Firm size – firm growth relationship during economic crises

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FIRM SIZE – FIRM GROWTH RELATIONSHIP DURING ECONOMIC CRISIS

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Abstract

The great recession of 2008 hit the entrepreneurial sector all over the world. Understanding the pattern of firms' reactions in a time of global crisis is essential for developing an adequate crisis and post-crisis policy. Using a sample of 7,563 surviving Croatian firms in the manufacturing and hospitality industries over the six-year period of economic recession (2008-2013) and total assets as a measurement of firm size and growth, this study seeks to examine whether the law of proportionate effect can be confirmed in times of economic recession. The results of a two-step dynamic panel indicate the rejection of the law in both industries since asset growth is positively associated with the size of the firms. However, firms' total assets dynamics differ across size classes and industries suggesting potentially different strategic decisions on asset utilization and/or investments.

Keywords: firm growth, Gibrat's Law, hospitality, manufacturing, recession

1. INTRODUCTION

Growing firms are vital to economic upturn and the question that incessantly arises is which characteristics make some firms' growth rates higher than others or enable them to be more resilient to crisis than others. Put differently, knowing the process and determinants of firm growth becomes imperative (Diaz Hermelo & Vassolo, 2007) and it is not only about survival but also about expansion plans in the future, a crucial part of managers' activities and business strategies.

Growth of a firm and its success are highly dependent but a major challenge that remains is how to measure firm growth (Wiklund, Patzelt, & Shepherd, 2009). The growth of the selected variable could be measured relatively and absolutely, typically the number of employees or sales (Delmar, Davidsson, & Gartner, 2003). However, other quantitative variables (e.g. assets, equity, profit, added value, etc.) and qualitative features (e.g. characteristics of a product, the competitive standing of a firm in the marketplace and the goodwill of customers) can also be used to measure growth (Weinzimmer, Nystrom, & Freeman, 1998; Davidsson & Wiklund, 2000; Kruger, 2004; Wiklund et al., 2009; Gupta, Guha, & Krishnaswami, 2013). Firm growth is indeed a multidimensional rather than unidimensional phenomenon and firms' growth patterns differ (Delmar et al., 2003).

Researchers of firm dynamics in industrial economics and management strategy are therefore focusing attention on the study of firm growth determinants. According to Mateev and Anastasov (2010) and Gupta et al. (2013), the large body of literature and different theories regarding various facets of firm growth can be divided into two main groups. The first group consists of empirical studies testing the relationship between a firm's size and age and its growth rate (e.g. Mata, 1994; Das, 1995; Hart & Oulton, 1999; Lotti, Santarelli, & Vivarelli, 2003; Calvo, 2006; Rufin, 2007; Morone & Testa, 2008; Bentzen, Strøjer Madsen, & Smith, 2012; Daunfeldt, Elert, & Lang, 2012; Daunfeldt & Elert, 2013; Hedija, 2017; Coad, Daunfeldt, & Halvarsson, 2018; Krasniqi & Lajqi, 2018). The second group of the empirical research suggests that firm-specific characteristics and contextual factors also influence firm growth. Investments in research and development (R&D) and innovation (Mudambi & Swift, 2011; Uhlaner et al., 2012; Capasso, Treibich, & Verspagen, 2015; Ipinnaiye, Dineen, & Lenihan, 2017; Stojčić, Srhoj, & Coad, 2020), export-oriented grant schemes for technology development and for commercialization (Srhoj & Walde, 2020), type of strategy and management systems (Mei-Pochtler, 1999; Parker, Storey, & Witteloostuijn, 2010; Lechner & Gudmundsson, 2012; Ipinnaiye et al., 2017; Martin-Rios & Pasamar, 2018), leverage, liabilities and financial resources (Carpenter & Petersen, 2002; Diaz Hermelo & Vassolo, 2007; Anton, 2016; Coad & Srhoj, 2019), inventories (Coad & Srhoj, 2019), and firm owner/manager characteristics (Janssen, 2006; Moreno & Casillas, 2008; Wiklund, Patzelt, & Shepherd, 2009; Lechner & Gudmundsson, 2012; Anderson & Eshima, 2013) are used most often.

Other interesting issue is that most of the studies examining firm growth were conducted in periods of economic prosperity and only a few in periods of economic crisis (Contini & Revelli, 1989; Hardwick & Adams, 2002; Peric & Vitezic, 2016; Serrasqueiro & Nunes, 2016). It is well known that the great recession of 2008-2009 hit the entrepreneurial sector worldwide, resulting in unfavorable effects on production (Liu, 2009), sales (Bricongne et al., 2012; Cowling, Liu, Ledger, & Zhang, 2014), investments (Campello, Graham, & Harvey 2010; Paunov, 2012), employment (Rafferty, Rees, Sensier, & Harding, 2013), performance (Akbar, Rehman, & Ormrod, 2013; Canarella & Miller, 2017), risk tolerance (Inklaar & Yang, 2012), and business confidence (Geels, 2013; Rostamkalaei, 2017). However, even in an industry that is declining in a recession, there will always be fast-growing firms alongside rapidly declining firms (Coad & Hölzl, 2012). Evidence also suggest that the more an economy is in the recession, the greater the probability that it will see high decline manufacturing firms (especially medium/large firms), but at the same time, concentration ratios increased in most of the sectors and high-tech firms exploited the recession showing upward trend of the growth rate distributions (Vitezić, Srhoj, & Perić, 2018).

This paper will focus on firm size as the traditional and the most widely studied factor for its contributions to growth (see Storey, 1994; Davidsson, Kirchhoff, Hatemi-J, & Gustavsson, 2002). Because there is no the most favorable measure of growth, this study uses total assets for measuring firm size and growth. Assets are considered a good reflection of the 'wealth of the firm' (Smith, Tether, Thwaites, Townsend, & Wynarczyk, 1993) and are often used as a composite indicator of growth and probable purchase price of the firm (Garnsey, 1998). Additionally, as a proxy for capital of the firm, assets make an input to the production function. A firm must have assets to generate revenues and value added (i.e. outputs of the production function) and the asset turnover (firm sales/total assets), as an activity ratio, is a measure of the firm level of efficiency in the use of resources, that is, firm's ability to generate revenues from its assets (Fairfield & Yohn, 2001; Moreno & Casillas, 2007). It is a stylized fact that asset turnover will decrease with an increase in the firm size, but it will increase with the firm sales growth (Gupta, 1969). The greater the asset turnover, the higher the level of efficiency of the assets (Moreno & Casillas, 2007). It could imply more production and sales are generated with the same resources. However, it could also mean that the firm is stretching its capacity to its limits and needs new investment to grow. Indeed, growth realized in the past as well as anticipated in the future requires an investment in assets (Collins, Pungaliya & Vijh, 2016). Although there is a high correlation among growth of sales, assets, and employments (Delmar et al., 2003, Moreno & Casillas, 2007), it is not always true that sales will lead the growth process and in some cases it is possible that assets will grow before any sales will occur (Delmar et al., 2003; Colombelli, 2015). Opposed to Gupta (1969), the asset utilization level is also found to be lower in high-growth firms than in non-high-growth firms within the same sector

forcing the high-growth firms to grow and balance the sales/assets ratio (Moreno & Casillas, 2007).

Therefore, this paper aims to examine the firm size-growth relationship during a period of economic recession. Using a sample of surviving Croatian firms in the manufacturing and hospitality industries over the 2008-2013 period of economic recession and total assets instead of the turnover as a measurement of firm size and growth, this study also seeks to check the robustness of the results from a prior study (Peric & Vitezic, 2016). In other words, this study intends to empirically investigate whether the firm growth measured by the total assets will follow the same pattern as when have been measured by the turnover? In the scope of the research are firms from the manufacturing and tourism industry (where hospitality firms are in the core), which are according to the Central Bureau of Statistics[1], industries with the largest share in the structure of the gross domestic product (GDP), total employment of the Republic of Croatia and with the absolute largest share in total exports. As a tourism-oriented country, Croatia recorded negative growth rates of Gross Domestic Product (GDP) over an aforementioned six-year period and efforts to analyze firm size-growth dependence from vital sectors in such conditions, and compare the results obtained by different measures of growth, would be interesting to both academics and practitioners.

The article is organized as follows. The first chapter provides an overview of the literature on firm dynamics, focusing on the firm size-growth relationship which is commonly explained by Gibrat's Law. The second chapter looks at the research method employed to build a small-business growth model based on the respective relationship. In the third part, research results are detailed and discussed. Finally, some concluding comments are made.

2. THEORETICAL BACKGROUND

The conceptual underpinning of the role of firm size in firm dynamics emerges from the law of proportionate effect or Gibrat's Law. In 1931 Robert Gibrat observed the size distribution of French manufacturing establishments and found it bears a resemblance to the lognormal distribution. He suggested that firm growth is a purely random effect and therefore independent of firm size, that is, that both small and large firms grow at the same rate (Gibrat, 1931). Hence, all firms in a particular industry, regardless of their initial size, have the same probability to experience a proportionate change in size (Mansfield, 1962).

There is a multitude of empirical studies dedicated to exploring the firm size-growth relationship, testing whether the Law holds (overviews can be found in Audretsch, Klomp, Santarelli, & Thurik, 2004; Santarelli, Klomp, & Thurik 2006; Nassar, Almsafir, & Al-Mahrouq, 2013). On the one hand, a number of studies found a negative relationship between firm size and firm growth, indicating that growth rates of small firms tend to be higher than the growth rates of large firms (Mata, 1994; Hart & Oulton, 1999; Calvo, 2006; Rufin, 2007; Daunfeldt et al., 2012; Ivandić, 2013; Hedija,

[1] www.dzs.hr; Accessed: 4th May 2020.

2017). On the other hand, many other studies have reached a conclusion that large firms grow faster than small ones (Hardwick & Adams, 2002; Lotti et al., 2003; Audretsch et al., 2004; Morone & Testa, 2008; Bentzen et al., 2012; Daunfeldt & Elert, 2013) or that there is no difference in growth rates of small and large firms (Del Monte & Papagni 2003; Fujiwara, Di Guilmi, Aoyama, Gallegati, & Souma, 2004; Leitao, Serrasqueiro, & Nunes, 2010; Vuković, Korent, & Kedmenec, 2014). Since the empirical findings on the relationship between firm size and growth are inconsistent, it is impossible to conclude whether the Law generally holds or not. Space and scope considerations for this article allow to present only brief reviews of this adjacent literature, focusing on the country, sector, time framework, size measurement, and major findings of the studies (see Table 1 for a compendium of the relevant studies).

Table 1

Empirical studies on firm growth rates

Author(s) (year)	Country	Sector	Period	SM	GL
Hymer and Pashigian (1962)	USA	Manufacturing	1946–1955	A	M
Evans (1987)	USA	Manufacturing	1976-1982	E	R
Contini and Revelli (1989)	Italy	Manufacturing	1980-1986*	E	R
Acs and Audretsch (1990)	USA	Manufacturing	1976-1980	E	M
Tschoegl and Yu (1990)	8 different countries	Liquor brand sales	1970-1986	S/MS	A
Variyam and Kraybill (1992)	USA	Manufacturing, sales and service	1985-1990	E	R
Mata (1994)	Portugal	Manufacturing	1983-1987	E	R
Weinzimmer et al. (1998)	USA	Different sectors	1987-1991	S, A	R
Hart and Oulton (1999)	UK	Hospitality	1989-1993	E	R
Almus (2000)	West Germany	Manufacturing	1989-1996	E	R
Becchetti and Trovato (2002)	Italy	Different sectors	1995-1997	E	M
Davidsson et al. (2002)	Sweden	Different sectors	1987-1996	E	R
Hardwick and Adams (2002)	UK	Insurance firms	1987-1996*	A	M
Del Monte and Papagni (2003)	Italy	Manufacturing	1989-1997	S	A
Lotti et al. (2003)	Italy	Manufacturing	1987-1993	E	M
Piergiovanni, Santarelli, Klomp and Thurik (2003)	Italy	Hospitality	1989-1994	E	M
Chen and Lu (2003)	Taiwan	Different sectors	1988-1999	A	M
Audretsch et al. (2004)	Netherlands	Manufacturing and hospitality	1987-1991	S	M
Fagiolo and Luzzi (2004)	Italy	Manufacturing	1995-2000	E, S, VA	R

Fujiwara et al. (2004)	45 European countries	Different sectors	1992-2001	E, A, S	A
Calvo (2006)	Spain	Manufacturing	1990-2000	E, S	R
Diaz Hermelo and Vassolo (2007)	Argentina	Different sectors	1994-1996	S	A
Rufin (2007)	Spain	Tourism	1997-2000	S	R
Falk (2008)	15 European countries	Different sectors	2000-2004	E, T	R
Morone and Testa (2008)	Italy	Manufacturing	2001-2003	T	R
Lotti, Santarelli and Vivarelli (2009)	Italy	Radio, TV and telecommunications	1987-1994	E	R
Fotopoulos and Giotopoulos (2010)	Greece	Manufacturing	1995–2001	A	M
Leitao et al. (2010)	Portugal	Trading	1998-2004	A	A
Mateev and Anastasov (2010)	6 European transition economies	Different sectors	2001-2005	E, A	M
Park, Shin and Kim (2010)	Korea	Manufacturing	1994-2003	E	R
Park and Sydnor (2011)	USA	Hospitality	1995-2006	S	M
Bentzen et al. (2012)	Denmark	Different sectors	1990–2004	T, A	R
Daunfeldt et al. (2012)	Sweden	Retail	1998-2004	E, T	M
Daunfeldt and Elert (2013)	Sweden	Different sectors	1998-2004	E, T	M
Ivandić (2013)	Croatia	Hospitality	1997-2008	T	R
Nunes, Gonçalves, and Serrasqueiro (2013)	Portugal	Different sectors	1999-2006	S	M
Vuković et al. (2014)	Croatia	Software	2002-2007	E, T	A
Peric and Vitezic (2016)	Croatia	Manufacturing and hospitality	2008-2013*	T	R
Zhang, Zhu, Wen and Zhuang (2016)	China	E-commerce	2005-2014	S	M
Serrasqueiro and Nunes (2016)	Portugal	Hospitality	2000-2009*	S	R
Canarella and Miller (2017)	USA	ICT	1990-2013	A	R
Hedija (2017)	Czech Republik	Different sectors	2008-2013	S	R
Krasniqi and Lajqi (2018)	Kosovo	Different sectors	2002-2004	E	R

*Note: * includes recession period; S(ize)M(easurement): E = Employees, S = Sales, T = Turnover, MS = Market share, A = Assets, V = Value added; G(ibrat's)L(aw): A = Accepted, R = Rejected, M = Mixed results*

Source: Authors' review

One of the reasons for this inconsistency of results lies in the fact that there are at least three ways of formulating Gibrat's Law. The first version according to Mansfield (1962) suggests that the Law is valid for all firms, both those that exited the industry and those remaining in the industry. The second

version postulates that the Law is valid for all firms other than those that leave the industry. In other words, the second version includes only those firms that have survived over a relevant period. The third main version assumes that the Law applies only to those firms that exceed the minimum efficient scale (MES) level of output. In this respect, Geroski (1995) argued that Gibrat's Law could not be defended as a general law but rather as a dynamic rule. This rule is therefore valid for large and mature firms which had reached their MES level of output, and not for smaller and younger firms which usually operate at a sub-optimal scale.

In addition, in most cases, Gibrat's Law has been tested for the manufacturing industry in developed countries during periods of economic progression, thus leaving services, developing countries and periods of recession out of the scope. While there are many studies outside Gibrat's framework that analyze the impact of economic crisis on the performance of firms of different sizes (e.g. Gertler & Gilchrist, 1994; Bugamelli, Cristadoro, & Zevi, 2009; Coad & Hölzl, 2012; Fort, Haltiwanger, Jarmin, & Miranda, 2013; Cowling et al. 2014; Siemer 2014), this review (see again Table 1) found only a few studies that test whether the Law holds in time of crisis. First, Contini and Revelli (1989) analyzed data for Italian manufacturing firms for a recession period (1980-1983) and an expansion period (1983-1986). Regression results suggest that firm growth rate declines significantly with size, while the coefficient changes only slightly when different periods of time are used. Although there is hardly any association between growth rates and age in the recession period, the growth rates decline with age in the expansion period. Second, Hardwick and Adams (2002) explored whether the organic growth rates of UK life insurance firms were independent of size in the period 1987-1996. Despite the fact that there were sub-periods when smaller or larger life insurers tended to grow faster (e.g. the larger firms grew faster during the recession of 1990-1993), they did not find any significant differences between the growth rates of small and large firms over the observed decade. Therefore, the findings from Hardwick and Adams (2002) support Gibrat's Law as a long-run tendency in the UK life insurance industry. Serrasqueiro and Nunes (2016) examined a sample of 177 small and medium-sized Portuguese hotels for the period 2000–2009 and concluded that the growth rate of small hotels is higher than the growth rate of large ones (although it is valid only for lower levels of size) and that the financial crisis of 2008 influenced negatively on growth of small and medium-sized hotels. Lastly, Peric and Vitezic (2016) rejected the Law for Croatian manufacturing and hospitality firms during the recession period 2008-2013 by finding that turnover growth was not a random effect, that is, growth was positively associated with firm size. This study is of particular importance since it encompasses an emerging region in adverse business environments, i.e. in times of crisis and periods of recession which are sometimes deliberately excluded from the analysis of the firm size-growth relationship (e.g. see Evans 1987).

In this respect, Audretsch and Elston (2010) emphasized that the validity of Gibrat's Law might depend on the time period under study. Daunfeldt et al.

(2012) and Daunfeldt and Elert (2013) also addressed this problem, pointing out that studies should focus more on investigating the circumstances in which Gibrat's Law holds or not. General opinion is that smaller firms are more sensitive to economic cycles and fluctuations (Gertler & Gilchrist, 1994; Kangasharju, 2000; Hardwick & Adams, 2002; Fort et al., 2013) and were hit harder by economic recession, relative to larger firms (Bugamelli et al., 2009; Fort et al., 2013; Siemer, 2014). It has been therefore argued that small firms could be more susceptible to adverse business conditions making it more probable that the Law will hold during the recession (Daunfeldt & Elert, 2013).

These conclusions strengthen the need for further research in this area and provide grounds for additional investigation. Implementing the methodology and context from the previously published paper (Peric and Vitezic, 2016), the novelty of this study is that it uses the total assets as a measure for firm size and growth, thus checking the robustness of the previous results from two industries (manufacturing and hospitality) as well as providing new discussion on the relationship between firm's turnover and total assets.

3. DATA AND EMPIRICAL METHOD

The simplicity of Gibrat's Law has encouraged many studies which are, however, difficult to compare because the samples used and the methodologies applied differ in most cases (see Santarelli, Klomp, & Thurik, 2006). Because economic behavior is inherently dynamic so are many econometrically interesting relationships explicitly or implicitly dynamic (Nerlove, 2002). Hence, the dynamic panel data model seems to be an adequate method for generating good predictions, thus providing micro-foundations for aggregate data analysis. According to Hsiao (2007), the advantages that panel data have over time series data or cross-section data refer to greater degrees of freedom, less multicollinearity, and more variation in the data, ultimately resulting in more-efficient estimators. Furthermore, panel data make it possible to control for heterogeneity, study dynamics and test more complex behavioral hypotheses than is possible with a single time series or cross-section (Hsiao, 2007). Based on the aims identified in the Introduction, the following empirical specification, compatible with the genuine definition of Gibrat's Law, is formulated:

$$\ln s_{i,t} = \beta_0 + \beta_1 \ln s_{i,t-1} + \varepsilon_{i,t} \tag{1}$$

where $S_{i,t}$ is the size of the ith firm at time t, $S_{i,t-1}$ is the size of the same firm in the previous period, and $\varepsilon_{i,t}$ is a random variable distributed independently of $S_{i,t-1}$.

Using the lags of the response variable as explanatory variables, a dynamic linear panel data model (DPD) can be defined as follows (Bond, 2002; Arellano, 2003):

$$s_{i,t} = \beta_0 + \beta_1 s_{i,t-1} + (\eta_i + v_{i,t}) \tag{2}$$

where η_i is an unobserved individual-specific time-invariant effect which allows for heterogeneity in mean values of the $s_{i,t}$ series across individuals, and $v_{i,t}$ is a disturbance term. The difference estimator can be established discarding individual effects by differencing. The following first-differencing equation (3) is estimated:

$$\Delta s_{i,t} = \beta_0 + \beta_1 s_{i,t-1} + \Delta v_{i,t} = \gamma' W_{i,t-1} + \Delta v_{i,t} \quad (3)$$

The disturbance term of (3), by design, it presents auto-correlation but also a correlation with the lagged dependent variable. Correspondingly, an estimator that takes both issues into account is needed. The endogeneity issue is solved by noting that all values of $s_{i,t-k}$ with k > 1 can be used as instruments for $\Delta s_{i,t-k}$. Non-observed values of $s_{i,t-k}$ can harmlessly be substituted with 0.

To test for the validity of Gibrat's Law of proportionate effect, the observed firm sizes were divided into several size classes and then scrutinized to see whether firm growth rates were equally distributed across the classes. Three variables determine the size category, namely: total assets, total revenues, and the average number of employees. According to the Accounting Act[2] thresholds, (see footnote), firms that do, or not, exceed any two conditions, were placed into one of three size categories, classifying as small, medium-sized, and large firms. Firm size was measured using annual data from the Financial Agency (FINA)[3].

In the econometric analysis, the database requirement concerning dynamic panel estimators is the inclusion of at least four successive years of cross-sections (Arellano & Bond, 1991). However, including all firms might obscure the relationship between size and growth and in case growth and exit (entry) are not treated as homogeneous appearance (assuming the disputable hypothesis that exit is equal to a minus one rate of growth), empirical estimates need to deal only with surviving firms (Lotti et al., 2003). The years leading to the entry and exit of particular firms can strongly affect both tail distribution and represent industry dynamics more unrealistically (Vitezić et al., 2018). Correspondingly, the dataset used in this paper includes all firms that stayed active, i.e. survived, in the manufacturing and hospitality industries[4] throughout the observed period between 2008 and 2013, in line with the stipulation of

[2] The Accounting Act(NN 78/2015) and indicators set out on the last day of the fiscal year preceding the fiscal year for which financial statements are drawn.
(1) Small firms are those that do not exceed any two of the following conditions: total assets of HRK 32,500,000.00; revenue 65,000,000.00; average number of employees in the course of the financial year 50.
(2) Medium-sized firms are those that exceed any two of the conditions referred to in paragraph (1), but do not exceed two of the following conditions: total assets of HRK 130,000,000.00; revenue 260,000,000.00; average number of employees 250.
(3) Large firms are those which exceed any two of the conditions referred to in paragraph (2).
[3] Obligation of all Croatian firms to deliver their annual financial statements and auditor's report for the purpose of public disclosure by 30 April of the subsequent year.
[4] Manufacturing and hospitality industries data series were transformed into real terms by deflating with the Industrial Producer Price Index (PPI) and Consumer Price Index (CPI), presented at constant prices of a referent year (2005 = 100).

Mansfield's (1962) second demarcation, Audretsch and Mahmood (1994), Audretsch (1999), Rufin (2007), Daunfeldt et al. (2012), and Watson (2012).

The final sample encompassed 7,563 surviving manufacturing and hospitality firms, observed across six years, creating a balanced panel data of 30,252 observations. The manufacturing sector accounted for 76.19% and the hospitality sector for 23.81% of the sample, respectively. The approach of taking a balanced panel is well known in the literature (e.g. Contini & Revelli, 1989; Johansson, 2005; Bottazzi & Secchi, 2006; Hall, Lotti & Mairesse, 2008; Lunardi, Micciche, Lillo, Mantegna, & Gallegati 2014). Consequently, in terms of statistical relevance, balanced panel is considered a more reliable choice, as a complete panel comprises all observations for each individual measured at the same time points, i.e. it is composed only of firms that are present both at the beginning and at the end of the observed period.

Table 2 presents the descriptive summary statistics data referring to the three variables determining firm size, i.e. total assets, total revenues, and the number of employees for each industry containing only those firms that survived in the period 2008-2013.

Table 2

Descriptive statistics for size variables using the observations 1:1 – 7563 (5762M+1801H):6

year	Manufacturing						Hospitality					
	Asset (1000s of HRK)		Revenue (1000s of HRK)		Employees		Asset (1000s of HRK)		Revenue (1000s of HRK)		Employees	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2008	24,835	310,735	23,263	327,839	36.32	190.40	20,094	105,348	4,910	24,216	16.23	66.74
2009	25,744	357,817	20,474	256,559	33.82	180.50	19,599	101,358	4,501	22,577	15.78	66.61
2010	24,617	367,739	20,246	298,133	32.35	176.19	19,374	99,721	4,390	22,685	15.78	66.61
2011	23,699	347,692	20,026	318,339	31.63	164.73	19,583	103,164	4,679	25,195	15.88	73.28
2012	22,146	312,578	19,363	303,829	30.69	163.79	19,170	102,446	4,939	28,765	15.86	73.54
2013	22,313	294,886	18,849	293,939	30.58	163.96	19,560	110,046	5,372	30,557	16.42	80.80

Note: M = Manufactory, H = Hospitality; SD = Standard Deviation; HRK = Croatian Kuna

Source: Authors' calculation based on FINA data

4. RESULTS AND DISCUSSION

Tables 3 and 4 summarize the estimation results of the relationship between the size and growth of Croatian firms. The results of the 2-step DPD model estimation of Eq. (1) including one variable, the natural logarithm of total assets, and referring to the examination period 2008-2013, show coefficients β_1, central to this analysis and through the estimates of which the validity of the Law is tested, robust standard errors and level of statistical significance. While Table 3 presents the estimation results for manufacturing firms, Table 4 displays the results for the relationship in the hospitality industry.

After testing the regression output, models in Tables 3 and 4 display absence of second-order serial correlation (AR (2), (p-value>0.05, in parentheses)) in all size classes of both industries. Following Arellano and Bond (1991), validation of the instrumental variables is obtained due to failure to reject the null hypothesis of this test. Moreover, the validity of instrument subsets in regression results is attested by Sargan's overidentification test (Sargan, 1958), which is founded on residuals' uncorrelation with the instruments (null hypothesis). In rejecting the null hypothesis in all observed size categories (in parentheses), with the exception of medium-sized and large hospitality firms, we must suspect the validation of instrumentals. Dynamic panel models do not include period-specific dummy variables.

Table 3

Model estimation results for small, medium and large firms in the manufacturing industry, 2008-2013

2-step dynamic panel, H-matrix as per Ox/DPD, dependent variable: *l_ASSET*			
	Model 1. Small	Model 2. Medium	Model 3. Large
l_ ASSET (-1) [a]	−0.302*** (0.040)	0.652*** (0.117)	0.917*** (0.122)
Const [b]	−0.120*** (−0.005)	−0.013*** (0.004)	−0.007 (0.006)
Test for AR(2) errors	0.564 (0.572)	0.729 (0.466)	0.677 (0.499)
Sargan over-identification test	21.677 (0.010)	25.452 (0.003)	18.798 (0.027)
N	5334	330	98
Observation	21336	1320	392

Notes: [a,b] Coefficients and their standard errors (in parenthesis) are shown.
****, ** and * denote significance at the 1, 5 and 10 percent level.*

Source: Authors' calculation based on FINA data

Table 4

Model estimation results for small, medium and large firms in the hospitality industry, 2008-2013

2-step dynamic panel, H-matrix as per Ox/DPD, dependent variable: *l_ASSET*			
	Model 1. Small	Model 2. Medium	Model 3. Large
l_ ASSET (-1) [a]	−0.427*** (0.136)	0.279 (0.234)	0.917*** (0.165)
Const [b]	−0.112*** (0.012)	0.009 (0.007)	0.012 (0.008)
Test for AR(2) errors	-0.454 (0.650)	-0.311 (0.756)	0.057 (0.954)
Sargan over-identification test	85.056 (0.000)	9.119 (0.426)	10.490 (0.312)
N	1726	57	18
Observation	6904	228	72

Notes: [a,b] Coefficients and their standard errors (in parentheses) are shown.
****, ** and * denote significance at the 1, 5 and 10 percent level.*

Source: Authors'own calculation based on FINA data

As can be seen from Tables 2 and 3, empirical findings bring to conclusion that total asset growth in the manufacturing and hospitality industry has been positively influenced by firm size. Econometric results from DPD models also indicate that the variations of growth rates across both industries are very similar, especially in the context of large firms showing identical growth rates. Small firms displayed a negative trend in both industries, while medium-sized firms maintained positive figures.

Further, in both industries the growth rate of medium-sized and large firms was higher than that of small firms during the observed period of economic decline, in contrast with Brusco, Giovannetti and Malagoli's (1979) suggestion that due to a sample selection bias the growth rates of smaller firms are expected to be higher than those of larger firms. The fact that firms' growth rates are positively associated to firm size is in line with Wiklund and Shepherd (2005), Morone and Testa (2008), and Bentzen et al. (2012). Regarding hospitality industry, the results obtained here contradict to the conclusions of Piergiovanni et al. (2003) and Serrasqueiro and Nunes (2016) who did reject the Gibrat's Law in most cases and found Italian and Portuguese small hospitality firms grow faster. The same contradiction is found when the results are compared to Ivandić (2013) who found smaller hospitality firms that survived the transition phase of economy 1997-2008 (i.e. before global crisis) achieved higher growth rates than larger firms regardless of the ownership modalities. Also, the results oppose to Audretsch et al. (2004) who provided evidence that Gibrat's Law holds for Dutch hospitality industries. However, more detailed comparison with these studies is difficult since only the study by Serrasqueiro and Nunes (2016) refer to the great recession within 2000-2009 period. On the other hand, antipodal to Fujiwara et al.

(2004) results which indicate that Gibrat's Law holds for large firms, and Lotti et al. (2009) and Daunfeldt et al. (2012) who contended that the focus on survivors would make it more likely to accept the Law, the estimates of the DPD models provide a basis for rejecting the Law in both industries. In other words, this study confirmed the robustness of the results delivered by Peric and Vitezic study (2016) suggesting that for Croatian manufacturing and hospitality industries Gibrat's Law does not hold, regardless the firm size is being measured by turnover or by total assets. This finding places Croatian firm-size distribution coherent with the bunch of prior theoretical reasoning and empirical testing that have also rejected the Law (see again Table 1).

However, this study's empirical findings can be further analyzed from the perspective of total asset dynamics. The results imply that small-sized firms in both industries recorded negative growth rates of total assets, that is, the total assets shrank during a period of economic recession. In this way, some previous inferences (Gertler & Gilchrist, 1994; Kangasharju, 2000; Hardwick & Adams, 2002; Bugamelli et al., 2009; Fort et al., 2013; Siemer, 2014; Serrasqueiro & Nunes, 2016) that small surviving firms presented more vulnerability to economic downturn compared with their larger counterparts were confirmed. However, the fact that small-sized firms in both industries exhibited positive turnover growth rates in the same period (see Peric and Vitezic, 2016) contradicts Delmar et al. (2003) and Morena and Casillas (2007) indicating that there is no positive correlation between small-sized firms' growth of sales (i.e. turnover) and growth of assets during crisis. Further, the increase of small-sized firms' turnover and decrease of their total assets in the same period imply to a conclusion that their asset turnover has increased. Usually the increase of the asset turnover means that firms became more efficient in asset utilization (see Moreno & Casillas, 2007). However, in this case, the reduction of resources could be a result of depreciation or disinvestment and the fact that small-sized firms probably had to sell their property (both active and/or idle assets) to acquire cash to overcome the crisis. In the long run, firms' capacities would be overstretched and, sooner or later, firms will have to invest to grow thus balancing (i.e. decreasing) the asset turnover. Still, since no adequate information on such data were available for an in depth analysis, this conclusion is of speculative nature.

Regarding large firms which grow fastest in both assets and turnover (see Peric and Vitezic, 2016), the opposite trend is noticed. It seems firms' total assets in both industries grow faster than turnover indicating that firms' asset turnover ratio declines over time. It could be a sign of "overinvestment" in assets or of a presence of idle resources (Moreno & Casillas, 2007). On the other hand, medium-sized firms show different pattern. This study results, when compared to Peric and Vitezic (2016), suggest that medium-sized firms in both industries grow at similar rates when measured by turnover, but total assets growth in manufacturing firms is higher than their turnover growth and higher than total assets growth in hospitality firms. It leads to a conclusion that asset utilization in medium-sized manufacturing firms is decreased whereas in medium-sized

hospitality firms is increased during recession. Additionally, viewing the issue from the perspective of employment, previous research by Peric and Vitezic (2016) reveals the diminishing rates of firms in all size classes, in both industries, with the exception of small and medium-sized hospitality firms (also, a lower percentage of change with regard to small manufacturers), indicating an alarming employment problem during the economic recession and emphasizing that large firms were more adversely affected.

5. CONCLUDING REMARKS

Change in total assets of surviving manufacturing and hospitality firms was used as a measure to empirically explore the relationship between the size and growth of firms faced with the effects of the current economic crisis. Based on a particularly long recession period, the examination of the linkage between firm size and growth of Croatian surviving firms, based on the FINA firm-level database, showed a significant and positive impact on the growth rate of total assets in the period between 2008 and 2013. This indicates that growth rate increases with the size of a firm, thus implying the rejection of Gibrat's Law. Therefore, with regard to the results of the empirical analysis, Gibrat's Law cannot be confirmed neither for surviving manufacturers nor hospitality firms during the recession.

In this way, this study confirmed the findings on Croatian manufacturing and hospitality firm dynamics during recession proposed by Peric and Vitezic (2016). However, despite the general conclusion on the rejection of the Law in both studies, the firm size – firm growth relation will remain a matter of future debate. Different and inconclusive findings of many empirical studies conducted in the last few decades (see again Table 1) might suggest that firm growth paths are close to random (Coad et al., 2015; Gibrat, 1931) but that it might depend on the research context as argued by Audretsch and Elston (2010), Daunfeldt et al. (2012) and Daunfeldt and Elert (2013).

The fact that small-sized firms were more vulnerable during economic downturn, as shown in this research, might has important policy implications. During and after recession, government policies should be focused more on small firms, which are after all the most numerous in most economies. The reallocation of resources should particularly focus on high-tech industries as well as stronger incentives for innovation across economy as a whole (as stated in Stojčić et al. (2020) and Vitezić et al. (2018)), thus including businesses of all sizes in knowledge, capital and labor intensive industries. Such incentives would foster the development of new business models capable to compete on international market and create and capture added value. This is especially important in the current situation when it is evident that Croatian economy, which relies heavily on hospitality and manufacturing, will suffer severely from the Coronavirus pandemic.

The usage of the total assets as a measure of firm size and growth instead of the turnover enabled comparison between turnover and asset dynamics during recession and, consequently, opened few questions on the asset turnover ratio and its interpretation in Croatian manufacturing and hospitality industries. It would be also worth examining whether the lower growth rate of small firms in comparison with their larger counterparts could be possibly related to lower available cash flow or innovative activity, thus leading to a higher exit rate from a long-term perspective. Since the manufacturing and hospitality industries are particularly relevant as a vector of the Croatian economy which is still struggling when compared to other transitional and/or new European Union member states, further research is needed to deepen the knowledge on these issues to facilitate the development and implementation of appropriate managerial strategies during unfavorable economic conditions.

As stated before, only one variable determining firm growth was used in this paper, that is, asset. Although the total asset value is considered as highly related to the capital intensity of the industry (Delmar et al., 2003), many of the smallest Croatian firms are actually without employees, and the inclusion of this variable as a size measure instead of the number of employees (as in "Gibrat's original") preserved the originality of the data sample. However, the obvious shortcoming of the assets as a measurement of firm size limits the applicability of results outside of this very specific contexts. Accordingly, other quantitative and qualitative variables such as capital structure and financial resources, investments in long-term assets and R&D, type of strategy or entrepreneurial competence will broaden the scope of future research. Also, the inclusion of other service industries and similar countries (with a long downturn period) would give more insights into the generalizability of the research and help to improve the overall conclusions.

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ODNOS VELIČINE I RASTA PODUZEĆA TIJEKOM EKONOMSKE KRIZE

Sažetak

Velika recesija 2008. godine snažno je pogodila poduzetnički sektor diljem svijeta. Razumijevanje načina kako poduzeća reagiraju u vrijeme globalne krize ključno je za formuliranje adekvatnih politika i mjera za ublažavanje krize. Koristeći uzorak od 7.563 hrvatskih poduzeća u prerađivačkoj industriji i ugostiteljstvu koje su preživjele šestogodišnje razdoblje ekonomske recesije (2008.-2013.) te ukupnu imovinu kao mjeru za veličinu i rast poduzeća, ovaj rad nastoji ispitati može li se zakon proporcionalnog efekta potvrditi u vremenima ekonomske recesije. Rezultati dvostupanjskog dinamičkog panela ukazuju na odbacivanje zakona u obje djelatnosti jer je rast imovine pozitivno povezan s veličinom poduzeća. Međutim, dinamika kretanja ukupne imovine razlikuje se ovisno o veličini i industriji kojoj poduzeća pripadaju, što ukazuje na potencijalno različite strateške odluke o korištenju imovine i/ili ulaganjima.

Ključne riječi: rast poduzeća, Gibratov zakon, ugostiteljstvo, prerađivačka industrija, recesija.

JEL klasifikacija: G01, G30, L25, L26, M13, M21.