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Which firms survive in a crisis? Corporate dynamics in Greece 2001-2014

Christos Axioglou & Nicos Christodoulakis

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ABSTRACT

Using a panel dataset of more than 40,000 Greek corporations over the period 2001-2014, the paper examines how their size measured by past turnover affects survival prospects and turnover growth. The analysis is carried out along three dimensions: (a) time-wise, by looking at the dynamics before and after the crisis in 2010; (b) sector-wise, by grouping firms in six areas of economic activity, namely manufacturing, construction, trade, recreation, real-estate, and the combined sectors of transport & communications; (c) region-wise, by examining firms in Northern Greece, the wider Attiki region, and the rest of the country. Other firm's characteristics like age, market share, leverage, and fixed asset ratio are also used as explanatory variables in the econometric estimation. Investigation takes place in the framework known in the literature as the Gibrat's Law, according to which market turnover is a random walk process and larger-size firms belong to the same population with smaller ones. Our findings suggest that in Greece larger-size firms were, in general, more likely to survive in the market than smaller ones and this relative advantage grew stronger during the crisis. Focusing on sectors, it is established that large companies in the manufacturing sector are by far more robust over the cycle, while those in the Real Estate and construction sectors manifest the highest extinction rate. Moreover, the rate of turnover growth for those firms survived is found to be negatively associated with their size, thus not confirming Gibrat's Law in Greece.

Keywords:

Industrial organisation, market share, manufacturing sector, crisis.

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[1]Hellenic Fiscal Council, christosaxioglou@gmail.com

[2]Athens University of Economics & Business and London School of Economics, Hellenic Observatory, e-mail: N.Christodoulakis@lse.ac.uk

1. Introduction

A recurring theme in industrial economics is whether, and to what extent, the size of firms influences their chances of staying in the market and/or the prospects for further expansion in turnover. If the effect is positive, it points to the existence of economies of scale as firms realize that by increasing size they are likely to secure a higher market share relative to smaller-size firms. If negative, it points to diseconomies of scale due either to internal factors such as increasing marginal costs or external obstacles to market expansion, such as - for example - congestion effects, over-regulation, etc.

Between the two opposite assumptions, market expansion might after all be independent of the size of firms, in which case the Law of Proportionate Effect is said to prevail. The hypothesis is known as 'Gibrat's Law' after French mathematician Robert Gibrat published a relevant analysis (Gibrat 1931). The Law amounts to assuming that market turnover is a random walk process and firms follow a lognormal distribution, no matter their size. In other words, larger-size firms belong to the same population with smaller ones and are equally likely to expand their turnover.

The simplicity, generality and intuition behind Gibrat's Law generated a prolific empirical literature aiming to test its validity in actual economies. Santarelli et al. (2006) provided one of the most comprehensive surveys describing more than sixty cases in different countries and over different periods, analyzed by employing a variety of econometric methods. Sectors with low capital requirements (i.e. the service sector) or populations of large firms appear to validate the hypothesis, as their expansion is independent of each particular size, but it seems to fail in other cases. The authors conclude that the hypothesis of Gibrat's Law is far from being an uncontested assumption, thus, it cannot really be a guiding principle in the analysis of market developments applied universally. This makes the investigation of Gibrat's Law an issue of importance that is specific to each country, epoch and sector of activity, rather than a unified pattern.

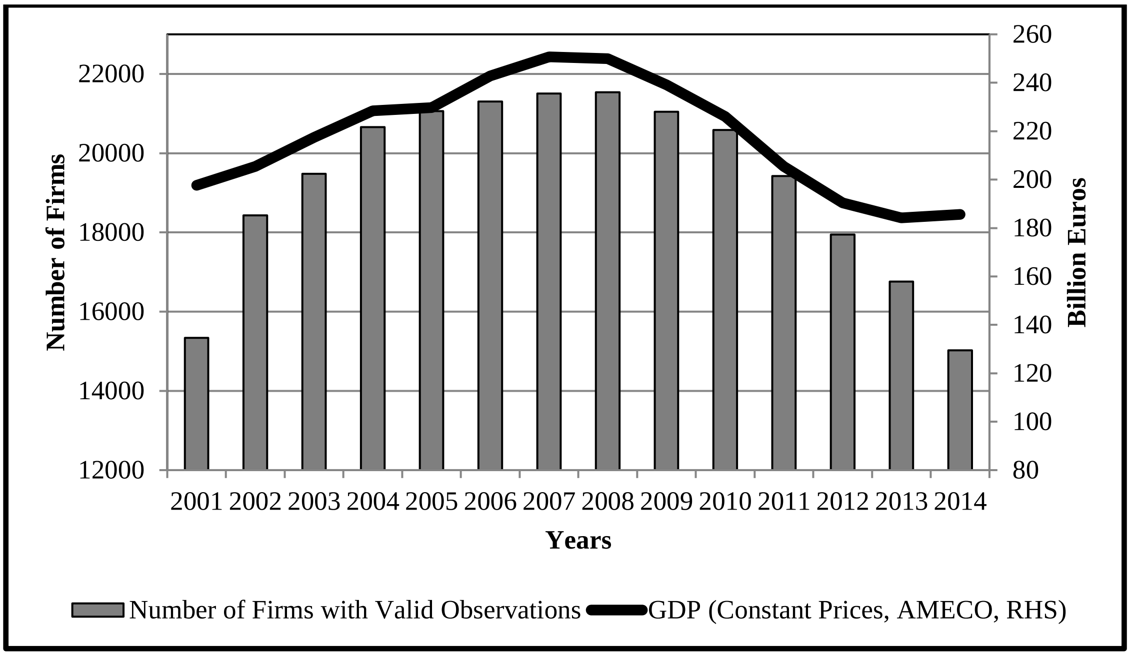
Furthermore, measuring the size effect on turnover growth might be of particular interest if examined over different phases of the business cycle. In the upturn of a cycle, the establishment of Gibrat's Law implies that market prospects open up to all firms, no matter their size, thus new firms enter across the spectrum of existing ones. In the downturn, several firms get out of business and Gibrat's Law amounts to making no size-related prediction regarding their survival. In contrast, a rejection of Gibrat's Law may provide decision-makers with valuable insights regarding the size of firms that are more likely to enter in the upswing or exit after a crisis.

In the aftermath of the recent financial crisis, the extent to which the properties of the firms' life-cycle depend on size may be of critical importance for their chances of survival and plans of restructuring. To the best of our knowledge, such questions have not yet received adequate attention in the existing empirical literature[3]. To fill the gap, we set out to investigate their relevance over a period that includes both an upswing and a

[3]An early empirical investigation of the issue by Boeri et al. (1995) for German establishments found low responsiveness of firms' growth or exit to aggregate cyclical fluctuations. Higson et al. (2004) report lower degree of sensitivity to aggregate shocks for UK firms at the tails of the cross-sectional growth distribution.

downswing phase taking place in Greece, a country distinctively hit by the global crisis of 2008 and the subsequent debt crisis of 2010. Indeed, the Greek economy reflects both phases of the cycle more starkly than any other does: during 2001-2008, Greek GDP on average was growing by 3.50% per year, and then experienced a cumulative fall by -22% by the end of 2014.

Figure 1: Population of operating firms and real GDP, 2001-2014.



Notes: Firms in thousands; GDP in €bn at 2010 prices. Source: Hellastat database.

The severe contraction in economic activity was not a one-off effect but rather a cumulative effect of the crisis spiral: In fact, as the global crisis started to unfold, Greece suffered only a mild recession and decision-makers in both Government and the European Union seemed to be reluctant on adopting emergency policy measures. However, in 2010, public debt and deficits went out of control and the country was denied access to financial markets. To avoid a sovereignty default, the European Union and the International Monetary Fund bailed out Greece in exchange for a front-loaded austerity programme. Under the measures envisaged by the adjustment programme, aggregate demand collapsed and the economy entered a prolonged period of recession; for a detailed analysis of the background and the effects of the Greek crisis see Christodoulakis (2016).

In the aftermath of the debt crisis, Greek firms faced several existential challenges, beyond those associated with market fluctuations over the business cycle. Several firms starved for lack of working capital, even if their sales or export prospects remained relatively unscathed. With liquidity draining out of the banking system, Greek firms became more pre-occupied with their survival rather than setting ambitious targets for further growth. As higher taxes on sales started to bite, several firms exited Greece by transferring operations elsewhere, without necessarily implying that they could no more compete in the market.

As shown in Figure 1, the population of firms moved in a roughly similar – though not identical – pattern with overall economic activity, as expressed by real GDP (see also Table I below). It is worth noting, however, that only few firms did quit the market immediately and was only after the recession deepened when firms begun to exit at a massive scale: In 2014, the number of surviving firms had returned to the population prevailing at the beginning of the century.

Hence, it is critical to explain how the determinants of growth and survival vary over time and across sectors of economic activity in Greece. Thus far, the role of firms' size on their market expansion and survival in Greece is examined to only a limited extent or just for specific sectors. For example, Vlachvei et al. (2007) used a small sample of manufacturing and trading firms in Greece for the period 1995-2000 and found that results are sensitive to the choice of variables measuring size and growth, thus reaching no conclusion regarding Gibrat's Law. Similarly, Fotopoulos et al. (2010) detected no indication of Gibrat's Law in their study of the Greek manufacturing sector over the period 1995-2001, while a subsequent study for the service sector by Giotopoulos et al. (2010)produced mixed results. Furthermore, their estimation methodology used balanced panel data and, therefore, was not capable of addressing issues such as entry or exit of firms. A recent exception was the study by Kontolaimou et al.(2017) on the behavior of small and medium enterprises before and after the recent financial crisis. However, by considering only surviving firms in their empirical analysis the study could not address survival effects on growth and vice versa.

The econometric analysis of firms' survival and their size effect on turnover growth requires a proper framework of identification and estimation, as described in the literature. Audretsch (1995) has explained the systematic variations of the aforementioned effects from industry to industry by the differences in innovation activity across markets. Analyzing the dynamics of firms' distribution has been the subject of several studies: an early attempt was by Quah(1993) to examine cross-sectional distributions, while Cabral et al. (2003) investigated the log-distribution of firms' sizes over time and across age cohorts. Ribeiro(2007) performed simple cross-sectional estimations for each year, while Lotti et al.(2009) employed Heckman's (1979) correction to face selection bias. More recently, Hutchinson et al. (2010) examined the distributional effects of inter-industry diversification, while Capasso et al. (2012) investigated the role of data truncation on firm size and growth rate variance. Meisenzahl (2016) addressed the impact of financial constraints on the evolution of firm size distribution, while Distante et al. (2018) analyze the effects of other economic and financial variables on growth and survival, using quantile regressions.

By employing a large unbalanced panel dataset of more than 40,000 Greek firms over the period 2001-2014, we test Gibrat's Law to find out whether and how their size affects survival and growth over two equal time-spans 2001-2008 and 2009-2014 reflecting the conditions before and during the financial crisis. To obtain aggregate estimates for the two sub-periods in the presence of a continuous exiting/entering market process, we follow Wooldridge's (2002) extension of the Heckman's (1979) cross-sectional approach to panel data. Moreover, Semykina et al.(2013) described the importance of obtaining estimation results that remain robust to sample selection bias. For results to remain robust to unobserved time-invariant firm-specific heterogeneity, our estimation method allows for cross-sectional fixed effects. In contrast to most of the existing empirical studies that mainly use balanced datasets to study firms' growth and, therefore, suffer from possible selection bias, our approach constitutes one of the few attempts to estimate dynamic panel data models using unbalanced data and, thus, controlling for both survival and firm's heterogeneity.

The rest of the paper is organised as follows: Section 2 describes the data and discusses some characteristic effects that recession exerted on Greek firms. Section 3 describes the general econometric framework employed in the analysis, while Sections 4 and 5 present the main findings on survival probabilities and turnover growth respectively. Finally, Section 6 draws some lessons for the character of policies aiming to support business firms in the aftermath of the Greek crisis, and outlines the directions of future research.

2. Data and stylised facts

We utilize an initial sample of 40,529 Greek corporations with the legal status of *Société Anonymes* (S.A.) for which annual data are available for the period 2001-2014, though not for all entries. Our sample is formed by collecting information from financial statements that SA firms are legally obliged to publish in the Official Government Gazette[4]. The sample contains firm-specific information for the year of establishment, the regional location of headquarters and sector of activity. It also contains annual information from firms' financial statements, specifically for total and current assets, turnover, equity and finally, the earnings before interest, taxes and depreciation allowance, (i.e. the EBIDTA). After filtering out some invalid cases (listed below Table IA), we keep an unbalanced panel-data of 270,104 firm-years in total, each of them containing valid firm-specific annual information.

The number of surviving firms for each year is shown in Table IA. Together, this Table reports aggregate statistics for the total number of Greek SA firms registered in the official Statistical Business Register (SBR). SBR is based on tax-related data and may therefore show substantial differences from our dataset especially in cases of inactive firms, which do not timely declare business closure to the tax authorities. This is available online from 2011 onwards via the Hellenic Statistical Authority's website.[5]

[4]Other legal types (including local branches) cover less than ten percent of our original sample and our therefore left out from the present analysis.
[5] Source: Data are from www.statistics.gr

Table IA: Number of Firms with Valid Observations

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of firms	15340	18430	19477	20660	21062	21304	21507	21536	21046	20409	19424	17949	16761	15026
Annual Percentage Change (%)		20.1	5.7	6.1	1.9	1.1	1.0	0.1	-2.3	-3.0	-4.8	-7.6	-6.6	-10.4
Average (%)		5.2							-5,8					
Percentage of Firms in the Statistical Business Register											71.8	69.4	67.6	52.1

Notes: Table shows the number of firms in the filtered sample after exclusion of cases which violate at least one of the following conditions: (a) Total Assets ≥ Current Assets > 0, (b) Total Assets ≥ Equity, (c) Turnover > 0, (d) Age > 0, where Age = Current Year – Year of Establishment + 1. We do not filter out firm-years with negative equity records, as they may signal cases where firms face insolvency or high debt issues, but still manage to survive and publish regular reports. We also excluded firms with reporting discontinuities. This led to reductions in the sample size ranging from less than 10% of firms in the Manufacturing and Trade Sectors to about 18% of firms in the Construction and/or Recreation Sectors. Source: Hellastat database. Statistics from the Statistical Business Register are available from 2011 onwards and obtained from the ELSTAT website: https://www.statistics.gr/el/statistics/-/publication/SBR01/-.

Table IB: Annual Statistics from filtered (F.S.) and unfiltered (UF.S) samples

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of Firms														
UF.S.	18814	21662	23053	24276	24792	25166	25928	26087	25604	25407	23943	21738	20812	18621
F.S.	15340	18430	19477	20660	21062	21304	21507	21536	21046	20409	19424	17949	16761	15026
% of UF.S.	81.5	85.1	84.5	85.1	85.0	84.7	82.9	82.6	82.2	80.3	81.1	82.6	80.5	80.7

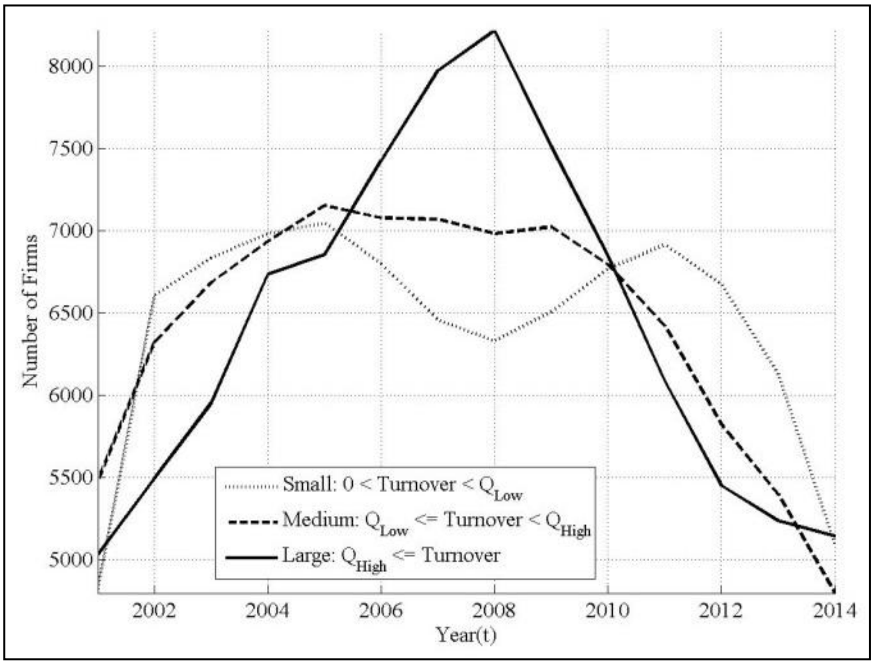
Median Turnover (in million Euros)														
UF.S. (1)	1.0	0.8	0.8	0.9	0.9	1.0	1.1	1.1	1.0	0.9	0.8	0.7	0.7	0.8
F.S (2)	1.2	1.0	1.0	1.1	1.1	1.2	1.3	1.4	1.2	1.1	1.0	0.9	0.9	1.1
(2) - (1):	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
% of UF.S.	21.2	18.3	19.2	17.5	17.2	20.0	22.8	22.1	22.6	25.3	26.6	22.7	29.2	29.4
Median Turnover Growth (%)														
UF.S. (1)		3.7	3.8	3.6	1.5	6.7	7.3	2.9	-8.6	-9.2	-9.0	-11.5	-1.2	2.1
F.S (2)		4.1	4.3	4.0	1.6	6.9	7.6	2.9	-8.8	-9.5	-9.3	-11.8	-1.3	2.0
(2) - (1):		0.4	0.5	0.4	0.0	0.2	0.3	0.0	-0.3	-0.3	-0.3	-0.3	-0.1	-0.1
Median Age (in Years)														
UF.S. (1)	9	9	9	10	10	11	12	12	13	14	15	16	17	18
F.S. (2)	9	9	9	10	10	11	12	12	13	14	15	16	17	18
(2) - (1):	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exit rate (%)														
UF.S (1)		7.7	5.5	7.2	7.1	6.5	6.0	7.6	9.2	8.6	11.3	14.0	10.2	13.6
F.S. (2)		5.3	4.0	4.8	5.3	4.9	4.5	5.6	6.4	6.6	8.7	10.2	8.7	12.2
(2) - (1):		-2.4	-1.6	-2.4	-1.8	-1.6	-1.5	-2.0	-2.8	-2.1	-2.6	-3.9	-1.5	-1.4

Notes: The Table shows the statistics from an unfiltered sample (UF.S.), which contains only non-missing turnover data. They are compared against the corresponding figures from the filtered sample (F.S.) as described in the text.

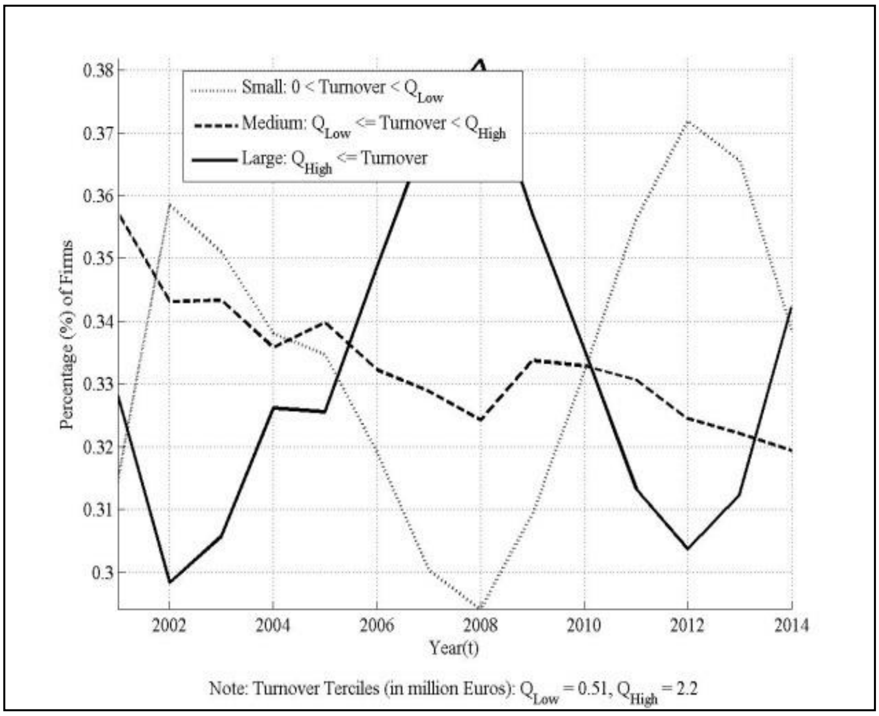
As shown in Table IB, compared with an unfiltered sample that contains only non-missing turnover data, our filtered sample contains on average more than 80 percent of firms. A median comparison across basic variables reveals that the filter sample includes firms with (i) higher sales, (ii) better performance before and during the economic crisis in terms of higher (lower) annual turnover growth before (after) 2008, (iii) lower exit rates consistently before and during the economic crisis and (iv) no significant differences in terms of age. Table 1B also shows that the increased growth of the filtered sample size observed in Table 1A for the year 2002 (20.1%) is not a result of this particular filtering, but may be attributed to other factors, such as the launch of the euro, which may have affected firms' reporting process.

Figure 2: (a) Size populations of operating firms

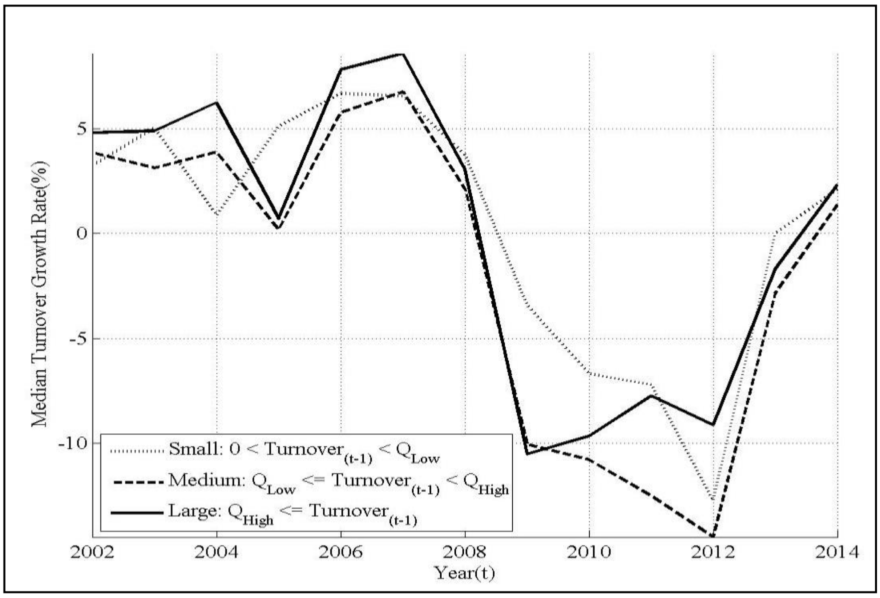
Absolute Size



Relative to Total Annual Size



(b) Median growth rate of annual turnover



Notes: Ranked in terciles by constant turnover thresholds (Q_{Low}, Q_{High}) over the period 2002-2014. Q_{Low}= 0.51 million Euros, Q_{Low}= 2.2 million Euros. *Source:* Hellastat database.

To get a first impression of how the size and composition of total firm population vary over the cycle, operating companies are classified as being small, medium or large ones by setting three fixed thresholds corresponding to the 33% and 67% terciles of annual turnover distribution across all firm-years of the initial sample. Subsequently, the terciles populations are juxtaposed versus turnover growth.

A similar analysis is conducted per sector of economic activity. Using sample information for the firms' sector of activity[6] we identify the six most populous, (i.e. with the highest number of firms), as follows: (1) Real Estate, (2) the TLC sector, including Transportation, Logistics and Communication, (3) Construction, (4) Recreation, including Hotels and Restaurants, (5) Trade, both wholesale and retail, and, (6) Manufacturing. Jointly, these sectors account for more than 90% of the firms surviving in each year. The rest consists of a small number of companies in the agricultural sector or elsewhere, with very low turnover to have a noticeable effect in our analysis. The following stylised facts are established:

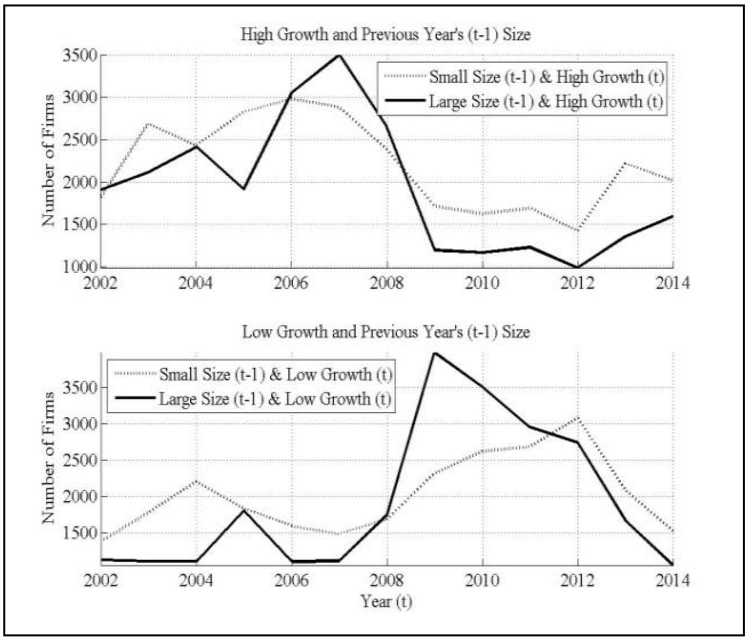
Fact #1. Turnover growth vs. size: The panels in Figure 2 depict the patterns of the three terciles of size distribution regarding their population and median growth rates, respectively. The first panel shows that in the upswing, the population of large firms increased more rapidly, while the population of small firms shrunk and that of medium size remained virtually stable. These findings suggest that firms initially not grouped as large ones exploited market prospects and subsequently advanced their ranking from small to medium and from medium to large ones. This provides an early indication that market expansion might be stronger for smaller and medium-size firms or, in other words, the size coefficient in Gibrat's equation is not likely to be positive and statistically significant. For the same reason, the fall in aggregate sales during recession hits larger-

[6]The classification in the Greek statistical system is STAKOD-03.

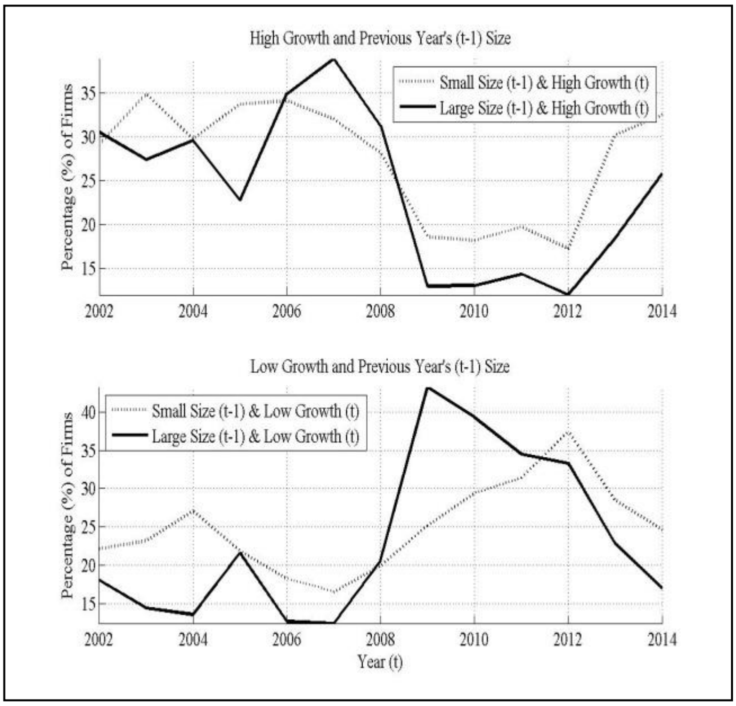
size firms more strongly, thus pushing them to the terciles of medium or small size firms. As shown in Figure 2a, the population of larger firms falls at a fast rate, while the population of small ones remains relatively stable between 2010 and 2013.

Figure 3: Populations of operating firms ranked by turnover and growth thresholds.

Absolute Size



Relative to Total Annual Size



Notes: Thresholds correspond to the 33% and 67% terciles of the distribution across all firm-years of the initial sample, 2002-2014. *Source:* Hellastat database.

The role of size is further illuminated by looking at the median growth. The panel in Figure 2b shows that the median growth rates in sales are not systematically different among small, medium and larger-size firms in the upswing. In the downswing phase, the sales by small firms fall proportionately less during 2009-2011, though later they follow a virtually common pattern.

In the first panel of Figure 3, the terciles of growth in sales are associated with those of size over time. Before the crisis, there seems to be no systematic differentiation between smaller and larger-size firms in growing fast. After the crisis, a higher proportion of small firms appears to have a better record in sales (i.e. a milder fall) than larger ones. In the second panel of Figure 3,it is worth mentioning the rapid increase in the number of large firms with a low sales record at the beginning of the crisis, though the effect dissipates later on. Again, the implication is that the size effect in Gibrat's Law is probably insignificant or negatively signed, confirming a similar conjecture in Figure 2a.

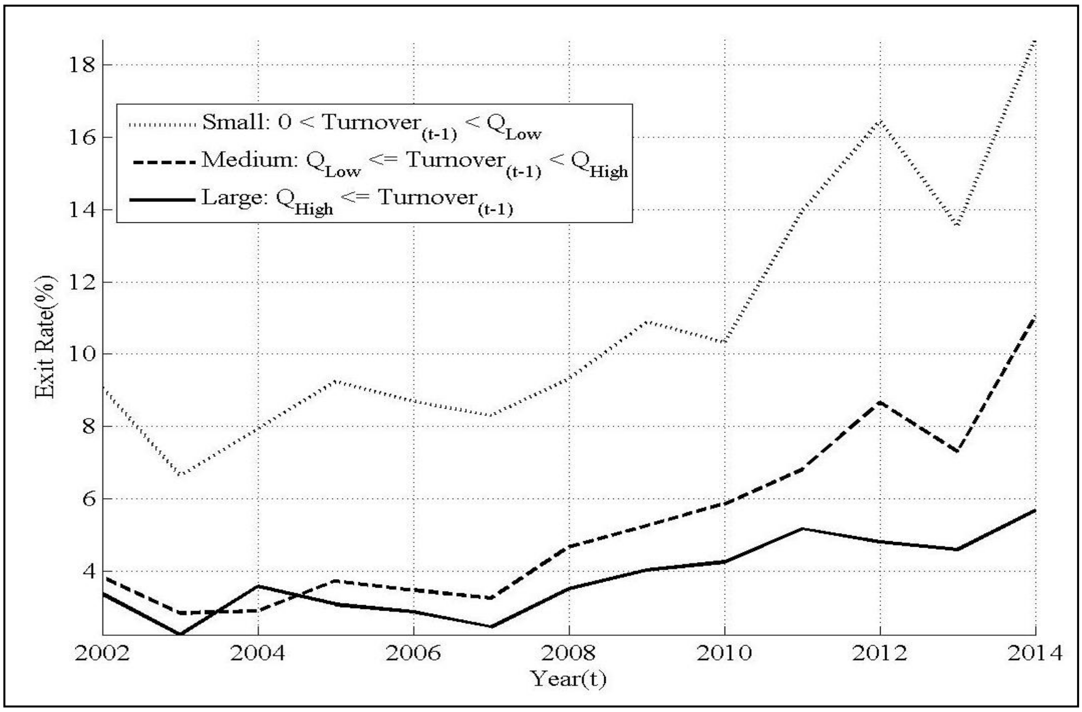
Fact #2. Survival vs. size: The pattern changes markedly regarding the survival of firms. Figure 4 depicts the exit rate of the three size-terciles, showing that smaller firms are more vulnerable for exiting the market throughout the period and even more so after the crisis. In contrast, larger-size firms prove to be far more salient, though their exit rate somewhat increased after 2008. Medium-size firms seem to exit at roughly a double rate than larger-size firms, while smaller ones at a tremble such rate.

Fact #3. Turnover growth by sectors: Figure 5depicts the population of firms in the various sectors and some interesting features readily emerge. The number of companies in the Real Estate and the Construction sector seem to rapidly expand before the crisis, but then shrink rather dramatically. In contrast, the population in the manufacturing sector experiences a mild increase before the crisis and then suffers a similarly mild reduction afterwards. Turnover growth rates seem to be roughly similar across sectors before the crisis; see Figure 6. After the crisis, turnover in the Construction and Trade sectors fall more rapidly during 2010-2012. Due to Greece attracting higher tourism shares in the wider regional market after 2010, the Recreation sector experienced the highest turnover growth especially during 2013 and 2014.[7]

Fact #4. Survival by sectors: To examine survival in more detail, the exit rates per sector of economic activity are depicted in Figure 7a. For all sectors, exit rates remain virtually stable before the crisis and rise afterwards. Construction and Real Estate sectors exhibit the highest exit rates throughout,[8] while the lowest rates characterize the Manufacturing companies, followed by those in Trade and Recreation sectors.

[7] In 2012, tourist arrivals fell short of expectations mainly because of widespread political uncertainty as two successive general elections in May and June fuelled fears of an eventual exit from the Eurozone.
[8]A surprisingly high outlier in 2002 for the construction sector is explained by the response of existing firms to new legislation on public projects companies. Adjusting to the new eligibility criteria envisaged by Law 2940/2001, about half of them merged in 2002 as reported in daily Kathimerini (4/2/2003). http://www.kathimerini.gr/141902/article/oikonomia/epixeirhseis/alla3e-shmantika-to-topio-ston-xwro-twn-ergolhptikwn

Figure 4: Exit rate (in percent) per size of firms ranked by last-period turnover.



Notes: Ranked in terciles by constant turnover thresholds (Q_{Low}, Q_{High}) over the period 2002-2014. Q_{Low}= 0.51 million Euros, Q_{Low}= 2.2 million Euros. *Source*: Hellastat database.

Figure 5: Number of Firms for the six main sectors of activity

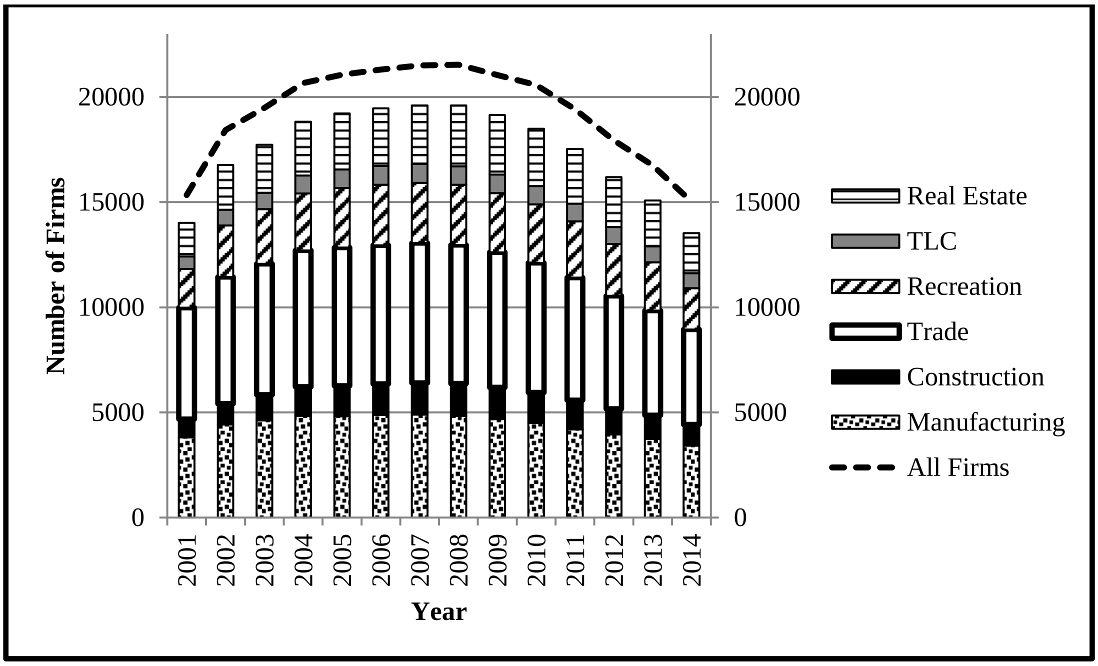


Figure 6: Turnover Growth (Median) for the six main sectors of activity

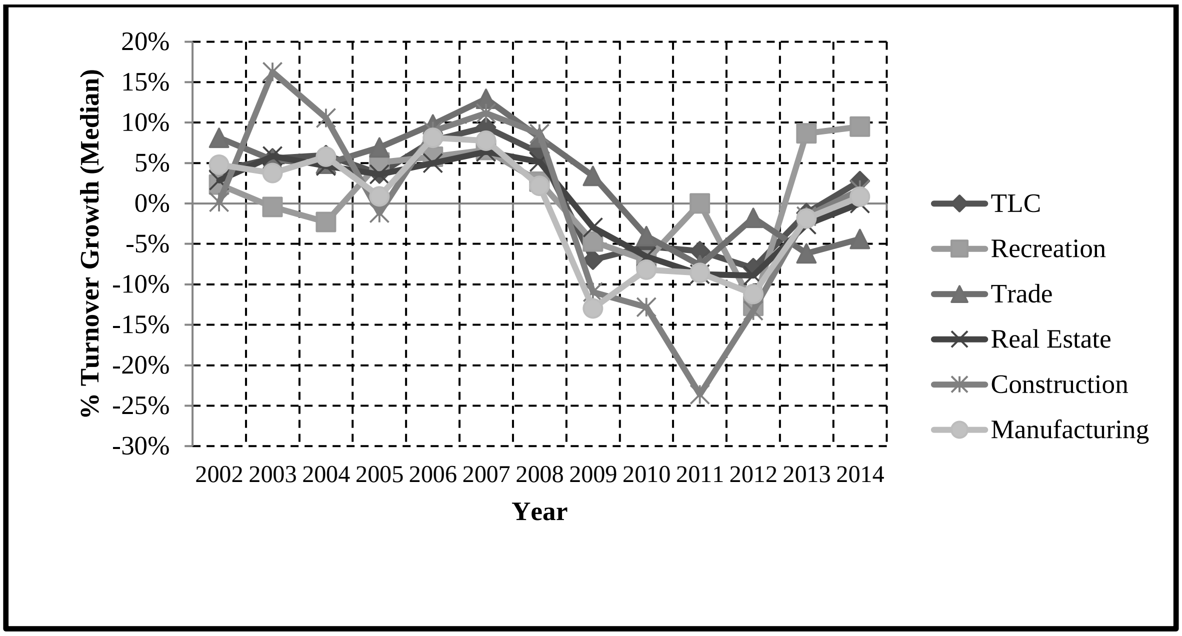


Figure 7a: Exit Rates for the six main sectors of activity

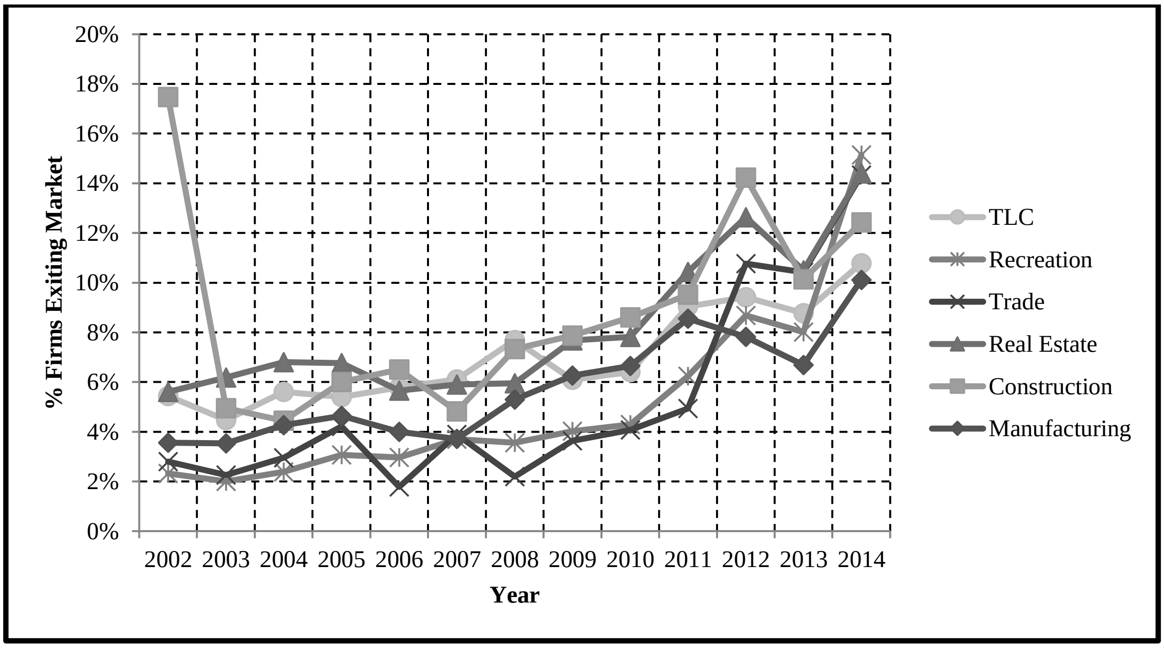
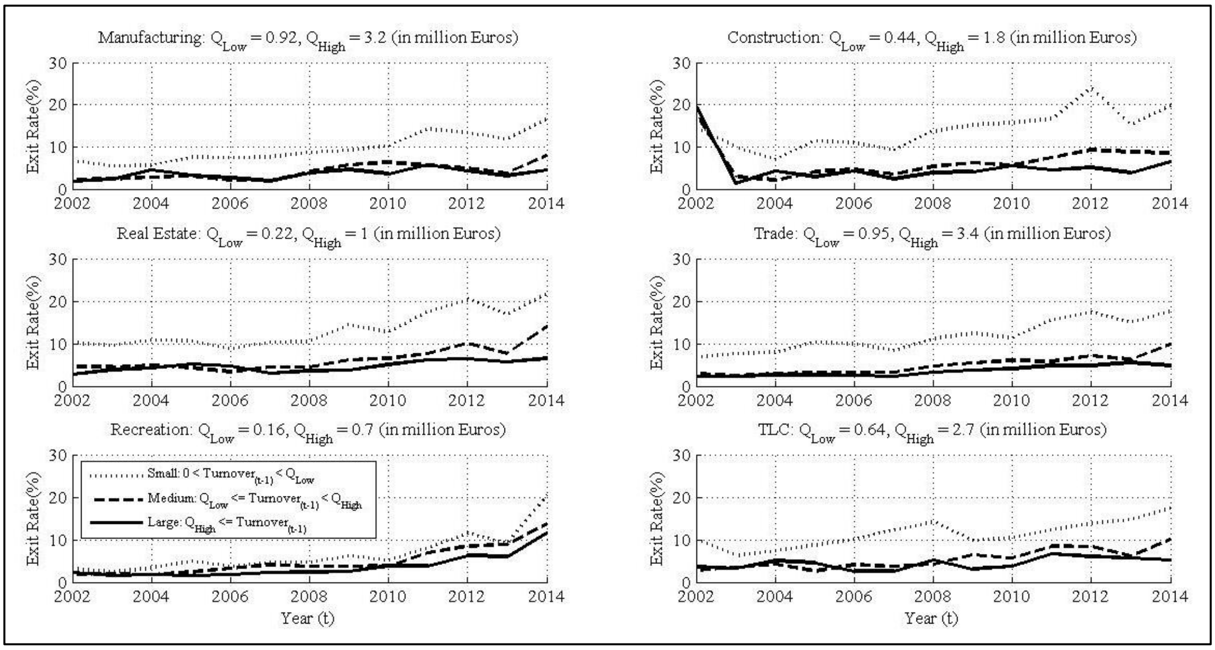


Figure 7b: Exit rate (in percent) per size of firms and sector of activity



Notes: Figure shows exit rates of small (dotted line), medium (dashed line) and large (straight line) firms ranked according to their turnover level at the previous year and using constant size thresholds that correspond to the terciles (Q_{Low}, Q_{High}) of the distribution of turnover across all firm–years. *Source:* Hellastat database.

Possible reasons for the notable failure of companies in the Construction and Real Estate sectors are the following:

(a) Several new firms were established or expanded as demand for housing rose sharply during the pre-crisis boom but then suddenly collapsed due to the curtailment of bank credit;

(b) Major construction projects financed for the occasion of the 2004 Olympic Games in Athens were terminated shortly afterwards;

(c) Government co-financing of various infrastructural projects in the context of the European Structural Funds was seriously handicapped by the fiscal cuts following the bailout programme in 2010.

Figure 7b depicts the exit rates of firms classified as large, medium and small ones across the six main sectors of activity. With few exceptions, it is obvious that larger-size firms show the lowest exit rate throughout the period of examination. Post-crisis, smaller firms seem to have the highest exit rate across all sectors, in accordance with the aggregate findings in Figure 4. Two explanations are likely for this behavior: One is the 'too big to fail' argument, according to which larger firms are more likely to be connected with the banking system and, therefore, better prepared to face the lack of liquidity that hit the Greek economy after the crisis. In contrast, smaller firms saw their access to the banking sector to cut-off and went out of business as soon as the liquidity drain intensified. Another explanation is that larger firms have more downsize flexibility, as they can reduce employment and operations without jeopardising their core of activity. For smaller firms, downsising frequently amounts to cut business altogether.

3. Econometric analysis: Basic methodology and construction of variables

In our econometric analysis, the cross-sectional Heckman selection model (or Heckit model, Heckman, 1979) is extended to estimate size effects on growth in our unbalanced panel dataset. Following the method proposed by Wooldridge (2002), we take account of possible selection bias due to entry and exit of firms in our panel and their effect on growth. We apply the method in two steps: In the first step, we estimate a Probit model for the probability of firms' survival, conditional on a number of firm-specific and market-specific variables. In the second step, we estimate a growth equation augmented with a 'selection' term, which corrects for sample selection and which has been estimated in the first step. Before presenting the associated results across these steps, we define a number of firm-specific and market-specific variables to be used in the estimation.

Following previous empirical studies (e.g. Santarelli, 2006), we use firms' turnover to measure their size and condition the growth rate on firms' age, profitability, liquidity[9], and leverage. Regional location distinguishes between firms established in the wider Attiki region, all regions in Northern Greece, and the rest of the country. We also include firms' investment activity as measured by the time evolution of fixed assets and the ratio over total assets as well as internal financing measured by equity growth, asin the studies by Fotopoulos et al. (2010) and Kontolaimou et al. (2017). The basic variables employed in our empirical investigation are the following:

(1) *Size:* Turnover in million Euros, measured in natural logarithms.

(2) *Growth (i.e. Turnover Growth):* Annual difference in firm size, as defined above.

(3) *Age:* Distance between the current year and the year of first establishment adding unity, so that Age = 1 at the year of establishment. Measured in natural logarithms.

(4) *Leverage:* [Total Assets - Equity] / Total Assets.

(5) *Fixed Assets:* [Total Assets - Current Assets] / Total Assets.

(6) *Profitability:* Earnings before Taxes / Total Assets.

(7) *Market Share: 100 x* [Firm's Turnover / Sector Turnover], where Sector Turnover is the aggregate turnover of all firms in the sector.

(8) *Attiki_D:* Dummy variable equal to unity for firms located in Attiki and zero otherwise.

(9) *North_D:* Dummy variable equal to unity for firms located in northern Greece and zero otherwise.

(10) *Year:* The current year in the sample.

[9] Lacking appropriate data to construct a direct liquidity indicator, we only indirectly condition on liquidity via the combined effect of other measured indicators, such as leverage or fixed investment.

The logarithmic transformations implemented on some of the above variables help reduce extreme variability and asymmetry in the annual cross-sectional distribution of the data and facilitate econometric estimation. Unreported quintile plots confirm that the main volume of the transformed data (>99%) is distributed within certain bounds that show little variation over time.

4. Estimation of survival probabilities

Following Heckman's (1979) approach, we first consider the probability of firms surviving in the market. This probability is estimated using a Probit model (Bliss 1935), specified as follows:

$$Pr\left(s_i^{(t+1)} = 1|\Omega_t\right) =$$

$$= \Phi\left\{a_1^{(t)} + a_2^{(t)} ln\left(S_i^{(t)}\right) + a_3^{(t)}\left[ln\left(S_i^{(t)}\right) - ln\left(S_i^{(t-1)}\right)\right] + \sum_{k=1}^{K} \theta_k^{(t)} X_i^{(k,t)}\right\}, \quad (1)$$

where $s_i^{(t+1)}$ denotes a binary variable that takes the value of one if the *i*-th firm survives in year t + 1 and zero otherwise. The total number of surviving firms in the market at time t is denoted by$N^{(t)}$, so that $i = 1,..,N^{(t)}$. $Pr\left(s_i^{(t+1)} = 1|\Omega_t\right)$ stands for the one period ahead survival probability, conditional on the current information set Ω_t. This probability is given by a function, $\Phi(.)$, of a linear combination of the size of the *i*-th firm in year *t*,$S_i^{(t)}$, current growth, $[ln\left(S_i^{(t)}\right) - ln\left(S_i^{(t-1)}\right)]$, and a set of *K* firm-specific and market-specific variables, observed at time *t*, which are denoted by $X_i^{(k,t)}$, *k* = 1,..,*K*.

The underlying assumption of the Probit model is that *Φ(.)* is the cumulative probability distribution function of the standard normal distribution, and *φ(.)* denotes the corresponding density function, namely:

$$\Phi(z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} \exp(-\frac{x^2}{2} dx), z{\sim}\mathrm{N}(0,1), \varphi(z) = \frac{\partial\Phi\{z\}}{\partial z}, \quad (2)$$

Alternatively, the Probit model may be specified in terms of the disturbance term $v_i^{(t+1)}$ defined as:

$$v_i^{(t+1)} = s_i^{(t+1)*} - \left\{a_1^{(t)} + a_2^{(t)} ln\left(S_i^{(t)}\right) + a_3^{(t)}\left[ln\left(S_i^{(t)}\right) - ln\left(S_i^{(t-1)}\right)\right] + \sum_{k=1}^{K} \theta_k^{(t)} X_i^{(k,t)}\right\}, \quad (3)$$

where $s_i^{(t+1)*}$ denotes a continuous unobservable variable, such that the binary variable $s_i^{(t+1)}$is unity, when $s_i^{(t+1)*} > 0$ and zero otherwise. The remaining terms and coefficients in equation (3) coincide with those in expression (1). The Probit normality assumption is ensured by setting$\nu_i^{(t+1)}$to follow the standard normal distribution, i.e. $\nu_i^{(t+1)} \sim N(0,1)$.

The model is repeatedly estimated via Maximum Likelihood (ML) for each year and sector.[10] We are particularly interested in the estimates (denoted by hat superscripts) of the one period ahead survival probabilities of each firm *I* ($\widehat{\Phi}_i$), the respective densities ($\widehat{\varphi}_i$) and the alpha coefficients in equation (1) or, equivalently, in (3).Combining these estimates, we obtain the estimated marginal effect of each explanatory variable in the model, say Z, on the survival probability, $\frac{\partial \widehat{\Phi}}{\partial Z}$, as the product of the (alpha) coefficient of the respective variable times the estimated density function ($\widehat{\varphi}_i$). For example, the marginal effect of size on the one period ahead survival probability is given by the term$[\widehat{a_2^{(t)}}\widehat{\varphi}_i]$. In order to get a single estimate for each year-sector sub-sample, we average the estimated marginal effects across firms (cross-sections), obtaining the Average Marginal Effect (AME) following the procedure described in Greene (2012).

To compare how the Average Marginal Effects might be affected by the economic crisis we further average these estimates taking the annual arithmetic mean for each sector over the two periods before and after the global crisis. The findings are depicted in Figure 8 and a brief commentary follows:

Firm's size exerts a positive impact on its survival probability in all sectors and over both periods. This is in line with stylised fact #2 examined in Section 2.The effect becomes roughly twice as strong after the crisis, with the strongest impact found for construction companies and those in the Real Estate, apart from Recreation. The implication is that lower-size companies associated with construction and housing sectors faced the prospect of exiting the market after the crisis at a rate much faster than firms in other sectors. This is in line with stylised fact #4 mentioned above.

The age of being present in the market seems to help a firm to keep going and for some sectors, this applies somewhat stronger after the crisis. The impact is found to be more pronounced in the TLC, Recreation and Trade sectors, where personal ties is crucial in maintaining retail customers at times of sluggish demand.

Leverage seems to exert a negative effect on survival throughout the period, though much stronger after the crisis. The effect seems far more pronounced in the construction sector, implying that its companies found it difficult to continue servicing their bank loans and had to exit the market.

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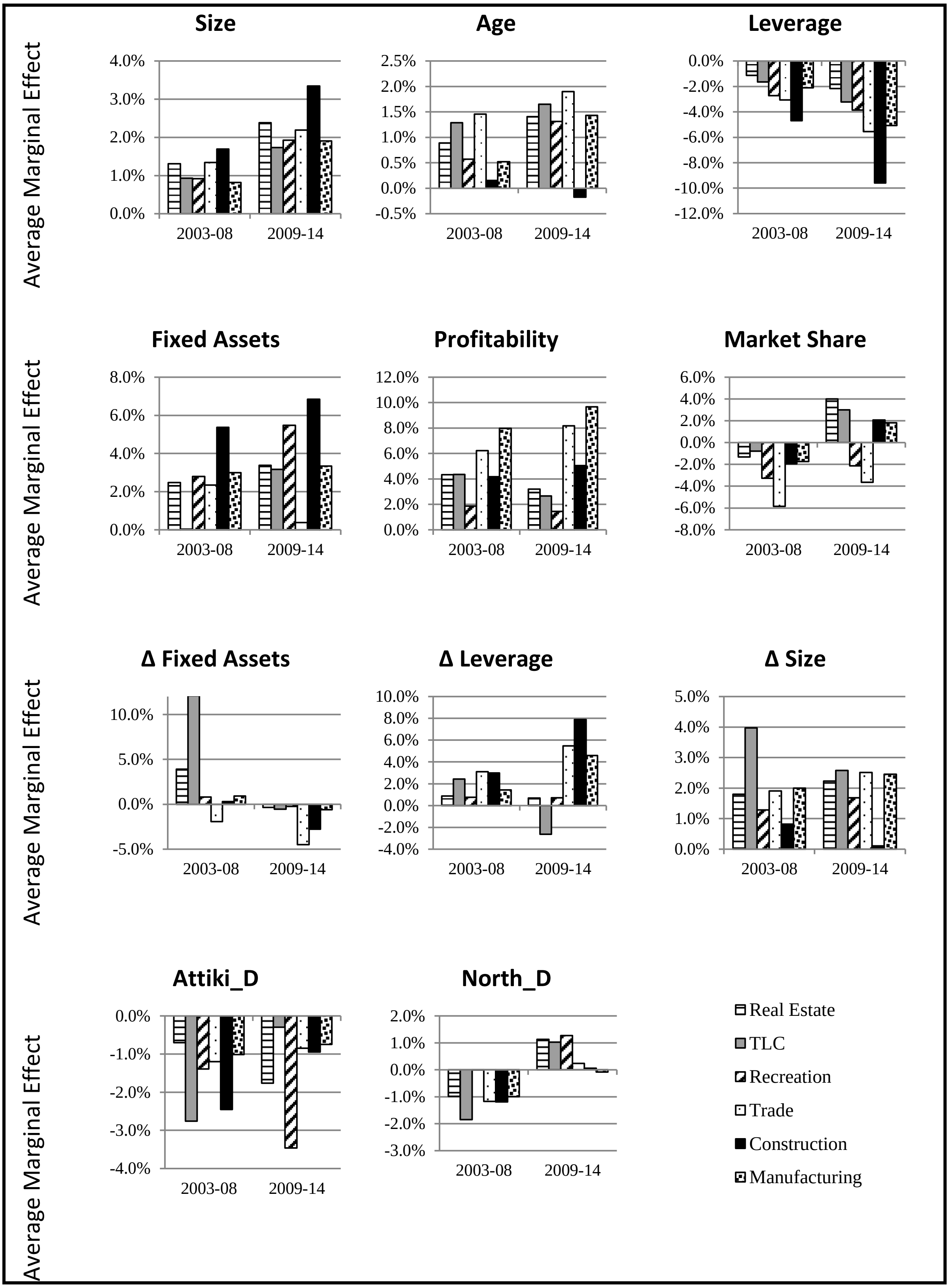
[10] As noted by Wooldridge (2002), Probit models can consistently estimate marginal effects even if normality is not the correct assumption. Heteroscedasticity, i.e. allowing for non-constant variance of the disturbance term in (3), results in a different functional form of the model and, therefore, cannot be corrected as in the linear regression model. As a robustness check, we compared our model's goodness of fit to one's allowing for size-related heteroscedasticity of the form $\nu_i^{(t+1)} \sim N\left(0, k ln\left(S_i^{(t)}\right)\right)$, where *k* stands for a constant parameter. Using the Mac-Fadden R-square goodness of fit criterion, we found both models performing equally well with the statistic ranging between 10 and 30 percent across sub-samples. Consequently, we proceed with the simpler one, namely the homoscedastic-unit variance model. Estimation results are available by the authors.

Figure 8: Average marginal effects on survival probability by sector of activity.



Notes: Figure shows the average (across firms) estimate of the marginal effect on the one period ahead survival probability of the variables in the Probit model defined in equation (1), averaged over the two periods before and after the beginning of the economic crisis. The term "Δ" stands for the first difference operator. *Source:* Hellastat database.

A positive effect is detected for the ratio of firms' fixed assets to total assets, that seems to be uniform for all sectors and becomes mildly stronger after 2008. Profitability exerts a similar positive impact, with the exception of construction firms. In that sector the size effect on survival is found to be weak and with a changing sign before and after the crisis. Market power, measured by firm's market share, exerted a negative impact on survival, though of different magnitude across sectors before the crisis. After 2008, however, its effect turns positive for most of the sectors, except Trade and Recreation.

Past changes (increases) in the ratio of fixed to total assets (reflecting new fixed investments) turn from positive to negative drivers of firms' survival probability before and after the crisis. In opposite, past changes (increases) in firm's leverage turnover seem to exert a positive impact on survival before and after 2008.

Finally, the location factor seems to exert a generally negative impact on firms operating in the wider Attiki region, with a slight exception of the TLC sector after the crisis. In contrast, a firm located in Northern Greece is likelier to survive in the market after the crisis.

4. Estimation of Turnover Growth

To estimate the effect of size on firms' growth, we consider the following dynamic panel data model for the growth rate of the size, *S*, of firm *i* from year *t* to *t*+1:

$$ln(S_{i,t+1}) - ln(S_{i,t}) = b_1 + b_2 ln(S_{i,t}) + b_3[ln(S_{i,t}) - ln(S_{i,t-1})] + b_4 \widehat{IMR_i^{t+1}} + \sum_{m=1}^{M} \beta_m \cdot W_{i,t}^{(m)} + u_{i,t+1}. \quad (4)$$

The model includes a set of M variables, $W_{i,t}^{(m)}$, m = 1,..,M, assumed to be relevant for forecasting growth in addition to the current size and past growth, $[ln(S_{i,t}) - ln(S_{i,t-1})]$. The set contains the variables included in the Probit model described in the previous section, a dummy variable for the impact of the 2008 economic crisis and additional lags of turnover growth which help reduce in-sample serial correlation of the disturbance term *u*.[11] The model allows also for the inclusion of unobserved firm-specific heterogeneity.

We use an unbalanced panel dataset, i.e. the sample contains all firms that survive at least for three subsequent years (so that it is possible to calculate past growth variables included in equation (4)), over the total period covered by the data (2001-2014). To control for possible sample selection bias we include the term $\widehat{IMR_i^{t+1}}$ in the model, following Heckman (1979) and the generalisation to panel data by Wooldridge (2002).

[11] There is low risk of multicollinearity in the model, since the correlations across the explanatory variables (elements of *W*) are fairly low. Results for these cross-correlations are unreported and available by the authors.

The term denotes an estimate of the Inverse Mills Ratio (IMR) associated with the probability of firms' survival and defined as:

$$IMR_i^{t+1} = \frac{\varphi_i^{t+1}}{\Phi_i^{t+1}}, \quad (5)$$

where Φ_i^{t+1} and φ_i^{t+1} have been defined in the previous section to be the survival probability of firm *i* in year *t*+1 and its probability density respectively. Under suitable conditions, demonstrated in Wooldridge (2002), consistent estimates of these quantities can be obtained from the Probit estimates of the previous section.[12] Equation (4) is a dynamic panel data model, since the dependent variable appears in lagged form in the right hand side. This differentiates the method of estimation depending on whether one assumes the existence of firm specific heterogeneity and fixed effects or not.

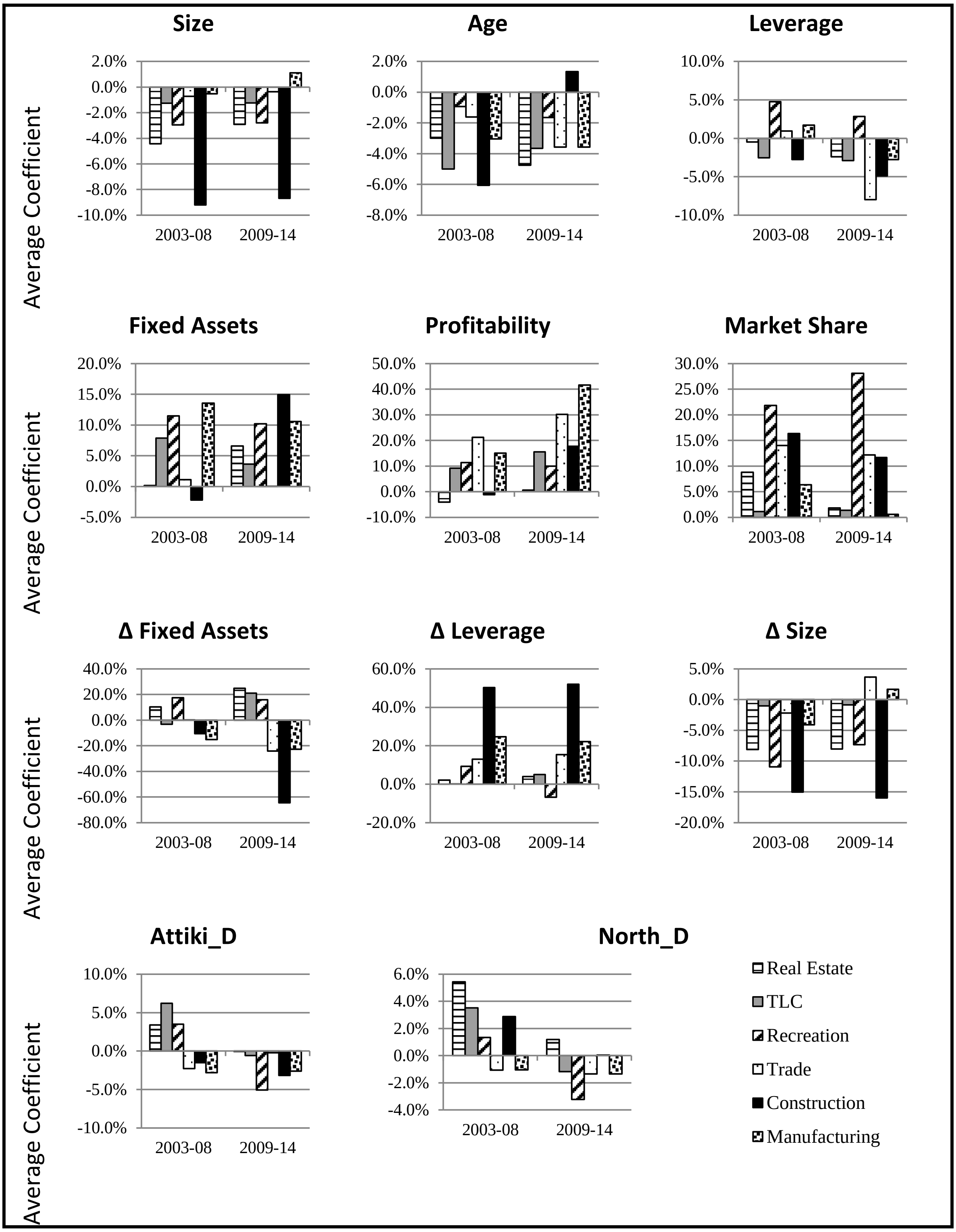
To get a first set of estimates under an unspecified form of firm-specific heterogeneity, we repeatedly estimate the model (4) with the correction term (in equation (5)) for each year and sector. Following Lotti et al. (2009), we present, in Figure 9, the Maximum Likelihood estimates of *β*-coefficients in the summation term in the Rhs of (4) in terms of their average (arithmetic mean) value over the two periods before and after 2008.[13] The size coefficient estimates are found relatively small and negative, in line with stylised fact #1 mentioned in Section 2.

The only exception occurs in the construction sector whereas the strong and negative effect implies serious difficulties for the expansion of large-scale construction firms both before and after the crisis, thus confirming stylised fact #3. The coefficients on age, leverage, turnover growth in the past appear to be negative in most sectors, suggesting that more recently set-up and/or low-leveraged firms are more likely to expand faster. Only older construction firms enjoy a positive age effect on growth after the crisis, but this seems too tiny to have any serious impact.

[12] Briefly stated, the correction via inclusion of *IMR* in (4) works as follows: if *u* was subject to selection bias, Wooldridge (2002) shows (under normality and suitable assumptions), that $\left(u_{i,t+1} | \Omega_t, s_i^{(t+1)} = 1\right) = \gamma IMR_i^{(t+1)}$, where *γ* stands for a constant parameter. The method therefore adds an otherwise omitted (but relevant) variable in the model, $IMR_i^{(t+1)}$, rendering the disturbance term *u* uncorrelated with the explanatory variables included in the model. In the traditional Heckit approach, the sign of the parameter *γ* is a function of the correlation between the disturbances in the growth and survival equations, i.e. the terms *u* in (4) and *v* in (3), respectively.

[13] Lotti et al. (2009) have previously adopted this approach in their study of the Italian market. In addition to the two step (TS) approach originally proposed by Heckman and presented here, they also present results from joint Maximum Likelihood estimation of the system of equations (1)-(4) based on multivariate normality. This method allows for contemporaneous correlation between the disturbance terms of the survival and growth equations. Lotti et al. (2009) argue that ML estimates are also superior to the original TS approach in term of efficiency and bias. Figure 9 presents those ML estimates while 'Two-Stage' estimation results remain unreported and available by the authors.

Figure 9: Average coefficients of the growth equation by sector of activity.



Notes: Figure shows the Maximum Likelihood estimate of the coefficient of the respective variable in the Growth Equation (4) averaged over the two periods before and after the beginning of the economic crisis. Coefficients show the effect of the respective variable on one period ahead growth in turnover. The term "Δ" stands for the first difference operator. Source: Hellastat database.

Profitability, market power and the ratio of fixed assets are positively associated with expansion in most sectors. Finally, the regional location after the crisis seems to exert a negative effect on expansion for those in Attica and in the North. The stronger adverse effect noticed in the Recreation sector in Northern Greece is probably associated with the reduced tourist flows from neighboring countries, as they were also hit by the economic crisis.

For a more formal assessment of the statistical significance of the above effects and the impact of economic crisis on their magnitude and direction, we turn to dynamic panel data estimation. This way allows us to take account of the dynamics of the growth model (1) and obtain estimates that are therefore more reliable[14]. We incorporate the effect of crisis on growth adding an appropriate dummy variable for the period 2009-2014, i.e. "YEAR>2008", as an explanatory variable in the model. We also include the interaction of this dummy with the other explanatory variables in the model in order to capture any difference in the impact of each explanatory variable on growth before and after the outburst of the crisis, and proceed in three stages:

5.1. Preliminary estimates

We first estimate the model using simple Panel Least Squares assuming no firm-specific fixed effects. Estimates with heteroscedasticity-robust standard errors are shown in Table II below.

[Table II approximately here]

The results of Table II lead to a non-rejection of Gibrat's Law for most sectors, since the coefficient of lagged size, i.e. *SIZE(-1)*, is found to be statistically insignificant.[15]The coefficient of the interaction term (*YEAR>2008)*SIZE(-1),* is found positive for most of the sectors indicating that the intensity of the negative relationship between growth and size is mitigated after 2008 in a direction towards Gibrat's Law predictions. However, the effect is statistically insignificant.

5.2. Cross-section effects

Unless the model is transformed, implementation of cross-section fixed effects estimation via Least Squares would produce biased results, as pointed out by Nickell (1981). Due to the nature of our system, most likely the coefficient of the lagged size will be downward biased, although the magnitude of the bias is unknown[16].

[14] For a related discussion, see Wawro (2002).
[15] Bond et al. (2005), in a related simulation study, show that a simple t-test on the coefficient of lagged size is capable of testing the null hypothesis of unit root, which in our case corresponds to the hypothesis that Gibrat's Law holds.
[16] The bias is of order 1/T, where T is the number of years in the sample.

Estimation under cross-section fixed effects is carried out by appropriately transforming the model so that firm specific heterogeneity is excluded from the transformed model. Table III presents potentially 'biased' coefficient estimates that result from applying Panel Least Squares with cross-section fixed effects on our dynamic panel data equation. It is worth noting here that the use of fixed effects implicitly accounts for other non-specified characteristics of the corporations in the sample; for example, whether they are private or public sector entities, etc.

[Table III approximately here]

In contrast to the previous estimates, the estimates of the lagged-size variable now appear to be negative, larger in magnitude and statistically significant, thus rejecting Gibrat's Law. The estimated cross-section fixed effects are found to be highly correlated with the lagged size variable (about 80%) and IMR (about -40%), a fact that explains the large differences (relative to the previous estimates) in the estimated coefficients of the respective variables.[17] Moreover, a statistically significant positive effect of size on growth is estimated for two out of six sectors after the beginning of the economic crisis (crisis effect).

5.3. GMM estimates

Potential cross-section fixed effects are excluded by taking first differences on both side of (4), as suggested by Arellano et al.(1991). Since, however, our dependent variable is already in first differences, we opted for the method proposed by the sequel Arellano et al. (1995), which uses 'orthogonal deviations' instead of first differences. In the transformed model, we apply Generalised Method of Moments estimation with appropriate instruments, taking account that the method does not induce serial correlation in the disturbance term of the transformed model. This method avoids problems associated with highly persistent series and 'weak instruments' and has been also found to exhibit comparable performance to the traditional method by Arellano et al. (1991); see Hayakawa (2009) or Canarella et al. (2018). Table IV summarizes the estimation results.

[Tables IVA & IVB approximately here]

A statistically significant negative relationship between growth and size is again established, though of smaller magnitude than the results of Table III, implying that the aforementioned 'Nickell' bias is somewhat mitigated. Rejecting Gibrat's law under fixed effects also implies that firm size exhibits a 'stationary' or 'mean-reverting' behavior, with larger firms being more difficult to expand than smaller ones. This effect holds uniformly across all sectors, but TLC. Similarly, a negative (and, for most sectors, statistically significant) effect of age on growth has been established, postulating that further growth opportunities diminish as a firm grows older in the market.The effect reveals that after a firm is established in the Greek market, it shows a limited capacity for innovation and continuous expansion, thus becoming more vulnerable in a

[17] The estimated correlations are available upon request.

downturn. The finding is consistent with the conclusions reached by Evans (1987) on the relationship between growth, size and age.

The inclusion of the Inverse Mills Ratio is found to be statistically significant in most sectors.[18] Since it is inversely related with the probability of survival, a positive coefficient implies that firms with lower survival probability (i.e. higher IMR) achieve higher growth rates. This result is consistent with the view that smaller firms have lower survival probability but higher growth potentials. Given that firm-specific unobserved heterogeneity has been removed from the model by taking orthogonal deviations, this finding implies that firm's survival has time-specific characteristics and cannot be treated as a firm-specific unobserved effect in econometric applications.

The remaining estimated coefficients are found to be statistically significant for just a few sectors, a fact that highlights the role different sectors play on firms' growth. The effect of other growth-related firm characteristics, identified by previous studies, such as investment in fixed assets, leverage and profitability, seems to differ before and after 2008 and it is also found to be statistically significant for some sectors only, as said above.

5. Conclusions

By examining a large data set of Greek companies over the period 2001-2014, we established certain characteristics regarding the role of company size on survival and turnover growth. A key finding is that larger-size firms are in general more likely to survive in the market than smaller size ones, and this relative size advantage grows stronger during a crisis, albeit to a different degree across the spectrum of economic activity. Focusing on sectors, it is evident that large companies in the manufacturing sector are by far more robust over the cycle, while those in the Real Estate and construction sectors manifest the highest extinction rate.

Regarding the role of firms' size on turnover growth, the conclusion is less clear-cut. Without taking into account firm-specific characteristics, there is no significant size effect on their growth potential, in accordance with the insights of Gibrat's Law. However, the picture radically changes by including time-invariant firm-specific effects. It is now found that, across all sectors of activity, larger-size firms are less probable to see their turnover expanding fast enough in an upswing or suffering only limited losses in a downturn.

Therefore, idiosyncratic characteristics of the firm seem to be more critical for exploiting market niches than general patterns of size and sector. A plausible explanation is that in Greece product markets are fragmented and over-regulated, thus making rent-seeking

[18] We acknowledge that the reported standard errors may be biased estimates of the true estimation uncertainty, since the Inverse Mills Ratio is a byproduct of a first step Probit estimation and therefore subject to estimation errors. Since the purpose of the current study is only to control for possible sample selection effects and not to assess their magnitude we leave the issue open to future research.

practices for small-size firms to be easier or politically more expedient than for bigger ones.

The role that size plays on the survival and expansion of firms may have substantial implications for policy options aiming at speeding-up economic recovery. For example, to avoid the closure of small firms, the Government or the banking system need to set up emergency credit facilities to provide companies with working capital, adequate to keep them in business during a crisis. In the same logic, partial covering of employment costs by emergency grants or a greater flexibility in wage and job-schedule arrangements will help lessening operational costs and, thus, raise their chances of survival in a crisis.

Another policy implication regards larger size firms and the need for supporting them to improve competitiveness and increase turnover. In several instances, Governments -as well as European authorities-frequently choose to concentrate on small firms for creating or disseminating innovation, as they are considered more flexible and efficient in experimenting with new technologies. However, this may be counterproductive during a crisis because small technology firms may become extinct as any other of similar size, before they manage to disseminate their results to other firms.

Since larger firms are more likely to stay in operation during a crisis, innovation policy should be directed toward them too in order to facilitate adjustment and accelerate the return to growth. However, this kind of support does not amount to the tendency of banking institutions to keep a large defunct company in a state of artificial existence, merely to avoid the losses from appearing in their own balance sheet. In fact, the sooner defunct companies are written-off, the more room they make for credit to be channeled to those better equipped to survive.

Hence, a dual strategy based on credit-enhancing measures for small-size firms and innovation-supporting policies for larger ones seems to be more promising. This direction is reminiscing of the creative destruction process as described by Schumpeter (1931): several firms are destroyed in the downturn of the cycle but then some of them manage to adjust to new technology and productivity requirements and start growing again, thus spearheading the upswing of economic activity. Smaller firms must be ready to jump on board when the boat sails again.

Future research perspectives include the investigation of corporate dynamics in connection with labour market characteristics, such as the level of employment, protection status and the wage formation process. We shall also investigate comparative dynamics along alternative groupings of firms, such as those belonging to the tradable versus non-tradable sectors, export-led firms versus import-based ones, knowledge-based versus labour-intensive, etc. Other grouping may be formed on the basis of local conditions, e.g. areas of high versus low unemployment, educational attainment, existence of natural resources, etc.[19]

[19] The specific research perspective was suggested by an anonymous referee.

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Appendix

TABLE II: PANEL LEAST SQUARES ESTIMATION OF THE GROWTH EQUATION (4)

	Manufacturing		Construction		Trade		Recreation		TLC		Real Estate		All 6	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
CONSTANT	-1.66	0.89	-27.96	0.16	13.53	0.39	-2.94	0.76	-7.71	0.53	-15.83	0.18	-20.02	0.48
YEAR>2008	**-60.75**	**0.00**	-37.85	0.44	**-66.57**	**0.01**	**-47.44**	**0.07**	**-29.47**	**0.07**	3.21	0.93	-39.77	0.24
SIZE(-1)	0.00	0.38	**-0.04**	**0.00**	**0.03**	**0.01**	-0.00	0.94	-0.01	0.35	-0.02	0.14	-0.00	0.45
× (YEAR>2008)	0.01	0.33	-0.02	0.37	0.00	0.77	-0.01	0.35	0.01	0.62	0.01	0.36	0.00	0.86
AGE(-1)	**-0.02**	**0.00**	**-0.03**	**0.07**	0.02	0.17	**0.01**	**0.05**	**-0.04**	**0.01**	-0.02	0.14	-0.00	0.91
× (YEAR>2008)	**-0.01**	**0.00**	0.02	0.38	**-0.03**	**0.01**	-0.01	0.27	0.02	0.44	-0.02	0.26	-0.01	0.34
LEVERAGE (-1)	-0.01	0.36	0.07	0.22	**-0.10**	**0.00**	-0.10	0.11	-0.03	0.39	-0.03	0.14	0.00	0.69
× (YEAR>2008)	-0.04	0.50	-0.13	0.11	-0.05	0.15	0.09	0.14	0.00	0.95	-0.03	0.36	**-0.05**	**0.00**
FIXED ASSETS (-1)	**0.16**	**0.00**	**0.22**	**0.00**	0.04	0.11	**0.22**	**0.00**	**0.08**	**0.04**	**0.05**	**0.07**	**0.08**	**0.00**
× (YEAR>2008)	-0.05	0.12	-0.04	0.75	-0.03	0.24	-0.09	0.15	-0.02	0.65	0.05	0.42	0.04	0.19
PROFITABILITY RATIO (-1)	**0.25**	**0.00**	**0.36**	**0.00**	**0.28**	**0.01**	**0.26**	**0.01**	**0.11**	**0.11**	0.01	0.88	**0.15**	**0.00**
× (YEAR>2008)	0.06	0.59	0.01	0.93	0.17	0.18	-0.10	0.41	0.05	0.54	0.05	0.53	0.06	0.39
MARKET SHARE (-1)	0.01	0.26	0.05	0.14	-0.06	0.26	**0.10**	**0.00**	0.01	0.33	**0.05**	**0.10**	0.01	0.16
× (YEAR>2008)	-0.01	0.34	0.04	0.26	**0.10**	**0.06**	**0.10**	**0.10**	0.01	0.43	-0.05	0.30	0.00	0.78
Δ LEVERAGE (-1)	**0.21**	**0.00**	**0.39**	**0.00**	**0.21**	**0.00**	**0.08**	**0.00**	0.03	0.49	-0.04	0.45	0.01	0.86
× (YEAR>2008)	-0.08	0.39	-0.07	0.54	**0.13**	**0.10**	-0.03	0.58	-0.04	0.50	0.08	0.24	0.09	0.17
Δ FIXED ASSETS (-1)	**-0.15**	**0.02**	**-0.34**	**0.10**	**-0.02**	**0.76**	**0.14**	**0.00**	0.02	0.91	**0.15**	**0.01**	0.01	0.89
× (YEAR>2008)	-0.02	0.91	-0.28	0.29	-0.21	0.11	-0.01	0.85	0.17	0.38	0.06	0.57	**-0.13**	**0.02**
ATTIKI_D	**-0.04**	**0.00**	**-0.09**	**0.05**	**-0.05**	**0.01**	-0.05	0.27	**0.05**	**0.06**	0.01	0.55	**-0.03**	**0.00**
× (YEAR>2008)	0.01	0.47	0.05	0.35	0.03	0.20	-0.03	0.63	-0.06	0.16	-0.03	0.44	-0.01	0.39
NORTH_D	**-0.02**	**0.01**	0.01	0.87	**-0.04**	**0.01**	0.01	0.74	0.02	0.36	0.03	0.44	**-0.01**	**0.06**
× (YEAR>2008)	0.01	0.32	-0.01	0.88	**0.05**	**0.06**	-0.05	0.15	0.00	0.92	-0.02	0.75	-0.02	0.13
IMR	**0.53**	**0.05**	**0.97**	**0.01**	**1.09**	**0.00**	**1.26**	**0.00**	0.13	0.76	**0.91**	**0.00**	**0.25**	**0.01**
× (YEAR>2008)	-0.40	0.26	-0.77	0.11	**-0.48**	**0.03**	-1.05	0.02	0.23	0.68	-0.24	0.58	**-0.20**	**0.04**
YEAR	0.00	0.89	0.01	0.15	-0.01	0.37	0.00	0.78	0.00	0.52	0.01	0.18	0.01	0.48
× (YEAR>2008)	**0.03**	**0.00**	0.02	0.44	**0.03**	**0.01**	0.02	0.07	**0.01**	**0.07**	0.00	0.92	0.02	0.25
Δ SIZE (-1)	0.01	0.54	**-0.20**	**0.00**	**0.06**	**0.00**	**-0.13**	**0.00**	0.00	0.97	**-0.05**	**0.00**	**-0.07**	**0.00**
Δ SIZE (-2)			**-0.08**	**0.00**			**-0.07**	**0.00**					**-0.01**	**0.07**
Δ SIZE (-3)							**-0.02**	**0.02**					0.00	0.93
Cross-sections included:	6024		1799		8473		3059		1235		3724		21339	
Total panel (unbalanced) obs.:	48501		11597		64894		22376		8620		25609		142729	
R-squared	0.04		0.10		0.05		0.06		0.02		0.04		0.04	
Adjusted R-squared	0.04		0.10		0.05		0.06		0.02		0.04		0.04	
First Order Correlation (Q-stat)	4.45	0.04	3.16	0.08	0.01	0.91	0.05	0.83	4.43	0.04	4.19	0.04	0.00	0.99

Notes: Table shows coefficient estimates and diagnostics from simple Panel Least Squares estimation of the growth equation (4). In addition to the variables described in the text, the growth equation contains a dummy variable 'YEAR>2008' with observations that take the value of unity for all years after 2008 and zero otherwise, and its interaction with all other explanatory variables. The reported p-values for the coefficients correspond to White cross-section standard errors & covariance (with degrees of freedom correction). IMR is estimated from the Probit Model described in equation (1) as a proxy for the Inverse Mills Ratio defined in equation (5). Additional lags of growth (ΔSIZE) are used in order to mitigate first order autocorrelation in the residuals tested by the Q-statistic (last row of the Table). *Source:* Hellastat database.

TABLE III: PANEL LEAST SQUARES ESTIMATION OF THE GROWTH EQUATION (4) WITH CROSS-SECTION FIXED EFFECTS

	Manufacturing		**Construction**		**Trade**		**Recreation**		**TLC**		**Real Estate**		**All 6**	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
CONSTANT	-2.30	0.85	-45.5	0.20	0.76	0.96	**-61.79**	**0.00**	-16.08	0.34	-23.82	0.14	-23.77	0.38
YEAR>2008	7.16	0.79	**157.1**	**0.07**	18.70	0.57	8.58	0.78	23.38	0.35	**94.29**	**0.04**	52.65	0.21
SIZE(-1)	**-0.28**	**0.00**	**-0.61**	**0.00**	**-0.28**	**0.00**	**-0.49**	**0.00**	**-0.40**	**0.00**	**-0.42**	**0.00**	**-0.39**	**0.00**
× (YEAR>2008)	**0.04**	**0.02**	0.02	0.71	**0.02**	**0.05**	0.00	0.74	0.01	0.12	-0.01	0.74	**0.01**	**0.05**
AGE(-1)	-0.04	0.16	-0.06	0.43	**-0.10**	**0.00**	**-0.26**	**0.00**	**-0.11**	**0.06**	-0.05	0.31	**-0.09**	**0.00**
× (YEAR>2008)	**-0.05**	**0.00**	-0.10	0.14	**-0.09**	**0.00**	**-0.09**	**0.00**	-0.01	0.64	-0.06	0.13	**-0.06**	**0.01**
LEVERAGE (-1)	0.02	0.54	**0.26**	**0.00**	-0.06	0.19	-0.03	0.67	-0.04	0.16	**-0.05**	**0.10**	0.02	0.32
× (YEAR>2008)	-0.06	0.26	-0.23	0.10	**-0.12**	**0.02**	0.05	0.41	**-0.07**	**0.05**	-0.02	0.54	**-0.09**	**0.00**
FIXED ASSETS (-1)	**0.09**	**0.01**	**-0.25**	**0.01**	-0.01	0.72	**0.12**	**0.03**	0.06	0.46	**0.11**	**0.03**	**-0.13**	**0.00**
× (YEAR>2008)	0.02	0.53	**0.33**	**0.00**	**-0.08**	**0.03**	0.08	0.16	0.03	0.40	**0.14**	**0.00**	**0.19**	**0.00**
PROFITABILITY RATIO (-1)	0.09	0.16	0.20	0.11	**0.18**	**0.03**	**0.16**	**0.02**	0.07	0.51	**-0.09**	**0.00**	0.02	0.42
× (YEAR>2008)	**0.23**	**0.05**	**0.51**	**0.00**	**0.33**	**0.00**	0.15	0.11	0.07	0.51	**0.18**	**0.00**	**0.23**	**0.00**
MARKET SHARE (-1)	**0.08**	**0.04**	**0.31**	**0.00**	**0.54**	**0.00**	**1.14**	**0.00**	**0.06**	**0.00**	**0.26**	**0.00**	**0.10**	**0.00**
× (YEAR>2008)	-0.03	0.13	-0.05	0.54	-0.03	0.72	0.07	0.38	**0.01**	**0.09**	-0.07	0.15	-0.01	0.26
Δ LEVERAGE (-1)	**0.12**	**0.00**	0.01	0.87	**0.17**	**0.00**	0.06	0.18	0.04	0.43	-0.03	0.22	0.00	0.94
× (YEAR>2008)	-0.04	0.63	**0.33**	**0.00**	0.03	0.68	0.09	0.34	0.01	0.85	**0.11**	**0.01**	**0.11**	**0.00**
Δ FIXED ASSETS (-1)	**-0.16**	**0.00**	-0.14	0.24	0.05	0.31	0.11	0.11	0.11	0.48	0.07	0.25	0.08	0.14
× (YEAR>2008)	-0.09	0.55	**-0.36**	**0.03**	**-0.22**	**0.01**	-0.10	0.17	0.00	0.99	-0.04	0.64	**-0.20**	**0.02**
IMR	**0.74**	**0.00**	0.84	0.10	**1.08**	**0.00**	**1.15**	**0.01**	0.39	0.29	**0.92**	**0.00**	**0.75**	**0.00**
× (YEAR>2008)	**-0.83**	**0.02**	-0.81	0.30	-0.72	0.11	**-1.12**	**0.01**	-0.35	0.55	**-0.68**	**0.09**	**-0.78**	**0.02**
YEAR	0.00	0.61	0.03	0.13	0.00	0.80	**0.03**	**0.00**	0.01	0.20	**0.01**	**0.07**	0.01	0.27
× (YEAR>2008)	0.00	0.77	**-0.08**	**0.07**	-0.01	0.56	0.00	0.78	-0.01	0.35	**-0.05**	**0.04**	-0.03	0.21
Δ SIZE (-1)	0.01	0.77	0.02	0.68	**0.05**	**0.00**	0.03	0.38	0.03	0.32	0.01	0.68	0.01	0.57
Δ SIZE (-2)			0.01	0.65			0.02	0.18					**0.02**	**0.10**
Δ SIZE (-3)							**0.02**	**0.09**					0.01	0.29
Cross-sections included:	6024		1799		8473		3059		1235		3724		21339	
Total panel (unbalanced) obs.:	48501		11597		64894		22376		8620		25609		142729	
R-squared	0.29		0.38		0.33		0.34		0.37		0.35		0.33	
Adjusted R-squared	0.19		0.26		0.21		0.24		0.26		0.24		0.22	

Notes: Table shows coefficient estimates and diagnostics from Panel Least Squares estimation of the growth equation (4) allowing for cross-section fixed effects. The reported estimates are subject to bias due to the dynamic nature of the equation (Nickell 1981) and serve as a benchmark to evaluate estimates that are robust to that bias, such as GMM estimators reported in the following Table. *Source:* Hellastat database.

TABLE IVA: GENERALISED METHOD OF MOMENTS ESTIMATION OF GROWTH EQUATION (4) WITH CROSS-SECTION FIXED EFFECTS

	Manufacturing		**Construction**		**Trade**		**Recreation**		**TLC**		**Real Estate**		**All 6**	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
YEAR>2008	-5.80	0.84	62.9	0.39	-32.68	0.43	-37.31	0.52	26.81	0.58	**100.08**	**0.01**	**132.56**	**0.00**
SIZE(-1)	**-0.18**	**0.08**	**-0.30**	**0.03**	**-0.16**	**0.09**	**-0.45**	**0.01**	-0.25	0.17	**-0.21**	**0.02**	-0.19	0.18
× (YEAR>2008)	**0.06**	**0.00**	**-0.20**	**0.03**	0.01	0.53	**0.05**	**0.02**	**0.05**	**0.10**	**0.09**	**0.00**	-0.01	0.69
AGE(-1)	**-0.14**	**0.01**	**-0.50**	**0.04**	**-0.20**	**0.01**	0.07	0.59	-0.03	0.85	**-0.25**	**0.02**	**-0.75**	**0.00**
× (YEAR>2008)	**-0.13**	**0.00**	**-0.34**	**0.07**	**-0.13**	**0.00**	**-0.09**	**0.07**	0.03	0.74	**-0.19**	**0.02**	**-0.15**	**0.00**
LEVERAGE (-1)	-0.05	0.46	0.21	0.80	0.14	0.65	-0.18	0.34	-0.02	0.90	-0.06	0.59	-0.29	0.43
× (YEAR>2008)	**-0.27**	**0.01**	-0.11	0.86	**-0.18**	**0.09**	-0.04	0.68	-0.15	0.40	**-0.25**	**0.07**	**-0.52**	**0.00**
FIXED ASSETS (-1)	0.37	0.23	-1.26	0.52	**-1.58**	**0.07**	0.64	0.23	1.35	0.23	**0.91**	**0.10**	**-1.82**	**0.01**
× (YEAR>2008)	**0.26**	**0.08**	-0.77	0.44	**-0.55**	**0.04**	0.42	0.15	0.60	0.19	**0.42**	**0.03**	-0.30	0.11
PROFITABILITY (-1)	-0.09	0.38	**0.70**	**0.00**	0.00	0.97	**0.25**	**0.02**	-0.03	0.90	**-0.15**	**0.01**	-0.09	0.33
× (YEAR>2008)	**0.57**	**0.00**	-0.28	0.47	0.01	0.96	**0.84**	**0.01**	-0.26	0.30	0.11	0.25	**0.31**	**0.07**
MARKET SHARE (-1)	0.06	0.27	**-0.33**	**0.03**	-0.27	0.20	-0.93	0.58	0.05	0.29	0.34	0.24	-0.13	0.36
× (YEAR>2008)	**-0.04**	**0.07**	**0.41**	**0.00**	0.11	0.24	-0.64	0.19	-0.04	0.41	**-0.22**	**0.07**	0.02	0.68
Δ LEVERAGE (-1)	**0.16**	**0.05**	0.18	0.32	**0.13**	**0.10**	**0.16**	**0.00**	0.09	0.31	-0.05	0.31	0.03	0.62
× (YEAR>2008)	-0.01	0.94	0.05	0.90	-0.06	0.59	-0.17	0.24	-0.06	0.52	0.08	0.18	0.05	0.49
Δ FIXED ASSETS (-1)	**-0.20**	**0.00**	-0.14	0.73	0.11	0.34	0.07	0.48	-0.05	0.76	-0.07	0.63	**0.18**	**0.10**
× (YEAR>2008)	0.16	0.19	0.19	0.58	-0.14	0.38	-0.09	0.48	-0.17	0.39	-0.07	0.62	-0.04	0.75
IMR	**0.42**	**0.02**	**5.24**	**0.00**	**1.10**	**0.00**	**0.94**	**0.01**	**0.71**	**0.02**	0.34	0.37	0.26	0.24
× (YEAR>2008)	-0.20	0.46	**-5.39**	**0.00**	**-1.31**	**0.01**	**-0.92**	**0.07**	-0.47	0.33	**0.76**	0.11	-0.14	0.64
YEAR	**0.02**	**0.00**	**0.09**	**0.00**	**0.03**	**0.00**	**0.03**	**0.02**	0.00	0.95	**0.05**	**0.00**	**0.09**	**0.00**
× (YEAR>2008)	0.00	0.86	-0.03	0.42	0.02	0.43	0.02	0.53	-0.01	0.57	**-0.05**	**0.01**	**-0.07**	**0.00**
Δ SIZE (-1)	**-0.04**	**0.02**	-0.04	0.55	-0.01	0.66	0.02	0.72	0.02	0.52	**-0.04**	**0.05**	**-0.22**	**0.00**
Δ SIZE (-2)			-0.08	0.32			0.08	0.28					0.07	0.22
Δ SIZE (-3)							**0.30**	**0.00**					**-0.95**	**0.00**
Cross-sections included:	5646		1629				2898		1108		3063		19809	
Total panel (unbalanced) obs.:	42477		9798				19317		7385		18502		121390	
Periods included	11		10		10		9		11		10		9	
J-stat	17.62	0.02	12.47	0.03	13.33	0.21	15.97	0.04	8.81	0.36	19.20	0.04	6.26	0.39
Instrument Set:	II		I		III		III		II		III		II	
Instrument Sets:	I	CONSTANT, YEAR>2008, YEAR, YEAR > 2008, SIZE(t), SIZE(t) x (YEAR>2008), AGE(t), AGE(t) x (YEAR>2008), LEVERAGE(t), LEVERAGE(t) x (YEAR>2008), FIXED ASSETS(t), FIXED ASSETS(t) x (YEAR>2008), PROFITABILITY(t), PROFITABILITY(t) x (YEAR>2008), MARKET SHARE(t), MARKET SHARE(t) x (YEAR>2008), t = {-2,-3}												
	II	All variables in I plus IMR(-1)												
	III	All variables in I plus IMR(-1) and IMR(-2)												

Notes: Table shows coefficient estimates and diagnostics from Generalised Method of Moments estimation of the growth equation (4) allowing for cross-section fixed effects. The latter are removed taking orthogonal deviations (Arellano et al., 1995). In addition to the variables described in the text, the growth equation contains a dummy variable 'YEAR>2008' with observations that take the value of unity for all years after 2008 and zero otherwise, and its interaction with all other explanatory variables. Reported p-values for the coefficients correspond to White period standard errors & covariance (with degrees of freedom correction). IMR isestimated from the Probit Model described in equation (1) as a proxy for the Inverse Mills Ratio defined in equation (5). The three instrument sets used in the estimation are reported below the row with the J-test for over-identified restrictions. Results support non-strict rejection (at least 1%level) of our instruments' choices. *Source:* Hellastat database.

TABLE IVB: GENERALISED METHOD OF MOMENTS ESTIMATION OF GROWTH EQUATION (4) WITH CROSS-SECTION FIXED EFFECTS (WHITE DIAGONAL WEIGHTING AND COVARIANCE)

	Manufacturing		**Construction**		**Trade**		**Recreation**		**TLC**		**Real Estate**		**All 6**	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
YEAR>2008	-5.05	0.85	67.29	0.34	-58.32	0.23	-35.40	0.69	30.83	0.55	67.33	0.10	40.04	0.17
SIZE(-1)	**-0.18**	**0.06**	**-0.29**	**0.03**	-0.16	0.14	**-0.46**	**0.05**	-0.23	0.24	**-0.16**	**0.09**	-0.18	0.10
× (YEAR>2008)	**0.06**	**0.00**	**-0.19**	**0.02**	0.01	0.72	0.02	0.50	**0.05**	**0.08**	**0.08**	**0.00**	**0.03**	**0.00**
AGE(-1)	**-0.15**	**0.00**	**-0.46**	**0.04**	**-0.23**	**0.00**	0.13	0.38	0.00	0.97	**-0.26**	**0.01**	**-0.24**	**0.00**
× (YEAR>2008)	**-0.14**	**0.00**	**-0.33**	**0.06**	**-0.15**	**0.00**	**-0.08**	**0.09**	0.05	0.52	**-0.20**	**0.01**	**-0.09**	**0.00**
LEVERAGE (-1)	-0.04	0.63	0.19	0.80	0.20	0.51	-0.17	0.39	-0.03	0.87	-0.10	0.41	-0.18	0.48
× (YEAR>2008)	**-0.24**	**0.00**	-0.07	0.90	-0.16	0.12	0.08	0.55	-0.17	0.26	-0.20	0.15	**-0.39**	**0.00**
FIXED ASSETS (-1)	0.36	0.26	-1.03	0.57	**-2.22**	**0.01**	0.64	0.21	**1.64**	**0.09**	0.78	0.15	**-1.01**	**0.04**
× (YEAR>2008)	**0.24**	**0.10**	-0.65	0.48	**-0.73**	**0.00**	0.35	0.19	**0.67**	**0.09**	**0.37**	**0.07**	-0.13	0.31
PROFITABILITY (-1)	-0.15	0.14	**0.77**	**0.00**	-0.01	0.91	**0.39**	**0.01**	-0.05	0.81	**-0.17**	**0.01**	-0.05	0.41
× (YEAR>2008)	**0.61**	**0.00**	-0.45	0.27	-0.01	0.98	**0.86**	**0.03**	-0.30	0.23	0.10	0.29	**0.34**	**0.00**
MARKET SHARE (-1)	0.07	0.29	-0.31	0.12	-0.32	0.18	-2.09	0.42	0.06	0.35	0.11	0.74	**-0.22**	**0.03**
× (YEAR>2008)	**-0.05**	**0.05**	**0.35**	**0.01**	0.14	0.11	-0.73	0.34	-0.04	0.39	**-0.23**	**0.00**	0.00	0.88
Δ LEVERAGE (-1)	**0.12**	**0.08**	0.20	0.30	0.10	0.21	**0.17**	**0.00**	0.09	0.34	-0.05	0.34	-0.02	0.78
× (YEAR>2008)	0.05	0.69	-0.03	0.94	-0.08	0.53	-0.13	0.38	-0.06	0.54	0.08	0.21	**0.18**	**0.01**
Δ FIXED ASSETS (-1)	**-0.21**	**0.00**	-0.12	0.74	0.15	0.20	0.05	0.59	-0.10	0.54	-0.04	0.75	**0.14**	**0.08**
× (YEAR>2008)	0.16	0.17	0.07	0.82	-0.17	0.31	-0.08	0.59	-0.14	0.50	-0.05	0.71	-0.10	0.19
IMR	**0.33**	**0.09**	**5.24**	**0.00**	**1.11**	**0.00**	1.51	0.12	**0.68**	**0.04**	0.50	0.21	**0.45**	**0.01**
× (YEAR>2008)	-0.13	0.63	**-5.61**	**0.00**	**-1.56**	**0.00**	**-1.72**	**0.04**	-0.36	0.45	0.47	0.34	-0.29	0.20
YEAR	**0.02**	**0.00**	**0.09**	**0.00**	**0.03**	**0.00**	**0.04**	**0.02**	0.00	0.86	**0.05**	**0.00**	**0.05**	**0.00**
× (YEAR>2008)	0.00	0.87	-0.03	0.36	0.03	0.23	0.02	0.69	-0.02	0.53	**-0.03**	**0.10**	**-0.02**	0.17
Δ SIZE (-1)	**-0.04**	**0.01**	-0.05	0.49	0.00	0.87	-0.03	0.79	0.01	0.82	**-0.04**	**0.06**	**-0.10**	**0.01**
Δ SIZE (-2)			-0.08	0.32			-0.09	0.48					**-0.06**	**0.06**
Δ SIZE (-3)							**0.44**	**0.01**					0.04	0.57
Cross-sections included:	5646		1629		7249		2898		1108		3063		19809	
Total panel (unbalanced) obs.:	42477		9798		48537		19317		7385		18502		121390	
Periods included	11		10		10		9		11		10		9.00	
J-stat	17.47	0.03	14.67	0.01	15.94	0.16		0.23	9.08	0.34	19.59	0.03	17.49	0.03
Instrument Set:	II		I		III		I		II		III		III	

Instrument Sets:		
	I	CONSTANT, YEAR>2008, YEAR, YEAR > 2008, SIZE(t), SIZE(t) x (YEAR>2008), AGE(t), AGE(t) x (YEAR>2008), LEVERAGE(t), LEVERAGE(t) x (YEAR>2008), FIXED ASSETS(t), FIXED ASSETS(t) x (YEAR>2008), PROFITABILITY(t), PROFITABILITY(t) x (YEAR>2008), MARKET SHARE(t), MARKET SHARE(t) x (YEAR>2008), t = {-2,-3}
	II	All variables in I plus IMR(-1)
	III	All variables in I plus IMR(-1) and IMR(-2)

Notes: Estimation output as in the previous Table, based on an alternative weighting scheme (White's diagonal) for the GMM estimates and their variance-covariance matrix. Results remain qualitatively similar; it is worth noting the overall effect of size on growth after 2008 for all six sectors, which turns positive and statistically significant. Source: Hellastat database.

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