

Performance of large firms in Greece during the unstable period of 2011–2016: lessons from the weak parts of Europe

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Abstract

Purpose – The unprecedented economic crisis in Greece deeply affected entrepreneurship, which was traditionally characterised by low levels of innovation and competitiveness, the dominant presence of micro-sized enterprises and the weak signs of prosperity in large firms. This paper, in acknowledgement of the necessary transformations that production incurred due to the crisis, attempts to detect the characteristics of large manufacturing firms that contributed to their greater resilience during the unstable period of 2011–2016 by analysing the determinants of the higher profitability of firms. The analysis shows that firms that improved their productivity and sales levels and in parallel are flexible, in the sense that they have limited amounts of both assets and liabilities and thus a small risk, are those that presented higher profits during the period under study. Initial conditions, sectoral characteristics and the broader national environment do not seem to have a strong contributive role in firms' profitability.

Design/methodology/approach – The analysis follows a dynamic system generalised method of moments (GMM) estimation based on a panel data set of 125 Greek large firms over the time span 2011–2016.

Findings – The analysis shows that firms that improve their productivity and sales levels and in parallel are flexible, in the sense that they have a limited amount of both assets and liabilities and thus a small risk, are those that present higher profits during the period under study. Initial conditions, sectoral characteristics and the broader national environment do not seem to have a strong contributive role in firms' profitability.

Research limitations/implications – The present paper attempts to explain the performance of the most dynamic large manufacturing firms in Greece by investigating the role of some of the most important determinants of firm profitability (according to data availability), acknowledging, however, some analysis' limitations as the absence of some other parameters like the export activity or the incorporation of any innovative features in the firms

Originality/value – The novelty of this paper lies in two points. First, the subject of the analysis is the large firms in Greece, which have not received much attention as Greek entrepreneurship was traditionally based on the light, labour- or resource-intensive production and the main bulk of the literature was not on that topic. Second, during the deep and protracted crisis that Greece has experienced, several production transformations have taken place that remain partly undiscovered. The present paper attempts to analyse the characteristics of large firms that drove their profitability and improved their resilience during the crucial time period 2011–16.

Keywords Large firms, Profitability, Greece, Economic crisis

Paper type Research paper

1. Introduction

Greek firms were largely characterised by their small sizes, inferior technological and innovative bases and low levels of productivity and competitiveness. The “Greek



eccentricity” was composed of too many very small firms with very few large firms. Recent data obtained have revealed that micro firms (with less than 9 employees) continue to exceed 90% of the manufacturing sector, while large firms (over 250 employees) have seriously lower shares in terms of employment and value-added, in relation to the European Union.

The entrepreneurship in Greece during the recent deep economic crisis has importantly shrunk (Notta and Vlachvei, 2014; Voulgaris *et al.*, 2015) without presenting strong signs of resilience and recovery. The anemic economic recovery is related to investment penury and companies’ low yields (PWC, 2017). The influence of the economic shock on firms was catalytic and decisive as it contributed either to keep (or further boost) firms to a vicious cycle of stagnancy or to motivate them to strive for their viability through proceeding to crucial structural changes. Under this context of upheavals, rearrangements and transformations that were preceded, it was expected that at the tail end of the economic crisis, the skewed production base in general and the structure of large enterprises in particular would have been affected. Specific firms showed greater resilience, which is reflected, initially, by their viability and next by a series of economic performance indicators. The pattern of their characteristics is under question.

This paper aims to investigate those characteristics that were apparent in large firms and contributed to their greater resilience and competitiveness by their higher profitability (Liargovas and Skandalis, 2008) during the crisis period of 2011–2016. These concern the firms’ characteristics (firm age, size, employment change), financial characteristics (liabilities, sales growth), efficiency (productivity), sectoral-specific characteristics (kind of sectoral intensity), national characteristics (national growth, corruption) and time-specific characteristics. The year 2011 was the year that has the full application of austerity policies, and the year 2016 was the year that has the most recent full data. In this period of pursuit of the production capacities and of proper transformations in Greece, the detection of the production pattern that would be related to higher gains and profitability constitutes an important issue.

Several studies have investigated the impact of the crisis on the performance of Greek firms, focusing, however, on specific sectoral fields (Voulgaris *et al.*, 2013; Voulgaris and Lemonakis, 2014; Agiomirgianakis *et al.*, 2013; Magoutas *et al.*, 2016). Large firms, to the best of our knowledge, have not been so far the main body of any analysis, so this paper sheds some light on those characteristics of large industries that helped them to be profitable and therefore more resistant during the recessional period of 2011–2016. Moreover, the present analysis gives insight on how a less dynamic production part of a developed country (that is, the Greek large industries) was affected by the recent severe economic crisis by proving that only a limited range of factors played a significant role in its growth as its weakness did not permit the exploitation of any cumulative experience and context of favoured initial conditions (economic performance, strong specialisations) for its reinforcement.

The remainder of this paper is organised as follows: Section 2 provides a literature review; Section 3 presents a general view of the role of large firms in Greece and explains some methodological issues. Section 4 specifies the econometric model and presents the empirical results. Finally, Section 5 offers conclusions.

2. Literature review

2.1 *The determinants of firm profitability*

A widely used firm performance indicator is the firm profitability which has been investigated by several aspects and research fields. In industrial organisation economics and the market-based view (the structure-conduct-performance model is employed by this school), although firm profitability is explored from both the firm- and industrial-levels, the industry factors are considered as the primary determinants of firm profitability

(Ravenscraft, 1983; Schmalensee, 1985; Goddard *et al.*, 2005). In the strategic management and the resource-based view (by firm effects models), the internal environment and firm characteristics have a major role in profitability (Hawawini *et al.*, 2003). In the accounting and finance literature, the random walk model is important in analysing firm profitability (Callen *et al.*, 1993). Recent studies have oriented towards the synthesis of empirical models of the three aforementioned research strands providing a more integrated aspect of firm profitability (Goddard *et al.*, 2005).

Based on this argument, the determinants of firm profitability range among firm-specific factors, industry factors, national factors and global factors (Schmalensee, 1985; McGahan and Porter, 2002). The firm-specific factors arguably explain more than twice the variations of profits in relation to the factors of industry (Asimakopoulos *et al.*, 2009; Spanos *et al.*, 2004).

Firstly, the *firm size* is one of the most cited variables where its influence is investigated on profitability. It has been proxied by different measures such as the employment (Voulgaris *et al.*, 2002), the gross sales (Hermelo and Vassolo, 2007; Alessi *et al.*, 2012) or the fixed assets (Chen and Lu, 2003). Nevertheless, conclusions are not consistent as the analyses arrived at different conclusions. On the one hand, a positive effect of firm size on profitability emanated from the explosion of economies of scale and of economies of scope, the lower cost to access capital than smaller firms, the generation of higher income, the better access to capital markets or the lower cost of borrowing (Titman and Wessels, 1988; Barbosa and Louri, 2005; Stierwald, 2009; Argyrou *et al.*, 2016; Genovevo da Costa *et al.*, 2017). On the other hand, studies have found a non-important (Ha-Brookshire, 2009) or a negative effect of firm size on profitability (Zhou and de Wit, 2009; Yasuda, 2005; Almus and Nerlinger, 2000; Bottazzi and Secchi, 2006; Calvo, 2006; Dunne and Hughes, 1994; Goddard *et al.*, 2002), which is due to increased monitoring costs, bureaucratisation, policies based on non-pecuniary benefits, diseconomies of scale or diversified production structure (Glancey, 1998; Barbosa and Louri, 2005). The influence of firm size on profitability during periods of economic recessions seems to be positive as the recession affects stronger smaller firms (Bugamelli *et al.*, 2009).

In the same vein, studies that explored the influence of *firm age* on profitability have reported controversial results. A positive relation has been highlighted based on the benefits of experience, know-how, established network of relationships and reputation, lack of liabilities and newness and therefore a superior performance (Stinchcombe, 1965; Glancey, 1998; Kueng *et al.*, 2014), as well as a negative one justified by the fact that the older firms are prone to inertia, bureaucracy and a less flexibility to adapt to external rapid changes in market conditions (Agiomirgianakis *et al.*, 2006; Glancey, 1998; Marshall, 1920; Papadogonas, 2007). As concerns the association of firm age on profitability by the crisis effect, young businesses seem to be more cyclically sensitive (Burger *et al.*, 2013).

The level of *leverage* constitutes another factor that might determine the firm's performance as a high value might hint risks, while a low value might ensure greater financial security (Fu *et al.*, 2002; Kester, 1986) but also low ability for important profits and growth opportunities (Jensen and Meckling, 1976). A negative correlation of financial leverage and firm performance is more often met (Opler and Titman, 1994; Jandik and Makhija, 2005), while a positive correlation of financial leverage is more limited (Niskanen and Niskanen, 2007). The relationship between leverage and firm performance during crisis periods differs among industries with different characteristics, although the general prediction underlines a positive one (Knudsen, 2011). More analytically, a high leverage at the pre-recession period is correlated with a more deteriorated firm performance (Geroski and Gregg, 1993), while highly leveraged firms that seem to have lost more market shares have fewer chances of resisting the pressures of economic recession (Kester, 1986; Burger *et al.*, 2013) and experiencing higher drops in operating profits during economic downturns compared to firms with lower debt levels (Opler and Titman, 1994). On the contrary, highly (poorly) leveraged firms have been found to be related with positive (negative) performance

characteristics when other parameters coexist (e.g. less liquid assets, low-debt industries, Campello and Fluck, 2006).

Arguably, the serious Greek sovereign debt crisis has created a peculiar environment and has made the subject of liabilities a burning issue. The evolution of debt to GDP has dramatically increased since from 109% in 2008 to 181% in 2018. The imposition of capital controls in 2015 restricted the movement of capital, and a chain of causal effects followed the linking of liquidity shortages with lower credit and resulting in weaker economic activity (Louri and Migiakis, 2019).

Other factors emerged which brought about a more unambiguous and clear contribution to firms' performance and profitability. The *growth of sales* is related, in general, to the dynamism and good market standing (Agiomirgianakis *et al.*, 2006), while in periods of crisis this relationship more often appears to be stable (Tailab, 2014) than the inverted one (previous profits do not define the following sales) (Fuertes-Callen and Cuellar-Fernández, 2019). Parameters that dominate in periods of instability, like uncertainty or less liquidity and tight loan repayment, have also a decisive role in the relation of sales growth with profitability (i.e. young firms are prone to the liabilities of newness, and this possibly explains why the positive effect of growth on profitability is not obvious especially in periods of instability (Lee, 2014)). In other cases, the positive relationship between sales growth and profitability might be less strong or profound (Coad, 2010) as it depends on the applied strategies. For instance, sales growth retains its positive relation to profitability in periods of short-term economic downturn through a restriction of investments in growth, while in periods of long-term recession through (public) investments in R&D which alleviate the cost burden and boost the dynamism of sales growth (Yoo and Kim, 2015). Moreover, sales growth in firms that apply growth-focused strategies may not be associated with cost reductions and consequently with high profits (Jang and Park, 2011). *Productivity* is related to higher returns, although some empirical studies have not found robust evidence (Bottazzi and Secchi, 2006). In periods of recession, firms with higher productivity are expected to be more resistant to the economic recession, but at the same time, firms might be, on average, more tempted to increase productivity by *reducing the number of employees* (Burger *et al.*, 2013).

Apart from the firm-specific factors, other factors at the industrial, national or global level are studied in order to achieve a more integrated aspect in explaining the variability of profitability. The industrial effects are considered to be the second largest influence on firm profitability after the firm effect (Kattuman *et al.*, 2011). The *sector* in which a firm operates co-determines importantly its growth dynamics (Burger *et al.*, 2013). A better economic performance has been detected in sectors of financial nature due to the high financial leverage, or of high technology due to the rapidly enhancing innovation in this sector (DeAngelo and Stulz, 2013; Genovevo da Costa *et al.*, 2017). In other studies, it has been evidenced that sector effects are present but play a minor role (Stierwald, 2009).

The national environment might also influence the firms' performance (Goddard *et al.*, 2009). Entrepreneurship and *national growth* have been found to be correlated in a causative way (Wong *et al.*, 2005; van Stel *et al.*, 2005), where entrepreneurship fosters economic growth and the latter reinforces entrepreneurship. The influence of national environment in firm performance has been proved to be significant even more in emerging countries than in developed countries as they are in a different stage of economic development and record high growth rates (Burstein Goldszmidt *et al.*, 2011). In periods of economic contraction, this trend shifts as firms revert on their idiosyncratic competencies and strategies. Yet, there is not a clear relevance of country effects on firm performance during varying economic conditions (Bamiatzi *et al.*, 2016). Moreover, there is a knowledge gap in the relationship between national growth and firm profitability as regards the recent economic crisis, which the present paper attempts to cover.

The quality of institutions has also a decisive role in a firm's growth (Dollar *et al.*, 2005). *Corruption* distorts markets, opposes the adoption of new technologies, discourages investments and prevents the viability and expansion of their firms (Hudson *et al.*, 2012). On the contrary, other views support that corruption has no impact on firm performance in either crisis or steady-state conditions (van Essen *et al.*, 2013), or claim a positive aspect of corruption in firm efficiency. This may occur when corruption plays the role of grease in the wheels of a deficient environment in which firms behave corruptly to surpass market failures (i.e. bureaucratic environment) and to increase their profits especially in crisis periods (Hanousek *et al.*, 2019; Ayaydm and Hayaloglu, 2014; Gaganis *et al.*, 2019).

2.2 The firm profitability in the case of Greece

As regards the bibliography that analyses the profitability of *Greek firms*, Table 1 reports the main findings of the papers that studied the determinants of firms' profitability in Greece for various time periods. Concisely, for the pre-crisis period (in 1990s or 2000s), the factors that have been detected with a positive influences on the profitability are the firm size, the investments, the human capital, the sales to assets ratio and the export activity (Agiomirgianakis *et al.*, 2006; Liargovas and Skandalis, 2008; Magoutas *et al.*, 2011; Papadogonas, 2007; Asimakopoulos *et al.*, 2009; Caloghirou *et al.*, 2004). On the contrary, an ambiguous relationship with the profitability has been found (as it is not clear by both positive and negative relationships of variables with profitability in different papers) for the age of firms, the exports and the leverage (Agiomirgianakis *et al.*, 2006; Liargovas and Skandalis, 2008; Magoutas *et al.*, 2011; Papadogonas, 2007; Kapopoulos and Lazaretou, 2007).

As regards studies that investigated the profitability of Greek firms separately or exclusively during the crisis period (post-2008 period), they were mostly focused on specific production sectors and are characterised to be limited. Specifically, large dairy firms during the period of 2009–2011 were found to be more profitable when they were associated with large market shares and loyal customers, with high liquidity that contributed to their survival during downturns and with low liability (Notta and Vlachvei, 2014). Firms with high fixed assets efficiency (for firms of the chemicals and plastics industries), labour efficiency (pharmaceutical firms), gross profit margin (pharmaceuticals and chemicals firms) and with small size (chemicals and plastics firms) have been proven to be more profitable during the period of 2008–2011 (Voulgaris and Lemonakis, 2014). For the tourism sector, the determinants of firm profitability that have been reported are the age of the firm, the size, the market share, the low high market share, the capitalisation, the investments, the turnover and the low leverage and cost-efficiency (Magoutas *et al.*, 2016; Agiomirgianakis *et al.*, 2013; Dimitrić *et al.*, 2019; Dimitropoulos, 2020).

Other studies have analysed the profitability of firms based on a more extensive period that includes both pre- and during the crisis period. Specifically, it has been detected that agricultural firms in the period of 2004–2011 with high exports, fixed assets, labour efficiency, liquidity and leverage in time intervals with high national growth and low inflation are related to high profits. Moreover, the competitiveness of agricultural firms constructed by a composite indicator that entails *inter alia* both the level and the change of profits has been found to be related to high age, size, liquidity and growth in net fixed assets for the period of 2009–2011 (Lemonakis *et al.*, 2016). In the hotel sector, the lagged profitability, cash flow to operating revenue, net asset turnover and company age are positively related with profitability (Dimitrić *et al.*, 2019).

3. Descriptive analysis

The firms' size in Greece was traditionally too small with the share of micro firms (1–9 employees), especially in the manufacturing sector, which is to be much higher than the EU

Author(s)	Theme of study	Period	Main results
Agiomirgianakis et al. (2006)	Manufacturing sector (3,094 corporate private firms)	1995–1999	Firm size, age, exports, sales growth, reliance on debt on fixed assets and investment growth, as well as efficient management of assets influence profitability
Agiomirgianakis et al. (2013)	Tourism sector (134 hotels)	2006–2010	Age of firm, firm's size and low-cost access to bank financing have positive effect in profitability; leverage and economic crisis have negative effect
Argyrou et al. (2016)	Manufacturing sector (25,181 firms)	2006–2013	Age is significantly correlated to profitability before the crisis, and negatively after. Employment is related positively with profitability with the exception for the years 2011 and 2012. Exports are related positively in the pre-crisis period and negatively in the crisis period. A controversial impact has been found also for sales
Asimakopoulos et al. (2009)	Non-financial firms (119 firms)	1995–2003	Firm profitability was positively affected by size, sales growth and investment, and negatively by leverage and current assets. Additionally, the EMU participation and the adoption of the euro were negatively related to firm profitability
Caloghirou et al. (2004)	Manufacturing, SMEs and large firms, firms with turnover exceeding 3 million euros in 1999, questionnaire analysis (280 firms)	1999	Industrial growth (by sales) and financial assets have a significant positive relation, while technological assets a negative relation to the profitability of large firms
Dimitrić et al. (2019)	Hotel companies (1,314 firms for Greece)	2007–2015	Lagged profitability, cash flow to operating revenue, net asset turnover and company age have positive significant effect in profitability
Dimitropoulos (2020)	Non-financial corporations (3,332 firm-year observations)	2003–2010, 2011–2016	Size, change in sale revenues, net working capital and flows to total assets have positive effect in profitability, while liabilities a negative one. R&D investments have a negative impact on the profitability of sample firms before the crisis and positive during the crisis (2011–2016)
Georgopoulos and Koumanakos (2007)	Affiliates of foreign TNCs (82 affiliates)	1999–2002	Weak empirical support of intra-firm trade impact on profitability

(continued)

Table 1. Literature overview on the determinant factors of firm profitability in Greece

Author(s)	Theme of study	Period	Main results
Kapopoulos and Lazaretou (2007)	Random sample of firms in all sectors (175 firms)	2000	Market concentration is related positively with profitability, while debt-to-assets ratio negatively
Lemonakis <i>et al.</i> (2016)	Agri-food sector (251 agri-food firms)	2004–2011	Positive effect of subsidies on competitiveness (which includes a strong component of profitability) is interesting only for the fruit-vegetable-cereal farms.
Lemonakis <i>et al.</i> (2013)	Agri-food sector (290 agricultural firms)	2004–2011	Exports, fixed assets and labour efficiency, good liquidity condition and careful use of foreign capital, along with economic growth, contribute to the profitability of agri-businesses
Liargovas and Skandalis (2008)	Manufacturing (102 industrial firms)	1997–2004	Leverage, export activity, location, size and the index for management competence significantly affect firm competitiveness (profitability)
Magoutas <i>et al.</i> (2011)	Manufacturing (287 firms)	2004–2006	Human capital, firm size, investments, assets to turnover ratio and dummy for location in the two metropolitan regions are related positively with profitability, while leverage negatively
Magoutas <i>et al.</i> (2016)	Tourism sector (4,433 firms)	2005–2011	Increased market share, decreasing leverage, a more efficient managerial performance, capital investment based on the principles of capital budgeting and innovation are crucial factors for financial performance during a period of economic crisis. Age is positively related with profitability only in the pre-crisis period and investments only in the crisis period.
Notta and Vlachvei (2014)	Food manufacturing firms (128 firms)	2006–2008, 2009–2011	Market share, liquidity and leverage have significant effect on profits for the crisis period, and only market share is related significantly with profits in the pre-crisis period
Papadogonas (2007)	Manufacturing (3,035 firms)	1995–1999	Size, managerial efficiency, debt structure, investment in fixed assets and sales growth affect significantly firm profitability

Table 1.

(continued)

Author(s)	Theme of study	Period	Main results
Salavou (2002)	SMEs in food industry, questionnaire analysis (745 firms)	1995–1997	Market orientation, in terms of customer responsiveness and market-driven pricing policy, and product innovation interact in affecting business profitability
Spanos <i>et al.</i> (2004)	Manufacturing firms with size of at least 20 employees (1,921 firms)	1995–1996	Firm-specific factors explain more than twice as much profit variability as industry factors
Tzelepis and Skuras (2004)	Food and drinks manufacturing firms (1,005 firms)	1982–1996	Market growth is related positively with profitability
Ventoura <i>et al.</i> (2007)	Chemical and textile industry (163 firms)	2001	Positive influence of productivity on profitability

Table 1.

average (93.1% vis-à-vis 82.5% of EU28, Table 2); reflecting a series of problems such as lack of financial resources, obsolete management methods, lagging innovation performance and competitive weakness. Large industries, on the antipode, after the serious deindustrialization waves in the 1980s and 1990s, never had a major role in the Greek economy due to the dominant light and labour-intensive industry.

The recent economic crisis led industries to a new deindustrialisation process by reducing the number of large industries and downsizing their production value, and thus shrinking the production base of the country. Inevitably, in both the pre-crisis and at the tail end of the crisis period, the contribution of large firms to the economy in terms of turnover ranged at low levels (Table 3) (National Bank of Greece, 2018).

	Manufacturing			All sectors		
	Greece	EU28	EU-15	Greece	EU28	EU-15
1–9 persons employed	93.07	82.54	80.34	96.54	92.91	92.53
10–49 persons employed	5.68	13.31	15.33	3.06	5.93	6.31
50–249 persons employed	1.07	3.39	3.55	0.35	0.96	0.97
>250 persons employed	0.18	0.76	0.77	0.05	0.19	0.19
<i>Total</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>	<i>100.00</i>

Source(s): Author's elaboration from OECD (2018)

Table 2.
Share (%) of firms in each firm size category in Greece and the EU, 2016

	Pre-crisis period (2006/08)		Tail end of the crisis period (2015/16)	
	Greece	EU28	Greece	EU28
Small firms	56	39	53	37
Medium firms	19	20	19	20
Large firms (except fuel)	21	39	21	41
Large firms (fuel)	4	2	7	2
<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>

Note(s): Small firms are defined those with turnover <10 million€ or <50 employees, medium firms with turnover 10–50 million€ or 50–250 employees and large firms with turnover >50 million€ or >250 employees

Source(s): National Bank of Greece (2018)

Table 3.
Share (%) of turnover in each firm size category in Greece and the EU

Undoubtedly, large firms experienced a serious decline in their profits during the period of 2008–2016, similar to that of small- and medium-sized firms [1]. However, the gap is widening between the profitable firms that managed to resist to the shock of crisis and the prejudicial firms in specific sectors (New Times, 2018).

The present paper, taking into consideration the unprecedented deep recession in which the Greek economy plunged into, the prominent small size of productive firms, the lack of important economies to scale and the inferior competitive position of large firms, aims at studying the performance of large firms in Greece and its determinants during the dramatically unstable period of 2011–2016.

Large firms are defined according to the employment size which is over 250 employees [2]. The list of large manufacturing firms is based on 2011 data which consisted initially of 132 firms. The data are sourced from the ICAP database which contains financial and non-financial information for all the companies that operate in Greece and are required to publish their annual balance sheet. Under this context, all Greek large firms of the manufacturing sector are included in the initial data set. From the list, firms from the fuel and the defence sector are excluded, as well as firms that closed down during the period of 2011–2016 or without any recently published recent data, reducing thus the number of firms to 125. Some basic figures about the profile of firms are displayed in Table 4. By the juxtaposition of the year 2011 with the year of 2016, it is profound that the ongoing crisis has led to further deviations between firms' characteristics (mainly in the earnings to sales ratio and the liabilities to assets ratio) that reflect the different ability of firms to respond to the shock and result eventually to a greater gap between the more profitable and the more prejudicial large firms.

4. Econometric analysis

The aim of this section is to clarify the parameters that define the performance and the competitiveness of large firms in Greece during the period of 2011–2016 by econometrically investigating the determinants of their profitability. The analysis follows an integrated approach of detecting determinants of firm profitability that includes firm-specific, industry-specific and national factors. Particularly, the following econometric dynamic panel model was estimated:

$$\begin{aligned}
 \text{PROF}_{it} = & \text{LPROF}_{it-1} + \text{AGE}_{it} + \text{ASSETS}_{it} + \text{LIAB}_{it} + \text{SALESGR}_{it} + \text{PROD}_{it} + \text{EMPCH}_{it} \\
 & + \text{RESLAB}_{it} + \text{SCIEN}_{it} + \text{NGR}_t + \text{LNGR}_{t-1} + \text{CORRCH}_t + \text{TIME}_t + e_{it}
 \end{aligned}$$

where *i* is the firm, *t* the year and *e* the error term. The analysis used an unbalanced panel data of 125 large firms over the time span of 2011–2016 (750 observations).

More analytically, for the determination of firm performance, the firm profitability was used (PROF) and specifically the variable of return on sales which measures how much a

	Base year (2011)				Final year (2016)			
	Mean	Stdev	min	max	Mean	Stdev	min	max
Earnings to sales ratio	-1.2	15.4	-82.4	68.9	-4.8	46.6	-451.8	50
Number of employees	489.6	305.7	220	1900	499.5	306.6	105	1494
Firm age	35.9	21.9	1	123	40.9	21.9	6	128
Liabilities to assets ratio	64.5	22.6	8.5	130.2	69.8	48.9	9.5	427.6

Table 4.
Descriptive statistics of the dataset

Source(s): Author's estimations from ICAP (2018)

company earns in relation to its sales (Liargovas and Skandalis, 2008). The indicator reveals the ability of a firm to withstand the competition forces as well as the deteriorated economic environment during the period under study which is characterised by rising costs and shrinking domestic market (in Table 5 is presented a description of the variables).

In the independent variables, the firm characteristics were primarily included in the model and explored for the firms' performance so as to detect those that are related to higher profitability and competitiveness of firms but also to delineate the pattern of the most dynamic and resilient firms that managed to resist to the crisis, to achieve higher profits to sales ratio and to hold a competitive position.

Firstly, the lagged profitability being a significant determinant of current profit margins (Pratheepan, 2014), accounts for a dynamic component in firms' profitability (Stierwald, 2009) and reveals the extent of profit persistence (Gschwandtner and Hirsch, 2018); for this reason, it is included in the model by the variable LPROF.

The firm age (AGE) was explored as a potential determinant of firm profitability. Its contribution is precarious as old firms might be associated with greater experience, lack of liabilities and newness, smaller sensitivity in recession periods (Stinchcombe, 1965; Fort *et al.*,

Variables	Explanation	Source
PROF	Firm profitability proxied by the return on sales that is the net profits by sales ratio $PROF = \left(\frac{NET\ PROFITS}{SALES} \right) * 100$	Author's estimations from ICAP (2018)
AGE	Firm age estimated by the number of years since the foundation of the firm	Author's estimations from ICAP (2018)
ASSETS	Logarithmic form of firm assets	Author's estimations from ICAP (2018)
LIAB	Liabilities to assets ratio	Author's estimations from ICAP (2018)
SALESGR	Growth of firm sales $SALESGR_i = \left(\frac{SALES_{i,t+1} - SALES_{i,t}}{SALES_{i,t}} \right) * 100$ where i the firm and t the year under study	Author's estimations from ICAP (2018)
PROD	Productivity proxied by the profits to employment ratio $PROD = \frac{PROFITS}{EMPLOYMENT}$	Author's estimations from ICAP (2018)
EMPCH	Change of employment, $EMPCH_i = \left(\frac{EMP_{i,t+1} - EMP_{i,t}}{EMP_{i,t}} \right) * 100$ where i the firm and t the year are under study	Author's estimations from ICAP (2018)
RESLAB	Resource-intensive sector	Author's estimations from OECD (1987)
SCIEN	Science-intensity sector	Author's estimations from OECD (1987)
NGR	National growth rate of GDP/cap $NGR = \left(\frac{GDPCAP_{t+1} - GDPCAP_t}{GDPCAP_t} \right) * 100$ where GDPCAP is the per capita GDP of the country (constant prices) and t the year under study	Author's estimations from ELSTAT (2018)
CORRCH	Change of corruption index $CORRCH = CORR_{t+1} - CORR_t$, where CORR is the corruption index of the country and t the year under study	Author's estimations from (Transparency International (2018))
TIME	Continuous variable of time	

Table 5. Description of the variables

2013), as well as with bureaucratic and less flexible structures (Burger *et al.*, 2013; Glancey, 1998). The variable of age is defined as the number of years since the foundation of the firm.

The firm size is broadly recognised as an important component of firm profitability (Stierwald, 2009; Steinerowska-Streb, 2012; Ito and Fukao, 2010). As this paper studies exclusively the performance of large firms defined by their employment size (over 250 employees), an additional measure has been added to capture the economic size of firms through the variable of firms' assets (ASSETS). Its contribution to profitability depends on whether size generates gains from economies of scale and scope, or losses from diseconomies of scale and diversification (Goddard *et al.*, 2005). In general, studies have shown that large firms during periods of crisis seem to be more flexible and resistant in relation to small firms that appear to be more sensitive (Burger *et al.*, 2013; Agiomirgianakis *et al.*, 2013).

The low levels of indebtedness and a small dependency on external sources of financing of a firm are associated with a better financing environment in which a firm has greater opportunities to resist any pressures of economic recession (Burger *et al.*, 2013; Manova *et al.*, 2015; Bricongne *et al.*, 2012). This view is extremely crucial for the viability of Greek firms as they have been operating in a suffocated financial environment characterised by a sovereign deep and protracted debt crisis and a lack of financial liquidity in the previous years. In order to confirm whether a higher leverage ratio conceals a greater risk in the Greek firms during the recessionary and unstable period of 2011–2016 and therefore undercuts their profitability, the variable of the liabilities to assets ratio (LIAB) was included in the econometric model.

Sales growth indicates a dynamic presence of firms in the markets, but its contribution to firms' profitability is not granted as it could be affected by an array of other (endogenous or exogenous) costs. The variable estimated the positive and statistically significant correlation of the variable of sales growth (SALESGR) to firms' profitability which signifies the margins left in the firms to convert their revenue to net profit, overpassing thus any high operational costs but especially the high taxes that Greece has overall imposed.

Although productivity is a key parameter to the firms' expansion and competitiveness, empirically, this association is not always confirmed (Bottazzi and Secchi, 2006) may be due to the fact that productivity rise might not be based on competitiveness improvements but on other inferior adjustments. This issue is crucial for Greece as traditionally, at national as well as at firm levels, the competitiveness was lagging behind, while this weakness is furthermore closely related to the recent deep crisis (Ioannides and Pissarides, 2015). The investigation of the relationship between productivity (PROD) and firms' profitability in the present analysis would shed some light if these two parameters have an associated improvement during the period of 2011–2016.

Importantly, while firms of higher productivity are expected to be more resistant to economic recessions, firms might be more tempted to increase productivity by reducing their employment (Burger *et al.*, 2013), a fact that has taken place extensively in Greece. In order to test this case, the variable of employment change (EMPCH) was included in the econometric model with the aim to explore its association with firms' profitability.

The performance and response of firms in any internal or external stimuli differentiate substantially from sector to sector (Genovevo da Costa *et al.*, 2017). With the aim to disentangle these different effects and to capture any industry-specific influences, a series of dummy variables was included in the econometric model defined according to the sectors of OECD classification, that is, the sectors of resource- and labour-intensity, of scale- and specialised-intensity, of science-intensity and the sector of services (RESLAB, SCSPEC, SCIEN and SERV respectively).

Finally, the determinants of firm profitability might lie not only along with firm-specific characteristics [3] but also along with national macroeconomic characteristics. National high growth rates indicate the country's economic health and the prosperity of the economic

environment in which firms operate. Therefore, the national growth rate (NGR) and its time lag (LNGR) are arguably expected to influence firms' profitability.

Among the factors of national socio-economic conditions, corruption might also affect the firms' performance and profitability. Corruption is one of the most pervasive obstacles to economic growth (Mauro, 1995), while partially the Greek crisis and the collapse of GDP are attributed to the high levels of corruption (Ormerod, 2016). Due to the significant role of the elimination of corruption for economies in general and for Greek firms in specific, the variable of change in the corruption index (CORRCH) was included in the model. High values of the corruption index indicate high transparency, so a positive change of the index signifies diminution of corruption.

Lastly, as the crisis shock is gradually expected to fade off and the entrepreneurial environment to be purged diachronically, the time variable (TIME) was included in the model in order to capture any positive developments in firms' profitability that are associated with their entry in a new phase of economic and entrepreneurial recovery.

To tackle any potential endogeneity issues, a generalised method of moment (GMM) estimator (Arellano and Bond, 1991; Blundell and Bond, 1998) was implemented which treated explanatory variables as potentially endogenous (Aiello and Scoppa, 2009; Kloss and Petrick, 2014; Kosfeld *et al.*, 2006). This methodological approach used GMM estimators and moment conditions from a system of equations which had better properties in terms of bias and efficiency than that of the GMM estimators for differences (Arellano and Bover, 1995; Blundell and Bond, 1998), in which it combines the first-differenced regression with the level equation which uses the lagged first differences of the dependent variable for instruments.

The results of the econometric analysis are displayed in Table 6 where the econometric model of firm profitability relied on dynamic panel GMM estimation which treats explanatory variables as potentially endogenous. The methodological approach of the dynamic GMM (Arellano–Bover/Blundell–Bond) uses the estimators and moment conditions from a system of equations which has better properties in terms of bias and efficiency than that of the GMM

Independent variables	Dependent variable: firm profitability		
	(1)	(2)	(3)
Constant	375.35(0.123)	328.52(0.161)	345.01(0.184)
LPROF	-0.34(0.260)	-0.35(0.302)	-0.34(0.297)
AGE	34.74(0.159)	25.56(0.090)*	19.77(0.332)
ASSETS	-27.21(0.066)*	-25.06(0.074)*	-25.72(0.070)*
LIAB	-0.34(0.036)**	-0.31(0.035)**	-0.32(0.030)**
SALESGR	0.014(0.118)	0.010(0.083)*	0.009(0.071)*
PROD	0.0009(0.074)*	0.0008(0.046)**	0.0008(0.035)**
EMPCH	26.26(0.394)	24.85(0.311)	18.00(0.514)
RESLAB		49.58(0.514)	53.17(0.490)
SCIEN		57.42(0.521)	60.59(0.485)
NGR			-1.36(0.446)
LNGR			0.86(0.501)
CORRCH			0.67(0.340)
TIME			2.75(0.459)
Nb of firms	122	122	122
Nb of observations	594	594	594
Hansen test (<i>p</i> -value)	0.854	0.833	0.819
Arellano–Bond test (<i>p</i> -value)	0.112	0.108	0.110

Note(s): The numbers in parentheses denote *p*-values. The number of asterisks denotes the significance level of the coefficients: ***significant at the 1% level; **significant at the 5% level; *significant at the 10% level. The number of instruments is less than the number of groups

Table 6. Econometric results of dynamic GMM model

estimators for differences (Arellano and Bover, 1995; Blundell and Bond, 1998), and combines the first differenced regression with the level equation in addition to the usual lagged levels as instruments for equations in first-differences. The use of robust standard errors provides consistent estimates in the presence of heteroscedasticity and autocorrelation. Problems of multicollinearity have not been detected [4]. The Sargan test for the validity of restrictions shows that the instruments are valid.

According to the results, the lagged profit rate (LPROF) is correlated negatively and statistically insignificantly with the dependent variable, signifying that profitability is not serially correlated over time. Thus, high levels of profits in the previous years do not seem to predetermine equally significant profits of firms in the following years (potentially by reinvestments in R&D or innovation processes, Stierwald, 2009).

The firm age (AGE) is not considered as an important determinant of firms' profitability according to the positive but statistically insignificant coefficient of the variable. Older and mature firms are not strongly related to levels of higher profitability, indicating that their long-established position in the market has not brought important economic gains and resilience during the crisis period.

Firms that are classified as large ones according to their employment size (> 250 employees) but of smaller economic size defined by the magnitude of their assets (ASSETS) are associated with higher profitability. Thus, large firms, in economic terms, seem to confront serious constraints that confine their profits, as in a deeply recessional environment, parameters like a feeble banking sector and steep tax increases escalate the instability of large firms.

A higher debt and leverage level expressed by the liabilities to assets ratio (LIAB) in firms is correlated to lower profitability, an outcome which expectably shows that a high firm risk by an important financial leverage could not lead to gains under fiscal austerity and a weak banking system such as in the period under study. Therefore, despite the widespread perception that large firms are more favoured in an environment of limited financial resources (Latham, 2009), the present analysis proves that liabilities constitute one of the greatest burdens in the Greek large firms in the recent crisis.

Sales growth (SALESGR), on the contrary, seems to contribute to the firms' profitability, highlighting the ability of firms to channel their gains from sales to profits exploiting any profitable opportunity.

Productivity (PROD) is related positively and statistically significant to firms' profitability, while the employment change (EMPCH) is related positively but statistically insignificantly to the dependent. This signifies that high productivity levels, which are not maintained overwhelmingly on employment losses, are associated to profits' rise. However, firms with higher profitability are not related to production transformations and technological advancements that are able to lead to strong recruitment of employees.

The profit potentials are not similar among firms in different sectors. However, despite the dissimilar performance of firms regarding their profits during the period under study, which is reflected by a positive coefficient of the variable of labour- and resource-intensity (RESLAB) as well as of the science-intensity firms (SCIEN), there is no profound distinction between profitable and non-profitable firms according to their sector, as the statistical significance of the coefficients of the defined variables is not important.

Not only firm-specific characteristics but also national ones might influence the firms' performance. However, this analysis shows that their influence is weak. Specifically, the one-year lag of national growth rate (LN GR) seems to positively affect the firm profits but not in an important degree, verifying the fact that the Greek economy has not yet obtained the appropriate momentum. Similarly, the improvements in the transparency by reductions in corruption (CORRCH) have a positive but weak influence in firms' profitability. It should be mentioned, nevertheless, that changes in both national growth and transparency have not

been high enough so far, to act as stimulus for the recovery of the entrepreneurship and the growth of firms. Lastly, the variable of time (TIME) has a statistically insignificant positive effect on firms' profitability, signifying that the gradual improvement (but not totally restored) of economic and entrepreneurial conditions in the country has not contributed substantively to the growth of firms' profits [5].

5. Conclusions

The production base in Greece was traditionally of low quality, with technological ability or value-added focusing on light, labour-intensive industry and on traditional or endowments-based services. The recent deep economic crisis led firms to experience a strong shock but also revealed a different degree of resistance and recovery ability in each firm. The goal of this paper was to study the performance of large manufacturing firms in Greece during the fragile period of 2011–2016 and to detect the determinants of their profitability in this unstable economic and entrepreneurial environment.

The analysis was based on all the large firms (defined by their employment size, namely over 250 employees) recorded for the period of 2011–2016, apart from those from the fuel or the defence sector. The econometric estimation was based on the GMM system methodology which resolves any endogeneity issues and offers efficiency in its results. The parameters that seem to play an important role in the firms' profits are the high sales growth and productivity, and the low leverage level and assets. Thus, firms that manage to improve their productivity levels and to increase their sales seem to create suitable conditions to confront the controversial conditions of the period under study and to perform better. Moreover, large firms with smaller economic size in terms of assets and lower liabilities to assets ratio signify that a manageable economic size and a low financial leverage and risk are those characteristics that lead to higher viability and profitability of firms in difficult periods of fiscal austerity and financial weakness.

On the contrary, high profit rates from previous years or a high firm age does not present any important influence on firms' profitability. This signifies two things: firstly, that previous high profits during the unstable crisis period do not in any way indicate a stable and viable growth of firms. As long as economic and business conditions fluctuate, the profitability of firms will be precarious. Secondly, historical parameters, which might be linked with experience and favourable initial conditions, do not play any significant role in the evolution and the positive route of large firms. This outcome eventually indicates the inability of large firms to evaluate past cumulative benefits and their inflexibility to be effectively restructured either in the past or in the present, resulting in a lack of resilience and of high profitability during the crisis.

Similarly, industrial-specific factors, such as broad sectors in which firms belong to, or national factors, such as the national growth rate or the corruption decline that could positively affect firms, have, on the contrary, a weak influence on firms' profitability, verifying the feeble growth of the Greek economy as well as the low rate of structural changes which are unable to adequately foster the entrepreneurship. The distortions, market rigidities and institutional inefficiencies that characterise the economy not only deter investments but allow an entrepreneurial environment to persist in being weak and introverted, as well as in relying on wrong practices. In the same vein, the time variable has not significantly affected the firms' profitability, highlighting the persistent weakness of the country to change the entrepreneurial environment and to enter into a viable cycle of vigour and growth.

Overall, the flexibility and adaptability seem to be some of the key parameters that favour the Greek large firms to be profitable and competitive in the seriously adverse socio-economic conditions of the period of 2011–2016. Manageable and flexible (in the sense of non-large) sizes of assets and liabilities are related to higher profitability as they seem to confine any

risks and to verify the imperative need for stable and viable changes in a continuing unbalanced environment. Moreover, timely adjustments, rather than favourable initial conditions, have played a decisive role in firms' profitability. This signifies their low ability to efficiently convert gains of previous years into cumulative value-added and significant transformations in production and to develop immunity to potential shocks. The restructuring and the smooth management of difficult situations, rather the extension (by employment increase), appeared to be the solution for the survival and growth of large industries. Finally, the Greek economy seems to be in a lethargic situation which unambiguously makes harder any effort of firms to recover and establish a strong position in the markets. Its weakness to improve the key elements of the business environment with targeted interventions just perpetuates a climate of instability and underperformance in which firms are called to operate.

The present paper has attempted to explain the performance of the most dynamic large firms in Greece investigating the role of some of the most important determinants of firm profitability. Its academic contribution lies in the fact that it gives insight on how a less traditionally competitive production part of Greece accommodated a severe crisis and on which characteristics are associated with a more resilient behaviour, an important issue for the evolution of large industry in the country, especially after the rebirth of industrial policy in the European Union (EU). The paper acknowledges, however, some analysis' limitations as the absence of some other parameters like the export activity, the incorporation of any innovative features in the firms, the sales markets, the foreign presence in the firm's operation or their role in the global value chains. Given these concerns, future research should explore a greater variety of factors that influence firm profitability, extending the analysis in the range of determinants as well as in the period (e.g. including the whole restoration period to the pre-crisis levels). Additionally, a similar analysis in large firms of another country with equally strong experience of an economic shock would reveal more the peculiarities of the production system of Greece.

As the production and financial system in Greece would gradually be improved and rationalised, future studies should shed light on those parameters that could determinedly restructure the Greek industry but also highlight in which degree the large industry has prospects to be developed in Greece or will remain limited under the persistent pattern of the domination of (micro) small-sized firms. Large manufacturing industries do not only need to survive and grow following "regularities", as this paper has shown, but also to extend looking for new competitive paths. Any enhancement at the present time would improve the initial conditions and the resilience to a future crisis, but the question is how possible is this?

Notes

1. The turnover of large firms presented a decline of 29%, of small firms 31% and of medium firms 28%. However, greater reduction of turnover in large firms was presented in the services in relation to the industrial sector (National Bank, 2018).
2. According to the official EC definition of SMEs, it takes account of three different factors (level of employment, level of turnover, and size of the balance sheet). This paper is based on the simplest definition of large enterprises that OECD also follows.
3. From which the variable of export activity is not included in the analysis due to data limitations in an annual time period.
4. The VIF test ranges from 1.01 to 1.37 across the variables (mean VIF: 1.14).
5. In the analysis alternative indices of profitability (in the place of the dependent variable of the econometric model) (Georgopoulos and Glaister, 2018) have also been used in order to be investigated the role of firm and national characteristics in firms' performance under different aspects. However, in the case the return of assets is used as a proxy of firm performance (net profits to assets ratio), only

the variable of the liabilities to assets ratio appears to have a significant (negative) role, while in the case of return on equity (net profits to equity ratio), no variable seems to play a significant role.

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