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GIBRAT'S LAW AND THE FIRM SIZE/FIRM GROWTH RELATIONSHIP IN ITALIAN SMALL SCALE SERVICES (*)

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Key words : Firm Growth, Service Industries, *Gibrat's Law*, Italy.

I. — INTRODUCTION

In a recent paper by Audretsch, Klomp, Santarelli and Thurik (2002) it is shown that, for a sample including both incumbent and new-born firms in the small scale services in The Netherlands, *Gibrat's Law* is generally valid, since the probability of a given proportionate change in size during a four-year period turns out to be the same for all firms – regardless of their size at the beginning of the period. This finding is at odds with those of recent studies based

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mostly upon evidence from manufacturing and large scale services, showing that the growth rates of surviving firms tend to decrease with increasing firm size in the majority of cases (1).

The aim of the present paper is to investigate whether the findings of testing *Gibrat's Law* for both incumbent and new-born firms in the Dutch hospitality sector are confirmed also limitedly to new-born firms in the same industry in Italy. Thus, it deals with the so-called post-entry performance of new firms, which is a relatively recent strand in the literature on *Gibrat's Law*. This line of investigation has so far produced a straightforward result for manufacturing: among new-born firms, smaller ones grow faster then their larger counterparts, therefore leading to a rejection of *Gibrat's Law*. In a previous study on Italian services, Santarelli (1997) tested whether *Gibrat's Law* also holds for start-ups in the whole hospitality aggregate for the twenty Italian regions. From application of 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 – it turns out that *Gibrat's Law* cannot be rejected in the case of fourteen out of twenty Italian regions. The present paper adds to Santarelli (1997) by breaking down the hospitality sector into five business groups (hotels, camping sites, restaurants, cafeterias, and cafés) for each of which separate estimations are carried out. It is important to allow for heterogeneity of firms and business groups even in a relatively homogeneous industry like the hospitality sector.

The paper is organised as follows. Section 2 outlines the features of the hospitality sector in Italy; Section 3 summarises the implications of *Gibrat's Law* for firm level studies and contains a description of the data; Section 4 presents the empirical results; Section 5 draws some concluding remarks.

II. — THE HOSPITALITY SECTOR IN ITALY

The types of Italian services we examine in this paper, for the 1989-1994 period, are in the hospitality sector, including hotels, camping sites (including holiday centres), restaurants, cafeterias, and cafés (2). The Italian hospitality sector is characterised by low levels of concentration and by the widespread presence of small firms with fewer than five employees. As a consequence, average firm size is very small in all the business groups mentioned above, with the sole exception of cafeterias (Table 1), in which it is fifteen times larger than in the whole industry. This is mostly due to the fact that in the cafe-

(1) A detailed survey of empirical studies testing *Gibrat's Law* can be found in Audretsch, Klomp, Santarelli and Thurik (2002).

(2) We adopt a somewhat rigid definition of the hospitality industries, which includes the typical activities of lodging guests and serving meals and beverages, but excludes travel services.

terias business group the five largest firms, which control more than 50 % of the market, are rather big in size. Besides, in this sub-market most firms operate with more than two establishments, as it is confirmed by the very high number of establishments (5,833) as compared to that of firms (1,535). As a consequence of concentration and the widespread presence of multi-plant firms, average firm size in this business group is therefore markedly above that found for the other business groups and the industry as a whole.

Value added in the hospitality sector (in constant prices) grew slightly over the relevant period, when its total contribution to GDP was nearly 3.2 %. Since the period between 1991 and 1993 has been typified in Italy by a significant slowdown in the GDP growth rates, decline in value added either at the industry level and in the two aggregate business groups for which data are available (Table 2) – namely hotels and camping sites on the one side and restaurants, cafés and cafeterias on the other – suggests that this industry follows a pro-cyclical pattern of growth. In particular, the overall industry figures reported in the first column of Table 2 show a significant decrease in the growth rates of value added since 1991, with a trough in 1993.

Table 1 - The structural features of the hospitality sector in Italy, year 1991

SBI (1) and business group		Number of firms	Number of establishments	Number of employees	Average firm size	Average establishment size
55.1	Hotels	25,959	28,145	150,606	5.8	5.4
55.2	Camping sites	15,612	17,082	35,093	2.2	2.1
55.3	Restaurants	66,837	70,186	238,162	3.6	3.4
55.4	Cafés	107,685	113,031	254,775	2.4	2.3
55.5	Cafeterias	1,535	5,883	46,845	30.5	8.0
55	**Total hospitality**	**217,628**	**234,327**	**725,481**	**3.3**	**3.1**

(1) For the SBI-code the « ATECO » of the Statistics Italy (ISTAT) of 1991 is used.
Source: 7th General Census of Industry and Services, 21st October 1991.

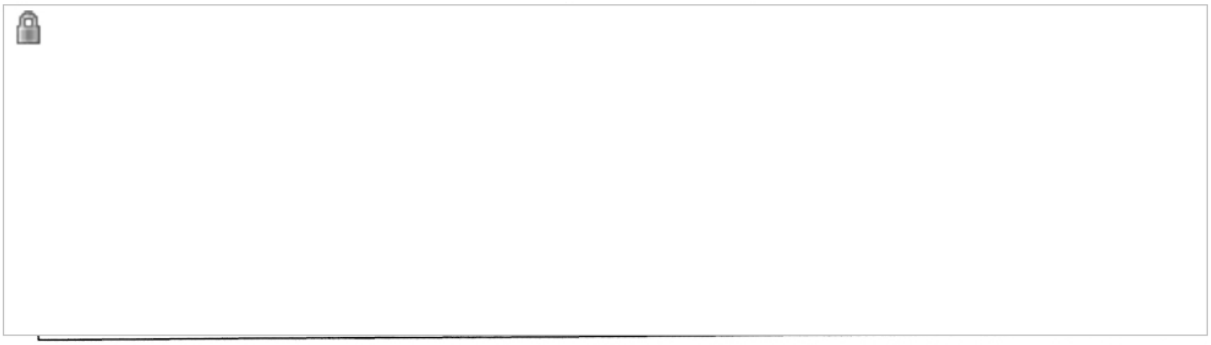
The existing literature suggests that exit is the most common reaction of small newly founded firms facing exogenous shocks. Conversely, under the same circumstances, large and incumbent firms tend to shrink without leaving the market. It will be therefore interesting to detect whether this pro-cyclical pattern of industry performance is confirmed also as far as the new firm survival and employment growth patterns are concerned.

III. — METHODOLOGY AND DATA

3.1. *Gibrat's Law* and the firm size/firm growth relationship

In *principle*, *Gibrat's Law* (Gibrat, 1931), applied to the analysis of market structure, is the first attempt to explain in stochastic terms the systematically

Table 2 - Value added at constant (1995) prices in the Italian hospitality sector (billions of lira)



Source : ISTAT, Statistics Italy

skewed pattern of the size distribution of firms within an industry (3). As shown by Armatte (1995, 1998), this rendition of the Law has mostly to do with a Galton-McAllister's or a Kapteyn's distribution, and it entails, from application of Laplace's central limit theorem, that the empirical distribution of firm sizes converges towards a lognormal distribution, under the hypothesis that this represents the limit distribution. As a consequence, it cannot be rejected when the resulting distributions of firms' size are approximately lognormal. Nevertheless, when identifying a FSD skewed to the right, one cannot *a priori* exclude that the skewness is the result of *turbulence*, namely the presence of new entrants in the right tail of the distribution. As regards its underlying *hypothesis*, which results in its other name of Law of Proportionate Effect, 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).

In fact, the empirical test of the Law can be carried out using at least three different approaches. *Firstly*, one can assume that *Gibrat's Law* holds for all firms in a given sector, including those that have exited the industry during the examined period (setting the proportional growth rate of disappearing firms equal -100). *Secondly*, one can postulate that the Law holds only for firms that survive over the entire time period. If survival is not independent of a firm's initial size – that is that the smaller firms are more likely to exit than their larger counterparts – this empirical test can be affected by a sample selection bias and estimates have to take into account this possibility. This observation is particularly true with regard to new and small firms, for which the hazard rate is generally high (about 10 % per year in the first five years of firm's life cycle,

(3) Cf. Aitchison and Brown (1957), Armatte (1995, 1998), De Bandt (1970) ; Lotti and Santarelli (2004) ; Sutton (1997).

see Audretsch, Santarelli and Vivarelli, 1999). *Thirdly*, one can state that the Law only applies to firms large enough to have overcome the minimum efficient scale (MES) level of output of a given industry (for instance, Simon and Bonini (1958) found a confirmation of *Gibrat's Law* for the 500 largest U.S. industrial corporations).

In most manufacturing industries, substantial sunk costs and high capital investment determine the presence of high scale economies. Accordingly, the consequences of low or negative growth for small firms in such industries are elevated costs, leading to a lower probability of survival. As a result of this survival bias, (surviving) small firms in such industries have systematically higher rates of growth than their larger counterparts, resulting in a violation of *Gibrat's Law* of Proportionate Effect. The general finding of empirical studies dealing with such industries is that firms' growth is not equi-proportional, since smaller firms grow at a higher rate compared with their larger counterparts.

The small-firm survival bias, and the resulting violation of *Gibrat's Law*, tends to disappear *a)* in industries with minimal sunk costs and where capital intensity and scale economies do not play an important role ; and *b)* in the case of small firms which enter the market at a sub-optimal scale and have initially to rush in order to reach a size comparable to that of larger entrants, but subsequently converge towards random growth rates (Gibrat-like). Consequently, observed growth rates also are found to be independent of firm size. Previous findings on Dutch both *incumbent* and new-born firms in the hospitality sector (Audretsch, Klomp, Santarelli, and Thurik, 2002) support the first hypothesis, whereas other findings on Italian *new-born* firms in manufacturing (Lotti, Santarelli, and Vivarelli, 2001) are consistent with the second one.

3.2 - Data

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 the Italian National Institute for Social Security (INPS) to track the growth performance of firms in the Italian hospitality sector between 1989 and 1994. All private Italian firms are compelled to transfer to INPS national security payments for their employees ; when a new firm is registered as « active » in INPS files an entry can be identified, while a firm cancellation denotes an « exit » (this happens when a firm ultimately stops paying national security fees). A limitation of the database is represented by the fact that no information on firms with zero paid employees is available from the INPS file ; however, these firms usually identify self-employment and only occasionally become true entrants with positive post-entry employment growth rates.

In industries, such as the hospitality services, in which production activity is strongly affected by seasonal factors, a significant number of firms suspend

temporarily operations for a few or many months during each year: accordingly, they result as « suspended », but cannot be taken as « exited », since they are not cancelling their position from the INPS files. Sometimes – for administrative reasons – cancellation is preceded by a period during which the firm results as « suspended ». In the present paper, suspended firms of this kind have been considered as « exited » at the moment (month) of their transition from the status of « active » to that of « suspended » firm. Besides, the original INPS file was subjected to further checking, in order to identify entry and failure times correctly and to detect inconsistencies in individual tracks due to administrative factors, problems related to file truncation in 1994, cancellations due to firm transfers, mergers and take-overs. Finally, all firms for which information on their main activity was forthcoming were inserted into the five different categories, which typically define the industry: restaurants, cafeterias, cafés, hotels and camping sites. The overall cleaning procedure reduced the total number of firms in the database from 11,720 to 9,051 (-22.77 %) (4). Thus, the data set employed for empirical analysis identifies 9,051 new tourism services firms (with at least one paid employee) born in 1989 and tracks their post-entry employment performance at yearly intervals until 1994. No information on firms with zero paid employees is available from the INPS file, and it is not possible to know if a firm consists of more than one establishment.

According to the first frame (« Firm survival ») of Table 3, the survival rates of new start-ups comprised in our analysis is particularly low since immediately after entry. With the sole exception of hotels and camping sites, in all business groups and in the industry as a whole nearly two third of new start-ups leave the market during the first six years of activity. This evidence is in sharp contrast with that for italian manufacturing, in which the percentage of firms leaving the market is of approximately 40 percent (cf., among others, Audretsch, Santarelli, and Vivarelli, 1999).

As the second frame (« Employment dynamics ») of Table 3 clearly shows, in close connection to the dramatic market selection reported in the first frame of the same table, all the cohorts are characterised by a negative employment evolution. In fact, the combined effects of the exits of the less efficient firms and of the growth of the surviving firms are unable to impose a positive trend in the employment evolution in all the business groups. Opposite to the findings found by Lotti, Santarelli and Vivarelli (2001) for Italian start-ups in manufacturing, this means that market selection *does* involve – in the hospitality sector – a decrease in employment.

(4) These start-up firms constitute approximately, for year 1989, 5.9 % of the Hotels business group, 0.5 % of Camping sites, 4.9 % of Restaurants, 3.6 % of Cafés, 44 % of Cafeterias (a rather new activity in Italy at the end of the 1980s), and 4.5 % of the entire Hospitality industry.

This evidence suggests that both the likelihood of survival and employment growth among new-born firms in this industry are likely to follow a pro-cyclical pattern, consistently with the dynamics of value added commented upon in Section 2. As first Mansfield (1962) and later Sutton (1997) point out, the discrepancy in conclusions about the validity of *Gibrat's Law* emanates from following the three different approaches – all firms, only surviving firms, and only large firms (that exceed the MES level of output) – described in Section 3.1 above. To ensure that the results in this paper are not slanted towards any one of these approaches, we were able to create two different samples. The first sample consists of all firms. We follow the earlier studies by assigning a growth rate of -100 to any firm that exited between 1989 and 1994. The second sample consists only of firms that survived the entire period between 1989 and 1994. About 60 percent of the firms in existence in 1989 are not in existence by 1994. As regards Italy, the resulting survival rates are not significantly different from those identified for business services in Italy (Piergiovanni and Santarelli, 1995), whereas they are much higher than those found for manufacturing (Audretsch, Santarelli, and Vivarelli, 1999). Thus, cyclical factors are confirmed to be more significant for the post-entry performance of new firms in small scale services than they are in manufacturing, and this is consistent with views of recessions as times of « cleansing », characterised by a higher likelihood of early exit for new-born firms in certain industries (Boeri and Bellmann, 1995). Due to the nature of firms included in our analysis – all new entrants with a start-up size that by definition is far below the industry MES level of output – it was not possible to construct a third sample consisting only of large surviving firms.

Table 3 - Survival rates and number of employees, by business group and year

	Firm survival						*Employment dynamics*					
	1989	1990	1991	1992	1993	1994	1989	1990	1991	1992	1993	1994
	Absolute values						*Absolute values*					
Hotels	1,395	1,193	1,065	959	874	781	6,403	5,876	6,101	6,011	5,512	5,082
Camping sites	79	62	51	48	45	40	231	176	236	275	321	350
Restaurants	3,276	2,652	2,121	1,808	1,548	1,300	7,582	6,381	5,757	5,245	4,644	4,100
Cafés	3,625	2,841	2,150	1,770	1,486	1,227	6,318	5,240	4,473	4,006	3,468	3,005
Cafeterias	676	525	407	331	282	240	1,464	1,257	895	839	767	744
Total hospitality	9,051	7,273	5,794	4,916	4,235	3,588	21,998	18,930	17,462	16,376	14,712	13,281
	Percentages						*Percentages*					
Hotels	-	85.5	76.3	68.7	62.7	56.0	-	91.8	95.3	93.9	86.1	79.4
Camping sites	-	78.5	64.6	60.8	57.0	50.6	-	76.2	102.2	119.0	139.0	151.5
Restaurants	-	81.0	64.7	55.2	47.3	39.7	-	84.2	75.9	69.2	61.3	54.1
Cafés	-	78.4	59.3	48.8	41.0	33.8	-	82.9	70.8	63.4	54.9	47.6
Cafeterias	-	77.7	60.2	49.0	41.7	35.5	-	85.9	61.1	57.3	52.4	50.8
Total hospitality	-	80.4	64.0	54.3	46.8	39.6	-	86.1	79.4	74.4	66.9	60.4

The original database tracks employment on a monthly base. However, we decided to use average employment in each year, in order to smooth the peaks that

emerge for firms that hire paid employees for short periods (e.g. during summer) due to the seasonal character of their business. Accordingly, firm size in each year is represented by the average number of employees in the twelve months.

Table 4 - Firm size and growth rates by business group and year for the period 1989-1994

Business Group	Version 1 (1)			Version 2 (2)		
	Growth (3)	Size (4)	N (5)	Growth (3)	Size (4)	N (5)
Hotels	-20.6	4.59	1,395	26.8	5.13	781
Camping sites	51.5	2.92	79	150.0	3.5	40
Restaurants	-45.9	2.31	3,276	24.5	2.53	1,300
Cafés	-52.4	1.74	3,625	15.4	2.12	1,227
Cafeterias	-49.2	2.17	676	50.6	2.06	240
Total hospitality	-39.6	2.43	9,051	26.0	2.94	3,588

(1) In the first version all firms are included. If a firm exits between 1989 and 1994 the growth rate (over the six-year period) is equated to – 100.
(2) In the second version all firms that survived during the period 1989-1994 are included.
(3) Firm growth rate measured by the average percentage of change in employment per firm for the period 1989-1994.
(4) Firm start-up size measured by the average employment per firm in 1989.
(5) N stands for the number of observations.

The mean growth rates, measured as the percentage change in firm employment size between 1989 and 1994 are shown for each of these two samples in Table 4. The mean growth rate for the 9,051 firms in the sample consisting of all firms is -39.60 percent and ranged from -52.40 percent in cafés to 51.50 percent for camping sites. For the sample consisting of only the 3,588 surviving firms the mean growth rate is considerably higher, 26.00 percent.

IV. — EMPIRICAL RESULTS

A way of characterising the studies testing *Gibrat's Law* is: static studies *versus* studies analysing 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 two versions of *Gibrat's Law* would lead to four specifications of modelling empirical growth. However, the first version of the Law cannot be estimated in the case of persistence of growth, since it is not possible to analyse the persistence of growth for firms that leave the industry during the observation period.

4.1. 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. See Hymer and Pashigian (1962), Singh and Whittington (1975) and Acs and Audretsch (1990) for examples. To construct such size classes firms were ranked according to employment size in the initial year (1989) and divided into quartiles in each business group in the hospitality sector. Similarly, firm average growth rates over the entire 1989-1994 period 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 (5).

Table 5 - Empirical results for Gibrat's Law, *which state that firm growth rates are distributed independently of firm size*

	Hotels	Camping sites	Restaurants	Cafés	Cafeterias	Hospitality
			All firms (version 1)			
χ^2 value	97.106	7.992	42.001	111.144	8.114	197.456
Degrees of freedom	9	9	6	4	4	6
Level of significance	0.000	0.535	0.000	0.000	0.087	0.000
			Survived firms (version 2)			
χ^2 value	104.246	16.776	461.159	30.452	27.061	1371.103
Degrees of freedom	9	9	9	4	4	9
Level of significance	0.000	0.052	0.000	0.000	0.000	0.000

(1) In the first version all firms are included. If a firm exits between 1989 and 1994 the growth rate (over the four-year period) is equated to – 100.
(2) In the second version all firms that survived during the period 1989-1994 are included.

The results for the two different versions of *Gibrat's Law* are presented in Table 5. *Gibrat's Law* is rejected in three of the five business groups for the sample including all firms (version 1 in Table 3), in which for the cafeterias and the camping sites sub-sectors size and growth are found to be statistically independent. For the sample containing only surviving firms the Law is accepted for the camping sites, but is rejected for the remaining business groups (version 2). However, it is worth noting that in the sample composed only by survivors, firms with a start-up size equal to 1 are not allowed to experience negative growth rates. As a consequence, the empirical results from application of the χ^2 statistic to version 2 of *Gibrat's Law* are likely to be severely biased.

(5) 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.

4.2. Persistence of Growth

In this section the other main methodology used to estimate *Gibrat's Law* is employed to test the hypothesis that firm growth is independent of size. In effect, one implication of *Gibrat's Law* is that it holds only if persistence of firm growth rate is observed (Singh and Whittington, 1975). Otherwise, if growth turns out to be an autocorrelated process, the Law cannot be accepted. As developed by Chesher (1979),

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

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. If $\beta \leq 1$ large firms are expected to grow more slowly than their smaller counterparts; if $\beta \geq 1$ small firms are expected to grow more slowly than larger enterprises. By increasing exponentially both sides of equation (1), it becomes clear that if β is equal to unity, then growth rate and initial size are independently distributed and follow a random walk stochastic process.

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. See Amirkhalkhali and Mukhopadhyay (1993) for an explanation. Thus, *Gibrat's Law* can be rejected even when the parameter β is (about) equal to one (6). Assuming a first order autoregressive process for the disturbances $\varepsilon_{t,i}$.

$$\varepsilon_{t,i} = \rho\, \varepsilon_{t,i} + \nu_{t,i} \tag{2}$$

where $\nu_{t,i}$ 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,

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

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 hypothesis $(\beta\ \rho) = (1\ 0)$ 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. See Malinvaud (1980).

(6) The condition that parameter β is equal to one is a necessary but not a sufficient condition for *Gibrat's Law* to be true.

The estimation results for equation (3), in which the linear independence hypothesis of firm size on firm growth is tested, are shown in Table 6.

With this estimation procedure, *Gibrat's Law* is accepted only for the camping sites business group and for all four time-periods for which analysis is carried out in relation to this sub-sector. Conversely, in the remaining 20 cases (four business groups besides the entire hospitality sector, each of which for all four time-periods) the Law cannot be accepted, although for three out of four time-periods in the cafeterias business group only at a 5 percent level of significance. 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 (1999) year, suggests that not only for the camping sites, but also for the cafeterias business groups does the empirical distribution of firm sizes converge towards a lognormal distribution, therefore not allowing rejection of *Gibrat's Law*.

The results obtained from estimation of the static and the dynamic versions of *Gibrat's Law* for newly founded firms in the service sector (Tables 5 and 6) are therefore to a large extent consistent with each other. *Gibrat's Law* holds for camping sites and (very likely) cafeterias, whereas it is rejected for hotels, cafés, restaurants, and the hospitality sector as a whole. Thus, from these

Table 6 - Empirical results for equation (3):
$z_{t,i} = (\beta + \rho)\, z_{t-1,i} + (-\beta\rho)\, z_{t-2,i} + \nu_{t,i}, \quad t = 1991, 1992, 1993, 1994$

	z_{94}	z_{93}	z_{92}	z_{91}	z_{94}	z_{93}	z_{92}	z_{91}
	Hotels				*Cafés*			
β	0.9793	0.9583	0.9697	0.9804	0.9407	0.9415	0.9635	0.9623
	(0.0086)	(0.0104)	(0.0108)	(0.0143)	(0.0114)	(0.0112)	(0.0118)	(0.0116)
ρ	-0.2663	-0.2338	-0.1920	-0.0139	-0.0294	-0.0769	-0.0954	-0.1305
	(0.0313)	(0.0384)	(0.0349)	(0.0330)	(0.0320)	(0.0308)	(0.0317)	(0.0286)
χ^2	69.639**	66.611**	67.573**	65.662**	48.628**	47.966**	47.125**	43.579**
	Camping sites				*Cafeterias*			
β	1.0555	1.0035	1.0776	1.0628	0.9467	0.9281	0.9419	0.9872
	(0.0432)	(0.0831)	(0.0708)	(0.0678)	(0.0263)	(0.0256)	(0.0341)	(0.0303)
ρ	-0.3143	-0.1062	-0.2851	-0.7988	-0.1444	-0.0208	0.0221	-0.0560
	(0.1193)	(0.2228)	(0.1307)	(0.1842)	(0.0873)	(0.0649)	(0.0809)	(0.0696)
χ^2	4.766	3.673	3.196	2.520	10.473**	10.560*	10.393*	9.646*
	Restaurants				*Total hospitality*			
β	0.9471	0.9458	0.9529	0.9371	0.9609	0.9500	0.9631	0.9668
	(0.0110)	(0.0120)	(0.0130)	(0.0158)	(0.0056)	(0.0062)	(0.0066)	(0.0075)
ρ	-0.0832	-0.0725	-0.1256	0.0180	-0.1379	-0.1163	-0.1323	-0.0550
	(0.0295)	(0.0288)	(0.0305)	(0.0321)	(0.0171)	(0.0062)	(0.0177)	(0.0173)
χ^2	52.639**	50.546**	46.805**	42.206**	185.81**	179.225**	174.970**	163.139**

(1) In equation (3) *Gibrat's Law* holds when the joint hypothesis (β ρ) = (1 0) is accepted. The test-statistic for this joint hypothesis is (asymptotically) χ^2 distributed with two degrees of freedom.
(2) Asymptotic standard errors are given between parentheses.
* The hypothesis β=1 or the hypothesis ρ=0 or *Gibrat's Law* is rejected at the 5 percent level of significance.
** The hypothesis β=1 or the hypothesis ρ=0 or *Gibrat's Law* is rejected at the 1 percent level of significance.

results one cannot conclude that the Law is generally valid, since the probability of a given proportionate change in size during the examined period turns out to be the same for all firms only in relation to certain business groups, whereas smaller firms are found to grow more than proportionally with respect to their larger counterparts in other business groups. Slight indication, partly consistent with Audretsch, Klomp, Santarelli and Thurik (2002), that industry dynamics in the small scale services might not simply mirror that in manufacturing is therefore obtained.

Of particular interest are the negative values of ρ in all equations. These suggest that firms experiencing higher (lower) growth rates in a given period are likely to be characterized by lower (higher) growth rates in the next one. This is consistent with the hypothesis that firms growing very fast in the initial year(s) after start-up tend to slow down their growth once they reach a size large enough to enhance their likelihood of survival (Lotti and Santarelli, 2004). A natural consequence of such finding is that *Gibrat's Law* should not be considered anymore as a general representation of industrial dynamics, but as a way to describe the growth behavior of established firms: it fails to hold during the first years after start-up and becomes acceptable once a certain threshold in terms of size and age is reached.

From a theoretical viewpoint, the empirical findings concerning the business groups for which the Law is rejected appear to be consistent with the model put forward by Cabral (1995): entering the market implies capacity and technology costs which can involve some degree of sunkness. In other words, in industries displaying certain characteristics small less efficient entrants are more likely to exit than are large entrants and so - since entry costs are sunk - it is optimal for them to invest more gradually and thus experience higher growth rates immediately after start-up.

Broadly speaking, if one follows the evolutionary perspective pointed out by Audretsch (1995) one may assume that new firm start-ups as well as larger incumbent firms are likely to contribute in a different manner to the dynamics of different industries (cf. also Audretsch and Fritsch, 2002). In this connection, a distinction can be made between an entrepreneurial regime, more favourable to innovative entry and unfavourable to established firms, and a routinised regime, characterised by opposite conditions (Audretsch and Thurik, 2000 and 2001). Accordingly, firm-specific characteristics, such as scale economies and the endowment of innovative capabilities, exert a significant impact on entry, exit, and the likelihood of survival of new start-ups. For example, in industries characterised by higher endowment of skilled human capital and technological knowledge, smaller entrants face higher costs that are likely to push them out of the market within a short period after start-up unless they are able to grow very fast. Conversely, smaller firms might not be at a disadvantage in less technologically progressive industries (cf. Audretsch, van Leeuwen, Menkveld and Thurik, 2001), where sunk costs are minimal and capital intensity and scale economies do not play an important role.

V. — CONCLUSIONS

The results of this paper show that in three out of five business groups in Italian hospitality services and in the industry as a whole smaller ones among new-born firms tend to have systematically higher growth rates than their larger counterparts. Thus, since over the entire period taken into account the inverse relationship between size and growth *does not* characterize the totality of the business groups examined, a first result of the present analysis is that *Gibrat's Law* cannot be regarded as a Law in the strict sense, given that heterogeneous patterns of behaviour *do* emerge across industries. However, this evidence supports only in part the findings by Audretsch, Klomp, Santarelli and Thurik (2002) 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. Nevertheless, they are consistent with the findings by Lotti and Santarelli (2004) that in most cases – *within* the sub-population of new entrants – smaller firms, which entered the market at a sub-optimal scale, have initially to rush in order to reach a size comparable to that of larger entrants, while subsequently they converge towards random growth rates (Gibrat-like). One might therefore conclude that a convergence towards a Gibrat-like pattern of growth is likely to emerge with the passage of time, once a certain threshold in terms of size and age is reached.

REFERENCES

ACS Z.J. and D.B. AUDRETSCH (1990), « Innovation and Small Firms », Cambridge (MA): The MIT Press.

AITCHISON, J. and J.A.C. BROWN (1957), « The Lognormal Distribution », Cambridge, Cambridge University Press.

AMIRKHALKHALI S. and A.K. MUKHOPADHYAY (1993), « The Influence of Size and R&D on the Growth of Firms in the U.S. », *Eastern Economic Journal*, 19(2), 223-233.

ARMATTE, M. (1995), « Robert Gibrat et la loi de l'effet proportionnel », *Mathématiques Informatiques et Science Humaines*, n° 129, 5-55.

ARMATTE, M. (1998), « Robert Gibrat and the Law of Proportional Effect », *in* W. J. SAMUELS (ed.), « European Economists of the Early 20th Century », Northampton, Edward Elgar, Vol. 1.

AUDRETSCH, D. B. (1995), « Innovation and Industry Evolution », Cambridge (MA), MIT Press.

AUDRETSCH, D.B., E. SANTARELLI and M. VIVARELLI (1999), « Start-up Size and Industrial Dynamics: Some Evidence from Italian Manufacturing », *International Journal of Industrial Organization*, 17(7), 965-983.

AUDRETSCH, D.B., L. KLOMP, E. SANTARELLI and A.R. THURIK (2002), « Gibrat's Law: Are the Services Different? », Research Report H200201, EIM Policy and Business Research, Zoetermeer, October.

AUDRETSCH, D.B. and M. FRITSCH (2002), « Growth Regimes over Time and Space », *Regional Studies*, 36(2), 113-124.

AUDRETSCH, D.B. and A.R. THURIK (2000), « Capitalism and Democracy in the 21st Century: from the Managed to the Entrepreneurial Economy », *Journal of Evolutionary Economics*, 10(1), 17-34.

AUDRETSCH, D.B. and A.R. THURIK (2001), « What is New about the New Economy: Sources of Growth in the Managed and Entrepreneurial Economies », *Industrial and Corporate Change*, 10(1), 267-315.
AUDRETSCH, D.B., G. van LEEUWEN, A.J. MENKVELD ad A.R. THURIK (2001), « Market Dynamics in the Netherlands: Competition Policy and the Response of Small Firms », *International Journal of Industrial Organisation*, 19, 795-821.
BOERI, T. and L. BELLMANN (1995), « Post-entry Behaviour and the Cycle: Evidence from Germany », *International Journal of Industrial Organization*, 13(4), 483-500.
CHESHER A. (1979), « Testing the Law of Proportionate Effect », *Journal of Industrial Economics*, 27(4), 403-411.
De BANDT, J. (1970), « Mesures de la dimension des unités de production: problèmes de méthode », Paris, Éditions Cujas.
GIBRAT R. (1931), « Les Inégalités Économiques », Paris: Librairie du Recueil Sirey.
HYMER S. and P. PASHIGIAN (1962), « Firm Size and Rate of Growth », *Journal of Political Economy*, 70(4), 556-569.
LOTTI, F. and E. SANTARELLI (2004), « Industry Dynamics and the Distribution of Firm Sizes: A Non-parametric Approach », *Southern Economic Journal*, 70, forthcoming.
LOTTI, F., E. SANTARELLI and M. VIVARELLI (2001), « Is It Really Wise to Design Policies in Support of New Firm Formation? », *in* L. LAMBERTINI (ed.), « Antitrust, Regulation and Competition: Theory and Practice », special issue of *Rivista di Politica Economica*, 91(4-5), 145-162.
MALINVAUD E. (1980), « Statistical Methods of Econometrics », 3rd ed., Amsterdam: North Holland.
MANSFIELD E. (1962), « Entry, Gibrat's Law, Innovation, and the Growth of Firms », *American Economic Review*, 52(6), 1023-1051.
PIERGIOVANNI, R. and E. SANTARELLI (1995), « The Determinants of Firm Start-up and Entry in Italian Producer Services », *Small Business Economics*, 7(3), 221-230.
SANTARELLI, E. (1997), « La relazione tra dimensione iniziale, sopravvivenza e crescita delle imprese nel settore turistico in Italia », *Statistica*, 57(1), 125-138.
SIMON H.A. and C.P. BONINI (1958), « The Size Distribution of Business Firms », *American Economic Review*, 48(3), 607-617.
SINGH A. and G. WHITTINGTON (1975), « The Size and Growth of Firms », *Review of Economic Studies*, 42(1), 15-26.
SUTTON J. (1997), « Gibrat's Legacy », *Journal of Economic Literature*, 35 (1), 40-59.
WAGNER J. (1992), « Firm Size, Firm Growth, and Persistence of Chance: Testing Gibrat's Law with Establishment Data from Lower Saxony, 1978-1989 », *Small Business Economics*, 4(2), 125-131.