistically significant at 1% significance; and ** statistically significant at 5% significance. 3. Estimations include annual dummy variables, but estimated parameters are not presented in the tables.

Table A2: Growth Determinants – Young SMEs and Old SMEs – Alternative Criterion for Selecting SMEs Based on Age

	Dependent Variable: $GROW_{i,t}$					
		Young SMEs			Old SMEs	
Independent Variables	GMM (1991)	GMM system (1998)	LSDVC (2005)	GMM (1991)	GMM system (1998)	LSDVC (2005)
$GROW_{i,t-1}$	0.01234	0.13454***	0.12938***	0.00738	0.02454	0.01554
	(0.04754)	(0.03334)	(0.03984)	(0.02995)	(0.03839)	(0.03678)
$AGE_{i,t-1}$	0.00984	-0.05554***	-0.05984***	-0.01634	-0.01099	-0.01776
	(0.01465)	(0.01546)	(0.00989)	(0.01888)	(0.01456)	(0.02546)
$SIZE_{i,t-1}$	-0.03119***	-0.06777***	-0.06193***	-0.01243	-0.01939	-0.01558
	(0.00956)	(0.01566)	(0.01453)	(0.08435)	(0.02347)	(0.02442)
$R\ \&\ D_{i,t-1}$	-0.05647	0.10394***	0.11293***	0.08393**	0.30928***	0.28928***
	(0.17384)	(0.03478)	(0.03667)	(0.04119)	(0.05839)	(0.05564)
$CF_{i,t-1}$	0.13454***	0.65848***	0.58877***	0.06112	0.18374***	0.17383***
	(0.04736)	(0.09083)	(0.07032)	(0.14533)	(0.05668)	(0.05444)
$LEV_{i,t-1}$	0.03092	0.17634***	0.18394***	-0.00938	-0.04007	0.00837
	(0.10555)	(0.04113)	(0.04567)	(0.05558)	(0.08996)	(0.03870)
$\lambda_{i,t}$	-0.15663***	-0.12839***	-0.14987***	-0.16376***	-0.18553***	-0.15454***
	(0.04771)	(0.02309)	(0.03822)	(0.03939)	(0.05445)	(0.05002)
$CONS$	0.01343	0.01008		-0.01643	0.00988	
	(0.05454)	(0.03775)		(0.04444)	(0.01544)	
Firms	236	236	236	1411	1411	1411
Observations	949	1185	1185	7055	8466	8466
$Wald(\chi^2)$	174.14***			151.92***		
$F(N(0,1))$		94.02***			70.09***	
Sargan (χ^2)	42.33***			36.19***		
Hansen (χ^2)		132.88			122.88	
$m_1(N(0,1))$	-5.89***	-5.97***		-4.87***	-5.44***	
$m_2(N(0,1))$	-0.28	-0.34		-0.40	-0.59	

Notes: 1. Robust Standard Deviations in parenthesis. 2. *** statistically significant at 1% significance; and ** statistically significant at 5% significance. 3. Estimations include annual dummy variables, but estimated parameters are not presented in the tables.

References

Ang, J. (1992). On the Theory of Finance for Privately Held Firms. The Journal of Small Business Finance, *1*, 185-203.

Arellano, M. & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, Review of Economic Studies, *58*, 277-297.

Audretsch, D. & Elston, J. (2002). Does Firm Size Matter? Evidence on the Impact of Liquidity Constraints on Firm Investment Behavior in Germany. International Journal of Industrial Organization, *20*, 1-17.

Audretsch D., Klomp, L., Santarelli, E. & Thurik, A. (2004). Gibrat´s Law: Are the Services Different?. Review of Industrial Organization, *24,* 301-324.

Baker, T. & Nelson, R. (2005). Creating Something From Nothing: Resource Construction Through Entrepreneurial Bricolage. Administrative Science Quarterly, *50*, 329-366.

Barkham, R., Gudgin, G., Hart, M. & Harvey, E. (1996). The Determinants of Small Firm Growth: As Inter – Regional Study in the United Kingdom 1986-90. Routledge: London.

Becchetti, L. & Trovato, G. (2002). The Determinants of Growth for Small and Medium Sized Firms. Small Business Economics, *19*, 291-306.

Beise-Zee, R. & Rammer, C. (2006). Local User-Producer Interaction in Innovation and Export Performance of Firms. Small Business Economics, *27,* 207-222.

Blundell, M., & Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. Journal of Econometrics, *87*, 115 - 143.

Bruno, G. (2005). Approximating the Bias of LSDV Estimator for Dynamic Unbalanced Panel Data Models. Economic Letters, *87*, 361 - 366.

Cabral L. & Mata, J. (2003). On the Evolution of the Firm Size Distribution: Facts and Theory. The American Economic Review, *93*, 1075-1095.

Calvo, J. (2006). Testing Gibrat´s Law for Small, Young and Innovating Firms. Small Business Economics, *26*, 117-123.

Carpenter, R. & Petersen, B. (2002). Is the Growth of Small Firms Constrained by Internal Finance?. The Review of Economics and Statistics, *84*, 298-309.

Cooley, T. & Quadrini, V. (2001). Financial Markets and Firm Dynamics. The American Economic Review, *91*, 1286-1310.

Deloof, M. (2003). Does Working Capital Management Affect Profitability of Belgian Firms. Journal of Business Finance and Accounting, *30*, 573-588.

Diamond, D. (1989). Reputation Acquisition in Debt Markets. Journal of Political Economy*, 97*, 828-862

Fagiolo, G. & Luzzi, A. (2006). Do liquidity Constrains Matter in Explaining Firm Size and Growth? Some Evidence From the Italian Manufacturing Industry. Industrial and Corporate Change, *15*, 1-39.

Fariñas, J. & Moreno, L. (1997). Size, Age and Growth: an Application to Spanish Manufacturing Firms, Working Paper 9705*,* Fundación Empresa Pública, Universidad Complutense de Madrid: Madrid.

Fazzari M., Hubbard, S. & Petersen, B. (1988). Financing Constraints and Capital Investment. Brooking Papers of Economic Activity, *1*, 141-195.

Ferrando, A., Köhler-Ulbrich, P. & Pál, R. (2007). Is the Growth of Euro Area Small and Medium-sized Enterprises Constrained by Financing Barriers?. Conference Proceedings of Financial Management Association, Barcelona, Spain.

Fotopoulos, G. & Giotopoulos, I. (2010). Gibrat´s Law and Persistence of Growth in Greek Manufacturing. Small Business Economics, *35*, 191-202.

Freel, M. (2003). Sectoral Patterns of Small Firms Innovations, Networking and Proximity. Research Policy, *32*, 751 – 770.

George, G. (2005). Slack Resources and the Performance of Privately Held Firms. Academy of Management Journal, *48,* 661-676

Gibrat, R. (1931). Les Inégalités Économiques. Librairie du Recueil Sirey: Paris

Gomez, J. & Vargas, P. (2009). The Effect of Financial Constraints, Absorptive Capacity and Complementarities on the Adoption of Multiple Process Technologies. Research Policy, *38,* 106 – 119.

Heckman, J. (1979). Sample Selection Bias as a Specification Error. Econometrica, *47*, 153 – 161.

Heshmati, A. (2001). On the Growth of Micro and Small Firms: Evidence From Sweden. Small Business Economics, *17*, 213-228.

Hölzl, W. (2009). Is the R&D Behaviour of Fast-Growing SMEs Different? Evidence From CIS III Data For 16 Countries. Small Business Economics, *33*, 59-75.

Honjo, Y. & Harada, N. (2006). SME Policy, Financial Structure and Firm Growth: Evidence From Japan. Small Business Economics, *27*, 289-300.

Hyytinen, A. & Pajarinen, M. (2004). Is the Cost of Debt Capital Higher for Younger Firms? The Research Institute of the Finnish Economy, Discussion Paper Nº. 946.

Jones, B. (1987). Diversification by Small and Medium – Size Enterprises With Special Reference to Australia. Journal of Small Business and Entrepreneurship, *4*, 25 – 31.

Jovanovic, B. (1982). Selection and Evolution of Industry. Econometrica, *50*, 649-670.

La Rocca, M., La Rocca, T. & Cariola, A. (2009). Capital Structure Decisions During a Firm`s Life Cycle. Small Business Economics, *ifirst*, Forthcoming.

Lotti, F., Santarelli, E. & Vivarelli, M. (2009). Defending Gibrat`s Law as a Long – Run Regularity. Small Business Economics, *32*, 31-44.

Lumpkin, G. (1998). Do New Entrants Have an Entrepreneurial Orientation?. Paper Presented at the 1998 Academy of Management Meeting, San Diego, CA.

Martin, F. (2010). Quantile Estimates of the Impact of R&D Intensity on Firm Performance. Small Business Economics, *ifirst*, Forthcoming.

Mata, J. (1994). Firm Growth During Infancy. Small Business Economics, *6*, 27-39.

Meyer, L. (1998). The Present and Future Roles of Banks in Small Business Finance. Journal of Banking and Finance, *22*, 1109-1116.

Montgomery, C. (1994). Corporate Diversification. Journal of Economic Perspectives, *8*, 163-178.

Moreno, A, & Casillas, J. (2007). High – Growth SMEs Versus Non – High Growth SMEs: a Discriminant Analysis. Entrepreneurship and Regional Development, *19*, 69 – 88.

Müller, E. & Zimmermann, V. (2009). The Importance of Equity Finance for R&D Activity. Small Business Economics, *33*, 303 – 318.

Oliveira, B. & Fortunato, A. (2006). Firm Growth and Liquidity Constraints: A Dynamic Analysis. Small Business Economics, *27*, 139-156.

Pettit, R. & Singer, R. (1985). Small Business Finance: a Research Agenda. Financial Management, *14*, 47-60.

Reid, G. (2003). Trajectories of Small Business Financial Structure. Small Business Economics, *20*, 273-285.

Rickne, A. (2006). Connectivity and Performance of Science-Based Firms. Small Business Economics, *26*, 393-407.

Robb, A. & Robinson, D. (2009). The Capital Structure Decisions of New Firms. Working Paper.

Rogers, M. (2004). Networks, Firm Size and Innovation. Small Business Economics, *22*, 141-153.

Serrasqueiro, Z., Maçãs Nunes, P., Leitão, J. & Armada, M. (2010). Are There Non-Linearities Between SME Growth and its Determinants? A Quantile Approach. Industrial and Corporate Change, *19*, 1071-1108.

Shane, S. & Venkataraman, S. (2000). The Promise of Entrepreneurship as a Field of Research. Academy of Management Review, *25*, 217-226.

Stam, E. & Wennberg, K. (2009). The Roles of R&D in New Firm Growth. Small Business Economics, *33*, 77-89.

Steffens, P., Davidsson, P. & Fitzsimmons, J. (2009). Performance Configurations Over Time: Implications For Growth-and Profit, Oriented Strategies. Entrepreneurship Theory and Practice, *33*, 125-148.

Sutton, J. (1997). Gibrat´s Legacy. Journal of Economic Literature, *35*, 40-59.

Sutton, J. (1998). Technology and Market Structure. Cambridge, MIT Press.

Tanabe, K. & Watanabe, C. (2005). Sources of Small and Medium Enterprises Excellent Business Performance in a Service Oriented Economy. Journal of Services Research, *5*, 5 – 20.

Yasuda, T. (2005). Firm Growth, Size, Age and Behaviour in Japanese Manufacturing. Small Business Economics, *24*, 1-15.

Table 1: Description of Database

	Young SMEs		Old SMEs	
	Firms	Observations	Firms	Observations
Firms Present in the Whole Period 1999 – 2006	223	1561	1188	8316
Firms Entering the Market in the Period 1999 –2006	236	1228	0	0
Firms Leaving the Market in the Period 1999-2006	36	172	162	776
Total Number of Firms	495		1350	
Total Number of Observations		2961		9092

Table 2: Variables and Measures

Variables	Measures
Growth ($GROW_{i,t}$)	Rate of Asset Growth
Age ($AGE_{i,t}$)	Logarithm of the Number of Years since Starting Activity
Size ($SIZE_{i,t}$)	Logarithm of Assets
Research and Development ($R\ \&\ D_{i,t}$)	Ratio of R&D expenditure to Total Assets
Cash Flow ($CF_{i,t}$)	Ratio of the sum of Net Results with Repayments to Total Assets
Debt ($LEV_{i,t}$)	Ratio of Total Liabilities to Total Assets

Table 3: Descriptive Statistics

	Young SMEs					Old SMEs				
Variable	N	Mean	S.D.	Min.	Max.	N	Mean	S. D.	Min.	Max.
$GROW_{i,t}$	2961	0.16178	0.50061	-2.70656	14.6743	9092	0.05433	0.34179	-0.96721	5.93132
$AGE_{i,t}$	2961	1.67492	0.31669	0	2.30258	9092	3.10792	0.52409	1.79175	5.09621
$SIZE_{i,t}$	2961	14.3602	1.28728	10.3662	17.3724	9092	15.1502	1.21112	10.6272	17.6963
$R\ \&\ D_{i,t}$	2961	0.00967	0.03166	0	0.69492	9092	0.00957	0.03541	0	0.66492
$CF_{i,t}$	2961	0.06233	0.08883	-0.34734	1.35330	9092	0.07498	0.94924	-0.23433	1.48341
$LEV_{i,t}$	2961	0.72361	0.21283	0.05019	0.99471	9092	0.65023	0.18727	0.00017	0.99829

Table 4: Survival Analysis – Young SMEs and Old SMEs

Dependent Variable: $\Pr(\delta_{i,t} = 1)$		
Independent Variables	Young SMEs	Old SMEs
$GROW_{i,t-1}$	0.06093***	0.02082
	(0.01647)	(0.01894)
$AGE_{i,t-1}$	0.10389***	0.04228***
	(0.02098)	(0.01458)
$SIZE_{i,t-1}$	0.13765***	0.02109
	(0.03289)	(0.03117)
$R\ \&\ D_{i,t-1}$	0.08764	0.30938***
	(0.10928)	(0.09747)
$CF_{i,t-1}$	0.41435***	0.09123
	(0.10432)	(0.09674)
$LEV_{i,t-1}$	0.17829***	0.08637**
	(0.04472)	(0.04289)
$CONS$	0.03495	0.02838
	(0.05845)	(0.05508)
$PseudoR^2$	0.48839	0.39657
$Log\ \ Likelihood$	-766.22	-726.98
$Firms$	495	1350
$Observations$	2961	9092

Notes: 1. Robust Standard Deviations in parenthesis. 2. *** statistically significant at 1% significance; and ** statistically significant at 5% significance. 3. Estimations include annual dummy variables, but estimated parameters are not presented in the tables.

Table 5: Chow Test – Differences for Survival Determinants – Young and Old SMEs

	Dependent Variable: $\Pr(\delta_{i,t} = 1)$
Independent Variables	
$(GROW_{i,t-1})\,\alpha_{YOUNG} - \alpha_{OLD} = 0$	18.07***
$F(1,12053)$	(0.0000)
$(AGE_{i,t-1})\,\tau_{1YOUNG} - \tau_{1OLD} = 0$	12.45***
$F(1,12053)$	(0.0000)
$(SIZE_{i,t-1})\,\tau_{2YOUNG} - \tau_{2OLD} = 0$	19.12***
$F(1,12053)$	(0.0000)
$(R\ \&\ D_{i,t-1})\,\tau_{3YOUNG} - \tau_{3OLD} = 0$	21.99***
$F(1,12053)$	(0.0000)
$(CF_{i,t-1})\ \tau_{4YOUNG} - \tau_{4OLD} = 0$	36.33***
$F(1,12053)$	(0.0000)
$(LEV_{i,t-1})\,\tau_{5YOUNG} - \tau_{5OLD} = 0$	15.02***
$F(1,12053)$	(0.0000)
Global Difference	22.12***
$F(6,12053)$	(0.0000)

Notes: 1. *** statistically significant at 1% significance. 2. Probabilities in parenthesis.

Table 6: Growth Determinants – Young SMEs and Old SMEs

	Dependent Variable: $GROW_{i,t}$					
	Young SMEs			Old SMEs		
Independent Variables	GMM (1991)	GMM system (1998)	LSDVC (2005)	GMM (1991)	GMM system (1998)	LSDVC (2005)
$GROW_{i,t-1}$	0.01092	0.11928***	0.10909***	0.00928	0.02113	0.01773
	(0.03097)	(0.03029)	(0.03227)	(0.02782)	(0.03554)	(0.03332)
$AGE_{i,t-1}$	0.00786	-0.05029***	-0.05473***	-0.02738*	-0.01164	-0.01588
	(0.01332)	(0.01245)	(0.00701)	(0.01407)	(0.01179)	(0.01909)
$SIZE_{i,t-1}$	-0.02637***	-0.06001***	-0.05776***	-0.01432	-0.01784	-0.01376
	(0.00873)	(0.01223)	(0.01118)	(0.09923)	(0.01991)	(0.02008)
$R\ \&\ D_{i,t-1}$	-0.09873	0.11238**	0.13289***	0.06832*	0.32637***	0.30828***
	(0.23631)	(0.05342)	(0.04012)	(0.03544)	(0.06534)	(0.05099)
$CF_{i,t-1}$	0.11123**	0.59838***	0.53628***	0.05636	0.16273***	0.14353**
	(0.05006)	(0.07623)	(0.06524)	(0.12278)	(0.04733)	(0.06998)
$LEV_{i,t-1}$	0.02788	0.14259***	0.15117***	-0.01119	-0.04329	0.01129
	(0.09898)	(0.03009)	(0.04118)	(0.04839)	(0.07766)	(0.045243)
$\lambda_{i,t}$	-0.12889***	-0.10625***	-0.13445***	-0.178273***	-0.18801***	-0.16615***
	(0.03966)	(0.01997)	(0.03298)	(0.04029)	(0.05004)	(0.04887)
$CONS$	0.00982	0.01334		-0.01283	0.00652	
	(0.02938)	(0.03992)		(0.02989)	(0.0177)	
Firms	459	459	459	1188	1188	1188
Observations	2064	2523	2523	5940	7128	7128
$Wald(\chi^2)$	172.98***			152.119***		
$F(N(0,1))$		92.23***			71.44***	
Sargan (χ^2)	44.18***			42.33***		
Hansen (χ^2)		135.10			126.61	
$m_1(N(0,1))$	-5.44***	-5.79***		-5.03***	-5.36***	
$m_2(N(0,1))$	-0.26	-0.38		-0.47	-0.52	

Notes: 1. Robust Standard Deviations in parenthesis. 2. *** statistically significant at 1% significance; and ** statistically significant at 5% significance. 3. Estimations include annual dummy variables, but estimated parameters are not presented in the tables.

Table 7: Chow Test – Growth Determinants – Young SMEs and Old SMEs

	Dependent Variable: $PROF_{i,t}$	
Independent Variables	GMM system (1998)	LSDVC (2005)
$(GROW_{i,t-1})\ \delta_{YOUNG} - \delta_{OLD} = 0$ $F(1,9651)$	17.89*** (0.0000)	17.02*** (0.0000)
$(AGE_{i,t-1})\ \beta_{1YOUNG} - \beta_{1OLD} = 0$ $F(1,9651)$	18.98*** (0.0000)	19.22*** (0.0000)
$(SIZE_{i,t-1})\ \beta_{2YOUNG} - \beta_{2OLD} = 0$ $F(1,9651)$	17.02*** (0.0000)	16.68*** (0.0000)
$(R\ \&\ D_{i,t-1})\ \beta_{3YOUNG} - \beta_{3OLD} = 0$ $F(1,9651)$	14.44*** (0.40000)	12.83*** (0.0000)
$(CF_{i,t-1})\ \beta_{4YOUNG} - \beta_{4OLD} = 0$ $F(1,9651)$	18.92*** (0.0000)	17.20*** (0.0000)
$(LEV_{i,t-1})\ \beta_{5YOUNG} - \beta_{5OLD} = 0$ $F(1,9651)$	15.16*** (0.0000)	14.99*** (0.0000)
Global Difference $F(6,9651)$	19.01*** (0.0000)	17.34*** (0.0000)

Notes: 1. *** significant at 1% significance. 2. Probabilities in parenthesis.