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Measuring the Magnitude of Significant Market Power in the Manufacturing and Services Industries: A Cross Country Approach

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Abstract This paper provides estimates of price-marginal cost ratios for manufacturing and services sectors in the Eurozone, the US and Japan over the period 1970–2007. The estimates are obtained applying the methodology developed by Hall (J Pol Econ 96:921-947 1988) and extended by Roeger (J Pol Econ 103:316-331 1995) on the EU KLEMS March 2011 database. The empirical findings show that sectors that are more open to internationalisation such as textiles, experience relatively the lowest mark up ratios, while policy makers should enhance their policy in fragmented industries in which profitability indicators of market players indicate evidence of imperfect competition. The major stylized facts that are emerged from the empirical results based on the Ordinary Least Squares, Two Step Least Squares and Bootstrap methods of estimation are a) there is no evidence of imperfect competition across the majority of industries in Eurozone, US and Japan, b) sectors that are more open to internationalisation, experience relatively lower mark up ratios than the ratios experienced in less open sectors to internationalisation and c) deregulated industries generally have lower mark – up ratios than regulated industries, while fragmented industries generally exhibit higher mark – up ratios than segmented ones.

Keywords Mark up ratio · US · Eurozone · Japan · Manufacturing · Services

JEL Classifications L13 · L16 · L60 · D43

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1 Introduction

Estimating the degree of competition in an industry 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 and the OECD. Specifically, 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.

It is noteworthy, that competition, inter alia, enhances economic activity and increases the level of employment by improving purchasing power and spurring firms to innovate. In this context, there is a need for structural indicators allowing the researchers and the government officials to identify clearly those sectors of the economy for which competition could be increased. Among the most commonly used indicators are the degree of market concentration in the sector, such as HHI and CR_4 indexes, and the degree of sectoral regulation. However, these indicators do not always reflect the real degree of competition in a sector.

An alternative approach is to use national accounts data to infer conclusions about the difference between the selling price (P) and the marginal cost (MC), since the less competition there is in a sector, the more the price can diverge from the marginal production cost. In other words, we can use the ratio between the sale price and the marginal production cost (mark up ratio) in order to gauge the intensity of competition in a sector. As a consequence, mark-up estimates of different sectors and different countries allowing for comparisons of the degree of competition, they should help in identifying which sectors and/or countries would benefit most from changes in legislation or regulation that affect competition.

The approach adopted here is to estimate econometrically the level of market power by following the methodology developed by Hall (1988) and extended by Roeger (1995). This methodology is based on the hypothesis that in a situation of perfect competition the selling price is equal to marginal cost. The equality of marginal cost and price is essential for the efficiency of the economy since, first, competitive markets can achieve higher productivity levels, and second, competition provides consumers with products of higher quality, increased variety and lower prices (Rezitis and Kalantzi 2013). However, this condition does not apply in a less competitive environment (i.e oligopoly markets, monopolies), since the price deviates from marginal cost. Therefore, the ratio between the selling price and marginal cost assesses the competitiveness of the market. However, while selling price is directly observable, the marginal production cost is not. This drawback was overcome by Hall (1988) and Roeger (1995) who both showed that under perfect competition, the nominal growth rate of the Solow residual is independent of the nominal capital productivity growth rate. It then follows that the coefficient linking the nominal growth rate of the Solow residual to the nominal capital productivity growth is the Lerner Index defined as the ratio of the price minus marginal cost to price ($L = \frac{P-MC}{P}$).

Despite the voluminous amount of work on the topic, none of these studies –to the best of our knowledge- has examined this relationship for the Eurozone countries.[1] Furthermore, unlike

[1] For the purposes of this paper the Eurozone consists of the following countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain.

previous studies, we use an array of econometric techniques such as Ordinary Least Squares (OLS), Two Stage Least Squares (2SLS) and bootstrap methods to test the robustness of the results. Investigating this relationship for the sample countries (i.e Eurozone, USA and Japan) will be interesting on many fronts, discussed next:

First, mark-up ratios can provide valuable information on competitive pressures in various sectors of the economies, 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, it will be interesting to measure the magnitude of market power which can be considered as large for the sample economies and thus, have some effects on the 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 sample economies. Third, it will be considerable for researchers to examine if market power changes over time or not.

Our analysis will be a useful policy tool 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 economic policy authorities may pursue horizontal strategies focusing on the further opening of the markets. Since the vast majority of the manufacturing firms in the sample countries are small and medium sized (SMEs), the governments must improve the access of micro and small SMEs to existing financial support mechanisms and to relevant information sources.

The remainder of this paper is organised as follows: Section 2 reviews the literature, while Section 3 discusses the data and outlines the methodology applied. Section 4 illustrates and evaluates the results of the empirical analysis, while Section 5 depicts some stylized facts. Finally, Section 6 provides some conclusions and policy implications.

2 Survey of the Literature

The estimation of the market power has been of interest to economists for a long time and there is a substantial body of literature assessing the main elements of competition in various countries and industries. In particular, there are two different methodological approaches in assessing the level of market power. The first is a reduced form method proposed by Hall (1988) and extended by Roeger (1995) estimating the average Lerner index and the mark up ratio by relaxing the assumption of perfect competition.[2] The second approach consists of the estimation of supply and demand relations, and can be complemented with input demand functions (Bresnahan 1982a, b). In other words, it aims at estimating marginal cost and in addition to the Lerner index, it incorporates the elasticity of demand and the elasticity-adjusted Lerner index as parameters to be estimated.

[2] See also Dobbelaere (2004) for another extension of Hall's methodology. The author investigates the heterogeneity in price-cost mark-up and workers' bargaining power parameters among 18 sectors within the Belgian manufacturing industry as well as the relationship between both parameters over the period 1988–1995.

Based on the above, the majority of these studies apply Roeger (1995) methodology in order to estimate industry markups (see Table 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; Molnár 2010; Molnar and Bottini 2010). This finding constitutes a major hypothesis that is empirically tested by using different econometric techniques, such as panel data methods (fixed, random effects) or cross-section analysis, in order to assess the level of competitive conditions in an industry.

Considering the above, Maioli (2004) calculates mark-up ratios for 30 French manufacturing industries over the period 1977–1997 according to two different methodologies. The first is based on the classical Solow residual approach, as adapted by Roeger (1995), while the second jointly estimates mark ups and returns to scale. The results reveal the absence of competitive conditions since the mark up ratios are generally larger than one in both methodologies. Wu (2009) uses the data from Martins et al. (1996) and finds insignificant effects of entry barriers on mark – up ratios. Weiss (2010) explores 299 4-digit US manufacturing industries for the period 1961–1989 and finds that mark – up ratios are significantly higher in concentrated and capital intensive industries with high growth rates and advertising to sales ratio.

The empirical findings in a similar study (Molnár 2010) for manufacturing and service industries in Slovenia consent that the estimated mark-up ratios are higher for services than manufacturing industries. The same results hold in the empirical study of Molnar and Bottini (2010). In general, the estimated mark-ups are higher for professional services, real estate, renting and utilities, while they tend to be substantially lower for construction, computer services, retail and wholesale trade and catering. Competitive pressures according to these markups should be large in the United Kingdom and most Scandinavian countries, and relatively small in Central European countries, Sweden and Italy.

Christopoulou and Vermeulen (2012), employ the same methodology in order to provide estimates of mark-up ratios for 50 sectors in eight euro area countries (Germany, France, Italy, Spain, Netherlands, Belgium, Austria and Finland) and the US. The data are taken from the EU Capital (K), Labour (L), Energy (E), Materials (M) and Service (S) inputs (KLEMS) database and cover the period 1981–2004. This study concurs with the perception that perfect competition can be rejected for all sectors in all the examined countries, since the relevant mark-up ratios exceed unity. Furthermore, average mark-up ratios are heterogenous across countries and sectors, with services having higher mark-up ratios on average than manufacturing. Particularly, services sectors depict higher mark-up ratios in the euro area than the US, whereas the pattern is the reverse for manufacturing.

Rezitis and Kalantzi (2011, 2012a, 2012b, 2013) investigate the market structure of the Greek manufacturing industry at the two-digit SIC level. They consent that there is significant market power in the sectors under scrutiny. Polemis (2014) investigated the level of market power in the Greek manufacturing and services industry over the period 1970–2007. The empirical results indicate that the Greek manufacturing and services industries operate in non-competitive conditions. Moreover, average mark-up ratios are heterogenous across sectors, with manufacturing having higher mark-up ratios on average than services.

Summarizing, the major stylized facts that are emerged from this paper are a) there is no evidence of imperfect competition across the majority of industries in Eurozone, US and Japan (75 % of the sectors under scrutiny across Eurozone, US and Japan are characterised as competitive and the remaining percentage (25 %) are characterized as less competitive), b) sectors that are more open to internationalisation, experience relatively lower mark up ratios than the ratios experienced in less open sectors to internationalisation (for instance, the

Table 1 Main empirical studies estimating mark-up ratios

Study	Country(ies)	Sectors	Period	Methodology/Econometric technique	Main Findings
Martins et al. (1996)	USA, Japan, Germany, France, Italy, United Kingdom, Canada, Australia, Belgium, Denmark, Finland, Netherlands, Norway, Sweden.	36 manufacturing sectors	1970–1992	Roeger (1995)/OLS in time series	a) The estimated mark-up ratios are positive and statistically significant in all of the countries considered b) The level of mark-up ratios appears related to the market structure of a particular industry. c) There is a considerable variation of mark-up ratios across countries and across industries.
Nishimura et al. (1999)	Japan	21 manufacturing and service sectors	1971–1994	Elasticity method/Panel data techniques	a) There is strong evidence of imperfect competition. b) The mark-up rate differs considerably among firms and its distribution is skewed. c) The mark-up rate over marginal cost shows strong procyclicality, and its sensitivity is uniform within the industry.
Martins and Scarpetta (1999)	Germany, France, Japan, United Kingdom, USA	36 manufacturing sectors	1970–1992	Roeger (1995) – gross output/OLS in time series	a) Mark – up ratios in USA manufacturing are in the range of 10–15 %. b) Mark – up ratios tend to be higher in Germany, France, Japan and United Kingdom than in USA within a range of 15–30 %.
Maioli (2004)	France	30 manufacturing and service sectors	1977–1997	a) Roeger (1995)/OLS in time series b) Lopez et al. (2002)/nonlinear three stages least squares (N3SLS)	a) The mark -up ratios are generally larger than one in both methodologies. b) Average mark -up ratios are heterogenous across industries.
Christopoulou and Vermeulen (2012)	USA, Germany, France, Italy, Spain, Netherlands, Belgium, Austria, Finland.	50 manufacturing and service sectors	1981–2004	Roeger (1995)/OLS in time series	a) The mark -up ratios are generally larger than one.

Table 1 (continued)

Study	Country(ies)	Sectors	Period	Methodology/Econometric technique	Main Findings
					b) Average mark -up ratios are heterogenous across countries. c) Mark -up ratios are heterogeneous across sectors, with services having higher markups on average than manufacturing. d) Services sectors generally have higher mark -up ratios in the euro area than the US, whereas the pattern is the reverse for manufacturing.
Molnár (2010)	Slovenia.	37 manufacturing and service sectors	1993–2006	Roeger (1995)/OLS in panel fixed effects	a) The mark-up ratios are high in some industries, such as real estate and food and beverages. b) Mark-up ratios also appeared high in transport, catering and professional services, c) Mark-up ratios are lower for most manufacturing industries, traded services and other industries (i.e construction, computer services and retail and wholesale trade).
Molnar and Bottini (2010)	France, Germany, Italy, United Kingdom, Austria, Belgium, Czech Republic, Denmark, Finland, Greece, Hungary, Iceland, Ireland, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland.	28 services sectors.	1993–2006	Roeger (1995)/OLS in panel with and without fixed effects	a) The mark-up ratios are higher for professional services, real estate, renting and utilities b) They are lower for construction, computer services, retail and wholesale trade and catering. c) There is also large variation across countries in terms of the size of the estimated mark-up ratios.

Table 1 (continued)

Study	Country(ies)	Sectors	Period	Methodology/Econometric technique	Main Findings
					d) Competitive pressures should be large in the United Kingdom and most Scandinavian countries, and relatively small in Central European countries, Sweden and Italy.
Rezitis and Kalantzi (2011)	Greece	Manufacturing sector	1984–2007	Hall - Roeger (1995)/panel data techniques	a) The whole Greek manufacturing industry, as well as each sector of the industry, operates in non-competitive conditions b) Labour intensity, the sector size, and the number of establishments influence the markup at the sectoral level. c) Labour intensity, growth and the number of establishments affect the markup over time.
Rezitis and Kalantzi (2013)	Greece	Manufacturing sector	1983–2007	Bresnahan (1982a)/bootstrap method	a) Each sector of the Greek manufacturing industry operate under imperfect competition, with the food and drink sector, the coke and refined sector and the communication equipment sector showing the highest degree of market power b) The transport equipment sector has the lowest degree of market power. c) There is a fluctuation in the degree of market power during the period 1983–1992.
Polemis (2014)	Greece	Manufacturing and services sector	1970–2007	Roeger (1995)/OLS, 2SLS and bootstap in panel with and without fixed effects	a) The Greek manufacturing and services industries operate in non-competitive conditions.

Table 1 (continued)

Study	Country(ies)	Sectors	Period	Methodology/Econometric technique	Main Findings
					b) Average mark-up ratios are heterogenous across sectors, with manufacturing having higher mark up ratios on average than services. c) The mark up ratios in the manufacturing sectors are on average higher in the post European Union (EU) accession period (1982–1992), as a result of the merger wave in the manufacturing industry. d) This upward trend stopped within the period (1993–2007), and the relevant ratios have decreased substantially.

Source: Authors' elaboration

estimated mark – up ratios for the textile sector in Eurozone, Japan and US and the Electrical and optical equipment sector in Eurozone and US are interesting examples) and c) deregulated industries generally have lower mark – up ratios than regulated industries, while fragmented industries generally exhibit higher mark – up ratios than segmented ones. This fact fully reflects the dynamics of deregulation in the relevant industries across major European countries over the period 1970–2007.[3]

3 Data and Methodology

The approach used in this paper is based on a methodology developed by Hall (1988) and extended by Roeger (1995). The basic insight 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). The (primal) Solow residual is given by the following equation:

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

where y, l, m and k are the first differences of the logs of Y,L,M,Krespectively, a_i is the input share of factor i and L now is the Lerner index.

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 as follows:

$$SRP = a_L w + a_M p_m + a_K r - p = (1-L)\theta - L(p-r) \tag{2}$$

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 equation (2) from equation (1) and assuming constant returns to scale ($\lambda = 1$), a suitable expression of L can be obtained by the following interpretation:

$$(p+y) - a_L(w+l) - a_M(p_m+m) - (1-a_L-a_M)(r+k) = L[(p+y)-(k+r)] \tag{3}$$

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

$$\Delta \mathrm{y} = L\Delta x + \varepsilon \tag{4}$$

where

$$\Delta \mathrm{y} = (p+y) - a_L(w+l) - a_M(p_m+m) - (1-a_L-a_M)(r+k) \tag{5}$$

$$\Delta \mathrm{x} = (p+y) - (k+r) \tag{6}$$

are the nominal Solow residual (Δy) and the growth rate of the nominal output/capital ratio (Δx) correspondingly.

[3] Evidence of estimated mark – up ratios using firm level data may be found in Konings et al. (2005); Konings and Vandenbussche (2005) and Görg and Warzynski (2006).

In equation (6) 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 Jorgenson (1967) approach. Therefore, the rental price of capital r can be computed by the following equation:

$$r = [(i - \pi_e) + \delta]P_i \tag{7}$$

where P_i is the fixed asset investment deflator, $(i\text{-}\pi_e)$ 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, $(i\text{-}\pi_e)$ is the real interest rate, both taken from the Annual Macro-Economic (AMECO) database. It is worth mentioning that different error terms are assumed for the sector-based estimation of mark-up ratios. As the unobservable productivity term, a cancels out with this subtraction, equation (4) is relatively easy to estimate by applying econometric techniques. The estimation of equation (1), 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).

In order to perform an in depth investigation of industry competitiveness in the sample countries (Eurozone, Japan and the US), 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. The starting date for the empirical analysis was dictated by data availability. However, we must bear in mind that this could not raise any issue regarding the sample selection since little reform of the manufacturing sector occurred before this date. The final date, represented the last year for which data were available at the time the research was conducted.

It is worth mentioning that one of the features of our study is the limited sample period. However, we must bear in mind that the EU-KLEMS and any other EU statistical organizations (i.e Eurostat, OECD, etc) provides data until 2007. In order to enhance the sample period, we tried to use an extended data-set from the Amadeus database but due to the fact that some observations for capital and labour were missing and not well specified the reported results were unsatisfactory without having a strong theoretical interpretation. Besides, we must bear in mind that similar papers apply time series analysis (see for example Christopoulou and Vermeulen 2012), using a more restrictive data set without having any problem in their empirical findings.

The interpretation of the variables 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.[4]

[4] 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 (Basanetti et al. 2008).

The empirical (econometric) methodology that we implement includes robust methods to the problem of endogeneity that may arise in standard estimation methods, like the method of OLS often employed in practice. Therefore, equation (4) will be estimated by employing a number of different econometric methods to test the robustness of the results and to deal with problems of endogeneity that can arise when estimating equations like it (i.e., 2SLS, bootstrap, etc). Ignoring the issue of endogeneity in estimating Equation (4) will lead to biased estimates of its parameters, and thus to wrong inference about the true mark up values of the sample countries manufacturing and services industries. Lastly, the results of our analysis will have a number of interesting implications for the competition policy authorities.

4 Empirical Results

In this section we present the empirical findings of the estimation of mark - up ratios in manufacturing and services sectors in the sample countries (Eurozone, Japan and the US) over the estimated period (1970–2007) by using time series analysis.

The econometric methodology adopted in this paper uses 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). Because of this, 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 utilize a 2SLS estimator, which deals with the potential endogeneity arising from the inclusion of several control variables. Moreover, in order to check for the validity of our empirical findings, and get more accurate and robust Lerner indices and mark-up ratios, we use the bootstrap method (Rezitis and Kalantzi 2012a, 2013; Polemis 2014). 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.

The empirical results of the OLS estimation of equation (4) regarding Eurozone are shown in Table 2. According to the empirical findings, the estimated mark -up coefficients 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). Regarding the magnitude of the relevant estimates, there is significant variation but the most of the mark -up ratios are below unity, implying the presence of competitive conditions for the manufacturing and services industry in the Eurozone over the period 1970─2007. It is worth mentioning that the magnitude of the estimations does not vary significantly from the ones reported by the bootstrap[5] and 2SLS methods (23 out of 29 estimations of mark –up ratios are below unity with the 3 methods) implying that the results are quite robust. In other words, the bootstrap

[5] 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 estimation of the bootstrap method provides more accurate estimates of the Lerner indices and the mark-up ratios.

Table 2 Estimation of mark up ratios by sector in Eurozone, 1970–2007

		OLS			BOOTSTRAP			2SLS		
ISIC	Sector	Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
D	Total Manufacturing	0.88**	0.15	4.15** [0.04]	1.11*	0.05	1.96 [0.16]	0.56*	–	0.52 [0.47]
15 t16	Food, Beverages and Tobacco	0.94**	0.27	7.92* [0.01]	1.00**	0.13	3.66*** [0.05]	0.78*	0.12	0.92 [0.34]
17 t19	Textile, Leather and Footwear	0.53*	–	0.47 [0.53]	0.52***	–	–	0.50**	–	1.00 [0.32]
20	Wood and of wood and cork	0.84**	0.14	4.00*** [0.06]	0.85***	0.06	2.09 [0.15]	0.88*	0.28	0.13 [0.72]
21 t22	Pulp, paper, printing and publishing	0.84***	0.23	7.31* [0.01]	0.81**	0.13	3.86** [0.05]	0.50*	–	0.00 [0.99]
23	Coke, refined petroleum and nuclear fuel	0.94*	–	0.32 [0.60]	1.37*	–	–	–	–	–
24	Chemicals and chemical products	0.96*	0.45	15.01* [0.00]	1.14*	0.24	5.43** [0.02]	1.22**	0.51	3.07*** [0.08]
25	Rubber and plastics	0.91*	0.36	14.04* [0.00]	0.98*	0.16	5.23** [0.02]	0.90**	0.14	2.73*** [0.10]
26	Other non-metallic mineral	0.86*	0.43	10.02* [0.01]	0.79**	0.24	3.85** [0.05]	0.74*	0.86	0.15 [0.70]
27 t28	Basic metals and fabricated metal	0.96**	0.16	4.46** [0.05]	0.95**	0.03	1.39 [0.24]	1.27***	0.79	5.79*** [0.02]
29	Machinery, nec	0.85**	0.16	5.89** [0.02]	0.96*	0.01	1.23 [0.27]	0.88***	0.14	6.56** [0.01]
30 t33	Electrical and optical equipment	0.86***	0.25	8.27* [0.01]	0.98**	0.17	5.40** [0.02]	0.51*	–	0.10 [0.75]
34 t35	Transport equipment	1.05**	0.31	9.66* [0.01]	1.06***	0.13	3.79** [0.05]	1.27**	0.31	0.89 [0.35]

Table 2 (continued)

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
36 t37	Manufacturing, nec, recycling	1.01*	0.10	3.30*** [0.08]	1.35**	0.18	6.16** [0.01]	–	–	–
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.98*	0.18	6.56** [0.02]	0.91*	0.10	3.73** [0.05]	0.58**	–	2.36 [0.12]
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.87*	0.24	8.70* [0.01]	0.84**	0.12	0.02 [0.04]	0.58**	–	0.02 [0.87]
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.91*	–	0.02 [0.89]	1.64*	–	0.13 [0.71]	0.93*	0.13	0.15 [0.69]
60 t63	Transport and storage	0.70**	–	0.00 [0.98]	0.83**	–	0.70 [0.40]	0.58***	–	0.99 [0.32]
64	Post and telecommunications	0.99*	0.36	14.33* [0.00]	1.14*	0.16	5.45* [0.02]	0.92***	0.45	0.43 [0.51]
70	Real estate activities	0.96*	0.41	24.37* [0.00]	0.95*	0.30	17.02* [0.00]	0.66*	–	0.00 [0.98]
71 t74	Renting of machinery & equipment and other business activities	0.98*	0.73	85.54* [0.00]	0.97***	0.47	30.70* [0.00]	0.88*	0.61	0.03 [0.87]
E	Elecricity, Gas & Water Supply	0.94**	0.36	13.74* [0.00]	0.85*	0.13	4.64** [0.03]	–	–	–
F	Construction	0.82**	0.14	4.67** [0.04]	0.93*	0.10	2.77*** [0.10]	0.46*	–	0.25 [0.62]
H	Hotels and restaurants	1.11*	0.26	3.43 [0.11]	1.52**	0.10	1.06 [0.30]	1.08**	0.38	0.08 [0.77]
J	Financial intermediation	0.95*	0.05	2.46 [0.13]	1.14*	0.05	2.42 [0.12]	0.34**	–	0.18 [0.67]
L	Public administration and defence; compulsory social security	0.99*	0.48	31.97* [0.00]	0.93*	0.21	10.17* [0.00]	0.36*	–	0.37 [0.55]

Table 2 (continued)

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
LtQ	Community, social and personal services	1.08*	0.77	114.37* [0.00]	1.12**	0.55	26.94* [0.00]	0.48**	–	0.04 [0.85]
M	Education	0.75**	–	0.36 [0.56]	0.96**	–	0.86 [0.35]	0.65**	–	1.50 [0.22]
N	Health and social work	0.89**	0.53	37.76* [0.00]	0.93**	0.29	15.77* [0.00]	0.85**	0.50	0.26 [0.61]
O	Other community, social and personal services	1.01*	0.68	69.88* [0.00]	1.03***	0.41	24.35* [0.00]	0.86**	0.55	1.46 [0.23]
P	Private households with employed persons	–	–	–	–	–	–	–	–	–

Figures in square brackets are the reported *p*-values. Significant at * 1 %, ** 5 % and *** 10 % respectively. Lerner Indexes are available upon request. "-" indicates that no data were available or estimates are statistical insignificant. Standard errors were computed by the delta method. For all the 2SLS regressions the Instrument Rank is bigger than the slope coefficients of the regression included constant

Source: Authors' calculations based on EU-KLEMS database

estimator reveals that the OLS findings are robust to any simultaneity bias between the control variables and the error terms.

Regarding the manufacturing sectors (15 to 37 two & four digit-codes), the mark-up ratios range from 0.53 (Textile, Leather and Footwear) to 1.05 (Transport equipment). This range differs from the high mark-ups obtained in previous studies for European countries (Martins et al. 1996; Molnar and Bottini 2010; Christopoulou and Vermeulen 2012; Rezitis and Kalantzi 2011, 2012a, 2012b, 2013; Polemis 2014). Especially, Christopoulou and Vermeulen (2012) report that in the Euro area (Germany, France Italy, Spain, Netherlands, Belgium, Austria and Finland) the statistically significant estimated weighted average mark – up ratio is 1.37. One explanation for this discrepancy is due to 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).

On average, mark-up ratios in Eurozone industries appear particularly low in comparison with other OECD countries (Molnár 2010; Christopoulou and Vermeulen 2012; Maioli 2004), but the average reveals 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.

In Eurozone, the statistical significant at 5 % level of mark up ratios in food, beverages and Tobacco industries (code 15 t16) which accounts for large portion of the total gross output in manufacturing is below unity (0.94). This outcome contradicts with previous studies regarding independent European countries (Molnár 2010; Polemis 2014), and indicates no evidence of market power in the specific sectors. Christopoulou and Vermeulen (2012) state that in the Euro area the weighted average mark – up ratio in the said industries is 1.12 and 1.34 in Food and Beverage and Tobacco sectors respectively. In textile, leather and footwear industry (code 17 t19) the estimated mark – up ratio (0.53) is even lower than in the aforementioned industries indicating an even more competitive environment in them. Lastly, transport equipment (34 t35) and manufacturing, nec, recycling (36 t37) industries are the only industries in manufacture sector in the Eurozone in which the estimated mark – up ratios exceed unity (1.05 & 10.1 respectively). However, the results are close to unity, except for the estimated mark – up ratios employed by Bootstrap and 2SLS methods in manufacturing, nec, recycling and transport equipment industries, showing modest pressures on competition.

Mark-up ratios are also below unity in some tradable services industries, such as electricity, gas & water supply (0.94), construction (0.82), financial intermediation (0.95), public administration and defence, compulsory social security (0.99), education (0.75) and health & social work (0.89). On the contrary, the estimated mark – up ratios exceed unity in hotel and restaurants (1.11), community, social and personal services (1.08) and other community, social and personal services (1.01) industries.

In the services industry (two & four digit codes from 50 to 74) the mark-up ratios range from 0.70 (OLS estimation in transport and storage industry) or 0.58 (2SLS estimations in Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel - Retail trade, except of motor vehicles and motorcycles; repair of household goods industries) to 0.99 (OLS estimation Post and telecommunications) or 1.64 (Bootstrap estimations in Retail trade, except of motor vehicles and motorcycles; repair of household goods). Even thought transport and storage communication constitute networks industries, which in general, exhibit higher mark-up ratios than competitive non-network sectors owing to the large sunk and fixed costs

(Molnár 2010), the estimated mark – up ratio is the lowest in services industry indicating no evidence of market power.

On the other hand, mark-up ratios are close to unity in highly traded services such as sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel (0.98 OLS estimation) as well as in Post and telecommunications, Real estate activities and Renting of machinery & equipment and other business activities. These findings are supported by Christopoulou and Vermeulen (2012). Their empirical results show that the estimated weighted average mark – up ratios are among the highest mark – up ratios in the services industry in the Euro area.

The empirical results of the OLS estimation of equation (4) regarding US are shown in Table 3. According to the empirical findings, the estimated mark -up coefficients 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). Regarding the magnitude of the relevant estimates, there is significant variation but the most of the mark -up ratios are below unity, implying the presence of competitive conditions for the manufacturing and services industry in the US over the period 1970─2007. It is worth mentioning that the magnitude of the estimations does not vary significantly from the ones reported by the bootstrap and 2SLS methods, 17 out of 30 estimations of mark –up ratios employed by the 3 methods of estimation are below unity, in 7 sectors the estimated results employed by OLS & 2SLS methods coincide, in 4 sectors the estimated results employed by OLS & Bootstrap methods coincide and in 2 sectors the results from the OLS estimation method differ from the corresponding results from 2SLS & Bootstrap methods of estimation. The above mentioned results imply that the empirical findings are quite robust, that is, the bootstrap estimator reveals that the OLS findings are robust to any simultaneity bias between the control variables and the error terms.

Also, the findings do support that the majority of the sectors of the US manufacturing and services industries appears to operate under competitive characteristics for the period under consideration. The statistical significant mark up ratios employed by the three methods of estimation in food, beverages and Tobacco industries (code 15 t16) which accounts for large portion of the total gross output in manufacturing is close to unity (0.97) with OLS estimation and above unity with Bootstrap & 2SLS methods of estimation (1.04 & 1.13 respectively). The estimated result from the OLS method of estimation is supported by Martins et al. (1996) and Martins and Scarpetta (1999) regarding the Food products sector (1.05), while Christopoulou and Vermeulen (2012) report an estimated mark – up ratio of 1.19 in Food & Beverages industry and 1.51 in Tobacco industry. Roeger (1995) has also reported an estimated mark – up ratio of 1.50 in Food & Beverages industry, while the corresponding ratio in Tobacco industry is 2.75.[6] The empirical results in food, beverages and Tobacco industries of this paper indicate modest pressures of competion and seem to contradict with the majority of the results of the previous studies.

The only sectors in manufacturing industries in which the estimated mark – up ratios exceed unity are those of Coke, refined petroleum and nuclear fuel (code 23), Chemicals and chemical products (code 24) and Manufacturing, nec, recycling (code 36 t37). These results are supported by the papers of Roeger (1995) and Christopoulou and Vermeulen (2012). Overall, in this paper the mark-up ratios range from 0.82 and 0.78 (OLS and Bootstrap estimations respectively in Basic metals and fabricated metal industry) or 0.60 (2SLS

[6] The said estimated mark – up ratio is almost the same (2.77) by the work of Hall (1988).

Table 3 Estimation of mark up ratios by sector in USA, 1970–2007

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
D	Total Manufacturing	0.94***	0.83	126.44* [0.00]	0.97**	0.57	34.86* [0.00]	0.85*	0.75	2.16 [0.00]
15 t16	Food, Beverages and Tobacco	0.97***	0.71	42.20* [0.00]	1.04*	0.49	15.11* [0.00]	1.13*	0.33	0.28 [0.09]
17 t19	Textile, Leather and Footwear	0.90**	0.46	20.81* [0.00]	1.04**	0.31	11.41* [0.00]	0.60***	0.21	0.38 [0.93]
20	Wood and of wood and cork	0.85*	0.77	34.41 [0.00]	0.88*	0.48	8.64* [0.00]	0.64**	0.34	0.04 [0.62]
21 t22	Pulp, paper, printing and publishing	0.91***	0.25	5.89** [0.03]	1.12**	0.20	4.77** [0.03]	0.61**	0.13	0.05 [0.93]
23	Coke, refined petroleum and nuclear fuel	1.16*	0.78	67.83 [0.00]	1.05**	0.59	24.94* [0.00]	1.09**	0.69	0.15 [0.38]
24	Chemicals and chemical products	1.03*	0.02	1.12 [0.32]	0.91**	0.10	0.19 [0.66]	1.25***	0.20	0.16 [0.45]
25	Rubber and plastics	0.93**	0.46	17.02 [0.00]	0.94*	0.25	6.77* [0.00]	0.82***	0.25	0.17 [0.51]
26	Other non-metallic mineral	1.00**	0.79	74.20 [0.00]	0.92***	0.53	19.14* [0.00]	1.02**	0.84	1.27 [0.95]
27 t28	Basic metals and fabricated metal	0.82**	0.49	12.49 [0.00]	0.78*	0.25	4.69** [0.03]	0.79**	0.38	0.51 [0.21]
29	Machinery, nec	0.92*	0.23	5.71** [0.03]	0.82**	0.13	3.56* [0.05]	0.69*	0.13	1.21 [0.95]
30 t33	Electrical and optical equipment	0.84*	0.54	18.47* [0.00]	0.90*	0.43	14.93* [0.00]	0.97*	0.90	1.15 [0.94]
34 t35	Transport equipment	0.85**	0.61	22.80* [0.00]	0.92**	0.39	9.33* [0.00]	1.08*	0.82	0.84 [0.66]

Table 3 (continued)

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
36 t37	Manufacturing, nec, recycling	1.11*	0.69	27.89* [0.00]	1.03**	0.47	9.68* [0.00]	1.27**	0.65	0.98 [0.81]
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.99**	0.61	33.53* [0.00]	0.93*	0.44	16.86* [0.00]	0.83**	0.62	0.74 [0.11]
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.93*	0.59	26.47* [0.00]	0.85**	0.29	8.05* [0.00]	1.00**	0.42	1.85 [0.47]
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.90***	0.57	26.95* [0.00]	0.90*	0.34	10.15* [0.00]	0.98**	0.53	1.42 [0.94]
60 t63	Transport and storage	0.86*	0.66	56.63* [0.00]	0.91*	0.43	27.40* [0.00]	0.89**	0.63	4.47 [0.00]
64	Post and telecommunications	0.90*	0.70	53.74* [0.00]	0.98*	0.48	20.45* [0.00]	0.90*	0.64	1.59 [0.88]
70	Real estate activities	0.87*	0.66	48.90* [0.00]	1.04**	0.44	20.44* [0.00]	0.88**	0.47	0.42 [0.26]
71 t74	Renting of machinery & equipment and other business activities	0.94*	0.58	34.17* [0.00]	0.95**	0.41	16.65* [0.00]	0.91**	0.75	2.46 [0.00]
E	Elecricity, Gas & Water Supply	0.91*	0.83	83.47* [0.00]	0.97*	0.56	22.16* [0.00]	0.82***	0.13	0.22 [0.93]
F	Construction	0.95**	0.32	7.21* [0.00]	0.95**	0.16	3.12* [0.08]	0.79*	0.28	1.90 [0.54]
H	Hotels and restaurants	0.99*	0.52	24.99* [0.00]	0.80*	0.30	9.50* [0.00]	0.72*	0.22	2.99 [0.47]
J	Financial intermediation	0.92*	0.72	51.33* [0.00]	0.95**	0.42	15.45* [0.00]	0.87**	0.68	0.42 [0.31]
L	Public administration and defence; compulsory social security	0.86***	0.94	444.26* [0.00]	1.07***	0.77	98.85* [0.00]	0.99**	0.91	5.38 [0.00]

Table 3 (continued)

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
LtQ	Community, social and personal services	1.06**	0.78	77.26* [0.00]	0.89*	0.56	27.86* [0.00]	0.84*	0.72	4.16 [0.00]
M	Education	1.03**	0.70	67.30* [0.00]	1.05**	0.56	45.46* [0.00]	0.84*	0.45	1.40 [0.31]
N	Health and social work	1.06*	0.91	303.18* [0.00]	1.08*	0.72	83.18* [0.00]	0.97**	0.85	2.21 [0.00]
O	Other community, social and personal services	1.01*	0.89	234.52* [0.00]	1.04*	0.70	63.26* [0.00]	0.92*	0.80	2.10 [0.00]
P	Private households with employed persons	0.98**	0.77	100.67* [0.00]	1.01***	0.57	46.62* [0.00]	0.95*	0.76	1.54 [0.98]

Figures in square brackets are the reported *p*-values. Significant at * 1 %, ** 5 % and *** 10 % respectively. Lerner Indexes are available upon request. "-" indicates that no data were available.Standard errors were computed by the delta method. For all the 2SLS regressions the Instrument Rank is bigger than the slope coefficients of the regression included constant

Source: Authors' calculations based on EU-KLEMS database

estimations in Textile, Leather and Footwear) to 1.16 (OLS estimation in Coke, refined petroleum and nuclear fuel) or 1.12 and 1.25 (Bootstrap and 2SLS estimations in Pulp, paper, printing and publishing and Chemicals and chemical products respectively). In the manufacturing industry as a whole the resulted mark – up ratios are all below unity (they range from 0.85 to 0.97) revealing that the specific industry in US behaves in a competitive manner.

In the services industry (two & four digit codes from 50 to 74) the mark-up ratios range from 0.86 and 0.89 (OLS and 2SLS estimations in transport and storage industry respectively) or 0.85 (Bootstrap estimations in Wholesale trade and commission trade, except for motor vehicles and motorcycles) to 0.99 (OLS estimation in Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel) or 1.00 (2SLS estimations in Wholesale trade and commission trade, except for motor vehicles and motorcycles). The only sector in services industries in which the estimated mark – up ratio exceeds unity is this of Real estate activities (1.04). However, this result is supported only from Bootstrap method of estimation, while OLS and 2SLS methods of estimation provide quite robust results which are lower than unity (0.87 and 0.88 respectively).

On the other hand, mark-up ratios are close to unity in highly traded services such as sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel (0.99 OLS estimation), Wholesale trade and commission trade, except for motor vehicles and motorcycles (0.93 OLS estimation), in Renting of machinery & equipment and other business activities (0.94 OLS estimation) as well as Retail trade, except for motor vehicles and motorcycles; repair of household goods and Post and telecommunications (0.90 OLS estimations). These findings seem to contradict the empirical findings of Christopoulou and Vermeulen (2012). Their empirical results show that the estimated mark – up ratios range from 1.19 (Retail trade, except for motor vehicles and motorcycles) to 2.98 (Renting of machinery & equipment).

Mark-up ratios are also below unity in the majority of some other tradable services industries, such as electricity, gas & water supply (0.91), construction (0.95), Hotels and restaurants (0.99) and financial intermediation (0.92). However, the ratios exceed unity in education (1.03), health & social work (0.06) and other community, social and personal services (1.01) industries.

The empirical results of the OLS estimation of equation (4) regarding Japan are shown in Table 4. According to the empirical findings, the estimated mark -up coefficients 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).

Regarding the magnitude of the relevant estimates, there is significant variation but the majority of the mark -up ratios estimated by OLS and Bootstrap methods are below unity (18 out of 30 industries), implying the presence of competitive conditions for the manufacturing and services industry in Japan over the period 1970─2007. It is worth mentioning that the magnitude of the estimations does not vary significantly from the ones reported by the bootstrap, 24 out of 30 estimations of mark –up ratios employed by the 2 methods of estimation are moving in the same direction (below or above unity) The above mentioned results imply that the empirical findings are quite robust, that is, the bootstrap estimator reveals that the OLS findings are robust to any simultaneity bias between the control variables and the error terms.

Also, the findings do support that the majority of the sectors of the Japanese manufacturing and services industries appears to operate under competitive characteristics for the period under consideration. The statistical significant mark up ratios employed by the OLS and

Table 4 Estimation of mark up ratios by sector in Japan, 1970–2007

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
D	Total Manufacturing	0.99**	0.48	21.43* [0.00]	0.79***	0.39	17.38* [0.00]	1.04*	0.54	2.58 [0.11]
15 t16	Food, Beverages and Tobacco	0.93***	0.43	13.24* [0.00]	0.74**	0.27	8.38* [0.05]	1.16**	0.34	3.49*** [0.06]
17 t19	Textile, Leather and Footwear	0.81*	0.25	5.11** [0.05]	0.60*	0.10	2.57 [0.11]	–	–	–
20	Wood and of wood and cork	3.38***	0.78	28.71* [0.00]	1.33***	0.42	4.21** [0.04]	0.97*	0.96	1.00 [0.32]
21 t22	Pulp, paper, printing and publishing	2.31**	0.54	6.77** [0.06]	1.22*	0.12	–	0.72**	–	–
23	Coke, refined petroleum and nuclear fuel	1.41*	0.43	10.65* [0.00]	0.93**	−0.02	0.68 [0.61]	0.55*	−0.16	0.01 [0.94]
24	Chemicals and chemical products	1.48**	0.31	5.07** [0.06]	2.63**	0.23	2.45 [0.12]	–	–	–
25	Rubber and plastics	0.85**	0.06	1.77 [0.21]	0.62***	−0.03	0.54 [0.46]	1.85*	−2.66	0.29 [0.59]
26	Other non-metallic mineral	0.91**	0.49	17.17* [0.00]	0.79*	0.35	11.24* [0.00]	0.88**	0.37	0.00 [0.99]
27 t28	Basic metals and fabricated metal	1.03*	0.43	9.91* [0.01]	0.71***	0.20	4.46** [0.03]	–	–	–
29	Machinery, nec	1.43*	0.12	2.20 [0.18]	0.98*	0.02	0.80 [0.37]	0.23*	−0.66	0.38 [0.54]
30 t33	Electrical and optical equipment	1.18*	0.56	20.28* [0.00]	0.86**	0.38	12.53* [0.00]	2.27*	0.46	0.46 [0.50]
34 t35	Transport equipment	0.99**	0.53	20.16* [0.00]	0.86**	0.36	15.18* [0.00]	1.02**	0.53	0.07 [0.79]

Table 4 (continued)

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
36 t37	Manufacturing, nec, recycling	1.05***	0.31	8.68* [0.01]	0.89*	0.21	7.37* [0.01]	–	–	–
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	1.37*	0.55	16.84* [0.00]	0.81**	0.38	11.89* [0.00]	0.71**	0.58	0.22 [0.64]
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.94*	0.27	4.36** [0.07]	0.68*	0.06	1.62 [0.20]	0.68*	0.50	1.55 [0.21]
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.99**	0.56	24.15* [0.00]	0.78*	0.40	16.45* [0.00]	0.68**	0.61	2.16 [0.14]
60 t63	Transport and storage	1.00**	0.61	34.50* [0.00]	0.88**	0.41	19.22* [0.00]	1.23**	0.45	2.26 [0.13]
64	Post and telecommunications	0.98*	0.47	14.96* [0.00]	0.86**	0.42	18.85* [0.00]	0.92***	0.81	1.78 [0.18]
70	Real estate activities	2.15*	0.75	47.84* [0.00]	1.23*	0.45	15.95* [0.00]	1.52**	0.67	1.20 [0.27]
71 t74	Renting of machinery & equipment and other business activities	0.88*	0.28	8.34* [0.01]	0.79***	0.16	5.47** [0.02]	–	–	–
E	Elecricity, Gas & Water Supply	0.90***	0.18	3.57*** [0.09]	0.74***	0.06	2.13 [0.14]	0.69*	0.01	0.08 [0.77]
F	Construction	0.90**	0.20	4.19** [0.06]	0.68*	0.01	1.17 [0.28]	0.69*	−0.41	0.10 [0.75]
H	Hotels and restaurants	0.72*	0.16	3.29*** [0.10]	0.75*	0.07	2.36 [0.12]	0.58*	−0.15	1.09 [0.30]
J	Financial intermediation	0.97***	0.24	5.33 [0.04]	0.92*	0.09	1.91 [0.17]	0.53*	−0.36	2.23 [0.14]
L	Public administration and defence; compulsory social security	1.08*	0.73	76.63* [0.00]	1.00**	0.63	104.90* [0.00]	0.83**	0.83	4.48** [0.03]

Table 4 (continued)

ISIC	Sector	OLS			BOOTSTRAP			2SLS		
		Mark-up ratio	Adjusted R^2	F-statistic	Mark-up ratio	Adjusted R^2	Quasi-LR stat	Mark-up ratio	Adjusted R^2	J-Statistic
LtQ	Community, social and personal services	0.87*	0.48	19.61* [0.00]	0.74**	0.28	10.15* [0.00]	0.74*	0.62	0.01 [0.94]
M	Education	1.95**	0.50	24.36* [0.00]	1.54*	0.43	33.66* [0.00]	0.59*	−0.08	0.48 [0.49]
N	Health and social work	1.25**	0.60	32.29* [0.00]	1.20*	0.43	22.86* [0.00]	1.00*	0.67	1.07 [0.30]
O	Other community, social and personal services	0.82***	0.43	22.05* [0.00]	0.82**	0.24	12.26* [0.00]	0.57**	−0.53	0.06 [0.81]
P	Private households with employed persons	0.74**	0.17	5.16** [0.03]	0.83**	0.17	7.87* [0.01]	0.56***	−1.74	0.03 [0.87]

Figures in square brackets are the reported *p*-values. Significant at * 1 %, ** 5 % and *** 10 % respectively. Lerner Indexes are available upon request. "-" indicates that no data were available or estimates are statistical insignificant. Standard errors were computed by the delta method. For all the 2SLS regressions the Instrument Rank is bigger than the slope coefficients of the regression included constant

Source: Authors' calculations based on EU-KLEMS database

Bootstrap methods of estimation in food, beverages and Tobacco industries (code 15 t16) which accounts for large portion of the total gross output in manufacturing is close to unity (0.93) with OLS estimation and below unity with Bootstrap method of estimation (0.74). The estimated results from both methods of estimation are not supported by Martins and Scarpetta (1999) regarding the Food products sector (1.32) and the Beverages sector (1.26). The empirical results in food, beverages and Tobacco industries of this paper indicate no evidence of market power.[7]

The only sectors in manufacturing industries in which the estimated mark – up ratios exceed unity and the empirical results are robust, that is they are confirmed by both OLS and Bootstrap methods of estimation, are those of Wood and of wood and cork (3.38 - code 20), Pulp, paper, printing and publishing (2.31 - code 21 t22) and Chemicals and chemical products (1.48 - code 24). These results are supported by the paper of Martins and Scarpetta (1999) and as it concerns Chemicals and chemical products industry by the paper of Nishimura et al. (1999). The Textile, Leather and Footwear industry (code 17 t19) depicts the lowest mark – up ratio employed by OLS and Bootstrap methods of estimation in Japanese manufacturing sector (0.81 and 0.60 respectively).

In the services industry (two & four digit codes from 50 to 74) almost all the mark-up ratios lie below unity implying that there is no evidence of market power. They range from 0.88 (Renting of m&eq. and other business activities – code 71 t74) to 1.00 (Transport and storage – 60 t63). The only sector in services industries in which the estimated mark – up ratio exceeds unity is this of Real estate activities (2.15 and 1.23 with OLS and Bootstrap estimators respectively – code 70).

The majority of mark-up ratios are close but below unity in other tradable services industries, such as electricity, gas & water supply (0.90), Construction (0.90), Hotels and restaurants (0.72), Financial intermediation (0.97), Community, social and personal services (0.87), Other community, social and personal services (1.82) and Private households with employed persons (0.74). However, the ratios exceed unity in education (1.95) and health & social work (1.25) industries.

5 Stylized Facts

From the empirical findings of the previous section some stylized facts are emerged. A first stylized fact that may be derived is that *there is no evidence of imperfect competition across the majority of industries in Eurozone*, *US and Japan*. It is evident from Tables 2, 3 and 4 that the majority of the estimated mark – up ratios are statistically significant below unity. Table 5 categorizes the sectors in Eurozone, US and Japan into competitive and less competitive ones.

Table 5 reveals that almost 75 % of the sectors under scrutiny across Eurozone, US and Japan are characterised as competitive and the remaining percentage (25 %) are characterized as less competitive. In 18 sectors we cannot draw a final conclusion regarding the degree of competition on them since the empirical findings of Bootstrap method of estimation do not coincide with the corresponding findings of OLS and 2SLS methods of estimation.

A second stylized fact that may be derived is that *mark – up ratios are heterogeneous across industries with services having higher mark – up ratios than manufacturing industries*.

[7] Nishimura et al. (1999) report that in Food processing industry the estimated average mark – up ratio exceeds unity.

Table 5 Estimated mark up ratios* & degree of competition in Eurozone, US and Japan, 1970–2007

ISIC	Sector	Eurozone			US			Japan		
		Mark-up ratio	Competitive**	Less competitive***	Mark-up ratio	Competitive**	Less competitive***	Mark-up ratio	Competitive**	Less competitive***
D	Total Manufacturing	0.88**	–	–	0.94***	✓		0.99**	✓	
15 t16	Food, Beverages and Tobacco	0.94**	✓		0.97***		✓	0.93***	✓	
17 t19	Textile, Leather and Footwear	0.53*	✓		0.90**	–	–	0.81*	✓	
20	Wood and of wood and cork	0.84**	✓		0.85*	✓		3.38***		✓
21 t22	Pulp, paper, printing and publishing	0.84***	✓		0.91***	–	–	2.31**		✓
23	Coke, refined petroleum and nuclear fuel	0.94*	✓		1.16*		✓	1.41*	–	–
24	Chemicals and chemical products	0.96*		✓	1.03*	–	–	1.48**	✓	
25	Rubber and plastics	0.91*	✓		0.93**	✓		0.85**	✓	
26	Other non-metallic mineral	0.86*	✓		1.00**	✓		0.91**	✓	
27 t28	Basic metals and fabricated metal	0.96**	✓		0.82**	✓		1.03*	–	–
29	Machinery, nec	0.85**	✓		0.92*	✓		1.43*	–	–
30 t33	Electrical and optical equipment	0.86***	✓		0.84*	✓		1.18*	–	–
34 t35	Transport equipment	1.05**		✓	0.85**	✓		0.99**	✓	
36 t37	Manufacturing, nec, recycling	1.01*		✓	1.11*		✓	1.05***	–	–
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel	0.98*	✓		0.99**	✓		1.37*	–	–
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.87*	✓		0.93*	✓		0.94*	✓	
52	Retail trade, except of motor vehicles and motorcycles; repair of household goods	0.91*	–	–	0.90***	✓		0.99**	✓	

Table 5 (continued)

ISIC	Sector	Eurozone			US			Japan		
		Mark-up ratio	Competitive**	Less competitive***	Mark-up ratio	Competitive**	Less competitive***	Mark-up ratio	Competitive**	Less competitive***
60 t63	Transport and storage	0.70**	✓		0.86*	✓		1.00**	✓	
64	Post and telecommunications	0.99*	–	–	0.90*	✓		0.98*	✓	
70	Real estate activities	0.96*	✓		0.87*	–	–	2.15*		✓
71 t74	Renting of machinery & equipment and other business activities	0.98*	✓		0.94*	✓		0.88*	✓	
E	Elecricity, Gas & Water Supply	0.94**	✓		0.91*	✓		0.90***	✓	
F	Construction	0.82**	✓		0.95**	✓		0.90**	✓	
H	Hotels and restaurants	1.11*		✓	0.99*	✓		0.72*	✓	
J	Financial intermediation	0.95*	–	–	0.92*	✓		0.97***	✓	
L	Public administration and defence; compulsory social security	0.99*	✓		0.86***	–	–	1.08*	✓	
LtQ	Community, social and personal services	1.08*		✓	1.06**	✓		0.87*	✓	
M	Education	0.75**	–	–	1.03**		✓	1.95**		✓
N	Health and social work	0.89**	✓		1.06*		✓	1.25**		✓
O	Other community, social and personal services	1.01*		✓	1.01*		✓	0.82***	✓	
P	Private households with employed persons	–	–	–	0.98**	–	–	0.74**	✓	

*Based on OLS Estimations. ** A competitive sector is defined when the estimated mark – up ratio is lower than unity by both OLS and Bootstrap methods of estimation or Bootstrap and 2SLS estimations move in the same direction (below unity). *** A less competitive sector is defined the estimated mark – up ratio is higher than unity by both OLS and Bootstrap methods of estimation or Bootstrap and 2SLS estimations move in the same direction (above unity). Dashes imply that the estimated mark – up ratio of Bootstrap method of estimation does not coincide with the corresponding ratios of OLS anf 2SLS methods of estimation

Interestingly, estimated mark – up ratios are higher in services industry than in manufacturing industry. In the Eurozone the statistically significant at 5 % level of significance estimated mark – up ratio in total manufacturing industry is 0.88. The average mark – up ratio in services industry is 0.93 indicating that manufacturing industry is exposed more to competition than services industry. The same argument holds in US where the estimated mark – up ratio in total manufacturing industry is 0.94 and the average mark – up ratio in services industry is 0.96 as well as in Japan where the estimated mark – up ratio in total manufacturing industry is 0.99 and the average mark – up ratio in services industry is 1.09.[8]

A third stylized fact that may be derived is that *mark – up ratios are heterogeneous across industries and countries*. It is evident from Tables 2, 3 and 4 and the second stylized fact that the estimated mark – up ratios in manufacturing and services industries are higher than the corresponding ratios in US which in turn are higher than the corresponding ratios in Eurozone. Therefore, Eurozone exhibits the lowest mark – up ratios both in manufacturing and services industries.

A fourth stylized fact that may be derived is that *sectors that are more open to internationalisation*, *experience relatively lower mark up ratios than the ratios experienced in less open sectors to internationalisation*. The textile sector is an interesting example. In Eurozone the estimated mark – up ratio is 0.53 while in Japan is 0.81. These ratios are the lowest among the estimated mark – up ratios in manufacturing industries in Japan and Eurozone. In the US the estimated ratio is 0.90 which is among the five lowest ratios in the manufacturing industry. Another interesting example is the Electrical and optical equipment sector in Eurozone and US. The estimated mark – up ratios in these two sectors are among the three and six lowest ratios in the manufacturing industries in Eurozone and US respectively.

A fifth stylized fact that may be derived is that *deregulated industries generally have lower mark – up ratios than regulated industries*, *while fragmented industries generally exhibit higher mark – up ratios than segmented ones*. In Table 2 the mark – up ratio in Post and telecommunications industry (code 64) is 0.99 (OLS estimation), 1.14 (Bootstrap estimation) and 0.92 (2SLS estimation). These estimated mark – up ratios are close to unity and depict no competitive pressures in the specific industry. Christopoulou and Vermeulen (2012) have stated that the mark – up ratio in the same industry in the Euro area over the period 1980–2004 is 1.48, but this ratio may not reflect the deregulation mechanism that took place in that industry recently. Taking into account the latter our estimation fully reflects the dynamics of deregulation in Post and telecommunications industry across major European countries (12) over the scrutinized period. In the US the corresponding ratios are lower than the ones reported in the Eurozone indicating that the deregulation mechanism that took place there earlier has stronger effects, in terms of competition, than in the Eurozone.

In addition, the mark – up ratio in Coke, refined petroleum and nuclear fuel (code 23) ranges from 0.94 (OLS estimation) to 1.37 (Bootstrap estimation). The latter estimate clearly depicts the existence of major players in the wholesale oil market and the possible fragmentation of that industry (Polemis and Fotis 2013, 2014; Martins and Scarpetta 1999). The same argument holds in the US, even though the magnitude of the estimated ratio is lower it is supported by the three methods of estimation, but the same cannot be argued in favour of the corresponding industry in Japan since the empirical findings are not robust.

[8] The estimated mark – up ratios in total manufacturing is given by EU KLEMS March 2011 database, while the averages mark – up ratios in services industries across countries and Eurozone are calculated given the sectors under scrutiny in this paper.

6 Conclusions and Policy Implications

The aim of this study is to investigate the level of market power of the manufacturing and services industries in Eurozone, US and Japan over the period 1970–2007. The empirical analysis was performed at a disaggregated level (two and four digit code), with the aim of investigating possible heterogeneity across different subsectors of the above industries.

The empirical findings indicate that the majority of manufacturing and services industries operate in competitive conditions during the investigated period since the estimated mark up ratios are generally lower than unity in all of the specifications. Average mark-up ratios are heterogenous across sectors, with services having higher mark – up ratios on average than manufacturing. Also, mark – up ratios are heterogeneous across countries within the Eurozone exhibiting the lowest mark – up ratios both in manufacturing and services industries among the scrutinized countries. The econometric results do not dramatically change when the Bootstrap and the 2SLS methods of estimation are applied implying the robustness of the results.

From the empirical findings it is evident that sectors that are more open to internationalisation such as textiles, experience relatively the lowest mark up ratios revealing no evidence of "*collusion*". In order to enhance the level of internationalisation in the manufacturing sectors, the policy makers and the governments' officials could pursue horizontal strategies focusing on the further opening of the markets.

Furthermore, policy makers should enhance their policy in fragmented industries in which profitability indicators of market players may indicate evidence of imperfect competition. A further segmentation of such industries may increase the degree of competition in upstream oil markets around the world.

To sum up, our analysis will be a useful policy tool to achieve structural micro-economic goals in light of the existing financial crisis. Firstly, given the primary indications regarding the high mark - up ratios in selected industries in manufacturing and services industries, 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.

Given the above considerations, our analysis can be further extended in order to tackle a number of constraints which may be addressed in future work. An analysis using more disaggregated firm level data may enrich our conclusions. Given the validity of the econometric results, the mark up ratios may be improved with the addition of new parameters especially those regarding price formulation. Furthermore, as more information and data become available, especially at the firm level, and more companies enter the sample, more in-depth analysis should be made in order to examine aspects that are not covered by the existing database, since it may not collect information from all the new small entrants. Such a consideration will better capture the dynamism of the manufacturing and services industries and lead the research to further outcomes on developing a consumer policy.

Finally, the methodology applied could be further refined, by estimating the input coefficients of the production function (shares) or by incorporating the role of returns to scale in the estimation of mark – up ratios. These are important issues and remain the subject of future research.

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