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The determinants of growth for SMEs. A longitudinal study from French manufacturing firms*

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Abstract

This paper investigates the structural and strategic determinants of firm growth using a unique data set for French firms employing between 10 and 250 employees in 1997 and active over the period 1997-2007. Starting from the idea that firm growth is not only a random process but that some regularities may be emphasized, we consider a growth model that combines different elements presented as determinant in the firm's growth path. Results based on two families of multinomial logit model does not confirm the conclusions about the exclusive role played by the previous size. In addition, thanks to the references to legal structure, market share and localization, one observes these variables shape strongly the individual growth path. However environment and structural elements are not the only elements to focus on in order to provide an explanation of the employment growth rate at the firm level. Strategic factors matter too. In particular we demonstrate, the crucial role of labor costs and financial structure as explanatory variables of firm growth.

Keywords: Firm growth, SMEs, Gibrat's law, French manufacturing, multinomial logistic regression
JEL Code: L25, C1, D22

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1 Introduction

The literature on the growth of firms was initiated in 1931, with the publication of Robert Gibrat's PhD. thesis entitled "Inégalités Économiques". Gibrat (1931) was the first to present a formal model of firm growth and industry structure that continues to influence industrial organization analysis today. His methodology is based on the assumption that during each period, the growth rate for each firm in a market is an independent, identically distributed random variable (for a discussion of this assumption, see Sutton 1997) what launched "the law of proportional effect", which stated that the expected increase in firm size is proportional to the current size. However, despite substantial increase in research volume, and a considerable amount of empirical works, recent reviews of the literature suggest that little is still known about the phenomenon and a lot remains to be done (Storey 1994, Wicklund 1999).

The purpose of this paper is to enlighten the growth process by following a cohort of firms identified as being SMEs in 1997. One possible way to address this question is to focus on Gibrat's Law in order to determine whether it is admissible or not. A big bunch of literature proceeds this way. One part confirms Gibrat's intuition demonstrating that firm's growth follows a random process (Geroski 2005) but a growing number of recent empirical studies contest this point of view, showing the limits of Gibrat's law (Santarelli and *al.* 2003, Rossi-Hansberg and Wright 2007), mainly because of the statistical properties of the data. Firstly, the variance of firm size does not tend to infinity contrary to results implied by Gibrat's model (Kalecki 1945). Furthermore, the distribution of growth rates is not normally distributed, but instead resembles the Laplace or "symmetric exponential" since growth is not equally distributed amongst firms of different sizes (Diaz-Hermelo and Vassolo 2007, Reichtein and Jensen 2005). Whilst a 'weak' version of Gibrat's law merely supposes that expected growth rate is independent of firm size, stronger versions of Gibrat's law imply a range of other issues. For example, Chesher (1979) rejects Gibrat's law due to the existence of an autocorrelation structure in the growth shocks. Bottazzi and Secchi (2006a) reject it too on the basis of a negative relationship between growth rate variance and firm size. That is why, looking carefully at the distribution of firms size and growth rate, several recent researches establish that firm size usually experiences a slight reversion to the mean (Sutton 1997, for a review). Many papers aim hence at demonstrating that growth is the result of the combination of different factors ranging from financial to environmental ones including productive and technical elements.

Considering then that growth is everything but a random process, this paper aims at identifying the key determinants of the growth rate using a cohort of 12 811 firms active over the period 1997-2007 whose accounts books are available for every year. All of these firms were SMEs in 1997 and can either grow or diminish over the time. Turning towards a literature that refers to the determinants of firm's growth, we propose a comprehensive research in this field putting all together main streams in firm growth analysis (see Wicklund and *al.* 2009). We thus conceive the growth of firm as the result of a combination of variables whose some are inspired by the resource based view inherited from Edith Penrose. That takes into account the environment of the firm thanks to industry and market wide variables. Some others determinants integrate entrepreneurial orientation given by shareholders perspective and control. From this perspective, we build an integrative multivariate model that embeds a set of variables representing each field. Two versions of generalized logit model are compared:

a pooled mulinomial logit model and an hybrid multinomial logit model that takes into account the longitudinal nature of the data. The results show, whatever the technique used, that growth rate does not depend only upon the previous size but that other variables whose influence varies according their status count too. This leads us to understate the Gibrat's hypothesis, since initial size matters. However, the impact of this variable is small and almost the same whatever the growth level considered which weakens our rejection. Structural variable such as industry, localization, age, and market size intervene as the major determinants of growth in employment. They are completed by strategic choices concerning the process of production and the financial structure. The conjuncture matters also. At an individual level, the growth rate results thus of a combination of variables that shape the firm's growth path and whose structure differs according to the rhythm of growth. The organization of the paper proceeds as follows. First section consists in a brief overview of the literature that gives the grounds to develop our hypotheses. Second section presents the data and the methodology. The empirical results are shown and discussed in section three. We conclude considering the implications of the study.

2 The theoretical and empirical literature on firm's growth: the state of art

Growth is sometimes regarded as the most important, reliable and easily accessible measure of a firm's performance (Wicklund 1999, Delmar 1997). As growth is a complex and multidimensional phenomenon (Weinzimmer 1993), a purely internal approach, limited to the impact of the resources, neglects the prediction potential of variables linked to the firm, the strategy, the environment and the interactions between these different types of variables. A really exhaustive presentation of the possible factors at the origin of firm's growth has been done by Coad (2007b). We only depict here the sets of variables that determine the growth process introducing a difference between environment and structural factors on one hand (2.1) and strategic elements controlled at the firm level on the other (2.2).

2.1 Structural variables

2.1.1 Location

Many external factors may influence the growth of the firm. The population ecology theory suggests that organizational survival and performance are determined by environmental selection (Aldrich 1979, Hannan and Freeman 1977). The founding conditions (Carroll and Hannan 1989, Stinchcombe 1965) and the characteristics of the environment have an important role in explaining organizational growth. For example, Carlsson (2002) or Davidsson and Henreksson (2002) found that institutional factors, such as regulations, taxation, scientific resources or capital availability, may affect the growth of independent businesses. In a broader context, Shane and Kolvereid (1995) suggest that variations in national environments accounted for almost all performance changes. Since the conjuncture and the general tendencies of the environment cannot be ignored in proposing an explanation of the growth process (Davidsson and *al.* 2002), we assume here that the location has a potential influence on firm growth. To support

this idea one can quote Storey (1994) that has argued that firm location may be important determining growth since the local market binds firms. We are thus allowed to formulate a first hypothesis according to:

H1A: Local market size positively affects firm growth.

It is nevertheless possible that in many cases the local market binds firm growth, but a firm does not necessarily restrain its sales to its local market. Therefore, the diversification into alternative geographic markets, such as nation-wide and international markets, will have an impact on growth instead of the firm's location. The relationship between firm growth and export has been extensively analyzed in literature since the mid 1990s. Wagner (2007) surveys 45 microeconometric studies with data from 33 countries published between 1995 and 2004. He concludes that exporters are more productive than non-exporters, and that the more productive firms self-select into the export markets, while exporting does not necessarily improve productivity (*ibid.*).

However empirical works fail in supporting a unique view concerning the relationship between exportation and growth at the firm level. This question is difficult to answer by simply observing the correlation between exports and firm performance in existing datasets, because exporting may be the consequence, and not the cause of high firm productivity (Melitz 2003). By the way, theoretical and empirical literature finds a two-way causal relationship between efficiency and export status (Aw and Hwang 1995, Clerides and *al.* 1998). The dilemma and the resulting apparent contradiction is often resolved, as in Becchetti and Trovato (2002), considering that since theoretical and empirical literature finds a two-way causal relationship between efficiency and export status it legitimates the introduction of exports as an additional explanatory variable of growth. That is why, still following Becchetti and Trovato (2002) that brought some evidence of the positive relationship between access to export markets and growth for firms employing more than 100 workers, we introduce an additional hypothesis.

H1B: Exports positively affect firm growth.

2.1.2 Industry

Broadly speaking, the population ecology literature emphasizes the prevalence of industry-specific factors in explaining growth of firms, because they share the same resources pool. In fact, from Schmalensee (1985) an important body of empirical work has sought to examine the relative impact of industry on firm's performances (see for example Rumelt 1991, and McGahan and Porter 1997). The results obtained differ considerably in relative magnitude estimates, a fact that may be attributed to different samples, operationalization of measures, and econometric specification employed.

Most of the literature nevertheless admits that the growth of firms varies across sectors and highlights several reasons to expect such a relationship. For instance, firms in high-technology industries may have high growth rates due to the rapid pace of technological progress and the apparition of new products, which may have an impact on the growth patterns of firms in different industries (Pavitt 1984). Being often shaped by sector-specific considerations, competition and concentration also strengthen the link between the growth of firms and industry.

Seminal works in this vein are due to Audretsch and Mahmood (1994) and Audretsch (1995) that provide evidence that industry growth has a positive effect on firm growth. Following them, several scholars conclude that the more dynamic indus-

tries are, the higher the number of growing firms can be found (Carroll and Hannan 2000, Jovanovic 1982). A more surprising result comes from Gabe and Kraybill (2002) analysis of a sample of Ohio establishments. Albeit the results of the tests are not significant, they conclude that the growth of firms is positively associated with the average size of plants in the same 2-digit industry.

We take thus into consideration the linkage between the industry and the rate of growth measured at the firm level but as a control variable only, to assess possible differences among industrial subsectors. That is why no hypothesis is presented there. We only expect to observe a significant relationship between the industry and the dependent variable.

2.1.3 Previous size

The basic tenet underlying Gibrat's Law is that the growth rate of a given firm is independent of its initial size at the beginning of the examined period (Gibrat 1931). In other words, "the probability of a given proportionate change in size during a specified period is the same for all firms in a given industry - regardless of their size at the beginning of the period" (Mansfield 1962, p. 1031).

We do not support this point of view however. Indeed, a large and growing body of research reports a negative relationship between size and growth. We can mention the work by Kumar (1985) and Dunne and Hughes (1994) for quoted UK manufacturing firms, Hall (1987), AmirKhalkhali and Mukhopadhyay (1993) and Bottazzi and Secchi (2003) for quoted US manufacturing firms (see also Evans 1987a for US manufacturing firms of a somewhat smaller size), Gabe and Kraybill (2002) for establishments in Ohio, and Goddard and *al.* (2002) for quoted Japanese manufacturing firms. The reason is that in manufacturing industries, substantial sunk costs and high capital investment determine the presence of high scale economies. Accordingly, the consequences of low or negative growth for small firms in such industries are elevated costs, leading to a lower probability of survival.

As a result of this survival bias, surviving small firms in such industries have systematically higher rates of growth than their larger counterparts, resulting in a violation of Gibrat's Law of Proportionate Effect. Some empirical investigations into Gibrat's law have focused on the services industry. The results, however, often confirm those gotten for manufacturing industry: they exhibit a negative relationship between size and expected growth rate for services too (see Variyan and Kraybill 1992, Johnson and *al.* 1999, Piergiovanni et *al.* 2002) Nevertheless, it should be mentioned that in some cases a weak version of Gibrat's law cannot be convincingly rejected, since there appears to be no significant relationship between expected growth rate and size (see the analyses provided by Bottazzi and *al.* 2009 for French manufacturing firms, Droucopoulos 1983 for the world's largest firms, and Audretsch and *al.* 2004 for small-scale Dutch services).

Notwithstanding these latter studies, however, we acknowledge that in most cases a negative relationship between firm size and growth is observed. Moreover, and in accordance with Mansfield's third rendition, a threshold effect is however often reminded by the authors that introduce a difference according to firms' size. One of the first papers in this field is due to Mowery (1983). He analyzes two samples of firms, one of which contains small firms while the other contains large firms. Gibrat's law is seen to hold in the latter sample, whereas mean reversion is observed in the former.

A similar result is reached by Hart and Oulton (1996). Considering a large sample of UK firms, they observe a mean reversion in the pooled data whereas a decomposition of the sample according to size classes reveals no relation between size and growth for the larger firms. In the same vein, results reported by Becchetti and Trovato (2002) for Italian manufacturing firms, and Geroski and Gugler (2004) for large European firms also find that the growth of large firms is independent of their size, although including smaller firms in the analysis introduces a dependence of growth on size.

The general finding of empirical studies dealing with such industries is that firms' growth is not equi-proportional, since smaller firms grow at a higher rate compared with their larger counterparts. One should then stick to Caves (1998) remarks that Gibrat's law holds for firms above a certain size threshold, whilst for smaller firms growth rates decrease with size. Looking at a sample composed of SMEs employing more than 10 and less that 250 employees, we can then formulate the following assumption:

H2: The size negatively impacts the rate of growth.

2.1.4 Age

In connection with the previous linkage, the relationship between a firm's age and its growth rate has also been frequently investigated. One of the first empirical studies about the influence of age on growth was made by Fizaine (1968), who examined the growth of enterprises from the French county of Bouches-du-Rhône. She concluded firstly that age has a negative effect on the growth of establishments, and also older the firm, smaller the variance of growth. Almost twenty years before Evans (1987a), Fizaine (1968) brought some evidence about the causality between the two variables. Whereas many investigations into firm growth based on Gibrat's law considered that the causality goes from size to growth, Fizaine demonstrated that the reverse is true. The same result was reached by Dunne and *al.* (1989). Analyzing US establishments they conclude that the expected growth rate on one hand and the growth variance on the other decrease with age.

This last finding is consistent with the idea that firms gradually learn their relative efficiency in the market after entry and need to grow at a higher rate if they want to survive (Jovanovic 1982, Geroski 1995, Baldwin and Rafiquzzaman 1995). This presentation of the existing literature about the relationship between age and growth rate would not be complete without quoting the paper by Brock and Evans (1989) that contrasts with the other results pointing out two regimes according to the firm's size. They found that firm growth decreases with firm age for firms with fewer than 25 employees, but increases with firm age for firms with more than 25 employees. Given that our sample consists of firms employing more than 10 workers, we would merely expect to find a negative relationship between growth and age of the firm what leads to formulate a third hypothesis such as:

H3: Firm growth decreases with firm age.

2.1.5 Legal form and management structure

Several factors can explain the association between legal form and firm growth. For instance, listed companies have the ability to issue stock and their stockholders have the freedom to resell their shares. This ability facilitates the process of raising capital for expansion. Such a difference however does not fit with the analysis of SMEs growth.

But without considering listed companies, it is also possible to assume that legal status has an influence and firms with limited liability have significantly higher growth rates in comparison with other companies (Harhoff and *al.* 1998). We just enlarge and adapt this possibility considering what is nowadays presented as a clear cut between the firms according to their legal form, i.e., the fact to belong to a group or to be independent. Legal status is however quite difficult to adopt.

The fact of being incorporated into a group drastically changes the strategic behavior and the becoming of a firm as shown by Thollon-Pommerol (1990). Taking into account such a characteristic is essential in an empirical analysis providing that groups of firms have become one of the salient facts in the transformation of productive system (Picart 2006). Ownership structure affect growth, when this latter is taken at the plant-level. Evidence suggests that the expected growth rate of a plant declines with size for plants owned by single-plant firms but increases with size for plants owned by multi-plant firms (Dunne and *al.* 1989).

H4: Firms embedded in business groups have a higher rate of growth than independent ones.

2.2 Economic and productive variables

The papers by Harhoff and *al.* (1998), Becchetti and Trovato (2002) initiated researches on a multivariate empirical analysis of firm's growth. Showing that the rate of growth for a sample of Italian SMEs is not due to chance, they enhance the role of finance and other variables. We refer to their conclusions and, more generally, to the resource based view to introduce additional explanatory variables.

2.2.1 Productivity

The relationship between productivity and firm's growth has been abundantly discussed by the literature. An early discussion of the subject can be found in Penrose (1995), who suggested that firm growth leads to decreases in productivity above a certain growth rate (the 'Penrose effect'). On the opposite, when applied at the firm level, the Kaldor-Verdoorn concept of 'dynamic increasing returns' consider that productivity growth is positively correlated to firm growth. Expanding firms may invest in new technologies and learn about more efficient methods of production. Evolutionary theory (Metcalfe 1994) strengthens this idea assuming that the most productive firms will grow in size as a result of resource reallocation from less to more productive firms. However, this assumption does not seem to be borne out by empirical work. Baily and *al.* (1996) observe that, among plants with increasing labor productivity between 1977 and 1987, firms that grew in terms of employees were balanced out by firms that decreased employment. Similarly, using a database of Italian manufacturing firms, Bottazzi and *al.* (2002, 2006) fail to find a robust relationship between productivity and growth, whereas Disney and *al.* (2003) put on light a negative interaction in allocation of market share between establishments according to productivity. This conclusion is confirmed by Coad and Broekel (2007) according to, if employment growth is negatively associated with subsequent growth of productivity, this result is however sensitive to the choice of productivity indicator.

Considering that firm's growth requires efficient productive resources and that labor tends to migrate from less productive industries to those industries with relatively

better performances, we assume that firm's growth depends positively on labor productivity, as highlight by the Kaldor-Verdoorn law.

H5: The labor productivity positively impacts the rate of growth.

2.2.2 Financial resources

Besides researches taking into account production factors in the firm's growth process, Marris and Wood (1971) introduced financial resources constraints as a determinant of firms growth. A large diversity in the nature of financial means is introduced. They could be found through in retained earnings, borrowing, and new issues of stock shares. At a national level, Rajan and Zingales (1998) found that industrial sectors with a great need for external finance grow substantially less in countries without well developed financial markets. This work induced a large number of subsequent comparative researches; much less studies have however included measures of financial resources on empirical research of firm growth. An important exception comes with Becchetti and Trovato (2002). They tested the effect of the leverage ratio of the firm on one hand and financial constraint on the other on growth. They conclude that while the effect of the leverage ratio is not significant, the qualitative dummy variable representing finance shortage proved to be an important restraint on growth.

The same ambiguity characterizes the results found by Fagiolo and Luzzi (2006). Investigating the evolution over time of the distributions of size and growth, conditioning on liquidity constraints and/or age, they suggest that liquidity constraints do not seem to engender a strongly negative impact on firm growth in any given year. However, the methodology used influences clearly the conclusion: the negative impact of liquidity constraints on firm growth is quite strong in the pooled sample but becomes unclear when one disaggregates over time.

According that credit shortage constrains firm's growth due to limited investment, and, more generally, that financial resources lack reduces possibilities of long term development, we state:

H6: External financial resources have a positive influence on firm growth.

2.2.3 Financial performance

Research into the relationship between financial performance and firm expansion rests upon the idea that financial performance is able to boost growth since it attracts external sources of financing. In this perspective, Chen and *al.* (1985) introduced profits instead of availability of external sources of financing as an explanatory variable of the rate of growth. They justify their choice considering that investors base their decisions on present and expected future values of profits or ratios of other financial variables on profits. They usually consider firms with high returns as a secure investment. The principle of "growth of the fitter" applies thus. It means that firms would compete for growth opportunities, and selective pressures would attribute these growth opportunities discriminating in favor of the most productive firms. In this way, there would be some sort of dynamic efficient reallocation at work, whereby an economy's scarce resources are redistributed to those firms that are able to employ them most efficiently (Coad 2007a). Firm expansion can then be expected to respond to financial performance.

Empirical research in this evolutionary context is sparse, however. Coad (2007b) finds a statistically significant relationship between financial performance and sales

growth for French manufacturing firms. In this view, in a competitive environment firms continuously look for growth opportunities, they are in a continual struggle to grow, and only those with superior financial performance will be able to gain additional market share. Nevertheless, the magnitude of the coefficient exhibited by the empirical analysis remains questionable. Coad concludes indeed that "it may be more useful to consider a firm's profit rate and its subsequent growth rate as entirely independent" (2007a: 385). The same result is reached from the analysis of Italian firms by Bottazzi and *al.* (2006). Insofar the coefficients on financial performance are statistically significant, we test the hypothesis of a positive relationship between realized profit and the firm growth rate.

H7: The sign of profitability is expected to be positive.

3 Data and methodology

The data base used in this paper comes from a merger of different French sources. The first one consists in the account books provided by the enterprise annual survey (Enquête annuelle d'entreprises,) collected by the French National Institute of Statistics and Economic Studies (INSEE). This database is exhaustive for firms employing more than 20 workers in industry and more than 10 in services. To be able to cope with a financial dimension, we completed it with the Diane database provided by Bureau Van Dijk which combines balance sheets, profit and loss account as well as other elements describing the corporate structure. That produces a cohort of 12 811 firms active from 1997 to 2007. Since business registration numbers (SIREN) are available, data compiled in the survey can be matched with the "financial connections" survey (LIFI database). For each company, it is thus possible to know the main number of shareholders and the majority interests in other companies.

3.1 Dataset and description of the variables

A wide variety of firm growth indicators have been used in the literature, such as sales and employment (Delmar 1997, Weinzimmer and *al.* 1998). In this paper we favor the employment measure although it might not be an objective the entrepreneur seeks to maximize. Its advantage comes from it insensitivity to price variations, currency and accounting problems that can be huge over a ten years period. However, choice of an appropriate growth index is also subject to discussion (Wooden and Hawke 2000, Birch 1987). Some use relative growth (Beck and *al.* 2008), annual logarithmic change (Rosenberg 2004), a centered difference of logarithms (Bottazzi and *al.* 2002) and the Birch-Schreyer criteria (Birch 1987, Schreyer 2000). As none of the proposed measures is neutral (Julien and *al.* 1998), we have explored the four indicators. They are presented in figure 1 below.

The dependent variable, *Gowth*, adopted in this paper is the annual growth rate in the number of employees for the i-th firm over the period 1997-2007. The similarity of the results and the sensibility of the Birch-Schreyer index to extreme values visible with the strong volatility (figure 1 bellow) lead us to present only the models in which the dependent variable is an annual growth rate measured by a difference of logarithms.

Two groups of explicative variables, one including environment and structural variable, the other consisting of a set of firm level variables are build up.

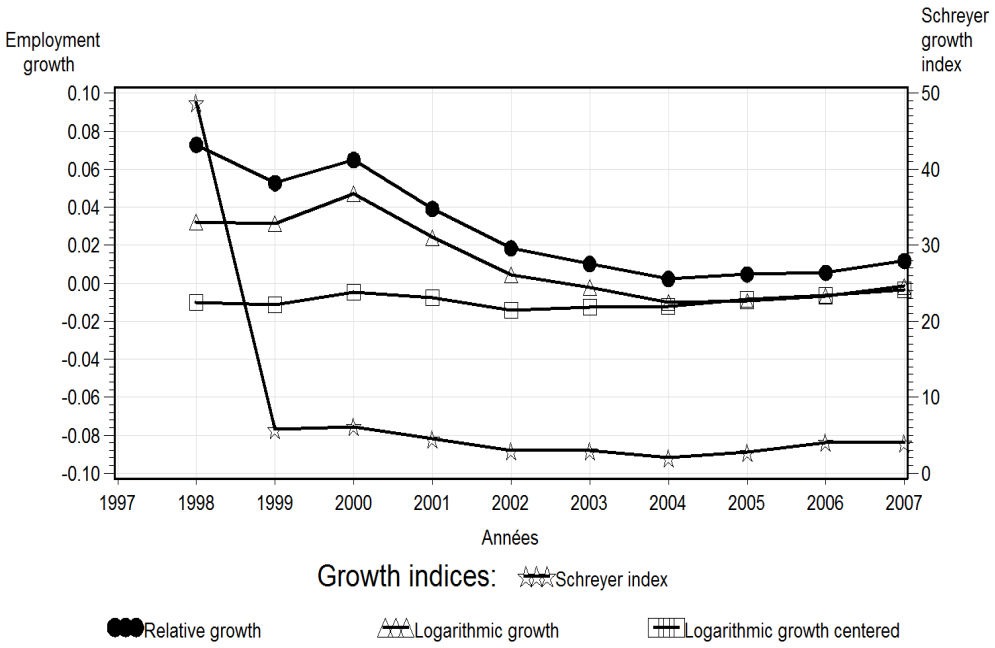


Figure 1: Growth rate indicators

Structural and environment variables

Ind are *m-1* industry dummies based on the French industry classification, review no. 1, 2003 (Nomenclature d'Activités Françaises NAF révision 1, 2003) we can define a scope of industry comprising eight sections (see Table 1 below). *Area* are *n-1* macro-area dummies (n=1, ..., 6) for firms located respectively in Île-de-France (Paris region as a reference), North-East, North West, South-East, South-West, and Center areas. *Size* is a lagged variable measuring the number of employees, *Age* is calculated as the difference between the current year and the year of enterprise creation.

Provided that ownership structure is a relevant factor in determining performance, we introduce a variable named *Group* which describes the situation of a firm given its ownership structure. It can be independent (reference), head of a group (*Group1*), controlled by a group (*Group2*) or an ordinary subsidiary without any control (*Group3*). We introduce *Export* as an additional explanatory variable of growth, a dummy for firms which exported in the period. *Year* is introduced to take into account the conjuncture effects.

Firm level variables

In addition to the environmental set of determinants, firm level variables are introduced. *LabCost* defined as wages and related charges by employee, considers the influence of the labor cost on firm growth. Its natural complement, productivity noted *Prod* defined as the value added amount per employee is taken into account. Financial structure has been proven to be a serious determinant of small and medium sized firms (Devereux and Schiantarelli 1989, Becchetti 1995). We therefore use *FinDebt* (the ratio of total financial debt to total liabilities) and *TradeDebt* (the ratio of trade debt to total liabilities) as variables representing the financing scheme of the firms. They are completed by *Profit*, a lagged variable measuring annual profit.The latter is approximated by the return on equity that is equals to the ratio of net profit to equity.

Name	Definition	Expected sign
Ind1	Dummy variable equals 1 if Manufacture of food products, beverages and tobacco products and 0 otherwise	$\neq 0$
Ind2	Dummy variable equals 1 if Manufacture of textiles, wearing apparel, leather and related products and 0 otherwise	$\neq 0$
Ind3	Dummy variable equals 1 if Manufacture of wood and paper products; printing and reproduction of recorded media and 0 otherwise	$\neq 0$
Ind4	Dummy variable equals 1 if Manufacture of chemicals and chemical products, Rubber, plastic products and 0 otherwise	$\neq 0$
Ind5	Dummy variable equals 1 if Manufacture of basic metals and fabricated metal products, except machinery and equipment, and other nonmetallic mineral products and 0 otherwise	ref.
Ind6	Dummy variable equals 1 if Manufacture of machinery; Manufacture of electrical, computer and electronic equipment and 0 otherwise	$\neq 0$
Ind7	Dummy variable equals 1 if Manufacture of transport equipment and 0 otherwise	$\neq 0$
Ind8	Dummy variable equals 1 if Other manufacturing industries and 0 otherwise	$\neq 0$
Area1	Dummy variable equals 1 if Ile de France (Paris region) and 0 otherwise	ref.
Area2	Dummy variable equals 1 if North-West and 0 otherwise	$\neq 0$
Area3	Dummy variable equals 1 if North-East and 0 otherwise	$\neq 0$
Area4	Dummy variable equals 1 if South-West and 0 otherwise	$\neq 0$
Area5	Dummy variable equals 1 if South-East and 0 otherwise	$\neq 0$
Area6	Dummy variable equals 1 if Centre and 0 otherwise	$\neq 0$
Group1	Dummy variable equal 1 if the firm is a group's head company and 0 otherwise	+
Group2	Dummy variable equals 1 if the firm is a subsidiary company controlled (more than 50% of equity) by a group and 0 otherwise	+
Group3	Dummy variable equals 1 if less than one half of firm's equity is controlled by at least one other firm	+
Group4	Independent firm	ref.
Size	Number of employees	-
Age	Firm's age equals to the year of observation minus the date of creation	-
Year	1997 to 2007 : Time trend introduced in the model as an indicator of conjuncture with 2007 as reference	$\neq 0$
Export	Firms which exported in the period. Dummy variable that equals 1 if the enterprise exports and 0 otherwise	+

Table 1: Structural and environment variables

We introduce it to measure its impact on growth net of the effect of *ex-ante* market power (details, table 2 below).

Name	Definition	Expected sign
LabCost	Total employment expenditures (wages and related charges) per employee	-
Prod	Value added per employee	+
TradeDebt	Ratio of trade debt to total liabilities	+
FinDebt	Ratio of total financial debt to total liabilities	+
Profit	Ratio of net profit to equity	+

Table 2: Firm level variables

3.2 Presentation of the sample

The sample used in this study is a balanced panel of 12811 firms belonging to the French manufacturing industry observed over 11 year from 1997 to 2007, which results in 140921 observations at the pooled level. In the first year we apply jointly two conditions to select a sample that satisfies the usual definition of small and medium sized enterprises (SMEs). So, the sample is limited to firms having between 10 and 250 employees and achieving less than or equal to 40 000 millions of Euros as annual turnover. Over the rest of the period, both employees and turnover of selected firms are allowed to vary without any constraint. Although the panel of firms obtained in the beginning of the period is subject to some selection problems, this procedure keeps out enterprises without any employee (self employment) and new creations that may represent interesting questions but remain outside the interest of the present work. Furthermore, having a balanced panel of SMEs make possible to assess the within individual variation in terms of growth with respect to time, an aspect that was rarely explored in the previous works.

According to the French industry classification (NAF rev. 1, 2003, 60 items) that aggregates sectors in reference to the homogeneity of their activities, our final sample is divided into the following sub-sectors (cf. table 3 bellow).

3.3 Econometric modeling of the probability to grow

Among the problems encountered to determine the factors that affect firm growth, the heterogeneity of data used to study corporate growth and the methods employed by authors to explore it are often highlighted. It remains that the empirical approaches chosen to investigate firm growth play the main role in determining the final findings. The raison for this is that the empirical distribution of growth rates does not follow a normal distribution (Bottazzi and Secchi 2006b). Consequently, the use of the standard linear regression method is not adequate in this case. There is a great heterogeneity in growth rates among firms leading to a skewed distribution. One solution to this problem is the use of techniques that account for heterogeneity in the data. For instance, Coad and Rao (2008) study the link between innovation and sales growth for incumbent firms in high-tech sectors using a quantile regression approach that is robust to several measurement error problems, including the presence of heteroskedasticity.

Manufacturing sectors		Total number of obs. per year	%
1.	Manufacture of food products, beverages and tobacco products	1697	13.25
2.	Manufacture of textiles, wearing apparel, leather and related products	1036	8.09
3.	Manufacture of wood and paper products; printing and reproduction of recorded media	1740	13.58
4.	Manufacture of chemicals and chemical products, Rubber, plastic products	1343	10.48
5.	Manufacture of basic metals and fabricated metal products, except machinery and equipment, and other nonmetallic mineral products	3576	27.91
6.	Manufacture of machinery; Manufacture of electrical, computer and electronic equipment	2354	18.37
7.	Manufacture of transport equipment	410	3.20
8.	Other manufacturing industries	655	5.11
Total pooled sample		12811	100

Table 3: Structure of the annual sample's by industrial sub-sectors

The authors put forth that innovation is of crucial importance for a handful of fast-growth firms.

In this paper we choose another technique of modeling, namely the multinomial logit model, in order to investigate the link between the growth rate of employment in French manufacturing firms and a set of explanatory variables. This approach is original for at least two reasons. In addition to the fact that growth is a strategic decision that suggests the use of probabilistic discrete choices, the use of a non-linear model can distinguish better the impact of predictors on the dependent variable, even if the former have a skewed distribution. Moreover, the data in our own database are available for several years which allows us to use a more complicated but realistic model that can jointly adjusts for the lack of independence in the observations (due to repeated data) and controls for their stable characteristics (features that do not change with time). Following the work of Becchetti and Trovato (2002) we test a set of strategic variables in addition to structural variables such as age and size that have been used in the most previous studies. Our study differs from theirs insofar instead of using cross section database we have a pooled panel sample's at our disposal.

In the multinomial logistic regression approach there are two wide families of models. According to the type of the dependent variable, we distinguish between ordered and unordered models. We consider a categorical response variable y_{it} that can take on more than two values. Assuming that those values are integers ranging from 1 to J, let $p_{itj} = Prob(y_{it}) = j$. What is needed at this stage is to model the dependence of this probability on explanatory variables x_{it}. To do so, the solution consists in considering a natural ordering of J categories. The most widely used model when the dependent variable is an ordered response variable is the cumulative logit model or proportional odds model (for formal details on this family of models cf. Agresti 1990). This model assumes a variable's effect on the odds of dependent variable below category j is the same for all j which gives only one coefficient for each explanatory variable in the empirical estimation. Hosmer and Lemeshow (1980) propose the score test to verify

this hypothesis. Our first investigations using a cumulative logit model indicate that the hypothesis of a proportional odds model does not hold referring to Hosmer and Lemshow test. It is recommended in this case to use a less constrained model in an unordered version, called the multinomial logit model or the generalized logit model which allow predictors effects to vary across categories j.

Note that one of the interests of this paper is to assess the inter-individual heterogeneity, since the data are indexed with an individual and a time dimension. The multinomial logit model extended to include fixed effects can be written as follows:

$$log\left(\frac{p_{ij}}{p_{iJ}}\right) = \mu_{it} + \beta_j x_{itj} + \alpha_{ij} \qquad j = 1, ..., J-1 \tag{1}$$

Where μ_{it} is an intercept that allowed varying with time, and β is a vector of parameters to be estimated. α_i refers to all differences between individuals that are stable over time. It is assumed in addition that for each individual i, y_{i1} and y_{i2} are independent. The empirical equation that will be estimated from the data can then be written as follows:

$$\begin{aligned} log\left(\frac{p_{ij}}{p_{iJ}}\right) &= \alpha_{ij} + \gamma_{1j} Size_{it-1} + \gamma_{2j} Age_{it} + \gamma_{3j} Export_{it} + \gamma_{4j} Group_{1it} + \gamma_{5j} Group_{2it} \\ &+\gamma_{6j} Group_{3it} + D_{kj} Area_i + D_{kj} Ind_i + \beta_{1j} Prod_{it} + \beta_{2j} Profit_{it-1} \\ &+\beta_{3j} LabCost_{it} + \beta_{4j} FinDebt_{it} + \beta_{5j} TradeDebt_{it} + \beta_{6j} Year \end{aligned} \tag{2}$$

where,

$Size_{t-1}$: lagged size of the firm;
Age: firm age;
Export: exporting firm ;
Group1: head of a group;
Group2: subsidiary companies (with more than 50% controlled equity);
Group3: subsidiary companies with minority control;
$Area_k$: geographical location of the enterprise ($k = 1, ..., 6$). Because the number of changes in location during the observed period is marginal, this variable is kept constant over the period.
Ind_k: sectoral firm affiliation ($k = 1, ..., 8$). Considering the marginal changes in activity, this variable is kept constant over time;
Prod: labor productivity;
LabCost: Labor costs ratio;
FinDebt: Financial debt ratio;
TradeDebt: Commercial debt ratio;
$Profit_{t-1}$: Lagged net profitability;
Year: Time trend, from 1997 to 2007.

In this study, the dependent variable is considered as a latent variable because it is not observed directly. Instead of using a quantitative dependent variable (due to the problems of linear modeling of the growth rates mentioned above), a categorical variable is constructed observing the empirical distribution of the annual growth rates. Annual growth rates are calculated as the difference in the logarithm of employment

between two successive years. Representing the empirical distribution of growth rates by a kernel estimation (cf. Appendix A), we can observe that the distribution is not so normal, rather it is tent-shaped. At first glance, we can distinguish three groups of firms, according to their growth regimes. The main group is represented by firms that present a growth rate oscillating around 0. This group can be labeled as firms with *stationary growth*. It contains firms that have not grown at all and those which perform a slightly positive or negative growth effort. The second group, situated on the left side of the distribution, refers to firms experiencing net decrease in employment. In the opposite side, there is a third group of firms that have performed a net positive growth, more than 1 percent per year. Furthermore, regarding the distribution tail's we observe that the right tail is significantly longer than the left one. That leads to consider there is a small portion of firms that perform a very high growth rate compared to the other groups. It is then worthwhile to identify this forth group of firms in the analysis; let's name them the *champions*.

As a result, the multi-categorical dependent variable Y' obtained from the distribution of growth rates of Y presents four possible levels ordered as follows:

$$Y' = \begin{cases} 1 & \text{if } Y < -0.01, \\ 2 & \text{if } -0.01 =< Y < 0.01, \\ 3 & \text{if } 0.01 =< Y < 0.2, \\ 4 & \text{if } Y >= 0.2. \end{cases}$$

Such an ordering fits with a multinomial logistic model which compares $J - 1$ categories to the reference category, in this case, $Y' = 1$. It estimates the impact of predictors on the odds of being in each category, compared to the reference category.

3.4 Estimation method

In the logistic regression it is commonly supposed that observations are independent. In the empirical applications however, many cases correspond to situations in which individuals are observed on several time intervals. It can then be expected a lack of independence of repeated observations for each individual. Analyses that ignore the correlation can well estimate model parameters, but the standard error estimators can be seriously biased (Agresti 2007). Another estimation technique may thus be considered to circumvent this problem. In addition to this issue, the dataset contains repeated data which permit to account for inter-individual heterogeneity. Such an opportunity to refine the analysis may be exploited in two possible ways. Either implementing a linear model adding for instance a dummy variable for each individual, to obtain the LSDV estimation or testing a non-linear model such as logistic regression that permits to distinguish different classes of the dependent variable. The choice of logistic regression as the modeling technique in this research, has to cope however with a couple of problems whose the main one is the so called incidental parameters (Neyman and Scott 1948). It occurs especially when T is fixed and N goes to infinity which is common in many panel data applications. In these situations the number of parameters in a model including dummy variables (fixed effects) is increasing at the same rate as the sample size, while the assumption underlying the maximum likelihood estimator assumes that parameters remain constant as the sample increases.

Chamberlain (1980) suggests a solution to this problem consisting in a conditional likelihood function that conditions on a set of sufficient statistics for the incidental parameters. The main idea is to reformulate the likelihood function so that it takes away the individual specific effects α_{ij} from equation (2). The sufficient statistic for α_{ij} is $s_{ij} = \sum_t y_{itj}$, which represents the occurrences of the number of observations in any of the four groups of events, when $y_{itj} = 1$ if individual i has chosen j and 0 otherwise. By conditioning on s_{ij} this model can be estimated by conditional maximum likelihood. Unfortunately there is no available software routine's to perform this estimate. It is thus necessary to find a palliative solution.

Following the alternative method suggested by Allison (2005), the coefficients of unordered multinomial logistic can be estimated by the conventional maximum likelihood using PROC SURVEYLOGISTIC of SAS system. It adjusts for dependence among observations due to repeated data and controls for stable characteristics. In addition to usual tests, it also provides standard errors and test statistics compatible with dependence among repeated observations. Specifically, the approach proposed consists in estimating a hybrid model that combines two variable components into a single equation, through the decomposition of the variables that change over time in *within-individual* and *between-individual* variations. The distinction between inter and intra variations is common in the analysis of clustered data (for a synthetic formal presentation cf. Neuhaus and Kalbfleisch 1998).

In the present study, the individual (enterprise) is regarded as a cluster $i = 1, ..., n(n = 12811)$. Each individual is distinguished by a unique identification number, which is repeated t times ($T = 11$) inside the cluster i. Two kinds of variables can be identified. Variables that do not change over time such as the firm sectoral affiliation and those that change over time. The first type of variables has the same value across the cluster i, i.e. $X_{it} = \bar{X}_i$ for all unit t. The effect on the response of varying-time variables is decomposed in 1) an overall effect measured by the mean $\bar{X}_i$ and 2) the effect of deviations from the average calculated as $X_{it} - \bar{X}_i$. The main advantage to do so, is the opportunity to use simultaneously the time-varying and time-invariant covariates such as geographical location or sectoral specialization in the present work. In addition, as recommended by Neuhaus and Kalbfleisch (1998), a test of the significance of the difference between the two effect types will be implemented. A family of models that is close to this form of modeling is the generalized mixed models. But in this approach, authors generally assume that the two types of effect are the same so that they do not distinguish between and within cluster covariate effects. Models that incorrectly assume common effects can lead to very misleading assessments of the association of covariates with response (*ibid.*).

The results of the hybrid model (HMN) will be compared to estimates from the multinomial logit model (MN) using the pooled sample. We discuss them in the next section.

4 Results and discussion

In order to assess the effects of structural and environmental variables on one hand and of strategic variables on the other, two kinds of models have been estimated; a multinomial logit that contains variables with intra-individual and inter-individual variations (cf. appendix B) and an unordered multinomial logit estimated on pooled

sample (cf. appendix C). At this stage of the analysis, two warnings should be expressed. Firstly, we primarily focus on the results provided by the hybrid multinomial model and we compare them to the estimates given by the unordered multinomial logit. The test below the table 5 (see appendix B) indicates that we should reject the null hypothesis that the deviation coefficients are equal to the corresponding mean coefficients. Accordingly, we should concentrate our attention on deviation coefficients, since they control for stable characteristics of individuals. Firstly, these estimates can be interpreted in the same way than the coefficients given by the conditional logistic regression. Secondly, the interpretation of the results rests upon the idea that the richest and the more reliable information is provided by the coefficients associated to the WITHIN form of the variables. There are however two exceptions that commonly concern the variables *Age* and *Group*. Even if they were remained free to change over the time, these variables appear to be very sticky. The reason to that is obvious according to *Age* but rather surprising concerning *Group*. In this case, things happen as once entered in a group, a firm never becomes independent again so that the only one and rare movements concern mergers and acquisitions that increase the relative weights of subsidiaries (*Group2* and *Group3*) compared to independent entities (*Group1*).

Let's first examine the structural variables associated to hypothesis 1 to 4. The first hypotheses we put concern the firm environment. Looking at the coefficients of the variable *Area*, it appears clearly that location matters in explaining firm growth, what confirms thus the hypothesis H1A. Whatever the technique used, Paris region is clearly the most favorable location for high growth SMEs. In no other place the probability a firm grow fast is higher. For the other regions, the results are almost the same in both models. North-West and South-West are the only areas to present positive coefficients for firms whose growth rate is positive but not very high. The North-East region and in a lesser extent the centre of France, two old industries regions, suffer of a real drawback: the coefficients associated to the group of firms that exhibit a growth rate between 1 and 20% a year are either negative or not significant. Environment intervenes thus as a determinant of individual growth. The variable *Export* (hypothesis H1B) does not have a clear-cut effect. Steady-state firms show a negative and significant correlation with exporting during the period. On the opposite, fast growing firms exhibit a positive sign. The hypothesis H1B should then be confirmed; however the coefficient is not significant for the high growth firms. Exporting has thus complex relationship with firm growth: the market size is not enough to explain performances.

Still considering structural variables, it is worthwhile to point out that *Industry* plays a role in explaining individual growth path. The correlation between the industry and growth rate is quite indifferent to the model one refers to. Two industries are associated to a higher probability to grow positively whatever the effective rate is: Manufacture of food products, and Manufacture of electrical, computer and electronic equipment. Two sectors exhibit a positive coefficient for the high growth firms only: Manufacture of chemicals and chemical products and, Manufacture of transport equipment. Manufacture of textiles, Manufacture of wood and paper products, and Other manufacturing industries mainly exhibit negative coefficients that fits with the image of old and contested industries.

The previous size of the firm ($Size_{t-1}$) is always associated to a negative and significant sign, confirming that size plays a negative role in the growth process. The bigger the firm, the more difficult it is to grow what allows us to consider that the hypothesis 2 cannot be rejected. And this is all the more visible that we consider fast

growing firms (class 4) whose odds ratio is smaller than the ones of classes 3 and 2. The deferences are negligible however. The second variable entering in consideration in a Gibrat's Law perspective is the age (*Age*). In both models, the variable *Age* is significantly negative for any class of firms. The significance of this variable, and the negative coefficient that characterizes it, is a sign of continuity with the preceding literature. This confirms the idea that old firms exhibit a weaker growth rate than young ones what confirms the hypothesis H3.

The variable $Group_k$(k= 1, ...,4) that concerned H4 hypothesis, appears to be one of the most important variables in our analysis. It highlights the crucial role played by shareholding and corporate structure of the firms. Indeed, any legal entity embedded in a group of firms has a higher probability to be a champion than an independent entity. This positive relationship between the incorporation within a group and the legal status is especially strong for the high growth firms what confirms the literature devoted to this question. More generally, heads of groups grow faster than subsidiaries completely controlled which, in turn, present a higher probability to exhibit a positive annual growth rate than independent companies. The hypothesis 4 is thus confirmed since firms embedded in groups significantly grow faster than the independent ones.

The last element to take into consideration concerning structural variables is the conjuncture, identified as *Year* in the model. Results show that when compared to 2007, conjuncture was rarely better concerning firm growth. The probability to grow very fast is increased in 2000, 2001 and 2006, indifferently to the technique used. For all the other years and whatever the rhythm of the growth, the conjuncture effects are clearly negative. Looking at the odds ratios, it appears the probability to be a fast growing firm was the weakest in 1998, 2002, 2003, and 2004.

Besides the structural variable discussed above, we have tested hypotheses referring to strategic indicators. Resulting from management decisions, these variables involve a growth process which is not due to chance.

The first comments concern the role played by the labor productivity. The signs and the statistics confirm hypothesis H5; the labor productivity is positively correlated to the rate of growth but not for high growth firms. Moreover, the estimated effect is weak. The role played by labor force is confirmed by the coefficient associated to the variable *LabCost*. As expected, it exerts a negative influence on growth. The stronger the growth, the higher the absolute value of both coefficients. These results suggest that management teams undertake actions to optimize factors endowments. Such a strategy produces positive effects on labor efficiency (*Prod*) and allows a decrease in labor costs (*LabCost*). Let's point out that the relationship is the same kind whatever the technique we refer to.

These efforts on productive variables have a financial counterpart. One may observe it looking at the two financial variables introduced in the model in accordance with hypothesis H6. The differences between the MN and the HMN models are never as important as for these variables. The positive relationship between financial debt and growth is not confirmed for high growth SMEs, even if the between component and the MN model contradict this result. A quite different result is observed about trade debt. It is positively correlated to growth for companies whose growth rate exceeds 1% a year whereas it is not significant, at a pinch negative, for firms whose growth rate is close to 0. One can then conclude that creditors are somehow reluctant to finance growth so that these companies are obliged to use trade debt as a substitute to financial debt. For the steady state group, financial debt is associated to a significantly negative

coefficient what leads us to the conclusion that below a certain level, an increase in financial resources does not grant any economic advantage.

Thanks to the introduction of the variable $Profit_{t-1}$, we aimed at testing the relationship between a lagged profit indicator and growth as presented about hypothesis H7. As in most of previous studies, this relation is not statistically significant except for fast growing firms what tends to confirm the intuition that these companies rest upon equity or shareholders to finance their development. For the 2 other classes, profit does not play any role.

Besides the results concerning the variables, it appears from the comparison between the two models that MN model tends to underestimate both coefficients magnitude and the corresponding standard errors. That is why we focused primarily on HMN estimates except for quasi-fixed variables. Looking at the signs of the coefficients and their statistical significance we note some differences especially for the high growth firms. Although in the HMN model the increase in productivity reduces non-significantly the chance to be a high growth firm, this effect appears to be positive and highly significant in the MN model. Another example of the additional precision permitted by the HMN model concerns the effect of financial debts. It results from the MN model that an increase in debts enhances (with a slight magnitude) the probability to be a high growth firm, while this effect is non-significant in the HMN estimate.

5 Conclusion

In this paper, our purpose was to go beyond the Gibrat's law. Our main assumption is that firm growth is not only a random process; strategic decisions intervene as explanatory factors of individual differences. To support this idea, we complemented structural variables usually tested in the literature by strategic and individual variables. Indeed, depending on management decisions, strategic variables determine firm growth performances what excludes a phenomenon due to chance only.

To increase the robustness of our results, we also worked with a very large sample (a cohort counting 12 811 firms active between 1997 and 2007 employing more than 10 employees in the first year of observation). As already described by prior literature, this huge database allows us to circumvent the problems of sensibility of models to the size of the sample. Last but not least, working with a cohort of active firms permits to avoid the problem of survivorship bias.

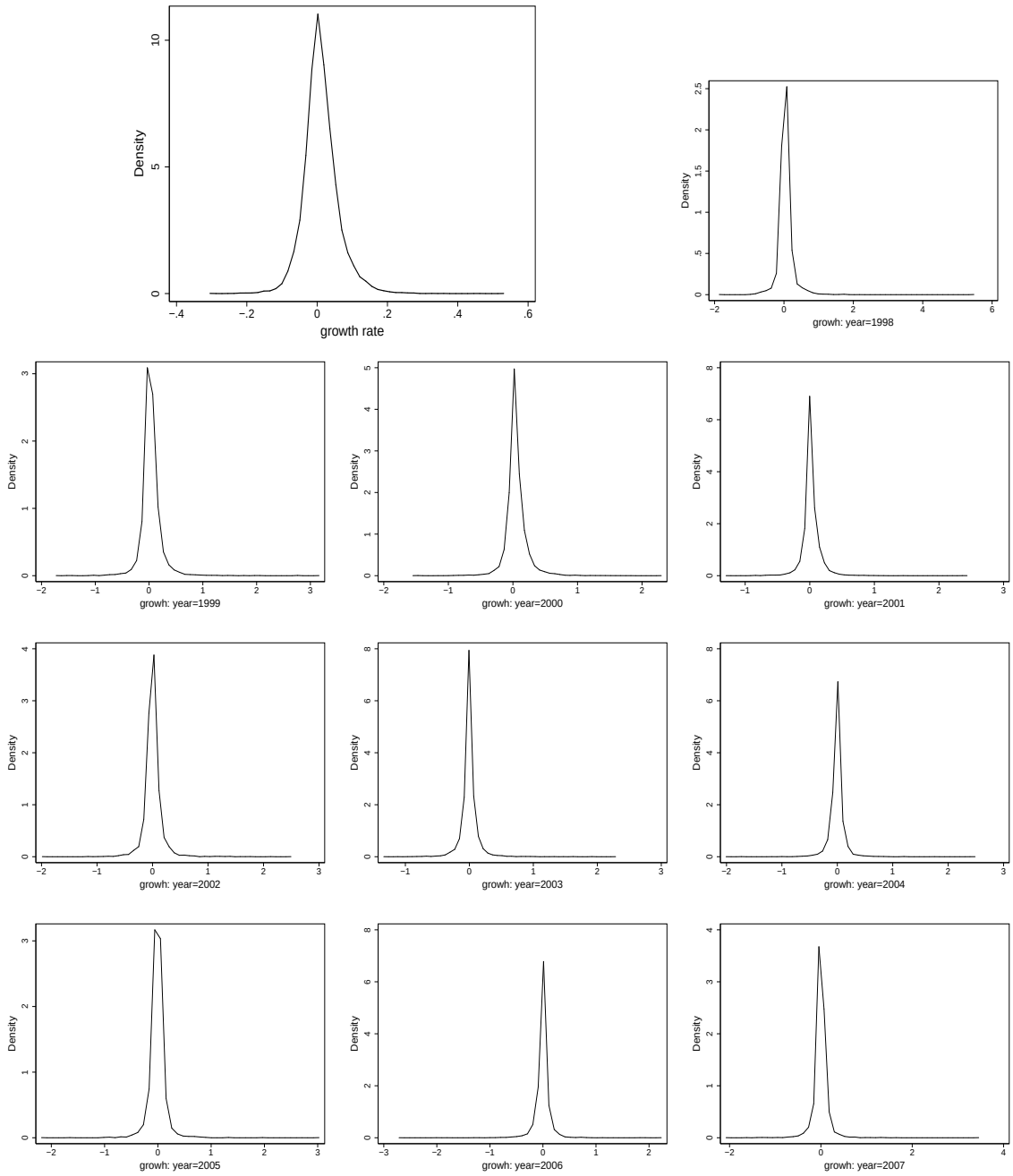
Our empirical findings seem to show that organization, productive optimization, and financing structure are key determinants in the growth process of industrial SMEs. The evidence we brought highlights the importance of a set of variables in determining the rate of growth. The joint effect of financial linkages, credit availability, and productive efficiency is inasmuch important that we look at high growth SMEs. But some limits and caveats remain. They concern the preeminent role played by structural variables (industry, and legal structure). A large share of the observed growth depends on these two variables what is clearly visible looking at the odds-ratios associated. As a correlated effect, the influence exerted by strategic variables appears secondary only. The structure of the sample may explain a part of this phenomenon. Even if all the firms belong to manufacturing industries, we may expect differences in sub sectoral growth paths. These effects should be so strong that they minor the role of strategic factors. A formal solution could consist either in narrowing the scope of

the analysis to some subparts of the sample only or to breakdown our database using a more disaggregated industry classification. In both cases, the problem concerns the low number of individuals remaining in each class.

Although independent, these variables should be consistent with management principles. Further empirical investigation remains to be done to understand better the role played by shareholding, organization and financing. More particularly, future research should focus upon the nature of firm organization and upon its effect on growth.

A first direction could consist in sorting out substitution and complementarity effects between labor and capital intensity. We observed that the more productive the firm, the highest the growth. The same favorable relationship exists between labor cost decreases per capita and growth. These two facts should induce decreasing returns due to the substitution effect (Penrose effect). Nothing allows us to conclude this way. One can wonder if qualitative phenomena are not taking over. Fast growing firms should then be submitted to changes in return to scale what allow them to become more efficient. Following an evolutionist approach (Kaldor-Verdoon effect), growing firms also experiment new forms of organization that are not only responsible for an increased productivity but give them an access to new market and resources too. A second possibility could consist in analyzing in depth the financial structure of firms according to their observed growth rates. It should then allow deciding whether financing strategy is part of the determinants of future growth.

A Kernel density estimation for the growth rate



- Average growth rate over the whole period (1997-2007) (first graphic on the left) followed by annual growth rate estimates density per year.
- Growth rate is measured as a difference of logarithms of employment between two successive years.

Table 4: Kernel density estimation (Epanechnikov kernel)

B Hybrid multinomial logit model (HMN)

Variables	Within variation			Between variation		
	Stationary growth	*Slow growth*	*High growth*	*Stationary growth*	*Slow growth*	*High growth*
α	0.15	-0.13	-0.88***			
	(0.114)	(0.089)	(0.170)			
Size	-0.01***	-0.02***	-0.06***	-0.003***	0.002***	-0.007***
	(0.002)	(0.002)	(0.007)	(0.0004)	(0.0003)	(0.001)
Productivity	0.004***	0.004***	-0.0003	0.007***	0.01***	0.008***
	(0.0009)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)
Profit	-0.00007	0.00002	0.00005**	-0.00005	0.00003*	0.000003
	(0.00005)	(0.00003)	(0.00002)	(0.00005)	(0.00002)	(0.00008)
Labor costs	-0.06***	-0.10***	-0.20***	-0.0001	-0.002	-0.03***
	(0.004)	(0.003)	(0.007)	(0.002)	(0.002)	(0.004)
Financial debt	-0.004***	-0.005***	0.0005	-0.002	0.0004	0.008***
	(0.001)	(0.00106)	(0.002)	(0.0009)	(0.0008)	(0.001)
Trade debt	0.0003	0.009***	0.02***	-0.003***	0.005***	0.01***
	(0.002)	(0.001)	(0.003)	(0.0009)	(0.0008)	(0.001)
Export	0.006	0.13***	0.26***	-0.28***	-0.07**	-0.20***
	(0.037)	(0.034)	(0.068)	(0.031)	(0.028)	(0.049)
Age	0.001	0.006	0.01	-0.002***	-0.006***	-0.017***
	(0.004)	(0.005)	(0.016)	(0.0005)	(0.0005)	(0.001)
Group1	0.005	-0.036	0.10	-0.32***	0.04	0.40***
	(0.071)	(0.059)	(0.115)	(0.070)	(0.058)	(0.103)
Group2	-0.14	-0.05	-0.11	-0.41***	-0.19***	0.01
	(0.044)	(0.040)	(0.074)	(0.033)	(0.029)	(0.055)
Group3	-0.11*	-0.06	-0.10	-0.38***	-0.03	0.20**
	(0.057)	(0.049)	(0.092)	(0.060)	(0.052)	(0.088)
Industry1	0.09***	0.03*	0.08**			
	(0.020)	(0.017)	(0.031)			
Industry2	-0.03	-0.16***	-0.05			
	(0.023)	(0.020)	(0.039)			
Industry3	0.05***	-0.03**	0.01			
	(0.018)	(0.02)	(0.030)			
Industry4	0.01	0.03	0.15***			
	(0.0206)	(0.018)	(0.031)			
Industry6	0.05***	0.05***	0.15***			
	(0.017)	(0.014)	(0.026)			
Industry7	0.06*	0.02	0.11**			
	(0.035)	(0.028)	(0.051)			
Industry8	-0.03	-0.05**	0.04			
	(0.026)	(0.022)	(0.043)			
Dummies Area						
Dummies Year						
Fixed effects vs.	DF	Chisq	p-value			
Random effects test	33	1252.97	0.0000			
R^2 (Cox and Snell)	0.15					
R^2 (McFadden)	0.07					
Number of obs used	86106					

***, **, *: indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors are in parentheses.

Table 5: Estimates for hybrid multinomial logit model of the probability to grow with different growth patterns

C Multinomial logit model (MN)

Variables	*Stationary growth*	*Slow growth*	*High growth*
α	0.27***	0.48***	0.30***
	(0.058)	(0.050)	(0.100)
Size	-0.005***	-0.0003**	-0.006***
	(0.0002)	(0.0001)	(0.0004)
Productivity	0.006***	0.008***	0.007***
	(0.0005)	(0.0004)	(0.0007)
Profit	-0.00007	0.00002	0.00004
	(0.0002)	(0.00005)	(0.00005)
Labor costs	-0.01***	-0.02***	-0.069***
	(0.001)	(0.001)	(0.002)
Financial debt	-0.003***	-0.002***	0.005***
	(0.0006)	(0.0005)	(0.0008)
Trade debt	-0.003***	0.005***	0.01***
	(0.0007)	(0.0006)	(0.001)
Export	-0.16***	0.05***	0.03
	(0.022)	(0.020)	(0.035)
Age	-0.0008*	-0.004***	-0.02***
	(0.0005)	(0.0004)	(0.001)
Group1	-0.15***	0.11***	0.53***
	(0.042)	(0.035)	(0.066)
Group2	-0.26***	-0.01	0.26***
	(0.023)	(0.019)	(0.037)
Group3	-0.24***	0.02***	0.23***
	(0.038)	(0.031)	(0.058)
Industry1	0.14***	0.006	0.09
	(0.034)	(0.030)	(0.054)
Industry2	-0.18***	-0.45***	-0.35***
	(0.039)	(0.034)	(0.066)
Industry3	0.11***	-0.06**	-0.02
	(0.030)	(0.027)	(0.053)
Industry4	0.007	0.06**	0.36***
	(0.036)	(0.029)	(0.054)
Industry6	0.10***	0.12***	0.32***
	(0.029)	(0.024)	(0.047)
Industry7	0.11**	0.03	0.25***
	(0.059)	(0.049)	(0.087)
Industry8	-0.13***	-0.17***	-0.07
	(0.047)	(0.039)	(0.074)
Dummies Area			
Dummies Year			
R^2 (Cox and Snell)	0.08		
R^2 (McFadden)	0,03		
Number of obs used	86106		

***, **, *: indicate significance at the 1%, 5% and 10% levels, respectively. Standard errors are in parentheses.

Table 6: Estimates for multinomial logit model of the probability to grow with different growth patterns

References

Agresti, A. (1990). *Categorical data analysis*, New York: John Wiley and Sons.

Agresti, A. (2007). *An introduction to categorical data analysis*, second edition, New York : John Wiley and Sons.

Aldrich, H.E. (1979). *Organizations and environments*, Englewood Cliffs, NJ: Prentice-Hall Inc.

Allison, P.A. (1999). *Logistic regression using SAS. Theory and application*, SAS Institute Inc.

Allison, P.A. (2005). *Fixed effects regression methods for longitudinal data using SAS*, SAS Institute Inc.

AmirKhalkhali, S. and Mukhopadhyay, A. K. (1993). "The influence of size and RD on the growth of firms in the U.S.", *Eastern Economic Journal*, 19(2), 223-233.

Audretsch, D.B., Klomp, L., Santarelli, E. and Thurik, A.R. (2004). "Gibrat's law: are the services different?", *Review of Industrial Organization*, 24, 301-324.

Audretsch, D.B. and Mahmood, T. (1994). "Firm selection and industry evolution: the post-entry performance of new firms", *Journal of Evolutionary Economics*, 4(3), 243-260.

Audretsch, D.B. (1995). *Innovation and industry evolution*, Cambridge MA: MIT Press.

Aw, B.Y. and Hwang, A. (1995). "Productivity and export market: A Firm Level Analysis", *Journal of Development Economics*, 47(2), 209-231.

Baily M.N., Bartelsman E.J. and Haltiwanger J. (1996). "Downsizing and productivity growth: Myth or reality?", *Small Business Economics*, 8(4), 259-278.

Baldwin, J.R. and Rafiquzzaman, M. (1995). "Selection versus evolutionary adaptation: Learning and post-entry performance", *International Journal of Industrial Organization*, 13(4), 501-522.

Becchetti, L. (1995). "Finance, investment and innovation: a theoretical and empirical comparative analysis, *Empirica*, 22(3), 167-184.

Becchetti, L. and Trovato, G. (2002). "The determinants of growth for small and medium sized firms. The role of the availability of external finance", *Small Business Economics*, 19(4), 291-306.

Beck, T., Demirgüç-Kunt, A., Laeven L. and Levine R. (2008). "Finance, firm size, and growth", *Journal of Money, Credit, and Banking*, 40(7), 1379-1405.

Birch, D. (1987). *Job Creation in America: How our Smallest Companies Put the Most People to Work*, New York: Free Press.

Bottazi, G., Dosi, G., Lippi, M., Pammolli, P. and Riccaboni, M. (2001). "Innovation and corporate growth in the drug industry", LEM, Working paper series, 2001/02, January.

Bottazzi, G. and Secchi, A. (2006a). "Gibrat's Law and diversification", *Industrial and Corporate Change*, 15 (5), 847-875.

Bottazzi, G. and A. Secchi (2006b). "Explaining the distribution of firm growth rates", *The Rand Journal of Economics*, 37: 235-256.

Bottazzi, G., Cefis, E., and Dosi, G. (2002). "Corporate growth and industrial structure: some evidence from the Italian manufacturing industry", *Industrial and Corporate Change*, 11, 705-723.

Bottazzi, G., Coad, A., Jacoby, N. and Secchi, A. (2009). "Corporate growth and industrial dynamics: evidence from French manufacturing", *Applied Economics*, Forthcoming.

Bottazzi, G., Secchi, A. and Tamagni, F. (2006). "Productivity, profitability and financial fragility: evidence from Italian business firms", LEM, Working Paper Series, 2006/08.

Bottazzi, G. and Secchi, A. (2003). "Common properties and sectoral specificities in the dynamics of U.S. manufacturing companies", *Review of Industrial Organization*, 23, 217-232.

Brock, W.A. and Evans, D.S. (1989). ""Small Business Economies", *Small Business Economics*, 1, 7-20.

Carlsson, B. (2002). "Institutions, entrepreneurship, and growth: biomedicine and polymers in Sweden and Ohio", *Small Business Economics*, 19(2), 105-121.

Carroll, G.R. and Hannan, M.T. (1989). "Density delay in the evolution of organizational populations: A model and five empirical tests", *Administrative Science Quarterly*, 34, 411-430.

Carroll, G.R. and Hannan M.T. (2000). *The Demography of Corporations and Industries*, Princeton: Princeton University Press.

Caves, R.E. (1998). "Industrial organization and new findings on the turnover and mobility of firms", *Journal of Economic Literature*, 36(4), 1947-1982.

Chamberlain, G. (1980). "Analysis of covariance with qualitative data", *The Revue of Economic Studies*, 47(1), 225-238.

Chen, K., Babb, E.M. and Schrader, L.F. (1985). "Growth of large cooperative and proprietary firms in the US food sector", *Agribusiness*, 1(2), 201-210.

Chesher, A. (1979). "Testing the law of proportionate effect", *Journal of Industrial Economics*, 27(4), 403-411.

Clerides, S.K., Lach, S. and Tybout, J.R. (1998). "Is learning-by-exporting important? Micro-dynamic evidence from Colombia, Mexico and Morocco", *Quarterly Journal of Economics*, 113(3), 903-947.

Clerides, S.K., Lach, S. and Tybout, J.R. (1998). "Firm growth and productivity growth: evidence from a panel VAR", Document de Travail du Centre d'Economie de la Sorbonne, n°2007/72.

Coad, A. (2007a). "Testing the principle of 'growth of the fitter': The relationship between profits and firm growth", *Structural Change and Economic Dynamics*, 18(3), 370-386.

Coad, A. (2007b). "Firm growth: a survey", *Papers on Economic and Evolution*, 0703, Max Planck Institute of Economics, Jena.

Coad, A. and Rao, R. (2008). "Innovation and firm growth in high-tech sectors: A quantile regression approach", *Research Policy*, 37(4), 633-648.

Davidsson, P., and Henreksson, M. (2002). "Institutional determinants of the prevalence of startups and high-growth firms: Evidence from Sweden", *Small Business Economics*, 19(2), 81-104.

Davidsson, P., Kirchhoff, B., Hatemi J.A., and Gustavsson, H. (2002). "Empirical analysis of business growth Factors using Swedish data", *Journal of Small Business Management*, 40(4), 332-349.

Devereux, M. and Schiantarelli, F. (1989). "Investment, Finacial Factors and Cash Flow: Evidence From UK Panel Data", *NBER working paper*, 3116.

Delmar, F. (1997). "Measuring growth: methodological considerations and empirical results", In Donckels, R. and Miettinen, A. (Eds), *Entrepreneurship and SME research: on its way to the next millennium*, Hants, England: Ashgate Publishing Ltd, 199-215.

Diaz-Hermelo, F. and Vassolo, R. (2007). "The determinants of firm's growth: An empirical examination", *Revista Abante*, 10(1), 3-20.

Disney, R., Haskel, J. and Heden, Y. (2003). "Restructuring and productivity growth in UK manufacturing", *Economic Journal*, 113, 666-694.

Droucopoulos, V. (1983). "International big business revisited: on the size and growth of the world's largest firms' ", *Managerial and Decision Economics*, 4(4), 244-252.

Dunne, P. and Hughes, A. (1994). "Age, size, growth and survival: UK companies in the 1980s", *Journal of Industrial Economics*, 42(2), 115-140.

Dunne, T., Roberts, M. and Samuelson, L. (1989). "The growth and failure of US Manufacturing plants", *Quarterly journal of economics*, 104(4), 671-698.

Evans, D.S. (1987a). "The Relationship Between Firm Growth, Size, and Age: Estimates for 100 Manufacturing Industries", *The Journal of Industrial Economics*, 35(4), 567-581.

Evans, D.S. (1987b). "Tests of alternative theories of firm growth", *Journal of Political Economy*, 95(4), 657-674.

Fagiolo, G. and Luzzi, A. (2006). "Do liquidity constraints matter in explaining firm size and growth? Some evidence from the Italian manufacturing industry", *Industrial and corporate change*, 15(1), 1-39.

Fizaine, F. (1968). "Analyse statistique de la croissance des entreprises selon l'âge et la taille", *Revue d'économie politique*, 78, 606-620.

Gabe, T.M. and Kraybill, D.S. (2002). "The effect of state economic development incentives on employment growth of establishments", *Journal of Regional Science*, 42(4), 703-730.

Geroski, P.A. and Gugler, K. (2004). "Corporate Growth Convergence in Europe", *Oxford economic papers*, 56, 597-620.

Geroski, P.A. (2005). "Understanding the implications of empirical work on corporate growth rates", *Managerial and decision economics*, 26, 129-138.

Geroski, P.A. (1995). "The growth of firms in theory and in practice", Working paper No. 2092, London: Centre for Economic Policy Research.

Gibrat, R. (1931). *Les inégalités économiques*, Paris: Librairie du Recueil Sirey.

Goddard, J., Wilson, J. and Blandon, P. (2002). "Panel tests of Gibrat's law for Japanese manufacturing", *International journal of industrial organization*, 20, 415-433.

Hall, B.H. (1987). "The relationship between firm size and firm growth in the U.S. manufacturing sector", *Journal of industrial economics*, 35(4), 583-600.

Hannan, M. and Freeman, J. (1977). "The population ecology of organizations", *American journal of sociology*, 82, 929-64.

Harhoff, D., Stahl, K. and Woywode, M. (1998). "Legal form, growth and exits of West German firms - Empirical results for manufacturing, construction, trade and service industries", *Journal of industrial economics*, 46(4), 453-488.

Hart, P.E. and Oulton, N. (1996). "The Growth and Size of Firms", *Economic Journal*, 106(3), 1242-1252.

Hosmer, D.W. and Lemeshow, S. (1980). "A goodness of fit test for the multiple logistic regression model", *Communications in Statistics - Theory and Method*, 10, 1043-1069.

Hosmer, D.W. and Lemeshow, S. (1989). *Applied Logistic Regression*, New York: John Wiley and Sons Inc.

Johnson, P., Conway, C. and Kattuman, P. (1999). "Small Business Growth in the Short Run", *Small Business Economics*, 12, 103-112.

Jovanovic, B. (1982). "Selection and the evolution of industry", *Econometrica*, 50, 649-670.

Julien, P.A., Morin, M. and Gélinas, J. (1998). "L'importance des P.M.E. à forte croissance au Québec de 1990 à 1996", *Cahiers de Recherche de l'Institut de recherche sur les P.M.E.*, Université du Québec à Trois Rivières, 97-15-C.

Kalecki, M. (1945). "On the Gibrat Distribution", *Econometrica*, 13(2), 161-170.

Kumar, M.S. (1985). "Growth, acquisition activity and firm size: Evidence from the United Kingdom", *Journal of industrial economics*, 33(3), 327-338.

Mansfield, E. (1962). "Entry, Gibrat's law, innovation, and the growth of firms", *American Economic Review*, 52(5), 1023-1051.

Marris, R. and Wood, A. (1971). *The corporate economy*, Cambridge, MA.: Harvard University Press.

McGahan, A. and Porter, M. (1997). "How much does industry matter, really?", *Strategic Management Journal*, 18, 15-30.

Melitz, M.J. (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica*, 71(6), 1695-1725.

Metcalfe, J.S. (1994). "Competition, Fisher's principle and increasing returns in the selection process", *Journal of Evolutionary Economics*, 4, 327-346.

Mowery, D.C. (1983). "Industrial research and firm size, survival, and growth in American manufacturing, 1921-1946: an assessment", *Journal of economic history*, 43(4), 953-980.

Neuhaus, J.M. and Kalbfleisch, J.D. (1998). "Between- and Within- cluster covariate effects in the analysis of clustered data", *Biometrics*, 54, 638-645.

Neyman, J. and Scott, E.L. (1948). "Consistent estimates based on partially consistent observations", *Econometrica*, 16(1), 1-32.

Pavitt, K. (1984). "Sectoral patterns of technical change: Towards a taxonomy and a theory", *Research Policy*, 13(6), 343-373.

Penrose, E. (1995). *The Theory of the Growth of the firm*, first edition, 1959, Oxford University Press.

Picart, C. (2006). "La place des groupes dans le tissu productif: d'une croissance extensive à une croissance intensive", In Petit, E. and Thevenot, N. (Eds.). *Les nouvelles frontières du travail subordonné*, Paris: Editions La Découverte.

Piergiovanni, R., Santarelli, E., Klomp, and Thurik, L.A. (2002). "Gibrat's Law and the firm size. Firm growth relationship in italian services", *Tinbergen Institute Discussion Paper*, TI 2002-080/3.

Rajan, R. and Zingales, L. (1998). "Financial Dependence and Growth", *American Economic Review*, 88(3): 559-586.

Rajan, R. and Zingales, L. (1998). "Firm size and growth rate distributions - The case of Denmark", *Industrial and Corporate Change*, 14(6), 1145-1166.

Rosenberg, M.M. (2004). "Firm risk, investment, and employment growth", *Journal of Economics and Finance*, 28(2), 164-184.

Rossi-Hansberg, E. and Wright, M.L.J. (2007). "Establishment size dynamics in the aggregate economy", *American Economic Review*, 97(5), 1639-1666.

Rumelt, R. (1991). "How much does industry matter?", *Strategic Management Journal*, 12, 167-185.

Santarelli, E., Thurik A.R., Piergiovanni, R. and Klomp, L. (2003). "Gibrat's Law and the firm size/firm growth relationship in Italian small scale services", *Revue d'Economie Industrielle*, 102, 69-82.

Schmalensee, R. (1985). "Do markets differ much?", *American Economic Review*, 75(2), 341-351.

Schreyer, P. (2000). "High-growth firms and employment", OECD Science, *Technology and Industry Working Papers*, 2000/3.

Shane, S. and Kolvereid, L. (1995). "National Environment, Strategy, and New Venture Performance: A Three Country Study", *Journal of small business management*, 33, 37-50.

Stinchcombe, A. L. (1965). "Social structure and organizations", In March, J. (Eds.), *Handbook of organizations*, Chicago: Rand McNally, 142-193.

Storey, D. (1994). *Understanding the Small Business Sector*, New York: Rutledge.

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

Thollon-Pommerol, V.(1990). "Les groupes et la déformation du système productif", *Economie et statistique*, 229, 21-28.

Variyan, J.N. and Kraybill, D.S. (1992). "Empirical Evidence on Determinants of Firm Growth", *Economic Letters*, 38, 31-36.

Wagner, J. (2007). "Exports and productivity: A survey of the evidence from firm level data", *The World Economy*, 30(1), 60-82.

Weinzimmer, L. (1993). *Organizational growth of U.S. corporations: environmental, organizational and managerial determinants*, *PhD dissertation*, University of Wisconsin - Milwaukee, Ann Arbor, U.M.I.

Weinzimmer, L.G., Nystrom, P.C. and Freeman, S.J. (1998). "Measuring Organizational Growth: Issues, Consequences and Guidelines", *Journal of Management*, 24(2), 235-262.

Wicklund, J. (1999). "The sustainability of the entrepreneurial orientation - performance relationship", *Entrepreneurship Theory and Practice*, 24, 37-48.

Wicklund, J., Patzelt, H. and Shepherd, D.A. (2009). "Building an integrative model of small business growth", *Small Business Economics*, 32, 351-374.

Wooden, M. and Hawke, A. (2000). "Unions and the employment growth: panel data evidence", *Industrial Relations*, 39(1), 88-107.