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Determinants of the Profitability of Greek Enterprises before and after the Crisis

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Abstract

This research project investigates the influence of a number of economic and financial variables on the profitability of Greek enterprises from 2006 to 2013, namely: annual revenue, exports as a binary variable, number of employees, sectoral composition, investments and founding year. Three models were tested using linear stepwise regression as well as logistic regression. The fit to the data is low, indicating that other important factors, in addition to those tested, influence the development of corporate profits more. Running the models for individual years we see that in the years 2010 and 2011 mark a shift in the direction of the relation of several of our variables to profits (such as the age of the enterprise and the number of employees). The full application of austerity policies because of the crisis may be the explanation for that, indicating that the crisis did not have a unified influence on profitability. More importantly statistically significant results are observed in relations which conflict with economic theory, namely exports are negatively correlated to profitability (Model 1) or not correlated at all (Model 2). Our models do not contribute to understanding the determinants of profitability but rather the difficulties to identify smooth profitability patterns at times of crisis and austerity. The research is still in progress as we strive to improve the explanatory power of the models, by expanding the number of variables and using additional statistical methods.

Keywords: Firm Performance, Profitability Determinants, Greek Firms.

JEL classification: L25

Introduction

This research project investigates the influence of a number of economic and financial variables on the profitability of Greek enterprises from 2006 to 2013.

The structure of the Greek production is one of the key problems of the Greek economy determining its lack of resilience to crises, the deteriorating terms of trade and persistent twin deficits. The production system is composed of 1) a disproportionately large share of companies producing non-tradable goods (i.e. low productivity in the absence of competition), 2) low value-added goods and 3) a very small share of internationally competitive high technology products and services.

Decades of Development Laws and European subsidies to upgrade the sectoral composition had limited impact. Greece is losing ground in all international rankings and ends up not only as Europe's laggard, but below many emerging economies in Asia, Latin America and even Africa. Independently of the criticism to the methodological limitations of scoring, the direction in the different scoreboards confirms the deteriorating trend in the country (see Table 1).

This decline of the business climate and the high number of bankruptcies, the declining profits and the huge unemployment reflect the deterioration of competitiveness. However, there are companies that have resisted the overall decline even after the introduction of the austerity policy

limiting national demand and most importantly the credit crunch and eventually capital controls suffocating bank credits.

Table 1: Greek performance in Global Competitiveness Index

Year	Ranking	Score
2000	34 /59	n/a
2005-2006	46 /117	4.26
2006-2007	47 /125	4.33
2007-2008	65 /131	4.08
2008-2009	67 /134	4.11
2009-2010	71 /133	4.04
2010-2011	83 /139	3.99
2011-2012	90 /142	3.92
2012-2013	96 /144	3.86
2013-2014	91 /147	3.93
2014-2015	81 /144	4.04

Source: World Economic Forum, The Global Competitiveness Report, corresponding year.

The target of the paper is to try and identify the determinants of company profitability differentiating between successful/growing businesses and worse performing ones under these generally negative enabling conditions. If these determinants are known, then policy agendas would need to shift towards companies with these characteristics in the future enabling growth, employment creation and more taxes flowing into the national budget.

Our research faced significant problems in terms of lack of data and had to limit the analyses to the companies for which data were available. There may be biases associated with this fact. At the same time the general perception that the austerity policies have increased tax evasion may also overshadow the final outcome. We consider, however, that it kick-starts a discussion on the determinants of profitability and the influence of the crisis. More research is obviously needed and efforts continue to access the necessary data to do so.

Literature review

Previous research on the determinants of profitability arrives to differentiated results depending on the country, the period, the methodology used etc.

Internationally the *size of the firm* is one of the mostly cited variables affecting (or not) profitability, yet with no overall agreement in the literature:

- Inconclusive studies: Ha-Brookshire (2009) concludes that the size of the firm is not statistically significant for profitability.
- Positive correlation: Majumdar (1997) and Stierwald (2009) find a positive correlation between size and profitability. Usually it is stated that it is easier for large firms to be profitable because they can benefit from economies of scale (Barbosa & Louri 2005; Glancey 1998; Majumdar 1997; Stierwald 2009), economies of scope (Majumdar 1997; Stierwald 2009) and from the lower cost to access capital than smaller firms (Davidson & Dutia 1991; Heshmati 2001; Holmes et al. 1994; Stierwald 2009).
- Negative correlation: The rationale of negative correlation is that as a firm expands it has to deal with increasing monitoring costs, bureaucratization, extensive hierarchies (Audretsch & Yamawaki 1992; Barbosa & Louri 2005) and mismanagement, which often lead to diseconomies of scale and impeding or decreasing profitability (Glancey 1998). Along these lines Goddard, Tavakoli and Wilson (2005) indicate

that "there is consistent evidence of a negative size-profitability relationship".

External economic conditions (as the current case in Greece) are not found to be a statistically significant variable of profitability for large firms, while for small firms there is a positive correlation (Fu, Ke & Huang 2002).

Similarly the correlation between the age of the firm and profitability is inconclusive:

- Inconclusive studies: Agiomirgianakis, Magoutas & Papadogonas (2011) find that the age of the firm is positively correlated but not statistically significant.
- Positive correlation: based on the rationale that older firms enjoy the benefits of experience, know-how, established network of relationships and reputation Glancey (1998) and Strinchcombe (1965) find a positive correlation; so do Agiomirgianakis, Magoutas & Sfakianakis (2013) in the case of Greece.
- Negative correlation: Following the logic that older firms are more bureaucratic and less flexible having difficulty adapting external changes (Agiomirgianakis, Voulgaris & Papadogonas 2006; Glancey 1998; Marshall 1920; Papadogonas, 2007) find a negative correlation.

The effect of exports on profitability is indeterminate too. Exporting firms benefit from economies of scale and are often considered as the most productive ones (Fryges & Wagner 2010; Mayer & Ottaviano 2007). Moreover, export activity is an opportunity for firms unable to compete against incumbents in closed and controlled home markets, mainly in developing countries. There exporting firms are found to be more productive in order to conquer export markets (Majumdar 1997). On the other hand, exporting companies face the extra costs of market research, transportation and adaptation of products to local regulations (Fryges & Wagner 2010), and usually higher labor costs (Schank, Schnabel & Wagner 2007). The empirical results fail to establish a statistically significant correlation between export activity and profit, yet it is argued that "exporting leads to a higher rate of profit". They find a peak of a 49% export/sales ratio, over and below which correlation to profitability is lower. Surprisingly enough they conclude that there is no statistically significant correlation between exports and profits for firms which almost only exports (Fryges and Wagner, 2010).

Other factors reported as positively correlated to profitability are market share, liquidity ratio (Goddard, Tavakoli & Wilson 2005), equity financing (Fu, Ke & Huang 2002), marketing expenditure (Agiomirgianakis, Magoutas & Sfakianakis 2014), lagged profit, productivity level, industry concentration and sector effects, which have a minor role (Stierwald 2009). In contrast, there is a negative relationship between profitability and debt financing (Fu, Ke & Huang 2002; Kester, 1986). Hansen and Wernerfelt (1989) state that "organizational factors (structure, systems, size, history) explain about twice as much variance in firm profit rates as economic factors (Industry characteristics, the firm's position relative to its competitors, the quality or quantity of the firm's resources.)"

In Greece the results are contradictory too. Table 2 presents the results of seven papers, investigate the correlation of different variables to the profitability of Greek firms. The period examined, the sample size, the methodology and the variables used differ in each research. Only two studies use a large sample (Agiomirgianakis, Voulgaris & Papadogonas 2006 and Papadogonas 2007), while the most recent ones are based on a significantly smaller number of firms. Moreover, most of the Greek

empirical findings are limited to specific sectors; only Asimakopoulos, Samitas & Papadogonas (2009) and Agiomirgianakis, Magoutas & Papadogonas (2011) use data from almost all sectors.

Despite the differences, one common conclusion is extracted in all studies; the size of the firm is positively correlated to profitability.

Age is the most controversial variable. Agiomirgianakis, Voulgaris & Papadogonas (2006) and Vlachvei, Notta & Demiri (2010) conclude that age is negatively correlated to profits, but Agiomirgianakis, Magoutas & Sfakianakis (2013) find a positive correlation, while for Agiomirgianakis, Magoutas & Papadogonas (2011) and Papadogonas (2007) age is not correlated to profitability.

Exports are negatively correlated to profitability (Agiomirgianakis, Magoutas & Papadogonas 2011; Agiomirgianakis, Voulgaris & Papadogonas 2006), but when the size of the firm is added as a variable Papadogonas (2007) concludes that the correlation is indeed negative for small firms, but not statistically significant for medium and large ones.

Similarly, sales growth is positively correlated to profitability (Agiomirgianakis, Voulgaris & Papadogonas 2006; Asimakopoulos, Samitas & Papadogonas 2009), but Papadogonas (2007) finds a positive correlation for small and medium-small firms only, not for medium-large and large ones.

Investments are positively correlated to profitability according to Agiomirgianakis, Magoutas & Papadogonas (2011) and Asimakopoulos, Samitas & Papadogonas (2009), while Papadogonas (2007) states that there is a negative correlation between investments and profitability for small firms, positive for larger ones and not statistically significant for medium-sized companies.

Table 2: Literature overview for Greek firms

	Agiomirgianakis, Voulgaris & Papadogonas (2006)	Papadogonas (2007)	Asimakopoulos, Samitas & Papadogonas (2009)	Agiomirgianakis, Magoutas & Papadogonas (2011)	Vlachvei, Notta & Demiri (2010)	Agiomirgianakis, Magoutas & Sfakianakis (2013)	Agiomirgianakis, Magoutas & Sfakianakis (2014)
	Greek manufacturing sector	Greek manufacturing sector	Greek non-financial firms listed in the Athens Stock Exchange	Random sample of Greek firms	Greek firms	Greek Hotels	Greek firms operating in the tourism sector
Period	1995-1999	1995-1999	1995-2003	2004-2006	2005-2007	2006-2010	2005-2011
Number of firms	2,772	3,035	119	287	34	134	186
Age	-	n.s.*		n.s.	-	+	
Exports	-	- for small firms /n.s. for medium and large ones		-			
Gross fixed assets growth	-						
Human capital				+			
Crisis/Interest rate spreads						-	

Industry age		- for large firms/n.s. for medium and small ones					
Investment		- for small firms/n.s. for medium firms/ + for large firms	+	+			
Leverage		-	-	-	+	-	-
Liquidity	-				n.s.		
Managerial efficiency		+					
Market share							+
Marketing expenditure							+
Net fixed assets /total assets	-						
Operation expenses					+		
Regional dummies (urban regions)				+			
Relative prices							+
Reliance on debt	-						
Sales growth	+	+ for small firms / n.s. for large ones	+				
Size	+	+	+	+	+	+	+
Total Assets turnover	+	+	-	+			

*n.s.: not statistically significant

Methodology

Data for companies included in the ICAP database (all limited liability companies publishing financial statements) were used for our investigation. The set of data was extracted from different ICAP's database versions (all available versions from 2/2014 to 11/2015) and included: Name, Tax ID, NACE code, Sales from 2003 to 2013, Profits from 2003 to 2013, Fixed Assets from 2003 to 2014, Export activity, Number of employees and Founding year. The total number of firms in the database is 47,796.

The extracted data are imperfect and deficient. Plenty of observations had missing values. In particular there was a lack of values for the Number of employees, the Founding year and the Export activity. As a result, the number of observations used significantly decreases and the final number varies between 16.251 and 25.1810 depending on the variables included in the corresponding model.

Moreover, different versions of ICAP's database provided significantly different values about Fixed Assets. In order to address this problem and

to create a database as consistent as possible, we assumed that the most recent ICAP value available was the correct one.

Our next step was to compose useful variables based on the initial data. We calculated Annual Investment Expenditures of year "x" as the difference of Fixed Assets of year "x" minus the Fixed Assets of year "x-1".

We also defined the "age" of the firms, as the difference of the current year (2015) minus the Founding year. Firms were then broken down into two categories (new and not-new). We defined as "new" every firm 5 years old or younger (first available balance sheet in 2009 or later).

Independent variables are sales, sector, export activity (binary), founding year, fixed assets and number of employees which were used as explanatory variables and profits as a measure of company performance.

We regressed sales on time from 2009 to 2013 (year multiplied by 2000) to derive sales as a function of time.

To minimize the number of variables we aggregated the NACE codes into the following 28 sectors; using the following rationale:

1. Non-tradables were excluded
2. Sectors with a very low share in the overall gross value added in the country were excluded, with the exception of sectors with high international growth rates.

As a consequence the following variables were selected and used for our analyses:

Table 3: Selected variables

Variable	Code Name	Description
Age of the enterprise	Age	2014 minus "founding year"
Annual investment expenditures	Investments	Fixed Assets of year "x+1" minus the Fixed Assets of year "x".
Annual sales	Sales	In Euro
Enterprise founded in 2008 or later	New	Binary variable
Export activity	EXPFLAG	Binary variable
Number of employees	COMPERSV	Employees (as of 2015)
Sales' growth rate	sales_growth	Sales as a function of time for years 2009-2013
Sector	28 NACE codes	28 binary variables

We defined the positive and negative outliers (>+150,000,000€ and <-150,000,000€ annual profit respectively). In our analysis, were present the results of both types for models (i.e. which either use or exclude the outliers).

Our analysis is differentiated compared to earlier literature on Greece because of the significantly larger number of firms and presents the results of each model in an annual base in order to investigate potential changes of trends in selected years.

Analysis

Stepwise Linear Regression and Logistic Regression were used to investigate the relation between the characteristics of Greek enterprises to profitability. Three models gave statistically significant results worth reporting and pursuing further:

Model 1: Stepwise regression, five basic explanatory variables including outliers, 2011-2013

Method:	Stepwise Regression
Dependent Variable:	Profit
Independent Variables:	Age of the enterprise Annual sales Export activity Number of employees Sales' growth rate
Years:	Separately for each year 2011, 2012, 2013
Outliers:	Included

According to Model 1 the following conclusions are drawn:

- "Export activity" is negatively correlated to profitability. This is a result, which needs further investigation.
- "Sales' growth" is negatively correlated to profitability too.
- "Age" is positively correlated to profitability.
- "Annual sales" are positively correlated to profitability, but according to the Model about the profit of 2013, the correlation is not statistically significant.
- The model's R^2 is low, indicating inadequate model fit, i.e. other variables not included in the model are expected to have better explanatory power.

Model 2: Stepwise regression, seven variables excluding outliers, 2006-2013

More variables were added in order to improve the statistical fit of the model. Thus, in Model 2 we added two new variables "Annual investment" and sector (in the form of 28 binary variables) and excluded the outliers.

Method:	Stepwise Regression
Dependent Variable:	Profit
Independent Variables:	Annual investment expenditures Age of the enterprise Annual sales Export activity Number of employees Sales' growth rate Sector
Years:	2006-2013
Outliers:	Excluded

According to Model 2 the following conclusions are drawn:

- "Number of employees", "sales" and "sales' growth" are highly positively correlated to profitability.

- "Enterprise age" correlation to profitability changed from positive before, to negative, after the crisis. This may imply more dynamism of younger firms.
- "Annual investment expenditures" demonstrate an "erratic" behavior: they oscillate between positive and negative correlation (positive before the crisis and in the middle of the crisis years, and negative at the beginning of the crisis and during the last year examined, 2013). Investment may be externally determined by the cycle of EU Structural funds and bank liquidity.
- After the crisis "export activity" was uncorrelated to profitability.
- "Manufacture of tobacco products" and "Manufacture of basic pharmaceutical products and pharmaceutical preparations" are positively related to profitability.
- "Manufacture of other non-metallic mineral products and basic metals", "Financial and insurance activities" and "other" sectors' correlation to profitability changed from positive before, to negative, after the crisis.
- "Information and communication", "tourism" and "oil" sectors are negatively correlated to profitability both before and after the crisis.
- "Constructions" had no statistically significant correlation to profitability before the crisis. After the crisis the correlation became negative.

Even though the second model includes more variables -without excluding the variables used in the first one- and excludes the outliers, its data fit is lower.

Model 3: Logistic regression, seven variables, outliers included, 2006-2013

Since the results were not adequate, one more method was tested. We used logistic regression in order to determine the variables contributing to the probability of profitability, using the same variables as with Model 2.

According to Model 3 the following conclusions can be extracted:

- The "number of employees" and "export activity" are positively correlated to the probability of profitability.
- "Engineering" and "R&D" sectors are positively correlated to the probability of profitability.
- "Manufacture of other non-metallic mineral products and basic metals", "financial and insurance activities", "other", "manufacture of beverages", "manufacture of fabricated metal products, except machinery and equipment", "accommodation and food service activities", "manufacture of textiles and wearing apparel, except fur apparel", "construction", "agriculture, forestry and fishing" and "manufacture of furniture sectors" are negatively correlated to the probability of profitability.
- The correlation of "Enterprise's age" to profitability changed from positive before to negative, after crisis.
- "Sales' growth" and "transporting and storage activities" correlation to profitability changed from negative to positive after crisis.
- "Annual investment expenditures", "sales" and "manufacture of coke and refined petroleum products" variables do not show any systematic correlation to profitability. However, "sales" is a variable highly positively related to profit in both the other two models. The investment results are highly controversial and need further investigation, as pointed out in Model 2.

The third model's data fit is not sufficiently satisfactory either.

Comparing the results of the three Models

Comparing the results of the three models there are significant differences between Model 1 and the two other models, but in both Model 2 and Model 3 the majority of findings is consistent. The following conclusions can be drawn by the variables in each model.

Age of the enterprise: according to Model 2 and Model 3 age is positively and significantly correlated to profits before the crisis, but during the first years of the crisis this correlation is not statistically significant, ending up as negative during the last years (2011-2013 in Model 2 and 2013 in Model 3). Conversely, in Model 1 age is significantly positively correlated to profit for the years 2011-2013. An explanation to these opposing conclusions could be the influence of the outliers, which are included in Model 1, but excluded in Model 2 and irrelevant in Model 3 (since it is the probability of profit and not its size that matters). Probably there are market-leading companies active for many years with high profits, which positively affect the results of Model 1. Oil products may also influence the model because of their high share in overall sales.

Number of employees (size): there is a general positive correlation between the number of employees and profit in all three models. There is a negative correlation only in Model 2 for 2012 (the correlation is negative for 2011 too, but its statistical significance is borderline). So, we can classify "Number of employees" as a positive influence on profit.

Export activity: the association between export activity and profit after the crisis is inconclusive. While exports' correlation to profit was positive in the years before the crisis (2006-2009) in all three Models, after the crisis (2009-2013) this relation changes; in Model 2 to not statistically significant (only for 2012 there is a negative correlation) and in Model 3 to negative for 2010 to become positive again the next year, and all years after 2011. Nevertheless, according to Model 1 there is a steady negative correlation between export activity and profit. The conclusions of Model 1 and Model 3 are conflicting. A possible explanation could again be the outliers group. Probably, in this group there are companies, which invested heavily in their export activity, but the time required for the return on investment is greater than the examined period.

Annual sales: sales are positively correlated to profit in Model 1 and Model 2 for years 2012 and 2013, but at the same time negatively in Model 3 for 2013 and not statistically significant for 2012. All models conclude that sales were not statistically significant for the profit of year 2011. For years from 2006-2010 the correlation was mainly positive in Model 2 and not statistically significant for Model 3. The general trend seems to be a positive correlation, but this association is weak. A possible explanation may be an aggressive pricing strategy, which is followed by some companies under certain circumstances.

Sales' growth rate: Using the 2009-2013 Annual Growth Rate for sales the tests indicate positive and significant correlation to profitability in Model 2 and Model 3 during the crisis. However, as the independent variable is arbitrarily composed to reflect the resistance to the crisis its results can be an input to further analysis.

Annual investment expenditures: investments' correlation to profit varies through the years from negative to positive and not statistically significant in both Models 2 and 3, and is not significant in Model 1. However, the former two models present consistent results for three years, and even a different kind of correlation in each year (in 2009 the

correlation is negative, in 2011 the variable is not statistically significant and in 2012 investments are positively correlated to profit), but in 2010 the results are opposite and for all other years the variable is not statistically significant only in Model 3. Providing that the correlation of the variable to profit is not clear even before crisis, since the results of the two models are different and the correlation changes through the years in Model 2, there is not a definite conclusion about the correlation between annual investment expenditures and profit.

Sectors: Comparing the results about sectors' relation to profitability in Model 2 to those in Model 3, we conclude that the trends are mainly consistent. Nevertheless, there are some significant differences, such as in the "manufacture of tobacco products" sector, which has a (statistically significant) positive correlation to profitability in Model 2 for all years examined, but is not statistically significant in Model 3. On the other hand, the "manufacture of furniture" and "research and development" sectors have a (statistically significant) correlation to profitability (negative and positive respectively) in Model 3, but are not statistically significant in Model 2.

An interesting result is that in 2010 and 2011 the relation of several variables (Age of the enterprise, number of employees, export activity, annual investment expenditure) to profit changes, possibly because of the crisis.

Conclusion and Future Steps

We have used statistical analyses to investigate the determinants of profitability of Greek companies in the period 2006-2013. We see the merit of our approach

- in the use of a comparatively very large sample of Greek companies compared to earlier literature
- a systematic statistical modeling of the relations, of which we selected the three with the best fit for reporting
- running the models for each year separately to see potential shifts of the direction of correlation before and after the crisis.

Unfortunately all three models have limited explanatory power, but we can still formulate conclusions based on the case where there is a relatively high congruence in the results of the three models or we see interesting or even counterintuitive results, or results diverging from earlier Greek studies. Model 1 is diverging from the other two more than Models 2 and 3, which are fairly consistent. The sectoral variables prove in most cases less relevant than the others.

The following conclusions are then formulated with potential interpretations. It goes without saying that the low fit of the models lead us to formulate these conclusions as hypotheses for further research rather than deterministic relationships:

Age is significantly correlated to profitability in models 2 and 3 before the crisis and negatively after. Model 1, which we ran only for the last three years has the reverse sign indicating that the change from positive to negative. The explanation for this reverse trend can be that on the average old companies are more complacent relying on their market but when conditions deteriorate younger firms have been more dynamic and adaptable to the crisis. This can be formulated as an intriguing hypothesis for further research.

Using employment as a proxy for size we see a much higher agreement among the three models with positive and significant correlation in all models for most years with the exception of two years (2011 and 2012) in Model 2, where the relation turns negative. The results of rather high positive correlation are in agreement with the rationale of economies rather than diseconomies of scale, because what we see as large companies in Greece are actually medium sized; only 470 firms have more than 250 employees. The two negative years can be interpreted as a result of labour market rigidities, as large companies are not allowed to massive layoffs.

Exports are positively correlated in Model 3 indicating a high probability of export and profitability correlation; this is complying with the international literature but against earlier findings in Greek studies and our Model 1. The negative correlation after the crisis (Model 1) may be attributed to the problems of funding Greek exports after the credit crunch.

Sales and sales growth are controversial. While in most cases of statistical significance they are positively correlated, there are too many years lacking statistical significance, hence the variable size is limited to employment and not sales.

Similarly, only few sectors have a very clear correlation trend: textiles have a negative correlation to profitability, because of the high labour cost and competition from low cost countries and neighbouring Bulgaria (where Greek companies often relocate) as well as construction, which was severely hit by the crisis with demand for new houses plummeting. Conversely oil refining has always been positively correlated to profitability and continued after the outbreak of the crisis thanks to the oligopolistic structure of the market and captive export markets.

Our future steps will be directed toward adding new variables (the amount of subsidies to the enterprises, exports value, corporate social responsibility activity and variables suggested by the previous research, such as marketing expenditures, leverage and liquidity) and using of alternative techniques. A major difficulty is the limited availability and even the non-existence of relevant data.

References

- Agiomirgianakis, G.M., Voulgaris, F. & Papadogonas, T., 2006. Financial factors affecting profitability and employment growth: the case of Greek manufacturing. *International Journal of Financial Services Management*, 1(2/3), p.232. Available at: <http://www.inderscience.com/link.php?id=9628> [Accessed May 31, 2016].
- Agiomirgianakis, G.M., Magoutas, A.I. & Papadogonas, T., 2011. Education and firm performance. Empirical evidence from Greece. *International Journal of Economic Research*, 8(2), pp.141-152.
- Agiomirgianakis, G.M., Magoutas, A.I. & Sfakianakis, G., 2013. Determinants of profitability in the Greek tourism sector revisited: The impact of the economic crisis. *Journal of Tourism and Hospitality Management*, 1(1), pp.12-17.
- Agiomirgianakis, G.M. & Sfakianakis, G., 2014. Short-term Microeconomic Reactions to International Crisis: The Role of Marketing Expenditure in the Profitability of Greek Tourism Enterprises. *The Empirical Economics Letters*, 13, pp.887-894.
- Asimakopoulous, I., Samitas, A. & Papadogonas, T., 2009. Firm-specific and economy wide determinants of firm profitability G. P. Artikis, ed. *Managerial Finance*, 35(11), pp.930-939. Available at:

- <http://www.emeraldinsight.com/doi/abs/10.1108/03074350910993818>
[Accessed May 31, 2016].
- Audretsch, D.B., Santarelli, E. & Vivarelli, M., 1999. Start-up size and industrial dynamics: some evidence from Italian manufacturing. *International Journal of Industrial Organization*, 17(7), pp.965-983.
- Audretsch, D.B. & Yamawaki, H., 1992. *Sub-optimal scale plants and compensating factor differentials in US and Japanese manufacturing*, Springer.
- Barbosa, N. & Louri, H., 2005. Corporate performance: does ownership matter? A comparison of foreign-and domestic-owned firms in Greece and Portugal. *Review of Industrial Organization*, 27(1), pp.73-102.
- Cefis, E., Ciccarelli, M. & Orsenigo, L., 2007. Testing Gibrat's legacy: A Bayesian approach to study the growth of firms. *Structural Change and Economic Dynamics*, 18(3), pp.348-369. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S0954349X07000276> [Accessed May 31, 2016].
- Davidson, W.N. & Dutia, D., 1991. Debt, liquidity, and profitability problems in small firms. *Entrepreneurship Theory and Practice*, 16(1), pp.53-64.
- Fryges, H. & Wagner, J., 2010. Exports and Profitability: First Evidence for German Manufacturing Firms. *World Economy*, 33(3), pp.399-423. Available at: <http://doi.wiley.com/10.1111/j.1467-9701.2010.01261.x> [Accessed May 31, 2016].
- Fu, T.-W., Ke, M.-C. & Huang, Y.-S., 2002. Capital growth, financing source and profitability of small businesses: evidence from Taiwan small enterprises. *Small Business Economics*, 18(4), pp.257-267.
- Gibrat, R., 1931. *Les inégalités économiques*, Recueil Sirey.
- Glancey, K., 1998. Determinants of growth and profitability in small entrepreneurial firms. *International Journal of Entrepreneurial Behavior & Research*, 4(1), pp.18-27.
- Goddard, J., Tavakoli, M. & Wilson, J.O.S., 2005. Determinants of profitability in European manufacturing and services: evidence from a dynamic panel model. *Applied Financial Economics*, 15(18), pp.1269-1282. Available at: <http://www.tandfonline.com/doi/abs/10.1080/09603100500387139> [Accessed May 31, 2016].
- Ha-Brookshire, J.E., 2009. Does the firm size matter on firm entrepreneurship and performance? *Journal of Small Business and Enterprise Development*, 16(1), pp.132-146. Available at: <http://www.emeraldinsight.com/doi/abs/10.1108/14626000910932926> [Accessed May 31, 2016].
- Hall, B.H., 1987. The relationship between firm size and firm growth in the US manufacturing sector. *Journal of Industrial Economics*, 35, pp.583-606.
- Hansen, G.S. & Wernerfelt, B., 1989. Determinants of firm performance: The relative importance of economic and organizational factors. *Strategic management journal*, 10(5), pp.399-411.
- Hart, P.E. & Oulton, N., 1996. Growth and size of firms. *The Economic Journal*, pp.1242-1252.
- Heshmati, A., 2001. On the growth of micro and small firms: evidence from Sweden. *Small business economics*, 17(3), pp.213-228.
- Holmes, S., Dunstan, K. & Dwyer, D., 1994. The cost of debt for small firms: Evidence from Australia. *Journal of Small Business Management*, 32(1), p.27.
- Jovanovic, B., 1982. Selection and the Evolution of Industry. *Econometrica: Journal of the Econometric Society*, pp.649-670.
- Kester, W.C., 1986. Capital and Ownership Structure: A Comparison of United States and Japanese Manufacturing Corporations. *Financial Management*, 15(1), pp.5-16. Available at: <http://www.jstor.org/stable/3665273>.

- Majumdar, S.K., 1997. The impact of size and age on firm-level performance: some evidence from India. *Review of industrial organization*, 12(2), pp.231-241.
- Mansfield, E., 1962. Entry, Gibrat's law, innovation, and the growth of firms. *The American Economic Review*, 52(5), pp.1023-1051.
- Marshall, A., 1920. Principles of economics, (London, McMillan).
- Mata, J., 1994. Firm growth during infancy. *Small Business Economics*, 6(1), pp.27-39.
- Mayer, T., Ottaviano, G.I.P. & others, 2007. *The happy few: the internationalisation of European firms*, Bruegel Brussels.
- Nassar, I. a., Almsafir, M.K. & Al-Mahrouq, M.H., 2014. The Validity of Gibrat's Law in Developed and Developing Countries (2008-2013): Comparison based Assessment. *Procedia - Social and Behavioral Sciences*, 129, pp.266-273. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S1877042814028584> [Accessed May 31, 2016].
- Papadogonas, T.A., 2006. The financial performance of large and small firms: evidence from Greece. *International Journal of Financial Services Management*, 2(1-2), pp.14-20.
- Du Reitz, G., 1975. New firm entry in Swedish manufacturing industries during the post-war period. *Doctoral Dissertation, Stockholm*.
- Schank, T., Schnabel, C. & Wagner, J., 2007. Do exporters really pay higher wages? First evidence from German linked employer-employee data. *Journal of International Economics*, 72(1), pp.52-74.
- Singh, A. & Whittington, G., 1975. The size and growth of firms. *The Review of Economic Studies*, 42(1), pp.15-26.
- Stierwald, A., 2009. Determinants of Firm Profitability-The Effect of Productivity and its Persistence. *Melbourne Institute of Applied Economic and Social Research*.
- Stinchcombe, A. L.. (1965). Social Structure and Organizations. In: March, J. G. *Handbook of Organizations*. Chicago: Rand McNally. 229-259.
- Vlachvei, A., Notta, O. & Demiri, S., 2010. Competitive Strategies and Business Performance: Evidence from Greek Fur Industry. In *Proceedings of the International Conference on Applied EconomicsICOAE*. pp. 821-826.

Appendices

Appendix 1: Sectors

Description	Variable Name
Agriculture, forestry and fishing	Agri
Manufacture of beverages	beverage
Manufacture of other non-metallic mineral products and basic metals	bmetals
Manufacture of chemicals and chemical products	chemicals
Manufacture of computer, electronic and optical products	computer
Construction	Construction
Manufacture of electrical equipment	electric
Architectural and engineering activities and related technical consultancy	Engineering
Financial and insurance activities	finance
Manufacture of fabricated metal products, except machinery and equipment	fmetals
Manufacture of food products	Food
Manufacture of furniture	furniture
Information and communication	Itc
Manufacture of articles of fur, leather and related products	leather

Manufacture of machinery and equipment n.e.c.	machine
Mining and quarrying	mining
Other	other
Manufacture of paper and paper products	paper
Manufacture of coke and refined petroleum products	oil
Manufacture of basic pharmaceutical products and pharmaceutical preparations	pharma
Printing and reproduction of recorded media	printing
Research and development	r and d
Manufacture of textiles and wearing apparel, except fur apparel	textiles
Manufacture of tobacco products	tobacco
Accommodation and food service activities	tourism
Transporting and storage	transport
Manufacture of motor vehicles, trailers and semi-trailers and other transport equipment	vehicles
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Wood

Appendix 2: Model 1 output

Model 1: profit 2011

Number of Observations Used : 22,615
Observations not used: 25,181

Variable	Parameter Estimate	Standard Error	Type II SS	F values	p-value
Intercept	-4,663,218	715,343	1.42103×10^{17}	42.50	<0.0001
COMPERSV	88,682	1,644.88665	9.719917×10^{18}	2,906.72	<0.0001
EXPFLAG	-3,838,455	891,103	6.204648×10^{16}	18.55	<0.0001
sales growth	-1,552.82493	70.83831	1.606825×10^{18}	480.52	<0.0001
Sales	0.06803	0.00443	7.876563×10^{17}	235.55	<0.0001
Age	118,079	28,282	5.828699×10^{16}	17.43	<0.0001

Model $R^2 = 0.1929$

Model 1: profit 2012

Number of Observations Used : 22,615
Observations not used: 25,181

Variable	Parameter Estimate	Standard Error	Type II SS	F values	p-value
Intercept	-5,511,068	735,068	1.984714×10^{17}	56.21	<0.0001
COMPERSV	98,122	1,706.53025	1.167319×10^{19}	3,306.04	<0.0001
EXPFLAG	-4,150,058	915,628	7.253557×10^{16}	20.54	<0.0001
sales growth	-1,788.16121	78.17556	1.847364×10^{18}	523.20	<0.0001
Sales	0.06526	0.00456	7.22508×10^{17}	204.63	<0.0001
Age	148,768	29,060	9.253325×10^{16}	26.21	<0.0001

Model $R^2 = 0.2120$

Model 1: profit 2013

Number of Observations Used : 22,615
Observations not used: 25,181

Variable	Parameter Estimate	Standard Error	Type II SS	F values	p-value
Intercept	-5,253,058	676,251	1.805091×10^{17}	60.34	<0.0001
COMPERSV	101,075	1,388.50660	1.5852×10^{19}	5,299.00	<0.0001
EXPFLAG	-3,651,170	842,626	5.616738×10^{16}	18.78	<0.0001
sales growth	-1,262.88255	60.17584	1.317564×10^{18}	440.43	<0.0001
Age	154,691	26,718	1.002795×10^{17}	33.52	<0.0001

Model $R^2 = 0.2107$

Appendix 3: Model 2 output

	2006		2007		2008		2009		2010		2011		2012		2013	
N	16,251		16,610		17,828		18,712		19,900		21,099		23,404		22,859	
Model R ²	0.2369		0.2348		0.0751		0.1120		0.1192		0.0229		0.1613		0.0775	
	beta	p-value	beta	p-value	beta	p-value	beta	p-value	beta	p-value	beta	p-value	beta	p-value	beta	p-value
Intercept	-127,585	0.049	-164,851	0.009	26,173	0.772	-35,145	0.544	-110	0.997	22,413	0.695	146,127	0.013	203,945	0.000
COMPPERSV	1,040	0.000	1,538	0.000	3,407	0.000	1,485	0.000	889	0.000	-872	0.000	-781	0.000	912	0.000
EXPFLAG	163,124	0.012	171,037	0.007	163,608	0.070							-124,332	0.058		
sales growth	-137	0.000	-83	0.000			85	0.000	198	0.000	218	0.000	161	0.000	64	0.000
Sales	0,0022	0,000	0,0065	0,000	0,0010	0,061	0,0021	0,000	0,0146	0,000	-0,0042	0,000	0,0267	0,000	0,0337	0,000
Invest- ments	0,1344	0,000	0,0144	0,000			-0,0554	0,000	-0,0091	0,000	0,0233	0,000	0,0043	0,060	-0,0505	0,000
Age	4,432	0.032	7,971	0.000	10,797	0.000	5,555	0.004			-3,340	0.116	-6,082	0.001	-7,941	0.000
Agri					-660,266	0.034									-902,462	0.000
Minining	2,280,496	0.000							-489,425	0.138						
Beverage	510,329	0.096	509,576	0.095			436,235	0.140							-865,636	0.004
tobacco	5,569,430	0.000	7,445,750	0.000	9,208,906	0.000	9,692,321	0.000	1,177,951	0.144	2,665,665	0.015			4,903,648	0.000
textiles			-345,837	0.109	-678,235	0.019	-433,430	0.044								
oil					-4,145,075	0.000							-1,136,924	0.121	-1,194,182	0.122
pharma	1,420,956	0.004	2,152,232	0.000	2,200,544	0.001	2,361,335	0.000			1,203,764	0.029	1,332,103	0.006	1,291,414	0.007
bmetals	418,580	0.022	343,777	0.058			-382,559	0.034			-511,132	0.013	-1,200,522	0.000	-927,957	0.000
fmetals									337,617	0.036	781,169	0.000				
computer	-2,076,380	0.000											-2,058,804	0.000	-1,246,258	0.012
vehicles													-1,113,644	0.024		
Constru- ction					-229,874	0.128							-264,765	0.012	-343,928	0.001
transport	389,879	0.015	534,265	0.001											248,483	0.084
tourism					-414,381	0.000	-218,271	0.006	-159,166	0.015			-163,904	0.054		
itc					-442,561	0.018	-238,603	0.080	-382,026	0.001	-467,964	0.002	-555,702	0.000	-350,126	0.006
finance	1,493,024	0.000	1,282,871	0.000	-394,908	0.077					-885,443	0.000	-808,999	0.000	-849,562	0.000
other	166,791	0.036	222,055	0.004	-240,773	0.027	-118,508	0.112					-205,763	0.006	-181,945	0.010
wood															-611,798	0.145

Appendix 4: Model 3 output

	2006		2007		2008		2009		2010		2011		2012		2013	
N	16,287		16,947		17,861		18,747		19,935		21,136		23,439		22,901	
	Beta	Pvalue	beta	Pvalue	beta	Pvalue	beta	Pvalue	beta	Pvalue	beta	Pvalue	Beta	Pvalue	beta	Pvalue
COMPERSV							0.0003	0.0033	0.0002	0.0028			0.0002	0.0019	0.0003	0.0010
EXPFLAG	0.3334	<.0001	0.3443	<.0001	0.3136	<.0001	0.2758	<.0001	-0.2321	<.0001	0.2369	<.0001	0.2463	<.0001	0.2677	<.0001
sales_growth			0.0000	<.0001	0.0000	0.0103							0.0000	0.0009	0.0000	0.0340
Sales			0.0000	<.0001											0.0000	0.0034
Investments							0.0000	0.0003	0.2913	0.0451			0.0000	0.0113		
Age	0.0098	<.0001	0.0075	<.0001	0.0042	0.0015									-0.0024	0.0162
Agri			-0.7434	<.0001	-0.6796	<.0001	-0.3421	<.0001	0.2617	0.0182			-0.1229	0.0370	-0.1939	0.0012
Beverage			-0.4402	<.0001	-0.3919	<.0001	-0.3300	0.0001	0.0000	0.0264	-0.2423	0.0022	-0.2313	0.0028	-0.2051	0.0094
Bmetals			-0.2693	<.0001	-0.3086	<.0001	-0.2553	<.0001	-0.1489	<.0001	-0.4483	<.0001	-0.4884	<.0001	-0.4320	<.0001
Chemicals			-0.2237	0.0361												
Computer													0.2989	0.0461		
Construction	- 0.1989	<.0001	-0.2806	<.0001	-0.1971	<.0001	-0.1069	0.0010			-0.0679	0.0141			-0.0814	0.0028
Electric									-0.1811	0.0105						
Engineering							0.2318	0.0012	-0.1879	<.0001	0.3146	<.0001	0.4217	<.0001	0.2576	<.0001
Finance	- 0.2657	<.0001	-0.5119	<.0001	-0.7087	<.0001	-0.4210	<.0001	0.9773	<.0001	-0.5535	<.0001	-0.4283	<.0001	-0.4237	<.0001
Fmetals											-0.1842	0.0003	-0.2310	<.0001	-0.3069	<.0001
Food			-0.3856	<.0001	-0.2751	<.0001										
Furniture							-0.2296	0.0147	-0.2735	0.0393	-0.4318	<.0001	-0.5704	<.0001	-0.4916	<.0001
Itc			-0.1363	0.0084									0.1314	<.0001		
Leather															0.2958	0.0379
machine							0.4771	0.0002								
other	- 0.2539	<.0001	-0.3372	<.0001	-0.3233	<.0001	-0.1687	<.0001					0.1061	<.0001		
paper					-0.2280	0.0475							0.1891	0.0345		
oil							0.9229	<.0001	-0.1815	<.0001	0.5426	0.0224			0.8133	0.0046
pharma			-0.6202	0.0001												
printing															0.2200	0.0124
r_and_d			4.1697	<.0001	3.2560	<.0001					1.6332	<.0001	1.8406	<.0001	1.0135	0.0020
textiles			-0.2866	0.0003	-0.3658	<.0001	-0.2103	0.0013	-0.4809	0.0018	-0.1585	0.0070	-0.1739	0.0020	-0.2075	0.0003
tourism	- 0.6061	<.0001	-0.6969	<.0001	-0.7471	<.0001	-0.5740	<.0001	-0.4916	<.0001	-0.2622	<.0001	-0.3554	<.0001	-0.1039	<.0001

Transport			-0.2455	<.0001	-0.1867	0.0002	-0.1505	0.0009			0.0894	0.0267	0.0808	0.0336		
Vehicles			-0.5834	0.0001	-0.3680	0.0168										
Wood									0.2941	0.0321	-0.5298	<.0001	-0.6404	<.0001	-0.7095	<.0001

Appendix 5: Models' comparison

		2006	2007	2008	2009	2010	2011	2012	2013
Age	Model 1	n/a	n/a	n/a	n/a	n/a	+	+	+
	Model 2	+	+	+	+		-	-	-
	Model 3	+	+	+					-
COMPPERSV	Model 1	n/a	n/a	n/a	n/a	n/a	+	+	+
	Model 2	+	+	+	+	+	-	-	+
	Model 3				+	+		+	+
EXPFLAG	Model 1	n/a	n/a	n/a	n/a	n/a	-	-	-
	Model 2	+	+	+				-	
	Model 3	+	+	+	+	-	+	+	+
Sales	Model 1	n/a	n/a	n/a	n/a	n/a		+	+
	Model 2	+	+	-	+	+	+	+	+
	Model 3		+						-
Sales_growth	Model 1	n/a	n/a	n/a	n/a	n/a	-	-	-
	Model 2	-	-		+	+	+	+	+
	Model 3		-	-				+	+
Investments	Model 2	-	+	+	-	-		+	+
	Model 3				-	+		+	
Agri	Model 2			-					-
	Model 3		-	-	-	+		-	-
Beverage	Model 2	+	+		+				-
	Model 3		-	-	-	-	-	-	-
Bmetals	Model 2	+	+		-		-	-	-
	Model 3		-	-	-	-	-	-	-
Computer	Model 2	-						-	-
	Model 3							+	
Construction	Model 2			-				-	-
	Model 3	-	-	-	-		-		-
Finance	Model 2	+	+	-			-	-	-
	Model 3	-	-	-	-	+	-	-	-
Fmetals	Model 2					+	+		
	Model 3						-	-	-
Itc	Model 2			-	-	-	-	-	-

	Model 3		-					+	
Other	Model 2	+	+	-	-			-	-
	Model 3	-	-	-	-			+	
Oil	Model 2			-				-	-
	Model 3				+	-	+		+
Pharma	Model 2	+	+	+	+		+	+	+
	Model 3		-						
Textiles	Model 2		-	-	-				
	Model 3		-	-	-	-	-	-	-
Tourism	Model 2			-	-	-		-	
	Model 3	-	-	-	-	-	-	-	-
Transport	Model 2	+	+						+
	Model 3		-	-	-		+	+	