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Gibrat's Law: Are the Services Different?

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Abstract. Several noted surveys on intra-industry dynamics have reached the conclusion from a large body of evidence that *Gibrat's Law* does not hold. However, almost all of these studies have been based on manufacturing or large scale services such as banking and insurance industries. There are compelling reasons to doubt whether these findings hold for small scale services such as the hospitality industries. In this paper we examine whether the basic tenet underlying *Gibrat's Law* – that growth rates are independent of firm size – can be rejected for the services as it has been for manufacturing. Based on a large sample of Dutch firms in the hospitality industries the evidence suggests that in most cases growth rates are independent of firm size. Validation of *Gibrat's Law* in some sub-sectors of the small scale services suggests that the dynamics of industrial organization for services may not simply mirror that for manufacturing. The present paper includes a survey of nearly 60 empirical studies on firm growth rates.

Key words: Firm growth, *Gibrat's Law*, service industries

JEL Classifications: D21, L11, L60, L80.

I. Introduction

In his exhaustive survey in the *Journal of Economic Literature*, Sutton (1997, p. 40) observed that publication of *Inégalités Économiques* by Gibrat (1931) triggered, "One of the most important strands in the literature on market structure." Sutton points out that what is commonly referred to as *Gibrat's Law* is something of a misnomer. Rather than constituting a bona fide Law, what Gibrat proposed is actually an assumption – that the probability of the "next opportunity is taken up by any particular active firm is proportional to

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the current size of the firm'' (Sutton, 1997, p. 43). From this simple proposition follows the equally simple prediction of proportional effect, that growth rates should be independent of size, which Mansfield (1962, pp. 1030–1031) characterized as, ''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.''

As Sutton (1997) summarizes, when *Gibrat's Law* was finally subjected to empirical scrutiny in the 1950s and 1960s the results were less than unambiguous.[1] While Scherer's (1980) reading of the literature was that assuming growth rates to be uncorrelated with initial firm size, ''is not a bad first approximation,'' persuasive empirical work by Mansfield (1962) led him to conclude that, ''*Gibrat's Law* does not seem to hold up very well empirically.''

The ambiguity with respect to *Gibrat's Law* seemed to be resolved in what Sutton (1997) refers to as the ''new literature of the 1980s.'' A series of studies spanning a broad range of countries, and including both small as well as large enterprises, resulted in a singular result – growth rates (of surviving firms) tend to systematically decrease with increasing firm size. This finding emerged so consistently across different studies that Geroski (1995) in his survey of ''What Do We Know About Entry?'' classified it as a Stylized Result.[2]

Closer inspection of the three survey articles focusing on firm growth reveals that Geroski (1995), Sutton (1997, 1998) and Caves (1998) did not acknowledge that virtually all of the knowledge assembled to date about *Gibrat's Law* is based on manufacturing. Perhaps this oversight is not surprising, since *Gibrat's Law* of Proportional Effect is sufficiently general as to not distinguish across specific types of economic activity. The Geroski (1995), Sutton (1997) and Caves (1998) surveys imply that what holds for manufacturing would be expected to hold for services. If this were not the case, the results based on manufacturing would actually represent a special case and application of *Gibrat's Law*; less than one-fifth of employment in the OECD countries is in manufacturing. Whether the dynamics of industrial organization for the services simply mirrors that in manufacturing is an open-ended question where little is known but has significant policy implications. In fact, as we make clear in the Section III of this paper, there are compelling theoretical reasons to expect the relationship between firm size and growth to be different for services than in manufacturing.

[1] See for example the early studies by Hart and Prais (1956), Simon and Bonini (1958), Hymer and Pashigian (1962), Hart (1962), Prais (1976), and Singh and Whittington (1962).

[2] More specifically Geroski's (1995, p. 434) *Stylised Result* 8 is ''Both firm size and age are correlated with the survival and growth of entrants.''

Recently, the three survey articles have been supplemented by a series of studies that also took services into account. We have identified 20 such studies of which five deal exclusively with the services. Four of these five studies are concerned with large scale services such as banking, insurance and assurance industries.[3] Only Santarelli (1997) deals with small scale services. See the table of Appendix paper for details.

The purpose of this paper is to examine whether Sutton's (1997) Statistical Regularities and Geroski's (1995) Stylized Results for the validity of *Gibrat's Law* based on evidence from the manufacturing sector holds for small scale services. Systematic differences in the size–growth relationship between small scale services and manufacturing may reflect underlying structural differences shaping the dynamics of industrial organization in these services in a way that is fundamentally different from that in manufacturing.

The following section of this paper characterizes the main findings and summarizes the state of knowledge regarding *Gibrat's Law* based on evidence from manufacturing. In section III theoretical reasons are presented as to why *Gibrat's Law* would be expected to hold for the services but not in manufacturing. The comprehensive longitudinal database used to track the growth rates of over 1,000 Dutch hospitality service firms is introduced and documented in Section IV. In Section V the empirical results are presented. Finally, conclusions and a summary are presented in Section VI. In particular, our empirical evidence indicates that, in contrast to manufacturing, *Gibrat's Law* is likely to hold for small scale services. This is in line with recent studies dealing with both manufacturing and services, which show mixed results in that *Gibrat's Law* is less persistently rejected when compared to what the three surveys report. This suggests that the dynamics of industrial organization for services may not simply mirror that for manufacturing.

II. Results from Manufacturing

Most of the knowledge about the validity of *Gibrat's Law* is from manufacturing (see the Appendix for a compilation of the most important studies). Geroski (1995), Sutton (1997) and – although only indirectly since his article deals mostly with the mobility and turnover of firms – Caves (1998) conclude from their surveys of the literature linking firm size to growth that "Both firm size and age are correlated with the survival and growth of entrants" (Geroski, 1995, p. 434), thus leaving little support for the validity of *Gibrat's Law*. While Geroski (1995) considers the empirical evidence compelling

[3] Among these the study by Keating (1974) on the Australian finance industry rejects the validity of *Gibrat's. Law, finding that large firms have a higher and les variable rate of groth than do small firms.*

enough to constitute a bona fide Stylized Result, Sutton (1997, p. 46) only concludes that the proportional rate of growth of a firm, conditional upon survival, decreases with size. This ambiguity seems to arise from the types of firms included in the sample. *Gibrat's Law* tends to hold when only large firms or firms that have exhausted scale economies are included in the sample (cf., for example, the results by Geroski et al., 2003; and those by Bottazzi et al., 2001). According to Geroski (1995, p. 435), "The results are interesting because they suggest that the growth patterns of large and small firms differ. As is well known, the growth rates of well-established corporations are, roughly speaking, random, and do not seem to vary in any stable or systematic way with firm size." However, as Caves (1998, p. 1948) aptly observes "Although the importance of these facts for economic behavior is manifest, their development has not been theory-driven," and *Gibrat's Law* is still an empirical regularity in search of sound theoretical justification (in this connection see McCloughan, 1995; Sutton, 1998; Brock, 1999; Cooley and Quadrini, 2001; Ghosal, 2001; Cabral and Mata, 2003).

Just as the earlier studies based solely on large manufacturing industries typically found support for *Gibrat's Law* (Hart and Prais, 1956), so have some of the most recent studies (Geroski and Machin, 1993; Pfaffermayr and Bellak, 2000; Geroski et al., 2003). By contrast, those studies, both pioneering (Samuels, 1965; Prais, 1976) and more recent (Evans, 1987a, b; Hall, 1987; Dunne et al., 1988; 1989; Reid, 1995; Audretsch et al., 1999; Almus and Nerlinger, 2000), including small firms in the sample typically concluded that growth rates tend to be negatively related to the size of (surviving) firms. Conversely, Lotti et al., (2001, 2003) show that *Gibrat's Law* fails to hold for Italian manufacturing firms only in the year(s) immediately after start-up, whereas it is confirmed in subsequent years. This implies that a post-entry size adjustment process takes place among the smaller ones of the new entrants which, having entered with a marked sub-optimal scale, adjust their size towards the mean size exhibited by larger entrants, but once they reach (in subsequent years) a size large enough to enhance their likelihood of survival, their pattern of behavior matches that of larger entrants.[4] This and other significant exceptions (Heshmati, 2001; Del Monte and Papagni, 2003) notwithstanding, the more general and broader samples of firms including a full spectrum across size classes have led to results inconsistent with *Gibrat's Law*.

Sutton (1997) has attempted to resolve any remaining ambiguities by recollecting Mansfield's (1962) interpretation of *Gibrat's Law*. Mansfield (1962) pointed out that there are three main renditions of *Gibrat's Law*. The first version postulates that the Law holds for firms that exited the industry as

[4] This finding is consistent with the hypothesis put forward by Cabral (1995) that entering the market implies capacity and technology costs that involves some degree of sunkness.

well as for those remaining in existence. The second interpretation is that the Law holds only for firms that survive over the relevant time period (Hart and Prais, 1956). The third main version is that the Law applies only to firms that are large enough to exceed the minimum efficient scale (MES) level of output (Simon and Bonini, 1958).

Sutton (1997) makes clear that the ambiguity created by different results for different samples becomes resolved when the empirical evidence is weighed through these three different lenses. In his view *Gibrat's Law* holds under the third version but not under the first two. Our survey, also containing more recent studies, shows that in the static analysis of version three for manufacturing industries *Gibrat's Law* is accepted in just three out of ten studies while four show mixed results.[5] See the table of Appendix.

III. Why the Services Should Differ

In contrast to Geroski's (1995) Stylized Result based on evidence from manufacturing, there are compelling theoretical reasons to expect that *Gibrat's Law* would hold for the services. These theoretical reasons are based on interpreting why *Gibrat's Law* fails to hold generally in manufacturing, but, in fact, does hold in a number of sub-samples. As Geroski (1995) and Sutton (1997) point out, the literature has been more focused on testing for the validity of the Law than on explaining and interpreting the empirical results.

The reasons why *Gibrat's Law* does not hold for manufacturing in general, but is, in fact, valid for particular sub-samples, such as for large established firms, is due to a discrepancy between the two assumptions underlying the Law. The first, as stated by Sutton (1997, p. 43), that the "next opportunity is taken up by any particular active firm is proportional to the current size of the firm" does not necessarily lead to the second, that firm growth should be independent of size. An important qualification is that the second proposition will follow from the first if and only if there is no relationship between size and survival.

If opportunities are stochastically distributed but proportional to firm size, the expected growth rate for each firm is the same. As long as the likelihood of survival is also independent of firm size, *Gibrat's Law* would be expected to hold for a reasonably large sample. Each firm has an equal probability of "drawing" any given growth rate. The observed growth rates would then be normally distributed for any given firm size or firm-size class, which would conform to *Gibrat's Law*.

[5] The table of Appendix also shows that in the temporal analysis of version three for manufacturing industries *Gibrat's Law* is accepted only in one of 10 cases.

However, when the likelihood of survival is positively related to firm size, the observed growth rates are no longer normally distributed for each firm size or firm-size class. If size is a requirement for survival, or at least positively influences the likelihood of survival, the consequences of not obtaining a growth opportunity, or even experiencing negative growth become asymmetrical across firm size classes. Negative growth for a large firm means that the firm will be smaller in period t−1 than in period t but it will still survive; negative growth for a small firm will mean that the firm has a lower probability of survival. Even the lack of growth or insufficient growth for a small firm will reduce the likelihood of survival if the relationship between survival and size is strong enough. The higher propensity for small firms experiencing low (or negative) growth to exit than for low-growth large firms serves to bias samples of surviving small firms towards higher growth enterprises. By contrast, a sample of surviving large firms consists of a greater spectrum including both low- and high-growth enterprises. Thus, when the consequences of not obtaining a high growth opportunity differ systematically between large and small firms in terms of the likelihood of survival, the resulting distributions of actual observed growth patterns across different firm size classes will also vary systematically between large and small firms in two ways. First, *Gibrat's Law* will tend to hold for larger firms but not for smaller enterprises. Second, growth rates will be negatively related to firm size for samples including a full spectrum of large and small firms.

The degree to which smaller firms are confronted with a lower likelihood of survival than their larger counterparts is not constant from industry to industry but rather varies systematically across industries. In some industries the difference between the large- and small-firm survival rates is relatively large; in others it is non-existent. A number of different studies spanning different countries and time periods have identified a common set of industry-specific characteristics shaping the degree to which a small-firm survival disadvantage exists, including the relative importance of sunk costs, industry growth, scale economies, and capital intensity (Audretsch, 1991, 1995; Mahmood, 1992; Mata and Portugal, 1994; Audretsch and Mahmood, 1995; Doms et al., 1995; Baldwin, 1995; Baldwin and Rafiquzzaman, 1995; Mata et al., 1995;). The gap between large-firm and small-firm survival diverges the most in industries with substantial sunk costs and which are capital intensive and characterized by high scale economies. 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.

By contrast, the small-firm survival bias tends to disappear in industries with minimal sunk costs and where capital intensity and scale economies do not play an important role. In such industries the consequences of low or even negative growth are symmetric between large and small enterprises. Consequently, observed growth rates also are found to be independent of firm size.

The types of Dutch services we examine in this paper are in the hospitality sector, including restaurants, cafeterias, cafes, hotels and camping sites. By definition these firms operate in very small sub-markets (neighborhoods rather than municipal areas), which in most cases are characterized by the presence of a few firms or even a single one. Thus, even very small firms in this industry are likely to operate at the minimum efficient scale level of output of their sub-market and do not need to rush for enhancing their likelihood of survival. While large chains and franchising may be more characteristic of the United States and the United Kingdom, the Dutch hospitality sector consists largely of family-owned and independent businesses, therefore displaying similarities with other EU countries such as Greece, Italy, Portugal and Spain. In a sector of family-owned and independent local businesses, sunk costs are likely to be minimal,[6] as are scale economies and capital requirements. Thus, those factors leading to a small-firm survival bias and ultimately to a negative relationship between firm size and growth rates in certain manufacturing industries are noticeably absent in the Dutch hospitality sector. Rather, the absence of scale economies, capital intensity and sunk costs leads to the prediction that the consequences of not growing should be symmetric across all firm sizes. In contrast to manufacturing, *Gibrat's Law* would be expected to hold for Dutch hospitality industries. In fact, this expectation is supported by the results found by Hart and Oulton (1999) – who identified a negative relation between size and growth in their estimates for the "Distribution and hotel" aggregate in the UK where large chains and franchising are quite characteristic for the business – and by Santarelli (1997) – who found that, in the entire Italian hospitality sector which consists largely of family-owned and independent businesses, *Gibrat's Law* holds for the majority of Italian regions.[7]

IV. Measurement

As Dunne et al. (1988, 1989) emphasize, one of the greatest impediments to examining the relationship between firm size and growth has been the lack of access to longitudinal data sets. This paucity of data has been even more exacerbated for services. In this paper we rely on Statistics Netherlands

[6] Although, as aptly shown by Evangelista (2000) for the Italian case, also firms in the Hotel and Restaurant industry tend to report some innovative activity, that is indication of the possible presence of endogenous sunk costs.

[7] In testing *Gibrat's Law* for selected manufacturing and service industries in the case of Taiwan, Chen and Lu (2003) have recently found that the *Law* can be rejected for the former but not for the latter ones.

(CBS) to track the growth performance of firms in the Dutch hospitality sector between 1987 and 1991. Annual observations for firm size are available from CBS 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.[8]

In compiling the data files, CBS follows three rules in their selection process. First, firms are classified according to their main activity (e.g., lodging guests or serving meals) and their size, which is measured by the number of employees. Second, for firms with at least twenty employees a census of the entire population is taken; for smaller firms a sample is taken where the sample proportion increases according to size class. Third, firms that are selected in the survey in 1 year remain in the sample for subsequent years, creating longitudinal observations.

As first Mansfield (1962) and later Sutton (1997) point out, the discrepancy in conclusions about the validity of *Gibrat's Law* emanates from using three different types of samples of firms – all firms, only surviving firms, and only large firms (that exceed the MES level of output). To ensure that the results in this paper are not slanted towards any one of these, we create three different samples. The first sample consists of all firms. We follow the precedent in previous studies by assigning a growth rate of −100 to any firm that existed between 1987 and 1991.

The second sample consists only of firms that survived the entire period between 1987 and 1991. About 40% of the firms in existence in 1987 are not in existence by 1991. The third sample consists only of large surviving firms. We adapt Mansfield's (1962) approach and define those enterprises accounting for one-half of the industry value-of-shipments as being large.

The mean growth rates, measured as the percentage change (in current prices) in firm sales between 1987 and 1991 are shown for each of these three samples in Tabel I. The mean growth rate for the 1,170 firms in the sample consisting of all firms is 12.20% and ranged from 1.09% in cafes to 25.72% for camping sites. For the sample consisting of only the 944 surviving firms the mean growth rate is considerably higher, 27.22%. When only the 291 (surviving) large firms are included, the mean growth rate is somewhat less, 20.83%.

V. Empirical Results

In the preceding section we refer to the three versions of *Gibrat's Law* that are tested in the literature: a first version where all firms are included, a second

[8] It is not possible to identify the separate establishments of the remaining six percent multi-establishment enterprises.

Table I. Firm size and growth rates in the Dutch hospitality sector for the period 1987—1991

Sub-Sector	Version 1[a]			Version 2[b]			Version3[c]		
	Growth[d]	Size[e]	N[f]	Growth[d]	Size[e]	N[f]	Growth[d]	Size[e]	N[f]
Restaurants	4.10	2219.70	213	17.48	2392.09	172	18.89	3440.93	116
Cafeterias	8.56	616.41	124	37.95	695.34	102	26.34	1653.58	34
Cafes	1.09	296.24	305	21.30	309.98	223	11.88	996.15	34
Hotels	10.19	4221.89	241	21.44	4351.79	206	9.70	11718.92	52
Camping Sites	25.72	805.31	103	36.05	810.22	91	34.18	1874.09	23
Entire Hospitality Sector[g]	12.20	1848.93	1170	27.22	2013.08	944	20.83	4544.76	291

[a] In the first version all firms are included. If a firm exits between 1987 and 1991 the growth rate (over the four year period) is equated to −100.
[b] In the second version all firms that survived during the period 1987–1991 are included.
[c] In the third version only surviving firms that operate above the minimum efficient scale (MES) are included. We define the MES as the minimum size of the largest firms in a sub-sector that accounts for one half of the value of sales in that sub-sector.
[d] Firm growth rate measured by the average percentage of change in sales per firm for the period 1987–1991.
[e] Firm size measured by the average sales per firm in 1987 (in 1,000 Dutch guilders).
[f] N stands for the number of observations. The entire hospitality sector consists of 13 four digit sub-sectors. Only five sub-sectors are analyzed separately. The remaining sub-sectors contain less than 100 firms.
[g] The entire hospitality sector consists of 13 four digit sub-sectors. Only five sub-sectors are analyzed separately. The remaining sub-sectors contain less than 100 firms.

version where only surviving firms are analyzed, and a third version including only large survivors, i.e., firms operating at or above the minimum efficient scale (MES). Another way of characterizing the studies testing *Gibrat's Law* is: static studies versus studies analyzing the persistence of growth. Mansfield (1962) is an example of a static approach, while Chesher's study (1979) is an example of a temporal analysis.

Both static and temporal analyses of the three versions of *Gibrat's Law* would lead to six specifications of modeling empirical growth. However, the first version of the Law cannot be estimated 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. The Appendix to this paper gives a review of empirical studies testing *Gibrat's Law*.[9] Studies denoted as type A, B, and C deal with the static analyses, while those denoted as type D and E cover the studies focusing on the persistence of growth.[10] Results for the static analysis for Dutch services are presented in Section 5.1 and the persistence of growth is analyzed in Section V.2.

1. Distribution of Firm Growth Rates

The first method used to test for the validity of *Gibrat's Law* in the literature divides the observed firm sizes into several size classes and then examines whether firm growth rates are equally distributed across these classes.[11] 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 sixteen 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.[12]

The results for the three different versions of *Gibrat's Law* are presented in Tabel II.[13] *Gibrat's Law* is rejected in four of the five sub-sectors for the sample including all firms (version 1 in Tabel II). Only for the camping sites are size and growth found to be statistically independent.

[9] See also Lotti et al (2003) Fotopoulos and Louri (2001) and Hart (2000) for reviews of a selection of empirical work on *Gibrat's Law*.

[10] A sixth group of studies on firm growth is added to Appendix as part F.See http//www.tinbergen.nl/discussionpapers/02080.pdf. They deal with the so-called post-entry performance of new firms, which is a relatively recent strand of studies in the liteature.

[11] See for examples Hymer and Pashigian (1962), Singh and Whittington (1975) and Acs and Audretsch (1990).

[12] To test for independence in the cross tables, the expected value of each cell in the table is at least five. To obtain these expected values we use only two or three classes of size and growth when the number of observations in a table is fewer than 80.

[13] In this case, for the static analysis we use the same growth rates for the period 1987–1991 that have been used for Tabel I.

Table II. Empirical results for *Gibrat's Law*, which states that firm growth rates are distributed independently of firm size

Chi-Square Value Degrees of Freedom Level of Significance Sub-sector	Version1[a]	Version2[b]	Version3[c]
Restaurants	34.43 9	27.27 9	16.74 9
Cafeterias	21.67 9	24.09 9	1.20 1
Cafes	42.02 9	11.53 9	0.01 1
Hotels	18.41 9	15.62 9	3.56 4
Camping sites	12.05 9	3.64 9	1.86 1
Entire hospitality	50.83 9	14.19 9	12.58 9

[a] In the first version all firms are included. If a firm exits between 1987 and 1991 the growth rate (over the four year period) is equated to − 100.
[b] In the second version all firms that survived during the period 1987–1991 are included.
[c] In the third version only surviving firms that operate above the minimum efficient scale (MES) are included. We define the MES as the minimum size of the largest firms in a sub-sector, which accounts for one half of the value of sales in that sub-sector.

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 (version 2). For the sample of large firms *Gibrat's Law* is accepted for four sub-sectors, the only exception being represented by the Restaurants sub-sector (version 3).

2. Persistence of Growth

In this section the other main methodology used to estimate *Gibrat's Law* is used to test the hypothesis that firm growth is independent of size.[14] As developed by Chesher (1979),

[14] Singh and Whittington (1975) show that the absence of persistence of firm growth rates is an implication of *Gibrat's Law*.

$$z_{t,i} = \beta z_{t-1,i} + \varepsilon_t, i, \tag{1}$$

where t is an index for time, i is an index for the firms, and $z_{t,i}$ is the deviation of the logarithm of the size of company i at time t from the mean of the logarithms of the sizes of companies at time t ($z_{t-1,i}$ is analogously defined).

If *Gibrat's Law* is valid and firm growth rates are distributed independently of firm size, the parameter β should be equal to unity.[15] If $\beta < 1$ large firms are expected to grow more slowly than their smaller counterparts; if $\beta > 1$ small firms are expected to grow more slowly than larger enterprises.

Equation (1) assumes that the disturbances, $\varepsilon_{t,\ i}$ are serially uncorrelated. In the case of serially correlated disturbances the firm growth rate in one period depends on the growth rate in the preceding period.[16] Thus, *Gibrat's Law* can be rejected even when the parameter ÿβ is (about) equal to one.[17] Assuming a first order autoregressive process for the disturbances $\varepsilon_{t,i}$

$$\varepsilon_t, i = \rho\varepsilon_{t-1,i} + v_{t,i} \tag{2}$$

where $v_{t,i}$ is assumed to be non-serially correlated. Expressing the disturbances $\varepsilon_{t,i}$ and $\varepsilon_{t-1,i}$ in terms of $z_{t,i,}z_{t-1,i}$ and $z_{t-1,i}$ and $z_{t-2,i}$ respectively,

$$z_{t,i} = (\beta + \rho)z_{t-1,i} + (-\beta\rho)z_{t-2,i} + v_{t,i}. \tag{3}$$

We 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.[18]

The estimation results for Equation (3) are shown in Tabel III. Equation (3) is not corrected for sample selection bias, and this for four reasons. First, one may assume that the residuals are not correlated with unobservable characteristics concerning the decision to exit the market. Second, we test for *Gibrat's Law* using a sample of only surviving firms. Third, because of the variety of reasons for an exit the sample selection bias cannot be corrected by a straightforward econometric technique (Wagner, 1992). Fourth, the period under study is short. Results in Hall (1987) show that for short periods the potential bias is unlikely to be serious.

There are three important results emerging in Tabel III. First, in 11 of the 15 cases *Gibrat's Law* is accepted. This is a sharp contrast to the findings for

[15] See Chesher (1979) for a more detailed explanation.

[16] See Amirkhalkhali and Mukhopadhyay (1993) for an explanation.

[17] The condition that parameter β is equal to one is a necessary but not a sufficient condition for *Gibrat's Law* to be true.

[18] See Malinvaud (1980).

Table III. Empirical results for Equation (3) $z_{t,i} = (\beta + \rho)z_{t-1,i} + (-\beta\rho)z_{t-2,i}$ t = 1989, 1990 or 1991

Sub-sector		Dependent variable		
		z_{91}	z_{90}	z_{89}
Restaurants	β	1.0203* (0.0098)[b]	1.0105 (0.0067)	0.9838* (0.0073)
	ρ	−0.0519 (0.1111)	−0.0869 (0.0864)	0.1419* (0.0565)
	(χ^2)[a]	4.117	3.739	10.334**
Cafeterias	β	1.0135 (0.0169)	1.0172 (0.0136)	0.9492** (0.0145)
	ρ	0.0672 (0.1303)	0.0454 (0.0895)	0.0925 (0.0588)
	χ^2	1.151	1.755	15.108**
Cafes	β	0.9986 (0.0134)	1.0035 (0.0122)	0.9870 (0.0176)
	ρ	0.0838 (0.0617)	−0.1317* (0.0648)	0.1652* (0.0776)
	χ^2	1.869	4.098	4.791
Hotels	β	0.9653** (0.0104)	0.9986 (0.0067)	0.9954 (0.0089)
	ρ	0.1935* (0.0782)	−0.0811 (0.0670)	0.1564* (0.0622)
	χ^2	18.271**	1.552	6.450*
Camping sites	β	0.9976 (0.0146)	1.0150 (0.0131)	0.9833 (0.0127)
	ρ	0.0061 (0.0985)	−0.2009 (0.1116)	−0.1342 (0.1125)
	χ^2	0.020	4.616	3.344
Entire hospitality sector	β	0.9954 (0.0039)	1.0018 (0.0032)	0.9964 (0.0038)
	ρ	0.0697* (0.0337)	−0.1009* (0.0335)	0.0975** (0.0300)
	χ^2	5.224	9.152*	11.089**

[a]In Equation (3) *Gibrat's Law* holds when the joint hypothesis $(\beta\ \rho) = (1\ 0)$ is accepted. The test-statistic for this joint hypothesis is (asymptotically) χ^2-distributed with two degrees of freedom.
[b]Asymptotic standard errors are given between parentheses.
*The hypothesis $\beta = 1$ or the hypothesis $\rho = 0$ or *Gibrat's Law* is rejected at the 5% level of significance.
**The hypothesis $\beta = 1$ or the hypothesis $\rho = 0$ or *Gibrat's Law* is rejected at the 1% level of significance.

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. For the results in Table III only modest autocorrelation coefficients are found.[19]

[19] The autocorrelation coefficients in the studies of Singh and Whittington (1975), Chesher (1979), Kumar (1985) and Wagner (1992) vary between 0.1 to 0.3. These coefficients deviate more from zero than those found for Tabel III.

The second important finding from Tabel III is that the results differ across the years and sub-sectors. When the dependent variable refers to the year 1990, *Gibrat's Law* is accepted for all sub-sectors. By contrast, the Law is rejected for three of the sub-sectors for 1989. These differences over time may reflect different stages in the business cycle. The years 1987 and 1988 show modest results in terms of sales and profit levels, while the years 1989 and 1990 show quite good results. Clear differences across the sub-sectors occur when the results for cafes and camping sites are compared with those for hotels. *Gibrat's Law* is accepted for all the three time periods for cafes and camping sites, whereas it is rejected for two periods in the case of hotels. The third major result is that for the entire hospitality sector the coefficient β never differs from one, but as the disturbances are serially correlated at the 5 percent level of significance, *Gibrat's Law* is rejected in two out of three time periods for the entire hospitality sector.

The data available also enable the estimation of a second and third order autoregressive process. In a second and third order autoregressive process $z_{t,i}$ is related to $z_{t-1,i}$, $z_{t-2,i}$ and $z_{t-3,i}$ and to $z_{t-1,i}$, $z_{t-2,i}$, $z_{t-3,i}$ and $z_{t-4,i}$ respectively. For 1991 neither a second nor a third order autoregressive process improves the estimation results significantly compared to a first order autoregressive process.[20] For 1990 the second order autoregressive coefficient ρ_2 differs significantly from zero for cafeterias, cafes and hotels. In all three sub-sectors the coefficient of ρ_2 is negative. This result suggests that high firm growth rates in 1988 coincide with low growth rates in 1990. There is no indication that higher order autocorrelation processes should be preferred to the first order autoregressive process. Therefore, the results of the second and third order autoregressive process are not presented here in detail.[21]

VI. Conclusions

In the most influential surveys about the intra-industry dynamics of firms, Geroski (1995), Sutton (1997) and Caves (1998) examine what has by now become a large literature and independently conclude that the empirical

[20] For the year 1991 the null hypothesis that $\rho_2 = 0$ and that $\rho_2 = \rho_3 = 0$ are accepted for all sub-sectors and for the entire hospitality sector.

[21] Equation (3) was also estimated for the sample including only large firms. Because of a lack of observations it is not possible to estimate the model for cafeterias, cafes and camping sites. However, the estimation results for large firms in restaurants and hotels, as well as the entire hospitality sector are virtually identical to the results for the sample of surviving enterprises. For the entire hospitality sector as well as for both restaurants and hotels, the coefficients of β are still statistically equal to one. This implies that there is no relationship between firm size and growth rates. For restaurants the autocorrelation coefficients (ρ) deviate more from zero than those in Tabel III. For the entire hospitality sector as well as for hotels the autocorrelation coefficients are quite similar to those reported in Tabel III.

evidence does not support *Gibrat's Law*. Our survey, also containing more recent studies, shows that in the static analysis of version three for manufacturing industries *Gibrat's Law* is accepted in only three out of eight studies while three show mixed results. In contrast to manufacturing, *Gibrat's Law* would be expected to hold for Dutch hospitality industries, which are characterized by a vast majority of small-sized firms. In fact, this expectation is supported by the results found by Hart and Oulton (1999) – who identified a negative relation between size and growth in their estimates for the ''Distribution and hotel'' aggregate in the UK characterized by large chains and franchise operations – and by Santarelli (1997) – who found that, in the entire Italian hospitality sector which consists largely of family-owned and independent businesses, *Gibrat's Law* holds for the majority of Italian regions. In fact, the results of our paper do not indicate that in Dutch hospitality industries small firms tend to have systematically higher growth rates than their larger counterparts. This conclusion is based upon the temporal analysis of the Law for five sub-sectors in Dutch hospitality. It is shown that the Law is accepted in 11 out of 15 cases. This is in sharp contrast to manufacturing.

What Geroski (1995) concludes is a Stylized Result for manufacturing does not appear to hold for a small but significant part of the services universe, that is the hospitality sector. As in the study by Piergiovanni et al. (2003) on the Italian hospitality sector, also from these results one cannot conclude that the Law is generally valid, since the probability of a given proportionate change in size during the relevant period turns out to be the same for all firms only in relation to certain sub-sectors. However, what follows from the present analysis is that *Gibrat's Law* cannot be regarded as a Law in the strict sense, given that heterogeneous patterns of behavior *do* emerge across the sub-sectors taken into account. This supports the hypothesis that industry dynamics in the small scale services might not simply mirror that in manufacturing, with *Gibrat's Law* more likely to be confirmed in the former than in the latter.

This discrepancy in the validity of *Gibrat's Law* between manufacturing and small scale services suggests that the structure of these services may be inherently different from manufacturing. While small firms are at a disadvantage in at least some manufacturing industries, this does not appear to be always the case in Dutch hospitality services. New entrants are typically under the pressure to grow to avoid being confronted by a greater likelihood of failure in manufacturing, but the absence of growth in the services does not apparently threaten the viability of the firm.

It may be that thinking about *Gibrat's Law* has been somewhat miscast. While *Gibrat's Law* may not hold in those situations where growth will reduce the likelihood of failure, the evidence from this paper suggests that such industry dynamics do not appear to be general enough to include at least some aspects of the services.

Appendix A. Empirical Studies Testing *Gibrat's Law*.

The comparison of empirical studies testing *Gibrat's Law* is not always possible in a straightforward manner because they differ widely in the samples used and the methods applied. Therefore, we divide the studies into groups of which the results can be compared. We take two characteristics into account when we distinguish the studies into these groups. First, in several studies, like Mansfield (1962), a static analysis is carried out, while other studies, like Chesher (1979), deal with the persistence of growth. Second, we follow Mansfield (1962) who tests three versions of *Gibrat's Law*. In version 1 all firms are included, also those leaving the industry during the observation period. In version 2 only the survivors are analyzed. According to version 3 only large surviving firms that operate at or above the minimum efficient scale (MES) are included.

Both static and temporal analysis of 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. This review can be downloaded at
http://www.eim.net/pdf-ez/H200201.pdf or
http://www.tinbergen.nl/discussionpapers/02080.pdf or
http://www.thurik.com.
It should be noted that different versions of *Gibrat's Law* are tested in some studies. Such studies appear more than once in the table.
A concise version of these tables is available below:

Empirical studies on firm growth rates

Study	Type	Country	Period	Ind	GL	Size	Age	LagGrow	EcIss
Mansfield (1962)	A	USA	1916–1957	M	M	Na	na	na	
Acs and Audretsch (1990)	A	USA	1976–1980	M	M	Na	na	na	
Fariñas and Moreno (2000)	A	Spain	1990–1995	M	A	0	0	na	ss; het
Mansfield (1962)	B	USA	1916–1957	M	M	Na	na	na	
Keating (1974)	B	Australia	1958–1969	S	R	+	na	na	
Evans (1987a)	B	USA	1976–1982	M	R	–	–	na	ss; het
Evans (1987b)	B	USA	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	USA	1985–1990	M/S	R	–	–	na	het
Bianco and Sestito (unpublished)	B	Italy	1985–1990	M/S	R	–	–	na	ss; het; mea
Dunne and Hughes (1994)	B	UK	1975–1985	M/S	R	–	–	na	ss; het
Lensink et al. (2000)	B	Netherlands	1995 and 1999	M/S	A	0	–	na	
Acs and Armington (2001)	B	USA	1994–1995	M/S	M	–/0	–	na	
Delmar et al. (2003)	B	Sweden	1987–1996	M/S	M	0	na	na	
Hart and Prais (1956)	C	UK	1885–1950	M	A	Na	na	na	
Simon and Bonini (1958)	C	USA	1954–1956	M	A	Na	na	na	
Hymer and Pashigian (1962)	C	USA	1946–1955	M	M	Na	na	na	
Mansfield (1962)	C	USA	1916–1957	M	M	Na	na	na	
Singh and Whittington (1975)	C	UK	1948–1960	M/S	M	+	na	na	
Droucopoulos (1983)	C	World	1957–1977	M	M	–	na	na	
Buckley et al. (1984)	C	World	1972–1977	M	A	0	na	na	
Hall (1987)	C	USA	1972–1983	M	R	–	na	na	ss; het; mea
Bourlakis (1990)	C	Greece	1966–1986	M	R	–	–	na	ss; het

Table (continued)

Study	Type	Country	Period	Ind	GL	Size	Age	LagGrow	EcIss
Faggio and Konings (2003)	C	5 transition countries	1993/94–1994	M/S	R	–	na	na	
Mansfield (1962)	D	USA	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 et al. (1998)	D	Germany	1989–1994	M	R	–	–/0	na	ss; het
Hart and Oulton (1999)	D	UK	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 and 1991	M	R	–	na	na	het
Heshmati (2001)	D	Sweden	1993–1998	M/S	M	–	–	na	het; mea
Van der Vennet (2001)	D	OECD area	1985–1994	S	M	–/0			
Fotopoulos and Louri (2001)	D	Greece	1992–1997	M	R	–	–	na	het
Hardwick and Adams (2002)	D	UK	1987–91 and 1992–96	S	M	–/0	na	na	ss; het; mea
Becchetti and Trovato (2002)	D	Italy	1989—1997	M	M	–/0	–	na	het
Del Monte and Papagni (2003)	D	Italy	1989–1997	M	A	0	–	+	purt
Chen and Lu (2003)	D	Taiwan	1988–1999	M/S	M	–/0	na	na	sur
Hart and Prais (1956)	E	UK	1885–1950	M	M	Na	na	na	
Singh and Whittington (1975)	E	UK	1948–1960	M/S	R	0	na	+	
Chesher (1979)	E	UK	1960–1969	M	R	0	na	+	
Kumar (1985)	E	UK	1960–1976	M/S	R	–	na	+	
Amirkhalkhali and Mukhopadhyay (1993)	E	USA	1965–1987	M	R	–	na	+	

Amaral et al. (1997)	E	USA	1974–1993	M	R	–	na	na	
Pfaffermayr and Bellak (2000)	E	Austria	1996–1999	M/S	A	0	na	na	
Bottazzi et al. (2001)	E	World	1987–1997	M	A	0	na	+	ss; het
Goddard et al. (2002)	E	Japan	1980–1996	M	R	–	na	na	purt
Geroski et al. (2003)	E	UK	1955–1985	M/S	A	0	na	na	purt
Dunne et al. (1988)	F	USA	1963–1982	M	na	Na	na	na	
Dunne et al. (1989)	F	USA	1967–1982	M	R	–	–	na	
Phillips and Kirchhoff (1989)	F	USA	1976–1986	M/S	na	Na	na	na	
Audretsch and Mahmood (1994)	F	USA	1976–1986	M	R	–	na	na	
Mata (1994)	F	Portugal	1983–1987	M	R	–	na	na	
Wagner (1994a)	F	Germany	1978–1990	M	A	0	na	na	
Reid (1995)	F	UK	1985–1988	M	R	–	–	na	het
Santarelli (1997)	F	Italy	1989–1994	S	M	0/–	na	na	het
Audretsch et al. (1999)	F	Italy	1987–1993	M	M	–/0	na	na	het
Almus and Nerlinger (2000)	F	W. Germany	1989–1996	M	R	–	na	na	het
Lotti et al. (2001)	F	Italy	1987–1993	M	M	–/0	0	na	ss; het
Piergiovanni et al. (2003)	F	Italy	1989–1994	S	M	–/0	na	na	het

Type (of empirical growth study)	Ind(ustry)	Size, Age and Lag(ged)	Ec(onometric)Iss(ues)
A: Static analysis and version 1	M: Manufacturing;	Grow(th)	ss: corrected for sample selection
B: Static analysis and version 2	S: Services	–: negative effect on growth	het: corrected for heteroscedasticity
C: Static analysis and version 3	G(ibrat's)L(aw)	0: no effect on growth	mea: corrected for measurement error
D: Temporal analysis and version 2	A: Accepted	+: positive effect on growt	purt : panel unit root tests
E: Temporal analysis and version 3	R: Rejected	na: not available	sur: seemingly unrelated regression
F: The post-entry performance of new firms	M: Mixed Results		

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