

Chapter 3

GIBRAT'S LAW: AN OVERVIEW OF THE EMPIRICAL LITERATURE

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1. INTRODUCTION

In two recent studies (Audretsch, Klomp, Santarelli and Thurik, 2004 and Piergovanni, Santarelli, Klomp and Thurik, 2003) we tried to test the validity of *Gibrat's Law*, i.e., growth rates are independent of size, for small scale service industries in the Netherlands and Italy. While generally the results seem to be inconclusive, there is a tendency that *Gibrat's Law* holds in the case of the Dutch industries while it does not for the Italian ones. Our findings do not contradict those of Geroski (1995), Sutton (1997) and Caves (1998). These influential surveys on intraindustry dynamics of firms conclude independently that the empirical evidence does not support *Gibrat's Law*. The fact that growth rates of surviving firms tend to systematically decrease with increasing firm size led Geroski (1995) to classify this as a Stylised Result in his survey of "What do we know about entry?"

Gibrat's Law (Gibrat, 1931) is the first attempt to explain in stochastic terms the systematically skewed pattern of the distributions of firms' size within an industry (Aitchison and Brown, 1957). As shown by Armatte (1995, 1998), this version of *Gibrat's Law* has to do with a Galton-McAllister's or a Kapteyn's distribution, and it predicts, when applying Laplace's central limit theorem, that the empirical distribution of firms' sizes converges towards a lognormal distribution, under the hypothesis that this represents the limit distribution. As a consequence, it cannot be rejected that

the resulting distributions of firms' sizes are approximately lognormal (McCloughan, 1995). Nevertheless, when identifying distributions of firms' sizes skewed to the right, one cannot a priori exclude that this skewness is the result of turbulence, i.e., the presence of new entrants in the right tail of the distribution. *Gibrat's Law* is sometimes referred to as the *Law of Proportionate Effect* because the basic tenet underlying *Gibrat's Law* is that the growth rate of a given firm is independent of its size at the beginning of the examined period. 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).

This simplicity of *Gibrat's Law* has led to waves of studies. Unfortunately they are difficult to compare because the samples used and the methodologies applied differ widely. In the context of our recent studies we tried to set up a new survey of empirical studies. In Audretsch, Klomp, Santarelli and Thurik (2004) a concise version of this survey is provided. Below we give an updated version of this survey with detailed description of the data material, method and findings. We do so because readers of Audretsch, Klomp, Santarelli and Thurik (2004) have often approached us with the question to make this detailed material available.

2. THIS SURVEY

The comparison of empirical studies testing *Gibrat's Law* is not always possible in a straightforward manner, since they differ in both the samples used and the methodologies applied. Therefore, we build this survey chapter by dividing the studies into groups of which the results can be compared. We take two characteristics into account.

Firstly, in several studies, like Mansfield (1962), a static analysis is carried out, while other studies, like Chesher (1979), deal with the persistence of growth.

Secondly, we follow Mansfield (1962) who shows that *Gibrat's Law* can be empirically tested in at least three different ways.

- a) One can assume that it holds for all firms in a given industry, including those which have exited the industry during the period examined (setting the proportional growth rate of disappearing firms equal to minus one).
- b) One can postulate that it holds only for firms that survive over the entire time period. If survival is not independent of firm's initial size - that is, if smaller firms are more likely to exit than their larger counterparts - this empirical test can be affected by a sample selection bias and estimates must take account of this possibility. This observation applies

in particular to new and small firms, for which the hazard rate is generally high.

- c) One can state that *Gibrat's Law* only applies to firms large enough to have overcome the minimum efficient scale (MES) of a given industry (for instance, Simon and Bonini (1958) found that the *Law* was confirmed for the 500 largest U.S. industrial corporations).

Both static and temporal analysis of the three versions would lead to six types of empirical growth studies. However, the first version of *Gibrat's Law* cannot be studied in the case of persistence of growth: it is not possible to analyze the persistence of growth for firms that leave the industry during the observation period. Recently, some attention has been paid to the post-entry growth of new firms. We add such studies as the sixth group to our review. In each of the Tables 1 through 6 one of the six groups is reviewed. It should be noted that different versions of *Gibrat's Law* are tested in some studies. Such studies appear more than once in the tables. Finally, a concise version of the contents of all six tables is given in Table 7. This table is an update of the table in Audretsch, Klomp, Santarelli and Thurik (2004).

From the about 60 papers taken into account in this survey, one cannot conclude that the *Law* is generally valid nor that it is systematically rejected. In effect, only in relation to certain sectors (in particular in the service industries) and size classes (the largest ones) the probability of a given proportionate change in size during the relevant period turns out to be the same for all firms. This implies that *Gibrat's Law* cannot be regarded as a Law in the strict sense, given that heterogeneous patterns of behavior do emerge across industries and size classes.

Table 1 - Static analysis and version 1

<i>Authors (year of publication)</i>	<i>Model and version</i>
Mansfield (1962)	<i>A - Static analysis and version 1</i>
DATA CHARACTERISTICS - Almost all firms in three U.S. manufacturing industries (Steel, Petroleum refining and Rubber tire) are observed; In each industry several periods of some 10 years between 1916 and 1957 are considered.	
RESEARCH METHODS - The distributions of growth rates for several size classes are compared.	
MAJOR FINDINGS - <i>Gibrat's Law</i> is rejected in 7 out of 10 cases; Smaller firms are more likely to leave the industry.	
Acs and Audretsch (1990)	<i>A - Static analysis and version 1</i>
DATA CHARACTERISTICS - Acs and Audretsch used the Small Business Data Base like Evans (1987a and 1987b) did; They aggregated the data into 408 4-digit U.S. manufacturing industries; Firm growth is considered for the period 1976-1980.	
RESEARCH METHODS - Based on 1,976 firm size each 4-digit industry is divided in 4 size classes; Mean (employment) firm growth rates are calculated for every size class in	

every industry; The hypothesis to be tested is that the mean growth rates in the 4 firm size classes are equal.

MAJOR FINDINGS - In 60% of the 408 industries mean growth rates in the size classes are not significantly different; *Gibrat's Law* holds in 60% of the industries, this finding is different from Evans (1987b), incorporating the impact of exits tends to produce more support for *Gibrat's Law* than otherwise would be found.

Fariñas and Moreno (2000)

A - Static analysis and version 1

DATA CHARACTERISTICS - Fariñas and Moreno used a sample of 1,971 manufacturing firms drawn from the Encuesta sobre Estrategias Empresariales (ESEE) carried by the Ministry of Industry in Spain; Average annual growth rates are considered over the period 1990-1995, for a total number of 7,265 observations; Size is measured in terms of employment.

RESEARCH METHODS - The empirical model examines how the mean growth rate and the exit rate vary across size and age of firms, controlling for industry and year categories; The offsetting effect predicted by the selection model is that the probability of failure diminishes with size and age; Fariñas and Moreno correct for sample selection bias and heteroscedasticity; They follow the method proposed by Dunne, Roberts and Samuelson (1988) to distinguish between potential and observed growth rates in order to account for sample selection due to exit.

MAJOR FINDINGS - Application of Wald statistics using robust variance estimates shows that the size pattern is not uniform at all, and the differences in growth rates across the size of firms are not statistically significant; This pattern of no relationship between expected growth and size appears because the reduction in the failure rate with increased size and the reduction in the growth rate of non-failing firms with increased size compensate each other; Besides, the net effect of age on firm growth is similar to the effects of size.

Piergiovanni, Santarelli, Klomp and Thurik (2003)

A - Static analysis and version 1

DATA CHARACTERISTICS – 9,051 newborn firms in five 4-digit Italian hospitality industries (Restaurants, Cafeterias, Cafes, Hotels and Camping sites) between 1989 and 1994; Annual observations for firm size are available from INPS (National Institute for Social Security) data files; Size is measured in terms of employment.

RESEARCH METHODS - Divide the observed firm sizes into several size classes and then examines whether firm growth rates are equally distributed across these classes; To construct these size classes firms were ranked in order of size and divided into quartiles in each sub-sector in the hospitality sector; Similarly, firm growth rates were also divided into quartiles; If the observed frequencies of the resulting 16 cells in the cross tables of firm size and growth rates are equal, *Gibrat's Law* would be supported; Whether or not growth rates and firm size are independent is tested using the χ^2 statistic.

MAJOR FINDINGS - *Gibrat's Law* is rejected in 3 of the 5 sub-sectors for the sample including all firms; Only for the Cafeterias and the Camping sites are size and growth found to be statistically independent.

Audretsch, Klomp, Santarelli and Thurik (2004)

A - Static analysis and version 1

DATA CHARACTERISTICS – 1,170 firms in five 4-digit Dutch hospitality industries (Restaurants, Cafeterias, Cafes, Hotels and Camping sites) between 1987 and 1991; Annual observations for firm size are available from CBS (Statistics Netherlands) data files; While a firm can consist of more than one establishment, 94% of all firms in Dutch hospitality are single-establishment enterprises, reflecting a sector of independent and family-owned businesses; Size is measured in terms of sales.

RESEARCH METHODS - Divide the observed firm sizes into several size classes and then examines whether firm growth rates are equally distributed across these classes; To construct these size classes firms were ranked in order of size and divided into quartiles in each sub-sector in the hospitality sector; Similarly, firm growth rates were also divided into quartiles; If the observed frequencies of the resulting 16 cells in the cross tables of firm size and growth rates are equal, *Gibrat's Law* would be supported; Whether or not growth rates and firm size are independent is tested using the χ^2 statistic.

MAJOR FINDINGS - *Gibrat's Law* is rejected in 4 of the 5 sub-sectors for the sample including all firms; Only for the Camping sites are size and growth found to be statistically independent.

Table 2 - Static analysis and version 2

Authors (year of publication)	Model and version
Mansfield (1962)	B - Static analysis and version 2
<p>DATA CHARACTERISTICS - Almost all firms in three U.S. manufacturing industries (Steel, Petroleum refining and Rubber tire) are observed; In each industry several periods of some 10 years between 1916 and 1957 are considered.</p> <p>RESEARCH METHODS - The distributions of growth rates for several size classes are compared; The regression of the logarithm of size at the end of the period on the logarithm of size in the beginning of the period is also carried out.</p> <p>MAJOR FINDINGS - <i>Gibrat's Law</i> is rejected in 4 out of 10 cases when distributions of growth rates for different size classes are compared and in 3 out of 10 cases when the regression estimates are used.</p>	
Evans (1987a)	B - Static analysis and version 2
<p>DATA CHARACTERISTICS - Data for approximately 20,000 U.S. manufacturing firms are used; Firm growth is analysed between 1976 and 1982; Data are pooled across industries; Very small firms are under-represented.</p> <p>RESEARCH METHODS - Regression analysis is carried out for (employment) growth rates on firm size, firm age, and quadratic terms and the cross product of size and age; Evans corrects for sample selection bias and heteroscedasticity and reports for young and old firms separately.</p> <p>MAJOR FINDINGS - Firm growth decreases with size; Departures from <i>Gibrat's Law</i> tend to decrease with firm size; For young firms growth decreases with age when size is held constant; This result supports Jovanovic's (1982) theory; Young firm survival increases with size and age.</p>	
Evans (1987b)	B - Static analysis and version 2
<p>DATA CHARACTERISTICS - A sample of 100 U.S. 4-digit manufacturing industries was selected randomly from the population of 450 4-digit industries; Data for 42,339 firms operating in 1976 were divided in 13,735 young and 28,604 old firms; Firm growth is considered for the period 1976-1980; During this period about 33% of the young firms and about 15% of the old firms are dissolved.</p> <p>RESEARCH METHODS - Regression analysis is carried out for (employment) growth rates on size, age, the number of plants, quadratic terms and cross products of these variables; Evans controls for sample selection bias and heteroscedasticity and reports for young and old firms separately.</p> <p>MAJOR FINDINGS - Firm growth decreases at a diminishing rate with firm size even after controlling for sample selection bias; <i>Gibrat's Law</i> fails and the departures from the <i>Law</i> are more severe for small firms; For young as well as for old firms growth</p>	

decreases with age; Firm growth decreases with size in 89% of the industries and with age in 76% of the industries.

Contini and Revelli (1989)

B - Static analysis and version 2

DATA CHARACTERISTICS - Data for Italian manufacturing firms are used for the period 1980-1986; The period is divided in two sub-periods, a recession period (1980-1983) and an expansion period (1983-1986); In both sub-periods data for over 1,000 firms are available.

RESEARCH METHODS - Regression results for (3 year employment) growth rates on firm size and age are obtained; Due to multicollinearity squared terms and the cross product are not included; Also lagged growth rates are added to the regressions; Problems of heteroscedasticity and sample selection bias are mentioned.

MAJOR FINDINGS - In all regressions the firm growth rate declines significantly with size; The coefficient changes only slightly when different periods of time or when only large firms are used or when lagged growth rates is added as an explanatory variable; Departures from *Gibrat's Law* are modest; In the recession period there is hardly association between growth rates and age; In the expansion period the growth rates decline with age.

FitzRoy and Kraft (1991)

B - Static analysis and version 2

DATA CHARACTERISTICS - A sample of 51 West German firms in the metalworking sector is used; Data are available for the years 1977 and 1979.

RESEARCH METHODS - Regression results for growth rates on size and several other explanatory variables, like age (measured by a dummy variable) are obtained; The growth rate is defined as the difference of the 1979 sales and the 1977 sales divided by the (initial) sales in 1977; The results are corrected for heteroscedasticity.

MAJOR FINDINGS - In the German metalworking sector larger firms display significantly lower growth than the smaller ones; *Gibrat's Law* seems to fail; The age dummy variable is positive, so younger firms do grow faster, controlling for employment; More innovative and more profitable firms grow faster, also firms with a higher education workforce do.

Variyam and Kraybill (1992)

B - Static analysis and version 2

DATA CHARACTERISTICS - Only small and medium sized firms, defined as businesses employing less than 500 employees, are included; A sample of 422 firms in Georgia (U.S.) is conducted; The firms belong to various sectors, including retailing as well as manufacturing.

RESEARCH METHODS - Regression analysis is carried out for 5 year (employment) growth rates on size, age and quadratic terms and the cross product of these two variables; Also some dummy variables are included; The results are controlled for heteroscedasticity.

MAJOR FINDINGS - Firm growth rates decreases significantly with firm size and age; *Gibrat's Law* is rejected; Holding other firm characteristics constant, the growth rate is significantly smaller for independent, single establishment firms compared to multiple establishment firms; The overall results come close to those reported by Evans (1987a).

Bianco and Sestito (1993)

B - Static analysis and version 2

DATA CHARACTERISTICS - A sample of 288,000 firms covering the entire private sector in Italy for the period 1985-1990 is used; For computational feasibility a sub-sample of 1 over 10 firms is used in the estimation procedures.

RESEARCH METHODS - The Authors use (almost) the same growth and survival equations like Evans (1987b) did; They discuss econometric issues like the functional form to be chosen, sample selection, heteroscedasticity and measurement error.

MAJOR FINDINGS - *Gibrat's Law* is rejected in favour of Jovanovic's theory of learning; Negative relationships between growth and size and growth and age are found; The correction for sample selection hardly changes the estimates; *Gibrat's Law* is accepted for firms employing more than 45 people.

Dunne and Hughes (1994) B - *Static analysis and version 2*

DATA CHARACTERISTICS - Data for over 2,000 U.K. companies covering the entire private sector are available; Growth is available for the periods 1975-1980 and 1980-1985, while survival is observed only for the most recent period; Small firms are underrepresented.

RESEARCH METHODS - A probit model for survival on (asset) growth is estimated; The logarithm of size at the end of the period is regressed on the logarithm of size at the beginning of the period; The effects of age on growth and survival are only considered for quoted companies; The Authors estimate a sample selection model and correct for heteroscedasticity.

MAJOR FINDINGS - Smaller companies grow faster than larger ones, *Gibrat's Law* does not hold amongst smaller firms and age is negatively related to growth; The results are not an artefact of sample selection bias; The smallest companies face the highest exit rates, but together with the largest firms they are least vulnerable to take-over.

Acs and Armington (2001) B - *Static analysis and version 2*

DATA CHARACTERISTICS - Data for the entire population of U.S. businesses with employees included in the LEEM file (approximately 6 million establishments) over the 1994-1995 period are used to analyse the relationship of their growth rates to their firm size, establishment age and establishment size.

RESEARCH METHODS - Observations on individual establishments are grouped into cells with other establishments that had similar characteristics (as in Dunne, Roberts and Samuelson, 1989); Then average gross and net job flows are calculated for each cell, based on the aggregate over all the establishments in each cell; These constructed cells are the observations on which the regression analysis is based; Finally, variations in gross and net job growth rates are estimated as log-linear functions of the age of establishments, the size of firms, and additionally, by the establishment size in multi-unit firms.

MAJOR FINDINGS - *Gibrat's Law* holds broadly only for existing firms with multiple establishments, after taking into consideration the effects of establishment size and age on their growth rates; The employment growth rates are negatively related to the size of establishments (individual business locations), whether they were single establishments/firms or units of multi-establishment firms; However, they are not significantly related to the size of the firms that own these establishments.

Delmar, Davidsson and Gartner (2003) B - *Static analysis and version 2*

DATA CHARACTERISTICS - Using data for 11,748 Swedish manufacturing and service firms in existence in 1996, the Authors analyse their growth for each year during the previous 10 years (1987 to 1996); From this population of firms a sample of 1,501 high-growth firms is extracted according to multiple criteria; Growth is measured using 19 different indicators, including relative and absolute sales growth, relative and absolute employee growth, organic growth vs. acquisition growth, the regularity and volatility of growth rates over the 10-year period.

RESEARCH METHODS - A four-step approach to cluster analysis is utilised for developing a taxonomy of growth patterns; The first step is the selection of 19 growth variables as a base for clustering; Then, the population of firms is divided into a try-out sample and a hold-out sample, with the latter used to validate the results from the former; The number of clusters is determined using hierarchical clustering with Ward's method and Euclidean distances; The third step is aimed at validating the

most stable solution; For this purpose, the hold-out sample is used and a K-means clustering is performed using the centroids from the try-out sample as a base; A second cluster using hierarchical clustering with Ward's method is then performed; By using the lambda statistics in comparing the first clustering to the second one, it is found that the highest stability is achieved with a seven-cluster solution, which is taken as optimal from both theoretical and empirical viewpoint; In the fourth step, the seven-cluster solution is extracted on the complete high-growth population of firms, and this in order to find a stable cluster solution and thereby securing its internal validity.

MAJOR FINDINGS - Seven growth patterns are identified, leading to contrasting results as far as *Gibrat's Law* is concerned; The most interesting results are found for the following clusters: *Super absolute growers*: SMEs in knowledge intensive manufacturing industries exhibit high absolute growth both in sales and employment; *Steady sales growers*: large firms in traditional manufacturing industries exhibit rapid growth in sales and negative employment growth; *Super relative growers*: SMEs in knowledge-intensive service industries are found to have a somewhat erratic development of both sales and employment; *Erratic one-shot growers*: SMEs in low-technology services exhibit on average negative size development, with exception of one single very strong-growth year.

Piergiovanni, Santarelli, Klomp and Thurik (2003) B - *Static analysis and version 2*

DATA CHARACTERISTICS – 9,051 newborn firms in five 4-digit Italian hospitality industries (Restaurants, Cafeterias, Cafes, Hotels and camping sites) between 1989 and 1994; Annual observations for firm size are available from INPS (National Institute for Social Security) data files; Size is measured in terms of employment.

RESEARCH METHODS - Divide the observed firm sizes into several size classes and then examines whether firm growth rates are equally distributed across these classes; To construct these size classes firms were ranked in order of size and divided into quartiles in each sub-sector in the hospitality sector; Similarly, firm growth rates were also divided into quartiles. If the observed frequencies of the resulting 16 cells in the cross tables of firm size and growth rates are equal, *Gibrat's Law* would be supported. Whether or not growth rates and firm size are independent is tested using the χ^2 statistic.

MAJOR FINDINGS - For the sample containing only surviving firms *Gibrat's Law* is rejected in 4 of the 5 sub-sectors; Only for the Camping sites are size and growth found to be statistically independent.

Audretsch, Klomp, Santarelli and Thurik (2004) B - *Static analysis and version 2*

DATA CHARACTERISTICS – 1,170 firm in five 4-digit Dutch hospitality industries (Restaurants, Cafeterias, Cafes, Hotels and Camping sites) between 1987 and 1991; Annual observations for firm size are available from CBS (Statistics Netherlands) data files; While a firm can consist of more than one establishment, 94% of all firms in Dutch hospitality are single-establishment enterprises, reflecting a sector of independent and family-owned businesses; Size is measured in terms of sales.

RESEARCH METHODS - Divide the observed firm sizes into several size classes and then examines whether firm growth rates are equally distributed across these classes; To construct these size classes firms were ranked in order of size and divided into quartiles in each sub-sector in the hospitality sector; Similarly, firm growth rates were also divided into quartiles; If the observed frequencies of the resulting 16 cells in the cross tables of firm size and growth rates are equal, *Gibrat's Law* would be supported; Whether or not growth rates and firm size are independent is tested using the χ^2 statistic.

MAJOR FINDINGS - For the sample containing only surviving firms the *Law* is accepted for the Cafes, Hotels and Camping sites, but is rejected for the Restaurants and Cafeterias.

Johansson (2004) B - *Static analysis and version 2*

DATA CHARACTERISTICS – Annual data for firms in the Swedish IT industry, covering manufacturing and services, compiled by Statistics Sweden are available for the 1993-1998 period; Size is measured in terms of employment.

RESEARCH METHODS - Conclusions are drawn based on regression results using OLS and fixed and random effects; A panel data approach is applied.

MAJOR FINDINGS - *Gibrat's Law* is rejected: firm growth decreases with firm size as well as with firm age; The research method does not influence the findings: *Gibrat's Law* is rejected regardless of the estimation technique that has been applied.

Lensink, van Steen and Sterken (2005) B - *Static analysis and version 2*

DATA CHARACTERISTICS – This paper used data from an annual survey among a panel of Dutch firms; Data on 811 firms for years 1995 and 1999 are used for the estimates dealing with *Gibrat's Law*.

RESEARCH METHODS - Separate multinomial logit regressions for investment, labour demand, and expected maturity are estimated for small firms with less than 50 employees and large firms with more than 50 employees in 1995; Lensink, van Steen and Sterken check whether firm growth (measured as the difference between the number of employees in 1999 and 1995) has a different shape for small and large firms.

MAJOR FINDINGS - In general, it is argued that there is no complete clear picture that emerges from the analysis of firm size; This finding is in line with *Gibrat's Law*: firm growth is independent of firm size.

Table 3 - Static analysis and version 3

<i>Authors (year of publication)</i>	<i>Model and version</i>
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Hart and Prais (1956) C - *Static analysis and version 3*

DATA CHARACTERISTICS - Quoted companies in the U.K. at 6 years between 1885 and 1950; Companies listed in the categories (Breweries and Distilleries, Commercial and Industrial and Iron, Coal and Steel) are added up.

RESEARCH METHODS - Firms have been grouped into 3 approximately numerical equal classes, called small, medium and large; The distribution of growth rates (defined as final size divided by original size) of small, medium and large firms are compared for a 16-year period.

MAJOR FINDINGS - The distributions of growth rates for the three size classes are quite equal; *Gibrat's Law* tends to hold.

Simon and Bonini (1958) C - *Static analysis and version 3*

DATA CHARACTERISTICS - 500 largest U.S. industrial corporations from 1954 to 1956; The sample of Hart and Prais (1956) is also used.

RESEARCH METHODS - Firms have been grouped into 3 size classes, called small, medium and large; The distribution of growth rates are compared for the three groups; Also a plot on a logarithmic scale of firm size at the beginning and the end of the time interval is drawn.

MAJOR FINDINGS - The distributions of growth rates for the 3 size classes are quite equal; The regression line in the plot has a slope of approximately 450 and the plot is homoscedastic; *Gibrat's Law* tends to hold.

Hymer and Pashigian (1962)*C - Static analysis and version 3*

DATA CHARACTERISTICS – 1,000 largest U.S. manufacturing firms of December 1946; Growth rate is measured by the percentage change in the assets between 1946 and 1955.

RESEARCH METHODS - In ten 2-digit industries the firms were ranked by size into quartiles; The mean and standard deviation for the size classes are compared.

MAJOR FINDINGS - The mean growth rate is not related to the size of the firm while the standard deviation of the distribution of growth rates is inversely related to the size of the firm; *Gibrat's Law* tends to fail.

Mansfield (1962)*C - Static analysis and version 3*

DATA CHARACTERISTICS – Almost all firms in three U.S. manufacturing industries (Steel, Petroleum refining and Rubber tire) are observed; In each industry several periods of some 10 years between 1916 and 1957 are considered.

RESEARCH METHODS - *Gibrat's Law* is tested in two ways; Firstly by regressing the logarithm of size at the end of the period on the logarithm of size at the beginning of the period and secondly by testing the ratio of variances of growth rates of the largest firms and the smallest firms.

MAJOR FINDINGS - The regression analyses show that the results are quite consistent with *Gibrat's Law* in all 10 cases; The variances of growth rates are significantly lower for the largest firms than for the smallest firms in 6 out of 10 cases; This last result conflicts with *Gibrat's Law*.

Singh and Whittington (1975)*C - Static analysis and version 3*

DATA CHARACTERISTICS – All quoted U.K. companies in some industries (Manufacturing, Construction, Distribution and Miscellaneous Services) which survived over the period 1948-1960 (1,955 companies); The period 1948-1960 is divided into the sub-periods 1948-1954 and 1954-1960.

RESEARCH METHODS - *Gibrat's Law* is tested for all industries together and for 21 industries separately; The mean and the standard deviation of the growth rates are related to the size classes of the firms; For every industry a regression is carried out for the logarithms of size in 1960 on the logarithm of size in 1948.

MAJOR FINDINGS - The average growth rate of firms shows a weak positive relationship with size, while the standard deviation of growth rates declines with an increase in firm size; *Gibrat's Law* fails; Regression results show that in 19 out of 21 industries the large firms grow faster; However the results are significant in only three industries.

Droucopoulos (1983)*C - Static analysis and version 3*

DATA CHARACTERISTICS – Data for the world's largest industrial firms are collected for 4 time periods, 1957-1977, 1967-1972, 1972-1977 and 1967-1977; The numbers of observations are 152, 420, 551 and 396 for the periods of time respectively.

RESEARCH METHODS - Growth rates are regressed on size and industry and country dummies; Second- and third-order results for the size variables are also given.

MAJOR FINDINGS - A weak negative relationship between growth and size is found for the bulk of the firms, although the period 1972-1977 suggests that growth is positively related to size; It seems that *Gibrat's Law* does not hold, but departures of the *Law* are modest and vary over time.

Buckley, Dunning and Pearce (1984)

C - Static analysis and version 3

DATA CHARACTERISTICS – Data for the world’s largest firms, classified by 19 industry groups and nationality, in 1972 and 1977 are obtained; The sample consists of 636 and 866 firms in 1972 and 1977 respectively.

RESEARCH METHODS - Growth rates and profitability are regressed on size, the degree of multinationality, quadratic terms of size and multinationality and industry and nationality dummies.

MAJOR FINDINGS - The relationship between firm growth and size is not (often) significant; *Gibrat’s Law* tends to hold; However, growth rates differ significantly between nationalities and industry groups.

Hall (1987)

C - Static analysis and version 3

DATA CHARACTERISTICS – A sample of 1,778 publicly traded manufacturing firms in the U.S. is used; The period considered is 1972-1983; The firms cover 90% of the employment in the manufacturing sector in 1976 but only 1% of the firms; Two sub-periods 1973-1979 and 1976-1983 are considered.

RESEARCH METHODS - Regression analysis is carried out for (employment) growth rates on size (measured by the logarithm of employment); Hall corrects for sample selection, measurement errors and heteroscedasticity and also tests for nonlinearity.

MAJOR FINDINGS - A negative relation between size and growth rates is found; The relation is almost the same for the smallest and the largest firms in the sample; *Gibrat’s Law* fails; The variance of growth rates declines with size.

Bourlakis (1990)

C - Static analysis and version 3

DATA CHARACTERISTICS – Data on 633 corporations in the Greek manufacturing industries between 1966 and 1986 are used; 305 corporations survived over the twenty years; All limited liability and public limited corporations into twenty 2-digit industries are registered.

RESEARCH METHODS - Regression results for growth rates on size, age and other explanatory variables are obtained; The results are controlled for sample selection bias and heteroscedasticity; Results are also reported separately for non-durable and durable consumers’ goods and for capital goods markets.

MAJOR FINDINGS - Firm growth rates decline with age and size; *Gibrat’s Law* is rejected; The effects of size and age on the growth equations are quite similar for three different types of markets.

Konings and Faggio (2003)

C - Static analysis and version 3

DATA CHARACTERISTICS – Firm level data from the Amadeus CD-ROM, a pan European financial database provided by Bureau van Dijk Electronic Publishing SA are available; The unbalanced panel data set contains information on 834 firms in Poland, 233 firms in Estonia, 511 firms in Slovenia and 1,548 firms in Bulgaria over the period 1993-1997, and for 3776 firms in Romania between 1994 and 1997; Data on firm employment size are retrieved from company accounts published by Polish InfoCredit, Estonian Krediidinfo AS, Intercredit Ljubljana, Creditreform Bulgaria and the Romanian Chamber of Commerce and Industry.

RESEARCH METHODS - Konings and Faggio estimate 5 (one for each country) nested specifications of an employment growth model where the dependent variable is the firm annual employment growth at time t and the independent variable is the log firm size at time $t-2$; They further include a trade orientation dummy, two ownership dummies (foreign and state, the benchmark being “domestic private”), interactions variables between lagged firm size and ownership dummies, regional

and time dummies; They follow Hamilton (1998) in using robust regression analysis to estimate the firm growth equation.

MAJOR FINDINGS - The underlying assumption is that a negative relationship between firm size and growth (implying that *Gibrat's Law* does not hold) might be interpreted as a test of initial restructuring of large enterprises, since transition requires the downsizing of large and inefficient state-owned enterprises; Negative relationship between size and growth is found for all five countries, leading to a rejection of *Gibrat's Law*.

Audretsch, Klomp, Santarelli and Thurik (2004) C - Static analysis and version 3

DATA CHARACTERISTICS - 1,170 firm in five 4-digit Dutch hospitality industries (Restaurants, Cafeterias, Cafes, Hotels and Camping sites) between 1987 and 1991; Annual observations for firm size are available from CBS (Statistics Netherlands) data files; While a firm can consist of more than one establishment, 94% of all firms in Dutch hospitality are single-establishment enterprises, reflecting a sector of independent and family-owned businesses; Size is measured in terms of sales.

RESEARCH METHODS - Divide the observed firm sizes into several size classes and then examines whether firm growth rates are equally distributed across these classes; To construct these size classes firms were ranked in order of size and divided into quartiles in each sub-sector in the hospitality sector; Similarly, firm growth rates were also divided into quartiles; If the observed frequencies of the resulting 16 cells in the cross tables of firm size and growth rates are equal, *Gibrat's Law* would be supported; Whether or not growth rates and firm size are independent is tested using the χ^2 statistic.

MAJOR FINDINGS - For the sample of large firms *Gibrat's Law* is accepted for 4 sub-sectors, the only exception being represented by the restaurants sub-sector.

Table 4 - Temporal analysis and version 2

<i>Authors (year of publication)</i>	<i>Model and version</i>
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Mansfield (1962) D - Temporal analysis and version 2

DATA CHARACTERISTICS - Almost all firms in three U.S. manufacturing industries (Steel, Petroleum refining and Rubber tire) are observed; In each industry several periods of some 10 years between 1916 and 1957 are considered.

RESEARCH METHODS - Mansfield analyses the amount of mobility in an industry i.e. the extent to which firms change their relative positions in the size distribution.

MAJOR FINDINGS - Tentative findings, based on only 10 observations, are reported; It is suggested however, that the amount of mobility in an industry depends significantly on its size and its market structure; *Gibrat's Law* seems to fail.

Contini and Revelli (1989) D - Temporal analysis and version 2

DATA CHARACTERISTICS - Data for Italian manufacturing firms are used for the period 1980-1986; The period is divided in two sub-periods, a recession period (1980-1983) and an expansion period (1983-1986); In both sub-periods data for over 1,000 firms are available.

RESEARCH METHODS - Regression results for (3 year employment) growth rates on (3 year) lagged growth rates, on firm size and on firm age are obtained; For the period 1983-1986 also estimates for only large firms (more than 10 employees) are given; The problems of heteroscedasticity and sample selection bias are mentioned.

MAJOR FINDINGS - The Authors argue that small firms (which form the largest part of the data) often have expansions and contractions, measured over periods of 3-4 years,

in alternating sequence; This explains the negative relation between growth and lagged growth; When only larger firms are selected the lagged growth changes sign and becomes significantly larger than zero; Overall the departures from *Gibrat's Law* are modest.

Wagner (1992)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS - Data for 7,000 firms which formed the manufacturing sector of the German federal state Lower Saxony between 1978 and 1989 are used; In most industries only firms in which at least 20 persons are employed are included; Results are given for various sub-periods.

RESEARCH METHODS - Chesher's (1979) method, regressing the deviation of the logarithm of the firm size from the mean of the logarithms of the firm sizes at year t (z_t) on the similar deviations one and two years before, is applied; Like Chesher a first order auto-regressive process is assumed; Results are reported for different periods of time and a distinction is made between firms producing basic products and firms producing consumer goods.

MAJOR FINDINGS - In 18 out of 20 regressions where no distinction in firm size has been made *Gibrat's Law* is rejected, although the (consistent) estimates for the coefficient in the regression of z_t on z_{t-1} is close to one in each of the 20 regressions; In general positive autocorrelation between growth rates is found; Neither in the case of firms producing basic products nor in the case of firms producing consumer goods small firms grow systematically faster or slower compared to large firms, or *vice versa*.

Tschoegl (1996)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS - Data (employment size) on 66 Japanese regional banks over the 1954-1993 period are available.

RESEARCH METHODS - A logarithmic model and a percentage growth model are estimated, each of which incorporates the possibility of serial correlation of growth rates in the equation.

MAJOR FINDINGS - The results suggest that *Gibrat's Law* does not hold, since larger Japanese regional banks tend to grow more slowly than smaller ones; Nevertheless, the magnitude of the deviation from one in the logarithmic specification is not large: the minimum estimate is 0.940 and the maximum 1.016; Controlling for sample selection was not necessary in this particular study because no Japanese regional bank has failed during the period of observation.

Harhoff, Stahl and Woywode (1998)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS - Data for 10,902 German manufacturing firms extracted from the Creditreform Database are used for the 1989-1994 period; Size is measured in terms of employment.

RESEARCH METHODS - Chesher's (1979) method, regressing the deviation of the logarithm of the firm size from the mean of the logarithms of the firm sizes at year t (z_t) on the similar deviations in the initial year and one year before is applied; Like Chesher a first order autoregressive process is assumed; Log of size in the last year for which data are available is regressed on log of initial size for the entire period; The problems of sample selection bias (Heckman's (1979) method), heteroscedasticity and the persistence of growth are analysed.

MAJOR FINDINGS - Evidence against *Gibrat's Law* is found, and the marginal effect of firm size is negative for 93.8% of all observations in the sample; The effect of firm age is less pronounced: it is negative for 86.4% of the observations and only weakly significant for the majority of cases.

Hart and Oulton (1999)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS - Data for 29,000 U.K. independent firms divided into 12 size (employment) classes over the period 1989-1993.

RESEARCH METHODS - Estimation of a Galton regression model in which Galtonian regression towards the geometric mean occurs when $\beta < 1$; A first group of estimations is run disaggregating the model to size classes, a second one disaggregating the model to ten SIC (1980) divisions.

MAJOR FINDINGS - Small companies grow more quickly than larger companies with more than eight employees, therefore leading to rejection of *Gibrat's Law*; The within size regressions show that the smallest size classes have the largest Galtonian regression towards the mean, which implies that the smaller companies created proportionately more jobs; Disaggregation of the Galton regression model to SIC divisions shows that in each SIC divisions (including "Distribution and Hotels") the regression slope is below unity.

Fariñas and Moreno (2000)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS - Fariñas and Moreno used a sample of 1,971 manufacturing firms drawn from the Encuesta sobre Estrategias Empresariales (ESEE) carried by the Ministry of Industry in Spain; Average annual growth rates are considered over the period 1990-1995, for a total number of 6,861 observations on non-failing firms; Size is measured in terms of employment.

RESEARCH METHODS - The empirical model examines how the mean growth rate varies across size and age of firms, controlling for industry and year categories.

MAJOR FINDINGS - Application of Wald statistics using robust variance estimates shows that size and age have significant effects on growth patterns, with the mean growth rates of non-failing firms which decrease with firm size and firm age; When coefficients are examined for a given size category, mean growth rates are decreasing with age although this relationship is less pronounced for the largest category of firms with more than 500 employees.

Machado and Mata (2000)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS - The data set includes all firms operating in 155 industries in Portuguese manufacturing in 1983 (18,552 firms) and 1991 (26,515 firms); Information comes from an inquiry conducted by the Portuguese Ministry of Employment and covers the whole range of firm sizes.

RESEARCH METHODS - Machado and Mata use the Box-Cox quantile regression model to analyse the firm size distribution (FSD); In particular, the effect of selected industry attributes is estimated on the location, scale, skewness, and kurtosis of the conditional FSD; The model is estimated by Generalised Least Squares and a normality test is performed on the standardized estimated residuals.

MAJOR FINDINGS - Industry attributes are found to affect the size of firms in the same direction across the distribution, but their effects are much greater at the largest quintiles; Over time, the FSD shifts toward smaller firms, due to the way the economy responds to industry characteristics; Accordingly, the prediction of lognormality, implied by *Gibrat's Law*, is rejected by the observed distribution of firm sizes.

Heshmati (2001)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS - A sample of Swedish firms (5,913) with a taxable turnover exceeding SEK 10,000 over the period 1993-1998 is considered; Size is measured in terms of employment, total assets and total sales.

RESEARCH METHODS - Three distinct panel models are estimated for employment growth, assets growth and sales growth respectively; In estimation of each model; The estimation methods account for heterogeneity among firms not reflected in their age and size differences; In the estimation of the growth rate Heshmati controls for various factors characterizing the sample firms, their performance, human capital and local labour market conditions.

MAJOR FINDINGS - The relationship between firm size and firm growth is found to be negative in the employment model, while it is positive in the sales model, which implies the presence of scale effects when sales are considered; The size effect is instead not statistically significant in the assets model.

Vander Venet (2001)

D - Temporal analysis and version 2

DATA CHARACTERISTICS - Data on the size of the aggregate banking sectors in 23 OECD countries over the 1985-1994 period are available; Two measures of size are employed: 1) the total asset volume of the aggregated banking sector, calculated for the broadest possible sample of credit institutions; 2) a measure of adjusted total asset (ATA) incorporating an estimate of off-balance-sheet activities.

RESEARCH METHODS - Panel data estimates for the entire 1985-1994 period and the 1985-1989 and 1990-1994 sub-periods are conducted for each of the two measures of size; Chesher's (1979) method, regressing the deviation of the logarithm of the size of market from the mean of the logarithms of market sizes at year t (z_t) on the similar deviations in the previous year is applied; Like Chesher a first order autoregressive process is assumed.

MAJOR FINDINGS - It is found that the 1985-1989 period was characterized by size convergence, implying that smaller bank sectors were expanding more rapidly; However, in the 1990-1994 period the pattern reversed to proportionate growth; From this evidence, Vander Venet argues that the shift in the growth pattern of the bank markets is related to other determinants of their expansion, including the macroeconomic growth performance of the economy and the degree of operational efficiency of the banking sector.

Becchetti and Trovato (2002)

D - Temporal analysis and version 2

DATA CHARACTERISTICS - A sample of Italian small and medium sized firm (included in the Mediocredito Centrale database) over the period 1995-1997 is considered: 1,144 with less than 50 employees, 1,427 with less than 100 employees. A control sample of 462 firms with more than 100 employees is also analysed.

RESEARCH METHODS - Estimation of a multivariate model in which the dependent variable represents changes in size and each regressor represents a different factor that is expected to affect firm growth. Controls are included for age, size, the availability of external finance, market rents and access to foreign market.

MAJOR FINDINGS - *Gibrat's Law* is not rejected for large firms, whereas it is rejected for small and medium sized firms under financial constraints.

Hardwick and Adams (2002)

D - Temporal analysis and version 2

DATA CHARACTERISTICS - Annual data for 176 firms in the life insurance industry in the U.K. that have been in operation in 1987 and survived until at least until the end of 1996 under the same corporate name have been collected. Size is measured as annual total net assets in the 1987-1996 period. Growth is measured as "organic" growth in firm size.

RESEARCH METHODS - Serial correlation is measured applying method introduced by Chesher (1979). Moreover, a multivariate model in which the dependent variable is the logarithm of size is regressed on a variety of different factors that is expected to affect firm growth. Controls are included for the input cost ratio, for profitability,

for the output mix and for some dummy variables. Estimation results are corrected for sample attrition bias and the WLS procedure is applied.

MAJOR FINDINGS - *Gibrat's Law* is accepted for the entire period of 1987-1996. The firm size-growth relation of life insurers varies, however, over time. Smaller firms grew faster than larger ones in the booming years 1987-1990, while the larger firms grew faster during the recession of 1990-1993 and continued to do so during the recovery years of 1993-1996. When firm-specific determinants of asset growth are analysed, no evidence is found that the growth of life insurance companies is inversely related to profitability.

Del Monte and Papagni (2003)

D - Temporal analysis and version 2

DATA CHARACTERISTICS - A sample of 659 Italian manufacturing firms over the period 1989-1997 is considered; Size is measured in terms of total sales (deflated with the industry deflator of value added) and employment.

RESEARCH METHODS - Distinct panel models are estimated for firms classified by sectors in Pavitt's sense and employment size class; A unit root test is employed based on the estimates carried out on the time series of each firm; The null hypothesis of unit root is $H_0: \beta_i = 0$ for all i ; A test based on individual Lagrange multiplier (introduced by Im, Pesaran and Shin, 2003) is employed on a sub-sample of firms relative to sales.

MAJOR FINDINGS - Test of *Gibrat's Law* performed by applying a panel unit root test confirms the hypothesis put forward by Gibrat on the stochastic features of the rate of growth of firms.

Chen and Lu (2003)

D - Temporal analysis and version 2

DATA CHARACTERISTICS - *Taiwan Economic Journal* (TAJ) database from 1988 to 1999, containing 48 seasons of data of publicly-traded companies; Total number of firms in the sample is 258; Size is measured in terms of fixed assets.

RESEARCH METHODS - Panel unit root test to study the relationship between the logarithms of firm sizes at the beginning of the period and at the end of the period: a) under the independent and identical distribution assumption (iid); b) by considering the cross-sectional correlations.

MAJOR FINDINGS - Under the iid assumption, *Gibrat's Law* does not hold in the case of 4 (including Food, Textiles, Electronics) out 18 industries alone; When the cross-sectional correlations are taken into account, the *Law* cannot be rejected for 6 (including Pulp, Automobile and Tourism) out of 18 industries; Thus, the conclusion is not the same when using different estimation procedures.

Piergiovanni, Santarelli, Klomp and Thurik (2003)

D - Temporal analysis and version 2

DATA CHARACTERISTICS - 9,051 newborn firms in five 4-digit Italian hospitality industries (Restaurants, Cafeterias, Cafes, Hotels and Camping sites) between 1989 and 1994; Annual observations for firm size are available from INPS (National Institute for Social Security) data files; Size is measured in terms of employment.

RESEARCH METHODS - Use the non-linear regression procedure by Marquardt (1963) to obtain (asymptotic) standard errors for β and ρ . *Gibrat's Law* is considered to be valid if the joint hypotheses $(\beta \rho) = (1 \ 0)$ is accepted. Assuming that the estimators of β and ρ are asymptotically normally distributed, the test-statistic for the joint hypothesis is (asymptotically) chi-squared distributed with two degrees of freedom.

MAJOR FINDINGS - Only in 1 of the 15 cases *Gibrat's Law* is accepted in a straightforward manner; However, application of a probability plot test of the "droit de Henry" type to the logarithm of the differences in size between final (1994) and initial (1989) year, suggests that also for the cafeterias business group does the empirical distribution of firm sizes converge towards a lognormal distribution.

Fotopoulos and Louri (2004)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS – Data on 2,640 Greek manufacturing firms operating in both 1992 and 1997 are used; Information on employment, age and share of foreign ownership is available.

RESEARCH METHODS - A non parametric kernel density estimation is performed; The data on the logarithm of firm size in 1997 are taken in deviation from their mean, so that the resulting variable has a zero mean; Besides, quantile regressions are performed at various quantiles.

MAJOR FINDINGS - Firm growth is not quite random, since both firm size and age have a definitely negative effect on growth, which is more important for the faster growing firms.

Audretsch, Klomp, Santarelli and Thurik (2004)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS – 1,170 firm in five 4-digit Dutch hospitality industries (Restaurants, Cafeterias, Cafes, Hotels and Camping sites) between 1987 and 1991; Annual observations for firm size are available from CBS (Statistics Netherlands) data files; While a firm can consist of more than one establishment, 94% of all firms in Dutch hospitality are single-establishment enterprises, reflecting a sector of independent and family-owned businesses; Size is measured in terms of sales.

RESEARCH METHODS - Use the non-linear regression procedure by Marquardt (1963) to obtain (asymptotic) standard errors for β and ρ . *Gibrat's Law* is considered to be valid if the joint hypotheses $(\beta \rho) = (1 \ 0)$ is accepted. Assuming that the estimators of β and ρ are asymptotically normally distributed, the test-statistic for the joint hypothesis is (asymptotically) chi-squared distributed with two degrees of freedom.

MAJOR FINDINGS - In 11 of the 15 cases *Gibrat's Law* is accepted; This is a sharp contrast to the findings for manufacturing by, among others, Singh and Whittington (1975), Chesher (1979), Kumar (1985) and Wagner (1992) where the *Law* is generally rejected; In all of these studies the autoregressive coefficients (ρ) are positive and statistically different from zero, while β is close to unity; Only negligible or very modest autocorrelation coefficients are found in this exercise.

Harris and Trainor (2005)D - *Temporal analysis and version 2*

DATA CHARACTERISTICS – Data from the Annual Respondents Database (ARD) for a subset of 26 4-digit industries in U.K. manufacturing covering the period 1973-1998. The sample accounts for one-third of total manufacturing real gross output during the relevant period; Size is measured as real gross output, employment and real gross value added.

RESEARCH METHODS - Four panel unit root tests to study the relationship between growth and size. The tests were applied to unbalanced plant-level panel data; Testing procedure based on the Levin, Lin and Chu (2002) tests and Im, Pesaran and Shin (2003) test as implemented by Pedroni (1999) when using unbalanced data.

MAJOR FINDINGS - *Gibrat's Law* is rejected in virtually all cases; The results of applying panel unit root tests to plant-level real gross output data for various industry samples, broken down into plant size and sub-periods shows that there is strong evidence to reject *Gibrat's Law* that firm growth is a random process in favour of the alternative proposition of mean reversion; Results are presented for real gross output only; However, results using employment or value added growth show the same pattern.

Table 5 - Temporal analysis and version 3

<i>Authors (year of publication)</i>	<i>Model and version</i>
Hart and Prais (1956)	<i>E - Temporal analysis and version 3</i>
<p>DATA CHARACTERISTICS - Quoted companies in the U.K. at 6 years between 1885 and 1950; Companies listed in the categories (Breweries and Distilleries, Commercial and Industrial and Iron, Coal and Steel) are added up.</p> <p>RESEARCH METHODS - The mobility of firms is considered for 5 periods of time; For the firms the consecutive ranks in the distributions and the deviations of the firm size from the mean size in the period are analysed; The birth of new firms, the exits of firms and the changes in size distributions of incumbents are looked after separately.</p> <p>MAJOR FINDINGS - In any period of time business units that cease to exist are smaller, by about a half than the average size of units alive at the beginning of the period; <i>Gibrat's Law</i> holds for the period from 1885 till 1939; In the period from 1939 till 1950 the smaller companies grow much faster than the larger ones; <i>Gibrat's Law</i> fails for the last period.</p>	
Singh and Whittington (1975)	<i>E - Temporal analysis and version 3</i>
<p>DATA CHARACTERISTICS - All quoted U.K. companies in some industries (Manufacturing, Construction, Distribution and Miscellaneous Services) which survived over the period 1948-1960 (1955 companies); The period 1948-1960 is divided into the sub-periods 1948-1954 and 1954-1960.</p> <p>RESEARCH METHODS - The growth rates in the period 1954-1960 are regressed on the growth rates in the period 1948-1954; The "opening" size is also added as an explanatory variable to the regression analysis.</p> <p>MAJOR FINDINGS - There is a significant tendency that firms which have an above (or below) average growth rate over the first 6-year period also have an above (or below) average growth rate in the subsequent 6-year period; So <i>Gibrat's Law</i> fails; The values of R^2 are uniformly low (about 0.05) for the different industries.</p>	
Chesher (1979)	<i>E - Temporal analysis and version 3</i>
<p>DATA CHARACTERISTICS - A sample of 183 quoted companies in the U.K. that are classified as "Commercial and Industrial" is used; Only companies that are in existence in 1960 and in 1969 are included; In each year of the period 1960-1969 data are available.</p> <p>RESEARCH METHODS - Regression analysis is proposed for the deviation of the logarithm of the firm size from the mean of the logarithms of the firm sizes at year t on the similar deviation one year before; Chesher assumes a first order autoregressive process in the disturbances to get consistent estimates for the regression coefficient.</p> <p>MAJOR FINDINGS - The estimation of the regression coefficient is close to unity (which is consistent with <i>Gibrat's Law</i>), but the first order autoregressive correlation coefficient is quite large and positive; For the various years the hypothesis that the regression coefficient is equal to one <i>and</i> the first order autoregressive coefficient is equal to zero is rejected; <i>Gibrat's Law</i> is not valid.</p>	
Kumar (1985)	<i>E - Temporal analysis and version 3</i>
<p>DATA CHARACTERISTICS - Over 2,000 quoted companies for the U.K. over the period 1960-1976 are used; 5 sub-samples for different periods are available; Internal growth rates and acquisition growth rates are distinguished; 5 different size measures are used.</p> <p>RESEARCH METHODS - Five year growth rates are regressed on growth rates in the period five years before and on the (initial) firm size; 3 different assets growth rates are used; Negligible heteroscedasticity was found, so no correction was made;</p>	

Regression results for acquisition growth rates on past acquisition growth rates and (initial) size are also obtained.

MAJOR FINDINGS - There was some persistency in firm growth rates over time, but it was weaker than in Singh and Whittington (1975); R^2_{adj} is about 0.02; There was a mild tendency for firm growth to be negatively related to size; *Gibrat's Law* is not valid; The results are quite robust for the use of different growth measures and time periods.

Amirkhalkhali and Mukhopadhyay (1993) E - Temporal analysis and version 3

DATA CHARACTERISTICS - The data set consists of 231 firms, chosen from the Fortune list of the largest firms in the U.S., who maintain their identity over the 1965-1987 period; The sample is broken down into 4 sub-periods.

RESEARCH METHODS - Growth rates are regressed on growth rates in the preceding period and on the (initial) firm size; A dummy variable for (76) R&D-intensive and (155) non-R&D-intensive firms is used; The Authors mention the problem of sample selection.

MAJOR FINDINGS - The results suggest that *Gibrat's Law* does not hold; The autocorrelation between growth rates appears to be positive; Moreover a weak negative relationship between firm size and growth is found.

Amaral, Buldyrev, Havlin, Leschhorn, Maass, Salinger, Stanley and Stanley (1997)

E - Temporal analysis and version 3

DATA CHARACTERISTICS - The Compustat database is used for analysis of all U.S. manufacturing publicly-traded firms (with SIC code from 2000 to 3999) during the 1974-1993 period.

RESEARCH METHODS - Standard and separate panel tests of *Gibrat's Law* are conducted, based on regression of log growth on initial log firm size; Tests include a set of time dummy variables, to control for macro-economic or other influences on growth common to all firms and specific to each time period, and a full set of interaction dummies between sectors and time periods, to control for sector-specific shocks in each time-period; Monte Carlo methods are used to investigate the sampling distributions and power functions of the tests.

MAJOR FINDINGS - The results, besides pointing to a limitation of the cross-sectional test - which suffers of a loss of power and therefore has difficulty in rejecting *Gibrat's Law* - support the hypothesis that log firm size are mean-reverting (with the tendency towards mean-reversion that is stronger during periods of sluggish economic growth than when growth is high), possibly towards heterogeneous individual firm effects; Accordingly, *Gibrat's Law* is rejected.

Bottazzi, Dosi, Lippi, Pammolli and Riccaboni (2001) E - Temporal analysis and version 3

DATA CHARACTERISTICS - Sales figures and market shares for 150 large firms in the pharmaceutical industry are used; The data set covers the seven largest Western markets (U.S., U.K., France, Germany, Spain, Italy and Canada) over the 1987-1997 period.

RESEARCH METHODS - Departure from *Gibrat's Law* is analysed by checking for possible "reversion to the mean" in the data; A growth model - $g_i(t+1) = \beta g_i(t) + \varepsilon(t)$ - is estimated cross-sectionally for all the years.

MAJOR FINDINGS - Values for β statistically equal to one are found, leading to rejection of the "reversion to the mean" hypothesis; According to the Authors, the autocorrelation in firm growth, increasing with the scale of observation, hints at some significant firm-specific structure in the growth process, related with firm-specific organizational competences in the search and introduction of products in different markets.

Goddard, Wilson and Blandon (2002)E - *Temporal analysis and version 3*

DATA CHARACTERISTICS - The data set consists of 443 manufacturing firms quoted on the First or Second Divisions of the Japanese Stock Exchange, for which continuous annual data on total assets are available for the period 1980-1996; The firms are classified in 13 broad industrial sectors.

RESEARCH METHODS - Standard and separate panel tests of *Gibrat's Law* are conducted, based on regression of log growth on initial log firm size; Tests include a set of time dummy variables, to control for macro-economic or other influences on growth common to all firms and specific to each time period, and a full set of interaction dummies between sectors and time periods, to control for sector-specific shocks in each time-period; Monte Carlo methods are used to investigate the sampling distributions and power functions of the tests.

MAJOR FINDINGS - The results, besides pointing to a limitation of the cross-sectional test - which suffers of a loss of power and therefore has difficulty in rejecting *Gibrat's Law* - support the hypothesis that log firm size are mean-reverting (with the tendency towards mean-reversion that is stronger during periods of sluggish economic growth than when growth is high), possibly towards heterogeneous individual firm effects; Accordingly, *Gibrat's Law* is rejected.

Pfaffermayr and Bellak (2002)E - *Temporal analysis and version 3*

DATA CHARACTERISTICS - Corporate level data for 700 large, both domestic and foreign-owned firms in Austrian manufacturing over the period 1996-1999 are available.

RESEARCH METHODS - Standard estimate of *Gibrat's Law* is conducted, based on regression of log growth on initial log firm size; Accordingly, *Gibrat's Law* cannot be rejected.

MAJOR FINDINGS - Firms' growth turns out to be mainly randomly determined and idiosyncratic with systematic influence being of minor importance.

Geroski, Lazarova, Urga and Walters (2003)E - *Temporal analysis and version 3*

DATA CHARACTERISTICS - Data on real total net assets for a sample of 147 large, quoted U.K. firms over the 1955-1985 period are used; These firms represent a balanced sub-sample of the DTI-Meeks-Whittington data set.

RESEARCH METHODS - This paper tests the hypothesis that firms converge towards a common long run size by applying the standard logarithmic model to each firm taken in turn; To check whether the individual time series are integrated, they examine the null hypothesis of non-stationarity by using Dickey-Fuller (DF) tests augmented with one lagged dependent variable, with and without deterministic trends; Since the DF tests are likely to suffer from small sample problems, the Authors then use the tests proposed by Im, Pesaran and Shin (2003) and by Maddala and Wu (1999) to overcome this problem.

MAJOR FINDINGS - The results suggest that the growth rates of firms who survive long enough to record 30 years of history are random; Besides, firm size displays no tendency to converge to either a common, steady state optimum firm size or to a set of stable size differences between firms.

Bothner (2005)E - *Temporal analysis and version 3*

DATA CHARACTERISTICS - The data set from International Data Corporation (IDC) consists of 1,140 market segments in 43 countries in which more than 400 vendors sale PCs for the period 1995-1999; Relative size of firms is measured as a function of the level of structural equivalence between firms having market contacts; After defining market contact as a binary outcome, the author weights by the degree of structural equivalence between firms i and k ; Consequently, after collecting k firms with which i firm has contact in at least one national market, the level of structural equivalence between i and k is computed on the basis of their similarity in patterns

of shipping computers across segments defined by geography, channel, and technology.

RESEARCH METHODS - Three standard panel tests of *Gibrat's Law* are conducted, based on regression of log growth on initial log firm size; Tests include a set of additional variables, to control for acquisitions, national market size, changes in firm strategy; Firm scope, and size-localized competition.

MAJOR FINDINGS - Proportional growth declines only moderately with size, showing a small departure from *Gibrat's Law*, according to which the estimate on lagged sales would equal unity; Adding fixed effects for firms and for time periods, it is apparent that the coefficient on lagged sales drops substantially below one; Adding covariates identified as important in previous studies of firm growth, the adjustment for acquisitions is significant in light of the added physical, human and marketing related resources a firm has in its possession after such events; The measure of strategic change is instead insignificant; Finally, the effects of scope and of size-localized competition are significant, while that of market size is not.

Table 6 - The post-entry performance of new firms

Authors (year of publication)	Model and version
Dunne, Roberts and Samuelson (1988)	F - <i>The post-entry performance of new firms</i>
DATA CHARACTERISTICS	The data set covers firms producing in each 4-digit manufacturing industry in the U.S. in the years 1963, 1967, 1972, 1977 and 1982; There are approximately 265,000 firms present in each of the first three years and 295,000 in the last two years; Information is available on different types of entrants, the entry and exits over time and the post entry performance of the entrants.
RESEARCH METHODS	- Results for market shares, relative average size of surviving firms and cumulative failure rates for each entry cohort in each year are presented; Means and standard deviations across 387 4-digit industries are given; The results are also disaggregated for 3 types of entrants, 1) new firms, new plant; 2) diversifying firm, new plant and 3) diversifying firm, product mix.
MAJOR FINDINGS	- The market share of each cohort declines, on average in each census year following entry; The relative size of each cohort's surviving firms increases as the cohort ages; The cumulative failure rates increases at diminishing rates over time for each cohort; Diversifying firms entering with new plants have the largest relative size of the 3 types of entrants, and the lowest exit rates.
Dunne, Roberts and Samuelson (1989)	F - <i>The post-entry performance of new firms</i>
DATA CHARACTERISTICS	- The sample of data contains U.S. manufacturing plants that entered in 1967, 1972 or 1977; In order to minimize the effects of potential measurement error only firms that have at least five employees in at least one year are included; This results in a total of 219,754 different plants and in a total of 326,936 plant/year observations because of the multiple time periods.
RESEARCH METHODS	- Plant (employment) growth rates and failure rates are regressed on dummies for age categories and size classes; Regressions for mean growth rates and variance of growth rates are carried out for successful plants and for all plants; Separate results are given for single-unit and multi-unit plants.
MAJOR FINDINGS	- Failure rates are lower for older plants, regardless of ownership type, and for larger plants, particularly those owned by multi-plant firms; Mean growth rates of successful plants and variance of growth rate of successful plants decline with firm size and age for both single unit and multi-unit plants; For single-plant and multi-plant firms <i>Gibrat's Law</i> is rejected in the case of including only successful plants as well as in the case of including all plants.

Phillips and Kirchoff (1989)F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - The database covers approximately 93% of full time business activity in the U.S. for the period 1976-1986; The new firms, defined as single, new establishment firms with 500 or fewer employees, are selected.

RESEARCH METHODS - Survival rates and growth rates are reported for different periods of time; Results are differentiated for 9 sectors such as manufacturing and retail trade; Survival and growth are also differentiated by age.

MAJOR FINDINGS - On average 39.8% of new firms survive 6 or more years; The survival rates however more than double for firms that grow; The proportion of firms that grow increases with age; The opportunities for growth varies substantially from industry to industry.

Audretsch and Mahmood (1994)F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - The post-entry performances of approximately 11,300 manufacturing new firms started in the U.S. in 1976 are observed bi-annually throughout the subsequent 10-year period; It is known if a start-up is a single-plant firm or a multi-plant firm.

RESEARCH METHODS - The mean firm growth rates and failure rates are given over time; The results are also presented for 19 manufacturing sectors; Regression of new firm (employment) growth and survival rates are carried out for different time periods; The explanatory variables used are: firm size, innovative activity, scale economies, capital intensity, industry growth and a dummy for multi-plant firms.

MAJOR FINDINGS - Firm growth is found to be (significantly) negatively influenced by firm size over all periods of time; Firm growth is found to be positively related to the innovative activity, the extent of scale economies, the capital intensity, the industry growth and the multi-plant dummy; The survival rates are positively affected by firm size, industry growth, capital intensity and negatively affected by the extent of scale economies and the multi-plant dummy.

Mata (1994)F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Data for 3,308 Portuguese manufacturing firms that entered in 1983 are available; Firms are followed during 5 consecutive years.

RESEARCH METHODS - For each of the years in the period 1984-1987 a growth and survival equation is estimated; (employment) growth rates and firm survival are assumed to depend on (employment) size in the preceding year; Mata discusses both the problems of sample selection and heteroscedasticity.

MAJOR FINDINGS - Survival increases with (start-up) firm size, but a great proportion of new firms disappear in the first years subsequent to their birth; Survivors, however, grow quite fast and small firms grow faster than their larger counterparts; *Gibrat's Law* fails.

Wagner (1994)F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Data for 10,743 manufacturing firms established in Lower Saxony, the second largest of the 'old' federal states of Germany, are used for the period 1978-1990; Single establishment new firms with a start-up size of less than 50 employees are focused.

RESEARCH METHODS - Survival and growth of new firms is analysed; A probit model is used to explain firm survival; Exogenous variables are start-up size and 4 industry variables, like concentration, capital intensity, R&D-intensity and the average rate of (employment) growth; For surviving entrants the heterogeneity of growth patterns and the persistence of growth are analysed.

MAJOR FINDINGS - Entrants face a high risk of failure, hazard rates tend to increase during the first years and to decrease afterwards; Firm survival is neither clearly related to start-up size nor to any of the industry variables; Moreover, the actual

annual growth of each new small firm seems to be determined by random sampling from the same distribution of growth possibilities; *Gibrat's Law* tends to hold.

Reid (1995) F - *The post-entry performance of new firms*

DATA CHARACTERISTICS Data for 73 less than 3-year old micro-firms (with fewer than 10 employees) in Scotland for the period 1985-1988 are available; The sample comprises private companies (50%), partnerships (20%), and sole proprietorships (30%).

RESEARCH METHODS - A simultaneous equations model of growth and profitability is estimated.

MAJOR FINDINGS - *Gibrat's Law* is rejected, with smaller among new Small Business Enterprises (SBEs) growing faster than larger new SBEs; *Gibrat's Law* is rejected in favour of an alternative (managerial) hypothesis put forward in the paper which implies a growth/profitability trade-off.

Santarelli (1997) F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Data for 11,660 Italian start-ups in the hospitality sector for the period 1989-1994 are available.

RESEARCH METHODS - Chesher's (1979) method, regressing the deviation of the logarithm of the firm size from the mean of the logarithms of the firm sizes at year t (z_t) on the similar deviations in the initial year is applied; Like Chesher a first order auto-regressive process is assumed; 20 groups of region-level equations are estimated.

MAJOR FINDINGS - *Gibrat's Law* cannot be rejected in the case of 14 out of 20 Italian regions, with the estimated parameters not significantly different from one.

Audretsch, Santarelli and Vivarelli (1999) F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Data for 1,570 Italian manufacturing (13 industries) firms that entered in 1987 are available; Firms are followed during 6 consecutive years.

RESEARCH METHODS - Survival rates and growth rates are reported; Logit and tobit equations are estimated, in which firm survival is assumed to depend on (employment) size in the initial year; Chesher's (1979) method, regressing the deviation of the logarithm of the firm size from the mean of the logarithms of the firm sizes at year t (z_t) on the similar deviations in the initial year is applied; Like Chesher a first order auto-regressive process is assumed; For the entire 1987-1993 period 2 groups of industry level equations are estimated: one for all firms and one for surviving firms only.

MAJOR FINDINGS - The likelihood of survival does not increase with (start-up) firm size; *Gibrat's Law* is rejected in 9 out of 13 cases in the estimations carried out for all firms, whereas in 11 out of 12 in those for surviving firms only.

Almus and Nerlinger (2000) F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Data for West German start-ups in manufacturing (both non-technology and technology intensive branches) for the period 1989-96 (divided into 5 sub-periods: 1990-92: 784 firms; 1991-93: 1, 420; 1992-94: 2, 831; 1993-95: 3, 495; 1994-96: 4, 278) and 3 size classes (less than 5 employers, between 6 and 19, more than 19).

RESEARCH METHODS - Kernel density estimations (with bandwidth parameter 2, so that to calculate the density all employment observations within the interval of the size of 2 employees around the number of employees chosen are included) to test whether the approx. log-normal distribution of firm size holds also for young firms.

MAJOR FINDINGS - Almus and Nerlinger find that *Gibrat's Law* is rejected in all cases with the estimated parameters smaller than one; In addition, the deviation from *Gibrat's Law* is found to decrease with increasing firm size.

Lotti, Santarelli and Vivarelli (2001) F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Data for 214 Italian instruments industry firms that entered in 1987 are available; Firms are followed during 6 consecutive years.

RESEARCH METHODS - Chesher's (1979) method, regressing the deviation of the logarithm of the firm size from the mean of the logarithms of the firm sizes at year t (z_t) on the similar deviations in the initial year and one year before is applied; Like Chesher a first order auto-regressive process is assumed; Log of size in the last year for which data are available is regressed on log of initial size for the entire period; Besides, log of size in each year is regressed on log of size in previous year; Each estimate is conducted for all firms, firms with an initial size comprised between 1 and 5 employees, firms with an initial size above 5 employees; The problems of sample selection bias - Heckman's (1979) method - heteroscedasticity and the persistence of growth are analyzed.

MAJOR FINDINGS - *Gibrat's Law* fails to hold during the first year following start-up - when smaller entrants grow faster than their larger counterparts - whereas it becomes valid once a minimum threshold in terms of size and age has been reached; Thus, smaller ones among new-born firms, having entered with a marked sub-optimal scale, adjust their size towards the mean size exhibited by larger entrants.

Lotti, Santarelli and Vivarelli (2003) F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Italian National Institute for Social Security (INPS) data set; This data set identifies 855 new firms (with at least one paid employee) in 6 (Electrical and electronic engineering, Instruments, Food, Footwear and clothing, Wood and furniture, Rubber and plastics) manufacturing industries born in January 1987 and tracks their post-entry employment performance at monthly intervals until January 1993; No information on firms with zero paid employees is obtainable from the INPS file; Size is measured in terms of employment.

RESEARCH METHODS - The Authors use the quantile regression as a suitable methodology to deal with *conditional objects* by hypothesizing the existence of an *unobserved* behavioral model; Normally, this leads to a deviation of the distribution of the error terms from the canonical hypotheses of normality and homoskedasticity; In such a framework, the quantile regression (QR) represents a robust alternative to the least squares estimation: it consists in a Least Absolute Deviation estimator (LAD) that fits the median to a linear function of the covariates; In this way, the estimates are robust for all the deviations from the normality of the error terms and especially for the presence of outliers; This methodology defines the conditional quantiles as a minimization problem of a non differentiable function in β that can be easily solved by linear programming (Buchinsky, 1995). It is studied, for the overall period and year by year, the effects of firm size on growth at different quantiles ($\theta[0.10]$, $\theta[0.25]$, $\theta[0.50]$, $\theta[0.75]$, $\theta[0.90]$).

MAJOR FINDINGS - The Authors first consider the results for the 6-year period (1987-1993): In 5 out of 6 industries (with the exception of food) and in the aggregate estimate, the QR estimates of β_1 , although significantly different from zero, are significantly less than one; This confirms that, in general, smaller firms grow faster than their larger counterparts over the entire period. Even more interesting results are yielded by the separate estimations carried out for each year and each industry: In five industries out of six, *Gibrat's Law* fails to hold in the year immediately following start-up, whereas it holds, or fails less severely, when firms approach maturity; In all sectors (apart from food) only in the first year following start-up do the QR estimates yield a β_1 significantly less than one, while an almost monotonic convergence of β_1 towards one occurs in the subsequent years, with the Wald test never rejecting *Gibrat's Law*.

Mata and Portugal (2004)F - *The post-entry performance of new firms*

DATA CHARACTERISTICS - Annual data for over 100,000 firms are obtained from the Portuguese Ministry of Employment for the period 1982-1992; Due to data characteristics analysis is applied for the period 1983-1989 only; Firms are divided in domestic and foreign firms; The latter group is split in greenfield and acquisition entrants; Size is measured as employment.

RESEARCH METHODS - Survival rates have been estimated for domestic and foreign firms. A logit model is applied to estimate differences in survival rates between domestic entrants and the two types of entrants from abroad: greenfield and acquisition; Growth rates are estimated for the 3 types of entrants and the significance of differences in growth rates is tested.

MAJOR FINDINGS - There are important differences in the post-entry performance of the different types of entrants; Domestic entrants are much more likely to exit than foreign ones, both greenfield and acquisition; With respect to post-entry growth, however a mixed pattern emerges; Foreign acquisition entrants grow very little, foreign greenfields grow very quickly, and domestic entrants are in between.

Table 7 – Empirical Studies on Firm Growth Rates

Study	Type	Country	Period	Ind	GL	Size	Age	Lag Grow	EcIss
Mansfield (1962)	A	U.S.	1916-1957	M	M	na	na	na	...
Acs and Audretsch (1990)	A	U.S.	1976-1980	M	M	na	na	na	...
Fariñas and Moreno (2000)	A	Spain	1990-1995	M	A	0	0	na	ss;het
Piergiovanni, Santarelli, Klomp and Thurik (2003)	A	Italy	1989-1994	S	M	-/0	na	na	het
Audretsch, Klomp, Santarelli and Thurik (2004)	A	Netherlands	1981-1991	S	M	-	-	+/0	het
Mansfield (1962)	B	U.S.	1916-1957	M	M	na	na	na	...
Evans (1987a)	B	U.S.	1976-1982	M	R	-	-	na	ss;het
Evans (1987b)	B	U.S.	1976-1980	M	R	-	-	na	ss;het
Contini and Revelli (1989)	B	Italy	1980-1986	M	R	-	-/0	na	het
FitzRoy and Kraft (1991)	B	Germany	1977-1979	M	R	-	-	na	het
Variyam and Kraybill (1992)	B	U.S.	1985-1990	M/S	R	-	-	na	het

<i>Study</i>	<i>Type</i>	<i>Country</i>	<i>Period</i>	<i>Ind</i>	<i>GL</i>	<i>Size</i>	<i>Age</i>	<i>Lag Grow</i>	<i>Eclss</i>
Bianco and Sestito (1993)	B	Italy	1985-1990	M/S	R	-	-	na	ss;het;mea
Dunne and Hughes (1994)	B	U.K.	1975-1985	M/S	R	-	-	na	ss;het
Acs and Armington (2001)	B	U.S.	1994-1995	M/S	M	-/0	-	na	...
Delmar, Davidsson and Gartner (2003)	B	Sweden	1987-1996	M/S	M	0	na	na	...
Piergiovanni, Santarelli, Klomp and Thurik (2003)	B	Italy	1989-1991	S	M	-/0	na	na	het
Audretsch, Klomp, Santarelli and Thurik (2004)	B	Netherlands	1987-1991	S	M	-	-	+/0	het
Johansson (2004)	B	Sweden	1993-1998	M/S	R	-	-	na	...
Lensink, van Steen and Sterken (2005)	B	Netherlands	1995,1999	M/S	A	0	-	na	...
Hart and Prais (1956)	C	U.K.	1885-1950	M	A	na	na	na	...
Simon and Bonini (1958)	C	U.S.	1954-1956	M	A	na	na	na	...
Hymer and Pashigian (1962)	C	U.S.	1946-1955	M	M	na	na	na	...
Mansfield (1962)	C	U.S.	1916-1957	M	M	na	na	na	...
Singh and Whittington (1975)	C	U.K.	1948-1960	M/S	M	+	na	na	...
Droucopoulos (1983)	C	World	1957-1977	M	M	-	na	na	...
Buckley, Dunning and Pearce (1984)	C	World	1972-1977	M	A	0	na	na	...
Hall (1987)	C	U.S.	1972-1983	M	R	-	na	na	ss;het;mea
Bourlakis (1990)	C	Greece	1966-1986	M	R	-	-	na	ss;het

<i>Study</i>	<i>Type</i>	<i>Country</i>	<i>Period</i>	<i>Ind</i>	<i>GL</i>	<i>Size</i>	<i>Age</i>	<i>Lag Grow</i>	<i>Eclss</i>
Konings and Faggio (2003)	C	5 transition countries	1993-1994	M/S	R	-	na	na	...
Audretsch, Klomp, Santarelli and Thurik (2004)	C	Netherlands	1987-1991	S	M	-	-	+/0	het
Mansfield (1962)	D	U.S.	1916-1957	M	R	na	na	na	...
Contini and Revelli (1989)	D	Italy	1980-1986	M	R	-	-	+/-	ss;het
Wagner (1992)	D	Germany	1978-1989	M	R	na	na	+	...
Tschoegl (1996)	D	Japan	1954-1993	S	R	-	na	+	het
Harhoff, Stahl and Woywode (1998)	D	Germany	1989-1994	M	R	-	-/0	na	ss;het
Hardwick and Adams (2002)	D	U.K.	1987-1996	S	M	-/0/ +	na	na	ss;het;me ea
Hart and Oulton (1999)	D	U.K.	1989-1993	M/S	R	-	na	na	het
Fariñas and Moreno (2000)	D	Spain	1990-1995	M	R	-	-	na	ss;het
Machado and Mata (2000)	D	Portugal	1983, 1991	M	R	-	na	na	het
Heshmati (2001)	D	Sweden	1993-1998	M/S	M	-	-	na	het;mea
Van der Venet (2001)	D	OECD area	1985-1994	S	M	-/0	...	...	...
Becchetti and Trovato (2002)	D	Italy	1989-1997	...	...	...	...	...	...
Del Monte and Papagni (2003)	D	Italy	1989-1997	M	A	0	-	+	purt
Chen and Lu (2003)	D	Taiwan	1988-1999	...	...	...	...	...	...
Fotopoulos and Louri (2004)	D	Greece	1992-1997	M	R	-	-	na	het
Piergiovanni, Santarelli, Klomp and Thurik (2003)	D	Italy	1989-1994	S	M	-/0	na	na	het

<i>Study</i>	<i>Type</i>	<i>Country</i>	<i>Period</i>	<i>Ind</i>	<i>GL</i>	<i>Size</i>	<i>Age</i>	<i>Lag Grow</i>	<i>Eclss</i>
Audretsch, Klomp, Santarelli and Thurik (2004)	D	Netherlands	1987-1991	S	M	-	-	+/0	het
Harris and Trainor (2005)	D	U.K.	1973-1998	M	R	-	na	na	put
Hart and Prais (1956)	E	U.K.	1885-1950	M	M	na	na	na	...
Singh and Whittington (1975)	E	U.K.	1948-1960	M/S	R	0	na	+	...
Chesher (1979)	E	U.K.	1960-1969	M	R	0	na	+	...
Kumar (1985)	E	U.K.	1960-1976	M/S	R	-	na	+	...
Amirkhalkhali and Mukhopadhyay (1993)	E	U.S.	1965-1987	M	R	-	na	+	...
Amaral <i>et al.</i> (1997)	E	U.S.	1974-1993	M	R	-	na	na	...
Geroski, Lazarova, Urga Walters (2003)	E	U.K.	1955-1985	M/S	A	0	na	na	put
Pfaffermayr and Bellak (2002)	E	Austria	1996-1999	M/S	A	0	na	na	...
Bottazzi <i>et al.</i> (2001)	E	World	1987-1997	M	A	0	na	+	ss;het
Goddard, Wilson and Blandon (2002)	E	Japan	1980-1996	M	R	-	na	na	put
Bothner (2005)	E	World	1995-1999	M	R	-	na	na	put
Dunne, Roberts and Samuelson (1988)	F	U.S.	1963-1982	M	na	na	na	na	...
Dunne, Roberts and Samuelson (1989)	F	U.S.	1967-1982	M	R	-	-	na	...
Phillips and Kirchhoff (1989)	F	U.S.	1976-1986	M/S	na	na	na	na	...

<i>Study</i>	<i>Type</i>	<i>Country</i>	<i>Period</i>	<i>Ind</i>	<i>GL</i>	<i>Size</i>	<i>Age</i>	<i>Lag Grow</i>	<i>Eclss</i>
Audretsch and Mahmood (1994)	F	U.S.	1976-1986	M	R	-	na	na	...
Mata (1994)	F	Portugal	1983-1987	M	R	-	na	na	...
Wagner (1994)	F	Germany	1978-1990	M	A	0	na	na	...
Reid (1995)	F	U.K.	1985-1988	M	R	-	-	na	het
Santarelli (1997)	F	Italy	1989-1994	S	M	0/-	na	na	het
Audretsch, Santarelli and Vivarelli (1999)	F	Italy	1987-1993	M	M	-/0	na	na	het
Almus and Nerlinger (2000)	F	West Germany	1989-1996	M	R	-	na	na	het
Lotti, Santarelli and Vivarelli (2001)	F	Italy	1987-1993	M	M	-/0	0	na	ss;het
Lotti, Santarelli and Vivarelli (2003)	F	Italy	1987-1993	M	M	-	na	na	ss;qua
Mata and Portugal (2004)	F	Portugal	1983-1989	M/S	M	-/0/ +	na	na	...

Type (of empirical growth study)

A : Static analysis and version 1
 B : Static analysis and version 2
 C : Static analysis and version 3
 D : Temporal analysis and version 2
 E : Temporal analysis and version 3
 F : The post-entry performance of new firms

Size, Age and Lag(ged) Grow(th)

- : negative effect on growth
 0 : no effect on growth
 + : positive effect on growth
 na : not available
 ...

Ind(ustry)

M : Manufacturing;
 S : Services

G(ibrat's)L(aw)

A : Accepted
 R : Rejected
 M : Mixed Results

Ec(ometric)Iss(ues)

ss : corrected for sample selection
 het : corrected for heteroscedasticity
 mea : corrected for measurement error
 purt : panel unit root tests
 qua : quantile regression

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