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Does regulation affect market power? Evidence from Greek SMEs

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Abstract

The aim of this study is to examine the level of market power of the Greek Small and Medium-sized Enterprises (SMEs) acting in the manufacturing and services industries respectively. This has been performed at a two digit level over the period 1970-2007, with the aim of investigating possible heterogeneity across different subsectors of the above industries. The results of our analysis are linked with a number of interesting implications for the competition authorities. First, mark-ups can provide valuable information on competitive pressures in various sectors of the Greek economy, reflecting pressures stemming from rules of conduct imposed by regulators as well. Second, the estimation of mark-up ratios may benefit policy makers and government officials to pursue pro-competitive regulatory reforms in order to maximize consumer surplus. Third, the regulators may examine if market power changes over time and assess the effectiveness of deregulation on it. Lastly, the empirical findings indicate that there is a negative relationship between mark-ups and regulation taken one-period back. In other words, we claim that the level of regulatory reform affect the level of market power one-period ahead and cannot explain a big part of the variation of the mark-up ratios, over time. However, there is no evidence of non-linearity into this relationship.

Keywords: SMEs; Regulation; Mark up; Competition; Greece.
JEL classification: L13, C5, C13

1. Introduction

The estimation of price-cost margins falls traditionally within the industrial organization domain. It is often linked with the Lerner index of market power and it is used for determining the limits of market power abuse. There are of course many ways to estimate mark ups and any choice between them is likely to involve trade offs (Tybout, 2003). The industrial economic approach is based on detailed product level information on own price elasticities, market shares, cross price elasticities, etc. Prior to this, careful assessment of markets and their boundaries has to be made. Clearly, such a detailed knowledge of market characteristics is not available at the macroeconomic level. By-passing these problems, Hall (1988) pioneered the use of production data for recovering price-costs mark ups. With good

firm level data becoming more available nowadays, this production approach for estimating mark ups has recently become popular among academics and practitioners (De Loecker, 2011).

In principle, there are two different methodological approaches to assess the level of market power. The first is a reduced form method proposed by Roeger (1995), which estimates the average Lerner index (L) and the mark up ratio by relaxing the assumption of perfect competition. The second approach estimates the supply and demand relationships, and it is accomplished with input demand functions (Bresnahan, 1982). This approach aims at estimating marginal cost and, in addition to Lerner index, it incorporates the elasticity of demand as structural parameters. The index ranges from zero to one, with higher numbers implying greater market power. For a perfectly competitive firm (where P=MC), the Lerner index equals zero (L=0). Alternatively, the Lerner index describes the relationship between the above elasticity and price margins for a profit-maximizing firm. If the Lerner index cannot be greater than one, then the elasticity can never be greater than minus one.

Despite the profound academic interest on this topic, there are only a few studies which examine this relationship for less developed European countries like Greece, which is characterized by a small industrial sector and thus the level of competiveness is expected to be lower than that of other European economies with larger market size (see for example Rezitis and Kalantzi, 2013; Polemis, 2014; Polemis and Fotis, 2016).[1]

Most of these studies consent that mark up ratios exceed unity, denoting the absence of competitive conditions in certain sectors/industries (see for example Martins et al, 1996; Christopoulou and Vermeulen, 2012; Borg, 2009; Molnar, 2010; Molnar and Bottini, 2010). This finding constitutes a major hypothesis which is tested by using different econometric techniques, such as panel data methods (i.e fixed, random effects) or cross-section analysis, in order to assess the level of competitive conditions in an industry. Our survey indicates that there is lack of studies estimating the mark-up level of the Greek manufacturing and services industries. More specifically, the only recent studies which solely investigate the market structure of the Greek economy at the two-digit SIC level are those undertaken by Rezitis and Kalantzi (2011, 2012a, 2012b, 2013), and Polemis (2014). These studies consent that there is significant market power in some of the manufacturing and services industries. Moreover, Polemis (2014) provides evidence of heterogeneity at the estimated mark-up ratios across sectors, with manufacturing having higher mark ups on average than services.

However the existing studies, fail to investigate the competitive conditions in the SMEs. This study aims to cover this gap in the empirical literature. Furthermore, we use an array of econometric techniques (OLS, 2SLS and bootstrap method) to test the robustness of the results.[2] Our methodology might be of use by other studies to evaluate the degree of competition in certain manufacturing and services sectors. To our knowledge, there exists no

[1] Even fewer studies have also tried to capture the impact of the recent financial crisis on some of the EU countries. A recent study of Psillaki and Eleftheriou (2015) examines this link by measuring the impact of the global financial crisis on the allocation of credit to French SMEs. For a thorough survey of the literature see Polemis and Fotis (2016).

[2] Bootstrap method involves estimating a model many times using simulated data. Quantities computed from the simulated data are then used to make inferences from the actual data. The implementation of the bootstrap method is used for inference since it provides more precise estimates of standard errors (Polemis and Fotis, 2016).

study on this issue targeted at the Greek SMEs and the variation of the mark-ups over time. Our study aims to cover this lacuna. Moreover, investigating this relationship for the Greek industry will be interesting on many fronts such as quantifying and measuring inter alia the level of competitive constraints in an industry/sector. In addition to this, it offers valuable comparisons between Greece and Europe (European Union) on the level of competiveness and it examines if deregulation policies adopted have significantly affected this level.

Using mark-ups as a measure of competiveness of the Greek SMEs are useful for the following reasons. First, mark-ups can provide valuable information on competitive pressures in various sectors of the Greek economy, reflecting pressures stemming from rules of conduct imposed by regulators as well as those arising from such factors as increasing consumer demands in terms of price and quality. Moreover, the estimation of mark-up ratios in manufacturing and services industry may benefit policy makers and government officials to pursue pro-competitive regulatory reforms in order to maximize consumer surplus. Second, mark-ups provide an interesting tool to measure the magnitude of market power which can be considered as large for the Greek economy and thus, have some effects on the Greek industrial production, as well as their degree of persistency. The latter may be associated with the duration of the business cycles or inflationary pressures of the Greek economy. Third, based on estimates of mark-ups one can easily examine if market power changes over time, or not, and can assess the effectiveness of deregulation or competition policies on it, and/or any other structural changes of the Greek economy.

The results of our analysis can be proved very useful to achieve structural micro-economic goals in light of the on-going financial crisis. Firstly, given the primarily indications regarding the high mark ups for services, a suitable ex ante policy is linked with a thorough investigation of mergers and acquisitions. Secondly, in order to enhance the level of internationalisation in manufacturing, the government could pursue horizontal strategies focusing on the further opening of the markets. Since the vast majority of the manufacturing firms in Greece are SMEs, the governments must improve the access of micro and small SMEs to existing financial support mechanisms and to relevant information sources. Moreover, estimating the degree of competition in an industry/sector is crucial for regulatory and competition authorities as well as the policy-makers. Regulators would like to know whether current regulation is conducive to competition. Likewise, competition authorities might gauge the current competitive situation in a sector (Christopoulou and Vermeulen, 2012).

As a consequence, boosting competition in the markets for goods and services is a growing economic policy concern, as evidenced by the policies employed by the European Commission (EU) and the OECD. Especially for Greece, the OECD has launched an extensive investigation report aiming at lifting regulatory restrictions that impede the level of effective competition in certain manufacturing sectors (food processing, retail trade, building materials and tourism sectors). This report identified 555 problematic regulations making more than 320 recommendations on legal provisions that should be amended or repealed (OECD, 2013). On the other hand, the European Commission, has recently announced its intention to amend the competition law legislation by fine tuning certain regulatory measures (i.e EC merger regulation, leniency program, application of State aid rules, etc) in order to facilitate competitive conditions across the member states.

The rest of this paper is organised as follows. Section 2 discusses the data and outlines the methodology applied. Section 3 illustrates and evaluates the results of the empirical analysis.

Finally, Section 4 concludes this study and summarizes the main findings of our study, placing emphasis on policy implications.

2. Data and Methodology

2.1 Sample and data collection

To carry out an in depth investigation of industry competitiveness in Greek SMEs, we use econometric techniques in an extended dataset for manufacturing and services sectors at the two and four digit level (ISIC Rev. 3 classification) covering the period 1970-2007. The data are taken from the EU KLEMS 2011 database. This database was developed to create measures of economic growth, productivity, employment creation, capital formation and technological change at the sector level for all European Union members and the US from 1970 onwards (Christopoulou and Vermeulen, 2012).

Summary statistics for variables included in the econometric analysis are provided in the Appendix (See Table A1). From the relevant table, it is evident that the sample data are well behaved showing limited variability in relation to the mean of the population (i.e values of the coefficient of variation are close to zero), while the variables are not normally distributed since the relative values of the skewness and kurtosis measures are not zero and three respectively.

The interpretation of the variables employed in our analysis, which are expressed in their natural logarithms, comes as follows: y and p denote the gross output volume and price indices respectively (1995=100), w measures the compensation of employees (million of Euros) and M and p_m denote the intermediate inputs indices for volume and price respectively (1995=100). Mark-up ratios are estimated by directly computing the relevant input shares (coefficients α_l and a_m). This method relies on computation of the revenue shares of factor inputs instead of econometric estimation of the production function[3].

The econometric methodology that we implement includes robust methods to the problem of endogeneity that may arise in standard estimation methods often employed in practice (i.e OLS). Therefore, equation 6 will be estimated by employing a number of different econometric methods such as 2SLS to test the robustness of the results and deal with endogeneity bias. Bootstrapping is also employed to conduct correct inference in small-sample. Ignoring the issue of endogeneity in estimating equation 6 will lead to biased estimates of its parameters, and thus to wrong inference about the true mark up values of the sample.

2.2 The theoretical framework

The basic assumption of Hall's (1988) and Roeger's (1995) methodology in estimating mark-ups is that the traditional Solow residual (SR) should be independent of variation in the log-change of output in the absence of monopoly power. The main contribution of Roeger (1995) is that he showed how the differences between the production-based (primal) Solow residual (SR) and the cost based (dual) Solow residual (DSR) can be used to eliminate the unobservable productivity shock in order to obtain an unbiased estimate of market power (Rezitis and Kalantzi 2012b).

[3] It is noteworthy that the alternative method of computing the input factor shares by estimating the elasticities of the production function has severe problems concerning the biasness of the relevant coefficients (Valentinyi and Herrendorf, 2008).

Assume that the production function which is homogenous of degree λ (returns to scale) is defined by the following neoclassical equation:

$$Y = Af(L, M, K) \tag{1}$$

where *Y* is gross output, A is the multifactor productivity growth (Hicks-neutral productivity term) and there are three basic inputs in the production process. More specifically, *L* denotes labour, *M* is the intermediate inputs, and *K* stands for capital. The inclusion of intermediate inputs allows defining the mark-up ratios using gross output, and hence overcoming the upward bias that would result if value added were used instead (Martins et al. 1996; Molnar and Bottini 2010). After log-differentiation and re-arranging we get the following equation:

$$SR = y - a_L l - a_m m - a_k k = L(y - k) + (1 - L)\theta \tag{2}$$

where SR is the (primal) Solow residual, *y, l, m* and *k* are the first differences of the logs of Y, L, M, K respectively, a_i is the input share of factor *i* and *L* now is the Lerner index[4], which relates the mark -up ratio μ:[5]

$$L = \frac{P - MC}{P} = 1 - \frac{1}{\mu} \tag{3}$$

From the equation 3 it is evident that the mark up ratio μ can be computed as $\mu = \frac{1}{1-L}$.[6] Under perfect competition (*L=0*) the Solow residual is identical to the rate of technical progress (θ). Equation (2) becomes

$$SR = y - a_L l - a_m m - a_k k = \theta \tag{2′}$$

Roeger (1995) showed that an equivalent expression can be derived for the dual productivity measure (price-based Solow residual) by using the cost function associated with the production function (equation 1) as follows:[7]

$$SRP = a_L w + a_M p_m + a_K r - p = (1 - L)\theta - L(p - r) \tag{4}$$

where *w* denotes the wages, p_m is the price of intermediate inputs, *r* is the rental price of capital and *p* is the price of output. By subtracting (4) from (2) and assuming constant returns to scale ($\lambda=1$), a suitable expression of *L* can be obtained by the following interpretation:

[4] The index ranges from 1 to 0, with higher numbers implying greater market power. For a perfectly competitive firm (where *P = MC*), *L= 0*. Alternatively, the Lerner index describes the relationship between elasticity and price margins for a profit-maximizing firm.

[5] The lower case indicates log-differentiation.

[6] Due to lack of data regarding (net indirect) taxes and value added rates across industries under scrutiny the estimation of mark – up ratio is possibly upward bias.

[7] Under perfect competition equation (4) becomes $SRP = a_L w + a_M p_m + a_K r - p = \theta$.

$$(p+y)-a_L(w+l)-a_M(p_m+m)-(1-a_L-a_M)(r+k)=L[(p+y)-(k+r)] \quad (5)$$

As can be seen, the unobservable productivity shock variable (A) simply cancels out. Thus, we can use observable data, i.e. sales growth, labour costs growth, capital costs growth and material costs growth, to directly estimate the Lerner index b from (5) without having to worry about the unobserved productivity change that may exist in the data – the above formula controls for unobserved productivity.

For the sake of simplicity the above equation can be re-written after adding a disturbance term (ε) as follows:[8]

$$\Delta y = L\Delta x + \varepsilon \quad (6)$$

where

$$\Delta y=(p+y)-a_L(w+l)-a_M(p_m+m)-(1-a_L-a_M)(r+k) \quad (7)$$
$$\Delta x=(p+y)-(k+r) \quad (8)$$

are the nominal Solow residual (Δy) and the growth rate of the nominal output/capital ratio (Δx) correspondingly. Thus the only data that are needed to estimate the price-cost margin (mark up) μ are the nominal values of sales, labour expenditure, capital expenditure, and other inputs expenditure in a time series format (so that we can calculate changes and thus growth rates). Note that since data from firms' financial statements always come in nominal value terms, the Roeger method can be used immediately without having to deflate these values by a proxy deflator. Usually the appropriate deflators do not exist, in which case we will be facing the so-called '*omitted-price'* bias (see Klette and Griliches, 1996; Konings et al, 2005). The Roeger method by-passes these issues by simply having assumed constant returns to scale (CRS). Imposing CRS is of course a strong assumption. However, Basu and Fernald (1997) show that this assumption violates the Roeger markup estimate in two ways: a) downwards, if data reveal increasing returns to scale (IRS) technologies, and b) upwards if data reveal decreasing return to scale (DRS) technologies.

Recently, De Loecker and Warzynski (2012) extended Hall's work by developing a method that allows estimating price-cost margins after controlling for unobserved productivity shocks and without having to assume anything about the production technology. Their method is rather general and it builds on techniques that Olley and Pakes (1996) and Levinshon and Petrin (2003) De Loecker (2011) developed for estimating consistently total factor productivity. As these techniques use deflated values, one has to use appropriate deflators for not creating an "*omitted-price*" bias. Another advantage of the De Loecker and Warzynski method is that it allows for firm-specific estimates for markups, while the Roeger method assumes the same production function for all firms and tries to identify heterogeneity through fixed effects (Lassen et al, 2014). Still, having a multi sector dataset with poor appropriate deflators, we opted for using the Roeger method for the purpose of this study.

[8] Essentially, $\Delta y=\left[\lambda*\left(L-1\right)+1\right]\Delta x+\varepsilon$. Under constant returns to scale ($\lambda=1$), $\Delta y = L\Delta x + \varepsilon$.

In equation (8) *k* is the capital compensation at basic current prices and *r* is the user (rental) cost of capital. Capital compensation is derived as the value added minus labour compensation, which in turns is derived by applying the ratio of hours worked by total persons engaged to hours worked by employees to compensation. Since the database does not contain a price series for capital we have to construct it, by following the Hall and Jorgensen (1967) approach. Therefore, the rental price of capital *r* can be computed by the following equation:

$$r = \left[\left(i - \pi_e\right) + \delta\right] P_i \tag{9}$$

where P_i is the fixed asset investment deflator, $(i-\pi_e)$ denotes the real interest rate, and δ is the depreciation rate, which is set at 5% across all sectors (Martins et al. 1996). In other words, real interest rate is the long-term interest rate minus the expected inflation rate, which in turn is the filtered inflation rate. For P_i we use the fixed capital deflator for the total economy since sector specific deflators were not available for the sample countries, $(i-\pi_e)$ is the real interest rate, both taken from the AMECO database.

It is worth mentioning that different error terms are assumed for the sector-based estimation of mark-ups. As the unobservable productivity term, *a* cancels out with this subtraction, equation (6) is relatively easy to estimate by applying econometric techniques. The estimation of equation (2), in contrast, would result in bias and inconsistency of the mark-up estimates as the input variables are correlated with the productivity shocks (Molnar and Bottini 2010).

3. Empirical results

3.1 Market power in Greek SMEs

The econometric methodology adopted in this paper relies on three different set of estimators. Firstly, we assess the level of market power by using OLS estimators. However, there is a potential endogeneity issue regarding the use of the capital compensation variable (k) and the rental cost of capital (r). That is, an OLS estimator would tend to underestimate the effect of these control variables on the Solow residual Δy (i.e coefficient biased towards zero). In order to overcome this problem, we include the 2SLS estimator that allows among other things the unobserved factors to be filtered out. The latter can be a problem because, if unobserved variables jointly affect both the dependent and control variables, then the coefficient estimates for the independent variables may be biased. For this reason, we employ a 2SLS estimator, which deals with the potential endogeneity arising from the inclusion of several control variables.

For robust inference in small samples, we employ the bootstrap method (Rezitis and Kalantzi, 2012a, 2013; Polemis, 2014; Polemis and Fotis, 2016). This involves estimating a model many times using simulated data. Quantities computed from the simulated data are then used to make inferences from the actual data. Tables 1 and 2 present the estimation results. According to these, the estimated mark-up coefficients (see columns 2) are on average statistically significant at any conventional level of significance. Besides, the F-statistics support the jointly statistical significance of the estimated regressions, while the error terms are not correlated over time (lack of autocorrelation).

Table 1: Manufacturing sectors

		Panel A – OLS					Panel B - 2SLS				
ISIC	**Sector**	**Lerner Index**	**Mark-up ratio**	**Adjusted R^2**	**F-statistic**	**LM-test**	**Lerner Index**	**Mark-up ratio**	**Adjusted R^2**	**F-statistic**	**LM-test**
15	Food and beverages	0.26* {0.22*}	1.120 {1.241}	0.72 {0.50}	72.16* [0.00]	0.96 [0.39]	0.34*	1.524	0.58	10.68* [0.00]	1.42 [0.49]
16	Tobacco	0.19* {0.22*}	1.346 {1.342}	0.56 {0.43}	43.23* [0.00]	7.34* [0.04]	0.31*	1.453	0.65	9.67* [0.00]	1.26 [0.56]
17	Textiles	0.24* {0.43*}	1.435 {1.357}	0.23 {0.56}	19.34* [0.00]	4.60* [0.00]	0.32*	1.837	0.22	5.43* [0.00]	1.21 [0.53]
18	Wearing Apparel, Dressing And Dying Of Fur	0.23* {0.44*}	1.435 {1.235}	0.67 {0.55}	32.54* [0.00]	1.88 [0.21]	0.34*	1.865	0.33	19.53* [0.00]	1.11 [0.68]
19	Leather, leather and footwear	0.20* {0.19*}	1.287 {1.235}	0.33 {0.44}	8.43* [0.00]	9.54* [0.00]	0.58*	1.987	0.36	6.54* [0.00]	1.87 [0.34]
20	Wood and of wood and cork	0.35* {0.23*}	1.398 {1.259}	0.88 {0.73}	6.80* [0.00]	0.00 [1.00]	0.45*	1.578	0.87	7.63* [0.00]	1.56 [0.30]
21	Pulp, paper and paper	0.43* {0.23*}	1.678 {1.332}	0.79 {0.44}	25.54* [0.00]	0.24 [0.67]	0.24*	1.571	0.74	55.43* [0.00]	0.49 [0.23]
22	Printing, publishing and reproduction	0.32** {0.45*}	1.235 {1.535}	0.57 {0.78}	69.23* [0.00]	0.04 [0.07]	0.29*	1.480	0.89	45.67* [0.00]	2.59 [0.55]
23	Coke, refined petroleum and nuclear fuel	0.34* {0.67*}	1.123 {1.145}	0.56 {0.57}	78.00* [0.00]	3.57** [0.04]	0.57**	1.782	0.54	2.45*** [0.09]	1.27 [0.67]
24	Chemicals and chemical products	0.43* {0.56*}	1.453 {1.348}	0.54 {0.67}	55.23* [0.00]	3.27* [0.00]	0.68*	1.345	0.65	5.35* [0.00]	1.35 [0.53]
25	Rubber and plastics	0.25* {0.14*}	1.245 {1.156}	0.45 {0.67}	13.67* [0.00]	4.67* [0.00]	0.35*	1.345	0.23	6.53* [0.00]	0.98 [0.34]
26	Other non-metallic mineral	0.21* {0.45*}	1.357 {1.345}	0.45 {0.65}	26.43* [0.00]	1.34 [0.10]	0.54*	1.678	0.66	54.67* [0.00]	1.54 [0.64]
30	Office, accounting and computing machinery	0.32* {0.34*}	1.344 {1.202}	0.43 {0.53}	53.23* [0.00]	0.54 [0.51]	0.32*	1.567	0.64	5.64** [0.04]	0.23 [0.54]
31	Electrical machinery and apparatus, nec	0.23* {0.23*}	1.324 {1.244}	0.54 {0.24}	43.55* [0.00]	1.43 [0.53]	0.13**	1.123	0.54	4.43* [0.00]	1.54 [0.24]
32	Radio, television and communication equipment	0.23* {0.24*}	1.332 {1.234}	0.53 {0.43}	42.45* [0.00]	2.45 [0.04]	0.43*	1.234	0.43	12.53* [0.00]	1.56 [0.78]
33	Medical, precision and optical instruments	0.32* {0.34*}	1.432 {1.345}	0.76 {0.45}	15.35* [0.00]	1.34 [0.56]	0.43*	1.986	0.75	12.43* [0.00]	1.45 [0.23]
36	Manufacturing nec	0.12* {0.45*}	1.765 {1.134}	0.87 {0.34}	32.34* [0.00]	1.74 [0.32]	0.45	1.156	0.79	12.65* [0.00]	1.45 [0.18]

Note: The numbers in figures {} denote the estimations of the Lerner indices and the mark up ratios by applying the bootstrap method. The numbers in square brackets denote the P-values. Significant at *1%, **5% and ***10%. Reported mark-ups estimates are statistically significant at 5% level.

Table 2: Services sectors

		Panel A - OLS					Panel B - 2SLS				
ISIC	**Sector**	**Lerner Index**	**Mark-up ratio**	**Adjusted R^2**	**F-statistic**	**LM-test**	**Lerner Index**	**Mark-up ratio**	**Adjusted R^2**	**F-statistic**	**LM-test**
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.67* {0.34*}	1.564 {1.234}	0.92 {0.85}	2.68* [0.00]	0.56 [0.23]	0.35*	1.345	0.78	44.34* [0.00]	1.34 [0.21]
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.32* {0.42*}	1.275 {1.344}	0.67 {0.86}	24.75* [0.00]	1.84 [0.17]	0.45*	1.244	0.83	14.64* [0.00]	2.65 [0.55]
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.42* {0.41*}	1.424 {1.234}	0.42 {0.31}	34.42* [0.00]	2.43 [0.13]	0.42*	1.321	0.34	42.33* [0.00]	1.32 [0.34]
60	Inland transport	0.97* {0.75*}	1.659 {1.536}	0.75 {0.42}	7.45* [0.00]	1.43 [0.10]	0.53*	1.453	0.79	9.98* [0.00]	3.42 [0.432]
61	Water transport	0.43* {0.67*}	1.423 {1.322}	0.54 {0.22}	54.76* [0.00]	1.32 [0.54]	0.51*	1.207	0.71	65.35* [0.00]	2.64 [0.12]
62	Air transport	0.32* {0.54*}	1.535 {1.322}	0.67 {0.43}	3.54* [0.00]	1.53 [0.01]	0.43*	1.324	0.65	53.65* [0.00]	3.95 [0.47]
63	Supporting and auxiliary transport activities; activities of travel agencies	0.32* {0.312*}	1.535 {1.545}	0.43 {0.65}	22.43* [0.00]	1.78 [0.42]	0.32*	1.432	0.64	42.76* [0.00]	3.43 [0.34]
64	Post and telecommunications	0.32* {0.43*}	1.323 {1.234}	0.43 {0.87}	96.34* [0.00]	2.45 [0.18]	0.53*	1.434	0.54	53.65* [0.00]	3.53 [0.27]
65	Financial intermediation, except insurance and pension funding	0.32* {0.43*}	1.653 {1.323}	0.34 {0.29}	33.86* [0.00]	2.43 [0.45]	0.65*	1.432	0.73	44.22* [0.00]	2.43 [0.31]
67	Activities related to financial intermediation	0.42* {0.32*}	1.431 {1.543}	0.32 {0.53}	53.76* [0.00]	0.32 [0.43]	0.07*	1.864	0.42	43.34* [0.00]	3.42 [0.54]
71	Renting of machinery and equipment	0.32* {0.32**}	1.423 {1.434}	0.34 {0.43}	43.43* [0.00]	3.42 [0.00]	0.32*	1.323	0.91	42.77* [0.00]	1.54 [0.43]
91	Activities of membership organizations nec	0.32* {0.32*}	1.323 {1.342}	0.34 {0.45}	3.32* [0.00]	1.32 [0.43]	0.45*	1.432	0.75	29.64* [0.00]	1.32 [0.34]
92	Recreational, cultural and sporting activities	0.32* {0.31*}	1.314 {1.534}	0.53 {0.43}	42.54* [0.00]	2.54 [0.05]	0.43*	1.434	0.42	32.43* [0.00]	1.43 [0.43]

Note: The numbers in figures {} denote the estimations of the Lerner indices and the mark up ratios by applying the bootstrap method. The numbers in square brackets denote the P-values. Significant at *1%, **5% and ***10%. Reported mark-ups estimates are statistically significant at 5% level.

Regarding the magnitude of the relevant estimates, there is significant variation but all of the marks up ratios exceed unity, implying the presence of non competitive conditions for the Greek SMEs in manufacturing and services industry respectively. It is worth mentioning that the magnitude of the (OLS) estimations does not vary significantly from the ones reported by the bootstrap method implying that the results are quite robust. In other words, the bootstrap estimators reveal that the OLS findings are robust to any simultaneity bias between the control variables and the error terms. Lastly, it is important to note that we reach the same conclusion by applying the 2SLS method (see Table 2 - Panel B).

Regarding the manufacturing sectors, the mark-up ratios show a significant variation across the majority of the two digit sectors. This range seems more plausible than the higher mark-ups obtained in previous studies for Greece (Rezitis and Kalantzi, 2013; Rezitis and Kalantzi, 2011; Molnár, and Bottini, 2010). One explanation for this discrepancy can be explained by the adjustment for intermediate inputs. This adjustment tends to lower mark-ups substantially, in particular for sectors with a large share of intermediate input in total output (i.e., rubber and plastics, pulp, paper, printing and publishing, etc). It is worth mentioning that these sectors are characterised by a small number of players and significant barriers to entry. However, the recent debt financial crisis, along with the extended recession in the real economy, has negatively affected the relevant sectors across Greece, thus overshooting the magnitude of the mark-up ratio.

As a general statement we argue that on average, mark-up ratios in Greek industries do not appear particularly high in comparison with other OECD countries (see also Molnár, 2010; Christopoulou and Vermeulen, 2012; Maioli, 2004) but the average reveals large differences across sectors (heterogeneity). This is not surprising given that on the one hand, sector specific characteristics affect the mark-up companies' pricing behaviour (prices above average costs), while on the other hand, the regulatory barriers (i.e legalities) vary considerably across sectors distorting the level of competition.

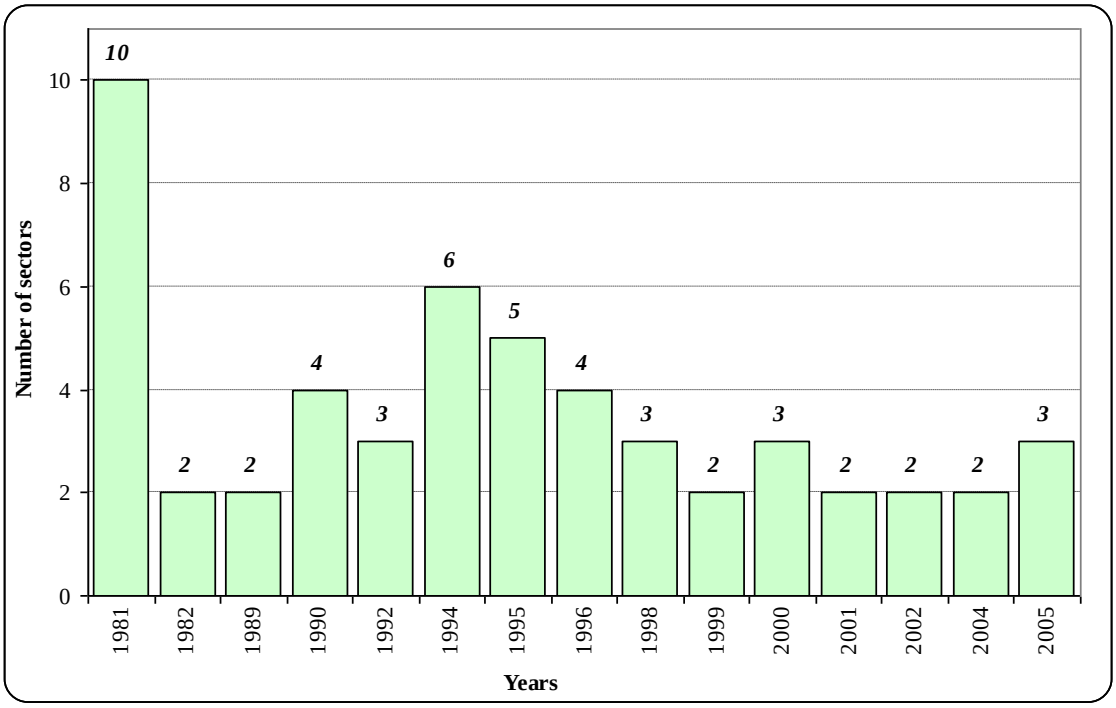
3.2 Structural breaks

In this section, we contact formal structural break procedures which can show the existence of breaks in the mark-up ratios implied by our data. The possible breaks can be justified by a number of events or economic policies adopted during period 1970-2007. To this end, we apply the well known structural break test of Quandt-Andrews (denoted QA), which treats the dates of the breaks as unknown. The reason for using this test is that it allows the detection for possible unknown breakpoints compared to other tests, such as CUSUM, based on formal testing procedures and the break points are estimated consistently. Given the big volume of the results on the above break test, we give its results (dates of breaks) in Table A2 of the Appendix.

Figure 1 provides the empirical distribution of industry breaks in the mark-up ratios identified by the QA tests, for all dates of our sample. Inspection of this figure reveals that, in the majority of sectors (10 sectors), there is a break in the mark-up ratio on the year of Greece's accession of Greece to the European Economic Community (EOC), i.e., 1981. This justifies the split of the sample considered in Polemis (2014) study. The entrance of Greece to the EOC was characterised by a more intense competition since many structural and regulatory barriers were lifted (i.e tariffs, quotas, taxes, trade restrictions, etc). As a consequence, the level of mark-up ratios were subjected a major structural change. Apart from year 2001, the

results of the QA test indicate that there is a second wave of structural changes in the mark-up ratios, for about 15 sample sectors. This occurs during period 1994-1996, after the Maastricht Treaty. This date is in accordance to the split of the sample assumed by Polemis (2014).

Figure 1: Distribution of structural breaks of mark-up ratios (1981-2005)



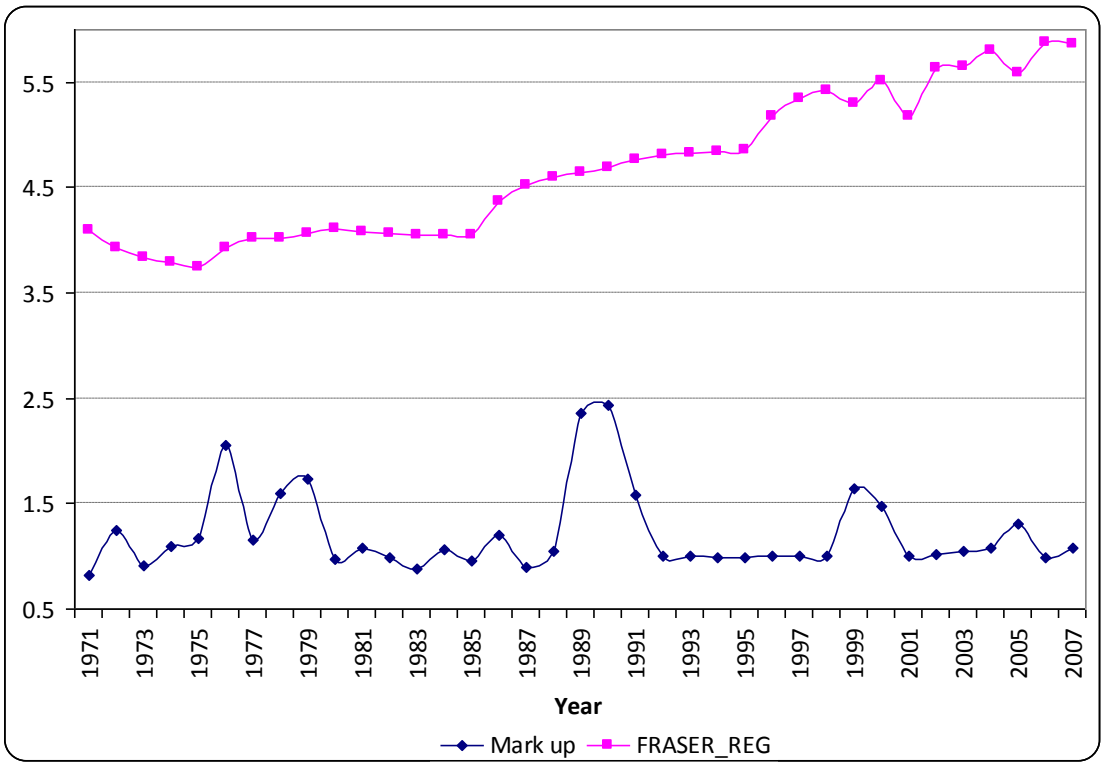
Source: Authors' elaboration

The entrance of Greece to the EOC and the sign of the Maastricht treaty by this country introduced a number of factors that have affected the level of market power, such as the level of regulation and concentration in each sector. The country should have adopted a number of de-regulation conditions according to the European standards and devices. To see if this has happened, consistently, over our sample, in Figure 2 we present graphs of time-varying least squares estimates of the mark-ups ratios of the Greek industry and services sectors considered in our sample based on cross-section regressions, for all dates of our sample. These estimates indicate shifts in the mark-up ratios at different points of time. These shifts seem to be temporary and they don't persist for many periods. They capture the distribution of breaks found by QA tests, but indicate more than two major periods of mark-up changes. They are very useful to see if they are related to competition policies adopted in Greece beyond those due to the EOC and the sign of the Maastricht Treaty.

In Figure 2, we also present values of the FRASER index measuring the impact of regulation on the economic conditions of Greece. This index can help us to investigate the effect of regulation (de-regulation) on the formulation of the mark-up ratios over time. The Fraser Index of Economic Freedom is used very often in the empirical economic literature to reveal the level of competiveness of the economy (see for example Carlsson and Lundstrom, 2002; Mamatzakis et al, 2013; Polemis and Stengos, 2016). This consists of three main factors: a) credit market regulations (bank ownership, private sector credit and interest rate controls), b)

labour market regulations (i.e minimum wage, hour regulations, etc) and c) business regulations (i.e starting a business, bureaucracy costs, tax compliance, etc). These are weighted to form a composite index, with 0 indicating the lowest and 10 the highest level of economic freedom (Gwartney et al., 2012).

Figure 2: Mark-up and Fraser regulation index (1970-2007)



Source: Authors' elaboration

Inspection of Figure 2 indicates that FRASER index shows an upward trend revealing that Greece has moved to a more deregulated regime. This trend is evident mostly in the period after the adoption of the Euro in its currency form (i.e., 2001-2007), where some important regulatory restrictions were removed (i.e., deregulation in the network industries such as telecommunications and energy).

Since the Fraser regulation index is a non-stationary variable, to investigate if there is a relationship between the deregulation procedures followed in Greece next we run the following regression:

$$M = c + \sum_{i=0}^{3} a_i \, \Delta(FR)_{\text{t-i}} + \sum_{i=0}^{3} b_i \, \Delta(FR)^2_{\text{t-i}} + \varepsilon_t \qquad (10)$$

where M, denotes the level of mark up ratios, FR is the regulatory component of the FRASER index (in first-differences) and ε_t stands for the error term. Note that the above regression, in addition to variables $\Delta(FR)$, also includes squared values of them as independent repressors. These can indicate potential sources of non-linearities into the

relationship between mark-up ratios and the de-regulation procedures adopted during our sample.

Table 3 presents estimates of different specifications of equation (10) under different lag specifications. The results of the table indicate that there is a relationship between mark-ups and $\Delta(FR)$ which is in accordance to the theory; it has negative sign and is significant if $\Delta(FR)$ is taken one-period back. There is no evidence of non-linearity into this relationship. Our results thus indicate that the level of regulatory reform affect the level of market power one-period ahead. However, the values of the R^2 indicate that this relationship is weak and cannot explain a big part of the variation of the mark-up ratios, over time. Part of it can be also attributed to the fact that the mark-up ratio hardly changes during the sample.

Table 3: Determinants of market power in Greece

Variable	Model (1)	Model (2)	Model (3)	Model (4)
Constant	1.221*** (17.730)	1.230*** (16.759)	1.210*** (16.691)	1.183*** (17.197)
Δ(FR)	5.441 (1.507)	-	-	-
$\Delta(FR)^2$	-0.541 (-1.526)	-	-	-
ΔFR(-1)	-	-0.065 (0.017)	-	-
$\Delta FR(-1)^2$	-	-0.021 (-0.056)	-	
ΔFR(-2)	-	-	4.209 (1.070)	
$\Delta FR(-2)^2$	-	-	-0.383 (-0.981)	
ΔFR(-3)	-	-	-	7.543** (2.029)
$\Delta FR(-3)^2$	-	-	-	-0.659* (-1.768)
Diagnostics				
Adjusted R^2	0.065	0.003	0.049	0.216
F-statistic	1.165 [0.324]	0.051 [0.949]	0.806 [0.455]	4.132** [0.025]
Observations	36	35	34	33

Note: The dependent variable is the mark up ratio (M), while FR denotes the Fraser regulation index. Δ is the first difference operator. T-statistics are in parentheses. The numbers in square brackets are the p-values. Significant at ***1%, **5% and *10% respectively.

4. Conclusions and policy implications

The aim of this study was to investigate the level of competition of the Greek SMEs in manufacturing and services industries over the period 1970-2007. The empirical analysis was performed at a disaggregated level (two digit level), with the aim of taking into account possible heterogeneity across different subsectors of the above industries.

The empirical findings indicate that the Greek manufacturing and services industries operate in non-competitive conditions over the last forty years. Average mark-up ratios are found to be heterogenous across sectors, with manufacturing having higher mark ups on average than services. Regarding the services industry, the mark-up ratios for Greece are relatively high in

transport and storage communication sector (network industries), compared to highly traded services sectors (e.g maintenance and repair of motor vehicles, retail trade, repair of household goods, financial insurance, real estate activities, etc), where the mark up ratios are relatively low revealing large competitive pressure in these industries.

By contacting a break point analysis and calculating time-varying mark-up ratios using the cross-section span of the data, the paper indicates that the mark-up ratios in the manufacturing sectors of Greece have been increased during the period 1982-1992 due to the wave of mergers and acquisitions, as well as the accession of Greece to the European Economic Community (1981). This upward trend stopped within the period (1993-2007). As a consequence, the relevant marks up ratios have decreased substantially. This can be attributed to deregulation policies adopted, by the sign of the Maastricht Treaty by Greece. More specifically, the implementation of the Single European Market (1992) which led to the increase of free trade among Greece and other EU members caused a fall of the profit margin, as well as a drop in the mark up ratios. In addition, deregulation of the markets have also increased Foreign Direct Investments (FDIs) targeted at the sectors of the "*new economy*" (i.e computer and related services, information technology, etc) and thus, may have boosted competition, decreasing the SMP of the incumbents and the subsequent mark up ratios. Our findings show that deregulation in Greece has played a crucial role in explaining variations in the level of market power and the reduction of mark-up ratios. However, we must stress that their results are not so large.

Our findings also indicate that sectors that are more open to internationalisation such as textiles, computers, electrical and other transportation equipment, experience relatively low mark up ratios revealing lower degrees of "collusion". In order to enhance the level of internationalisation in the manufacturing sectors, the policy makers and the governments' officials should pursue horizontal strategies focusing on the further opening of the markets. Since the vast majority of the manufacturing firms in Greece are SMEs, the government must improve the access of micro and small SMEs to existing financial support mechanisms (i.e., specific business funds, business angels, etc) and to relevant information sources.

Policy instruments for international business should not only be aimed at potential exporters but also at importers. Exports do indeed bring in 'foreign currency', but for many economic sectors efficient access to required inputs is a very important factor in staying (internationally) competitive. Given that in most of the cases SMEs commence their internationalisation process with imports and later go into export markets, supporting importers, will also result in promoting more exports. In addition to the aforementioned strategies, policies must be developed to support greater use of the Internet by SMEs and especially of electronic commerce as this lowers barriers for internationalisation for smaller companies. Finally, policies targeted at the increase of FDI either by financial (i.e., low corporate taxes, preferential tariffs, soft loan or loan guarantees, etc) or political mechanisms (i.e., infrastructure subsidies, derogation from regulations for very large projects, etc) should also enhance the competitive conditions of the sectors involved.

Acknowledgments

The authors wish to thank an anonymous referee of this journal for his valuable comments and suggestions that enhanced the merit of the paper. The first author would like to acknowledge financial support from the John S. Latsis Public Benefit Foundation (EP-2212-01). The sole responsibility for its content lies with its authors. Usual disclaimer applies.

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APPENDIX

Table A1: Summary statistics

	ΔY		**ΔX**	
Statistical measures	***Manufacturing***	***Services***	***Manufacturing***	***Services***
Observations	37	37	37	37
Mean	2.98	-3.04	-2.84	0.58
Median	2.98	-3.00	-2.85	0.58
Maximum	0.94	-1.57	-0.94	2.43
Minimum	6.64	-6.64	-4.38	-1.35
Standard deviation	0.51	0.47	0.56	0.44
Coefficient of variation	0.17	-0.15	-0.20	0.76
Skewness	1.03	-2.65	0.30	-0.42
Kurtosis	12.37	20.74	4.03	5.93

Table A2: Quandt-Andrews unknown breakpoint tests

ISIC	Sector	Year of Break	Maximum LR F-statistic	Maximum Wald F-statistic	Average LR F-statistic	Average Wald F-statistic
15	Food and beverages	1980	0.3325	0.0951	0.0722	0.0270
16	Tobacco	1981	0.0000	0.0000	0.0001	0.0001
17	Textiles	1990	0.0000	0.0015	0.0008	0.0004
18	Wearing Apparel, Dressing And Dying Of Fur	1982	0.1503	0.0002	0.0174	0.0004
19	Leather, leather and footwear	1990	0.0005	0.0000	0.0434	0.0073
20	WOOD AND OF WOOD AND CORK	1992	0.0665	0.0000	0.1620	0.0001
21	Pulp, paper and paper	1990	0.8419	0.2235	0.2424	0.0337
22	Printing, publishing and reproduction	1998	0.0000	0.0000	0.0013	0.0001
23	Coke, refined petroleum and nuclear fuel	1990	0.0000	0.0000	0.0003	0.0018
24	Chemicals and chemical products	1991	0.0001	0.0000	0.0003	0.0004
25	Rubber and plastics	1999	0.2195	0.3911	0.3718	0.0998
26	OTHER NON-METALLIC MINERAL	1992	0.5586	0.0886	0.2394	0.0160
27	Basic metals	2005	0.0000	0.0000	0.1181	0.1181
31	Electrical machinery and apparatus, nec	1994	0.0024	0.0024	0.0039	0.0039
32	Radio, television and communication equipment	1994	0.0000	0.0000	0.0001	0.0009
33	Medical, precision and optical instruments	1994	0.0018	0.0018	0.0064	0.0064
36	Manufacturing nec	1989	0.0011	0.0011	0.0062	0.0062
40	ELECTRICITY AND GAS	1981	0.0022	0.0022	0.0013	0.0013
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	1995	0.0000	0.0000	0.0008	0.0008
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	1996	0.0000	0.0000	0.0002	0.0002
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods	1996	0.0000	0.0000	0.0033	0.0033
60	Inland transport	1981	0.0001	0.0001	0.0001	0.0001
61	Water transport	1981	0.0589	0.0589	0.0227	0.0227
62	Air transport	1981	0.0001	0.0001	0.0001	0.0001
63	Supporting and auxiliary transport activities; activities of travel agencies	1988	0.0007	0.0007	0.0003	0.0003
64	POST AND TELECOMMUNICATIONS	2004	0.0002	0.0002	0.0238	0.0238
65	Financial intermediation, except insurance and pension funding	2003	0.0529	0.0529	0.1021	0.1021
67	Activities related to financial intermediation	1999	0.0025	0.0025	0.0004	0.0004
70	Real estate activities	1996	0.0000	0.0000	0.0001	0.0001
71	Renting of machinery and equipment	1995	0.0689	0.0689	0.0213	0.0213
72	Computer and related activities	1994	0.0000	0.0000	0.2868	0.2868
73	Research and development	1997	0.0000	0.0000	0.0001	0.0001
74	Other business activities	1981	0.0207	0.0207	0.0330	0.0330
90	Sewage and refuse disposal, sanitation and similar activities	1995	0.0041	0.0041	0.0178	0.0178
91	Activities of membership organizations nec	1995	0.0002	0.0002	0.0023	0.0023
92	Recreational, cultural and sporting activities	2001	0.0001	0.0001	0.0109	0.0109