Classical competition and regulating capital: theory and empirical evidence

Tsoulfidis, Lefteris and Tsaliki, Persefoni

University of Macedonia, Thessaloniki, Aristotle University, Thessaloniki

2011

Classical Competition and Regulating Capital: Theory and Empirical Evidence

Lefteris Tsoulfidis[*] and Persefoni Tsaliki[**]

Abstract

In this article we discuss the salient features of the classical and neoclassical theories of competition and we test their fundamental propositions using data from Greek manufacturing industries. The cross section data of 3-digit (total 91) industries of the three (pooled together) census years show no evidence of a direct statistical relationship between the degree of concentration and profitability. The econometric analysis of time series data for 2-digit industries lends support to the hypothesis for the long-run tendential equalization of incremental rates of profit to the economy's average.

JEL Classification: B14; C22; L10; 014

Key Words: Competition; regulating capital; incremental rate of profit; tendential equalization

1. Introduction

Classical economists viewed competition as the mechanism through which economic phenomena become independent of "people's will" and give rise to regularities which are amenable to abstract theorization. For instance, J.S. Mill notes: "only, through the principle of competition has political economy any pretension to the character of science. So far as rents, profits, wages, prices, are determined by competition, laws may be assigned for them. Assume competition to be the exclusive regulator, and principles of broad generality and scientific precision may be laid down, according to which they will be regulated" (J.S. Mill, 1848, p. 147). It is important to point out that in this often- cited quotation J.S. Mill simply states what competition does and not what competition is. Classical economists viewed

---

[*] Department of Economics, University of Macedonia, 156 Egnatia Street, P.O. Box 1591, Thessaloniki, Greece. Tel.: 30 31 891-788, e-mail: lnt@uom.gr.

[**] Department of Economics, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece, e-mail: ptsaliki@auth.gr. Authors' note: Author names are randomly ordered.

The authors are indebted to Cyrus Bina, Theologos Dergiades, Costas Leon, Theodore Mariolis, Patrick Mason and Jamee Moudud for their valuable comments and observations, without thereby implicating any of them in the final product.

competition as a process of rivalry among firms in their incessant struggle for survival. The condition *sine qua non* for success of firms in this struggle is the reduction in their unit cost of production in order to undercut prices and expand their market share at the expense of their rivals. The most effective reduction in cost is through innovations which are mainly associated with the investment in fixed capital and also reorganization of the production process.

By the mid-1870s, this realistic notion of competition was gradually replaced by the neoclassical static notion of competition in which the number of firms in the market is the decisive feature of the degree of competition. The fewer the firms, the higher the imperfection in competition and the higher the profitability of the top firms of the industry. By contrast, competition becomes "perfect" when the number of firms becomes infinitely large and each of these firms possesses a tiny fraction of the whole market. In such an industry, the firms merely react to parametrically given prices by selecting the level of output which is consistent with the maximization of their profits. In short, in perfect competition there is no price-cutting behavior, which is equivalent to saying that the very essence of real life competition is spirited away. In fact, in such an environment firms do not really compete with each other.[1] Neoclassical competition also abuses the law of one price. When the law of one price is combined with the complete absence of price-setting capacity by firms and the absence of evolutionary change due to technological progress, firm heterogeneity is destroyed. Hence, all firms will have the same technology, same managerial strategy, same marketing strategy, and produce a product of identical quality with an equal share of the market by all firms within the industry. There will be no threat of entry from firms operating in other industries because all are earning the same rate of profit. Game theory flourished because neoclassicals are unhappy with the textbook analysis of competition, but there is no generally agreed upon game which characterizes a competitive industry. At the other end of the spectrum are Austrian economists, who do have a process theory of competition and who are not concerned with the number of firms in the industry.

---

[1] For detailed discussions of the neoclassical conception of competition and its comparison with the classical see *inter alia* the papers by Clifton (1977), Shaikh (1980), Eatwell (1981), Weeks (1981) Semmler (1984) and Bina (1985, ch. 6).

The purpose of this paper is to test the fundamental tenets of these two alternative theories using data from the Greek manufacturing industries. The remainder of the paper is organized as follows: Section 2 highlights the most important features of the alternative conceptions of competition. Section 3 investigates the extent to which the degree of concentration in Greece changed over time and also subjects to empirical testing the hypothesis of a direct relationship between the degree of competition as measured by the usual variables and profitability. Section 4 discusses the extent to which there is a long-run equalization of profit rates between industries. Finally, Section 5 concludes and makes some remarks about the direction of future research efforts

2. Static and Dynamic Conceptions of Competition

The static notion of competition is associated with neoclassical economics, which is taught in the standard microeconomic theory. In this approach, competition is viewed as a state of equilibrium, where perfectly informed agents producing a product exactly like their "rivals" operate in a market with no entry or exit barriers. In such an environment, each agent in and of itself cannot affect the market outcome and simply reacts to parametrically given prices. The number of participants in an industry and their size relative to the market defines the degree of competition, and when the number of participants is sufficiently large and the market share of each participant is relatively small one expects a uniform profitability within and across industries. By contrast, as the number of participants diminishes, phenomena such as oligopolistic or monopolistic behavior arise, which lead to differential profitability between firms within the industry but also between industries. One of the fundamental propositions in standard microeconomic theory is that the presence of profits over and above the average is attributed to market imperfections and to the degree of monopoly power of firms over market forces. In such non-competitive equilibrium, some prices remain higher than their marginal cost and society underutilizes its resources.

Historically, within the neoclassical approach to competition there are two major lines of research. The first comprised by proponents of monopolistic competition arguing that the actual economy is characterized by imperfections giving rise to distortions and by theorizing these imperfections propose specific antitrust and regulation policies in order to correct the actual economic life and make it look more like perfect competition. This approach originating from economists from Harvard University (with main representatives Edwin Chamberlin, Joe Bain and John K. Galbraith) naturally has been characterized as "imperfectionist". The antimonopoly legislation and government regulation of industry instituted in the USA and have been subsequently adopted, to a great extent, in a number of European countries is rooted into this "imperfectionist" approach. It is important to stress at this point that these imperfect competition models were further elaborated in the recent decades so as to become part of New Trade Theory and New Growth Theory. And yet lurking under all these imperfect competition models was the fundamental faith in perfect competition. As Krugman and Wells (2006, p. 365) point out "[…] much of what we learn from the study of perfectly competitive markets-about costs, entry and exit, and efficiency-remains valid despite the fact that many industries are not perfectly competitive."

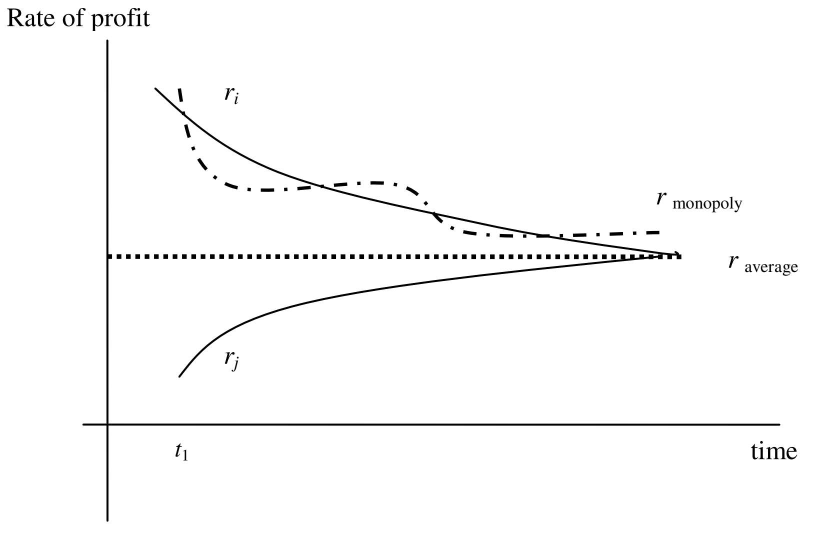
On the second camp, there are economists arguing, on both methodological and empirical grounds, that there is no such a thing as "monopolistic" or "oligopolostic" competition and the actual economic life is not in any empirically significant deviation from the ideal model of perfect competition. Historically, these economists are associated mainly with the University of Chicago, with chief representatives George Stigler, Milton Friedman and Arnold Harberger. Naturally, the approach of these economists has been characterized "perfectionist" and the relaxation of antimonopoly legislation in the USA and also the ideas for deregulation that swept the globe in the past few decades is attributed to the perfectionists' arguments.

In the ensuing debates, the "perfectionists" view dominated over the "imperfectionist" in the first postwar decades, but from the late-1970s onwards the imperfectionists made a strong comeback by modeling, this time, their views of monopolistic competition in a more rigorous way and by providing the much-needed (but not necessarily well formulated as this can be judged by the results) microfoundations to the current macroeconomic theory. Fierce as it may have been the debate between the economists in the two camps, it is recognized that, at the end, they both, perfectionists and imperfectionists, assumed the importance of perfect competition. The imperfectionists use the perfect competition concept as a yardstick to gauge the extent to which real economic life differs from the perfectly competitive one, while the perfectionists argue that there are no significant differences between the actual and the perfectly competitive economy. It is interesting to note that the pro-market conclusions of the perfectionist approach are reached using time series data spanning over a long period of time. However, such an approach is at odds with the neoclassical concept of competition, an essentially static approach for it is oriented to the study of market forms and not to organizational changes of enterprises that take place over time.

In the neoclassical conception of the interindustry equalization of profit rates, we observe that the mechanism that restores equilibrium is approximately the same with the classical economists (Flaschel and Semmler, 1987; Duménil and Lévy, 1987). The idea is that profit rate differences from the average (normal) rate of profit are caused by external shocks (in preferences, technology, costs and the like) which sooner or later dissipate, unless there are further external shocks or barriers to free mobility of resources that prevent the convergence of profit rates to the economy's equilibrium average profit rate. It is important to stress that, in the usual neoclassical analysis; the emphasis is placed on the entry or exit as well as the number of firms and not on the acceleration or deceleration of capital accumulation.

Figuratively speaking, the equalization of profit rates in neoclassical economics is visualized as an initial displacement from equilibrium at time t_1, as a result of a positive or negative external shock and sooner or later the individual rates of return to their equilibrium position and stay there, unless the economy or the industries are hit by more shocks (see Figure 1). If the path of the rate of profit of an industry remains above the economy's average over time (the dotted line in Figure 1), this is taken as an indication that such an industry possesses (some sort of monopoly) power over market forces.

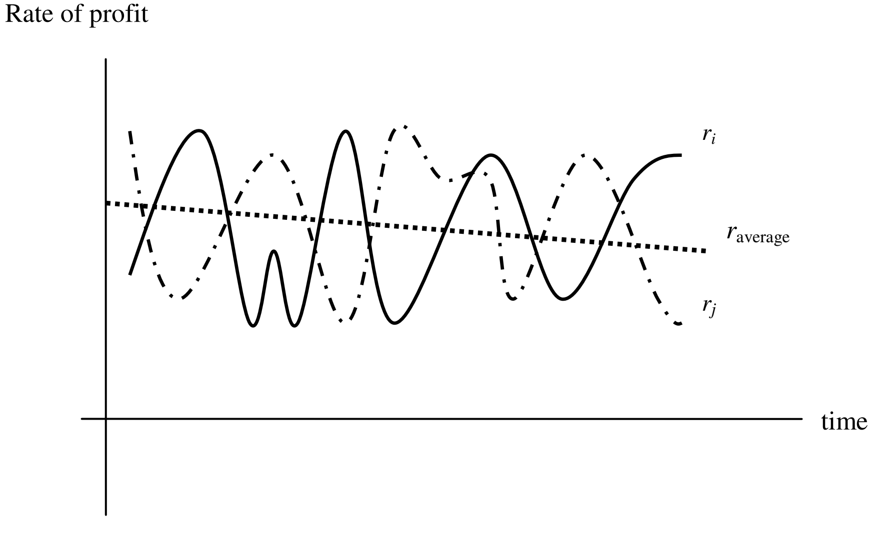
Figure 1. Neoclassical Process of Convergence



The dynamic notion of competition is found in the writings of classical economists, Adam Smith (1776), David Ricardo (1821) and John Stuart Mill (1848), who theorized competition as a process characterized by the free mobility of capital and labor that in the long-run leads to the equalization of profit rates across industries. For classical economists, the mechanism for the elimination of inter-industry profit rate differentials is the flow of capital (and not necessarily of firms) in and out of industries in its relentless effort to take advantage of profit opportunities. For example, Ricardo (1821, pp. 88-89) notes "[t]his restless desire on the part of all the employers of stock, to quit a less profitable for a more advantageous business, has a strong tendency to equalize the rate of profits of all, […] There is perhaps no manufacturer, however rich, who limits his business to the extent that his own funds alone will allow: he has always some portion of this floating capital, increasing or diminishing according to the activity of the demand for his commodities." This process of capital flows by no means implies that overtime there is equality of profit rates between industries, but that the equalization is only tendential and is established on an average and after the passage of long time. At any moment in time one can only observe differences, small or large, between an industry's profit rate and the economy's average.

More specifically, in this turbulent equalization the profit rates orbit around the economy's average rate of profit and only over a long period of time, the positive and negative deviations cancel each other out, and, therefore, equalize the interindustry profit rates to the economy's average (Figure 2, below). Alternatively, in the classical competitive process the interindustry profit rates are mean-attracted variables. Furthermore, it should be mentioned that classical profit rate equalization involves large and small firms all of which are price-setters, whereas the neoclassical perspective it assumes that the firms are tiny price-takers.

Figure 2. Turbulent Equalization of Interindustry Profit Rates



Both the neoclassical and the classical approaches to competition would share the view for the equalization of profit rates between industries. However, there are important differences between the two approaches as the neoclassical would begin with the equalization of profit rates which is disrupted by an exogenous (positive or negative) shock. The industry affected by such a shock its rate of profit would be displaced away from the average and in the absence of further shocks it would converge asymptotically back to its initial position (see Figure 1).[2] Convergence at a rate of profit above the economy-wide average is also possible but this would be *prima facie* evidence of the presence of monopoly power caused mainly by imperfections in the operation of the market. Such imperfections may include various barriers to entry, risk, government regulation and the like.

By contrast, in the classical approach to competition there is no convergence, but persistent fluctuations of industries' profit rates around the economy's average; hence, the profit rate of any particular industry will be different from the average; however, over a sufficiently long period of time these deviations from the average cancel each other out and their sum is not expected to be different from zero.

The analysis of competition in Marx is an extension and further elaboration of the analysis of the classical economists. Marx theorizes competition as a process of rivalry involving units of capital struggling for survival, which in conditions of capitalism is manifested in the insatiable desire of capital to expand its profits as a condition *sine qua non* for survival. The desire for profit drives each unit of capital in rivalry with anything that stands as an obstacle to fulfilling its primary objective. This rivalry is what Marx defines as competition which is not restricted to capitals struggling over market shares and profits but it extends to include various other competitions. For example, competition of capital against workers in the labor process to increase productivity and reduce unit cost of production. The details of this type of competition have been discussed extensively in vol. I of *Capital* and have been widely read for their social consequences (length of working day, division of labor, automation, *etc*.). Capital against state for the decrease in taxation and the lifting of various government regulations; state against state over markets and sources of raw materials. Some other competitions may also include workers against workers over employment positions, and many more. In short, capitalist competition in Marx is viewed as "war of all against all" or according to Heraclitous famous dictum "war [=competition]

[2] There is no obvious reason for smooth or quick convergence in a neoclassical model. Neoclassical economists have models of cobwebs in agricultural production and cycles of above and below average profitability in capital-intensive manufacturing. However, neoclassical models do require homogeneous firms.

is the father of all and king of all". Marx's analysis, however, is not limited to these war-like social aspects of competition but expands to analyze the economic results of this universal rivalry in capitalism that gives rise to law-like generalizations which Marx developed in the third volume of *Capital*.

This view of competition as a process of rivalry between firms can also be found in the works of Joseph Schumpeter (1942) and the modern Austrian economists (*e.g.*, Kirzner, 1987). In the various Austrian strands to competition, the entrepreneur is a pivotal figure assuming the risk and uncertainty that are inherently built into the system in which individuals grope toward equilibrium. The trouble with the various Austrian approaches to competition is that they are simply critical to the unrealistic aspects of neoclassical competition, without managing to formulate their own approach into a workable model and in so doing to demonstrate their alternative in a coherent manner. This is not, however, the case in Marx's analysis, where there is a clear distinction of competition between firms (units of capital) that are activated within industries and competition between industries. Such a distinction across interindustry and intraindustry competition is not developed neither in the writings of classical nor Austrian economists, where often the two types of competition are intermingled and so the theoretical insights of these economists could not develop to a fully operational model.[3] In neo-classical economics we do find the distinction; nevertheless, it is made for formal and not analytical and substantive reasons, inasmuch as all firms, regardless where they are activated are assumed to gain the same rate of profit, and, therefore, the distinction of competition between and within industries is not used to explain the different phenomena associated with each type of competition.[4]

[3] In the exceptions are included the efforts to operationalize the Schumpeterian view of competition in the works of Nelson and Winter (1982) and other evolutionary theorists although there has not been significant progress. In similar vain, one could include Baumol's (1982) contestable market hypothesis which however did not generalize to include industries other than specific ones.

[4] It is interesting to note at this point, in addition to the classical and Austrian traditions there is another important anti-marginalist and anti-monopoly capital approach developed by the Oxford Economists' Research Group, in particular the work of P.W.S. Andrews. Moudud (2010, ch. 2) shows that P.W.S. Andrews contributions rule out the notion of competition as a market structure and his pragmatic approach bears striking similarities with the classical approach to competition.

By contrast, in Marx the distinction of competition between and within industries is being made for substantive reasons, as he identified certain phenomena caused by the two "moments" of competition. Thus, competition within industries establishes a uniform price; the famous "law of one price" which Marx (1894, p. 865) stated it as follows, "competition can only make the producers within the same sphere of production sell their commodities at the same price". The "law of one price" is a tendency generated by cost cutting firms in their continual struggle to obtain and maintain a cost advantage. As a consequence, the law of one price is a manifestation of cost differences between firms activated within an industry, which gives rise to excess profits or losses and therefore makes possible the transfers of values within industries from the less to more efficient firms. Hence, it is important to note that both classical and neo-classical perspectives also share the law of one price. This law has enormous implication; for instance, in international trade the law of one price is being used to establish the purchasing power parity hypothesis; in the labor markets to advocate that there is no racial or gender discrimination, and that wage differentials simply reflect skill differences; in product markets price differences represent differences in quality; and managerial and marketing strategies advocate the idea that everybody behaves the same way. The Marxian concept of competition also uses the law of one price, but when combined with the notion of regulating and sub-dominant capitals produces heterogeneity in all of the areas neoclassicals posit homogeneity. The idea is that as all firms in the industry sell at the same price the differences in their unit costs gives rise to differential profit rates. There are differences in unit costs of production because of differences in the vintages of physical capital, differences in managerial strategies, differences in marketing strategies, and differences in non-labor input costs. Hence, a single price combined with inter-firm differences in competitive structure may accommodate within-industry differences in profitability.

In the other moment of competition between industries, the main phenomenon that we expect to identify is the tendential equalization of profit rates. For example, Marx notes that "[w]hat competition, first in a single sphere, achieves is a single market-value and market-price derived from the various individual values of commodities. And it is competition of capitals in different spheres, which first brings out the price of production equalizing the rates of profit in the different spheres. The latter process requires a higher development of capitalist production that the previous one" Marx (1894, p. 180). The interindustry equalization of profit rates implies that industries with high capital requirements per unit of output (or labor) are expected to display profit margins on sales higher than those industries with low capital requirements per unit of output (or labor). Furthermore, industries with high capital requirements tend to respond to variations in demand more with variations in their capacity utilization and less by price changes. As a result, capital intensive industries are expected to display relatively more stable prices, profit margins (on sales) and profit rates for every percentage change in demand. These phenomena of competition (high profit margins, sticky prices and reserve capacity) are often interpreted as evidence of the presence of monopoly power, however these are precisely the expected, and, therefore, normal results of the equalization of profit rates between industries.[5] Equalization of profit rates takes place among regulating capitals. Combined with the law of one price, it implies that competition is associated with persistent inter- and intra-industry difference in the rate of profit.

3. Concentration and Profitability in Greek Manufacturing

Industrial organization studies for the Greek economy, in general, and for its manufacturing sector, in particular, are rare; those few studies usually measure concentration ratios at the 2-digit industry aggregation level (Tsaliki and Tsoulfidis 1998, Kaskarelis and Tsoulfidis, 1999). In the present study, we employ data at the 3-digit industry detail providing a classification of 91 industries for three manufacturing censuses (years 1978, 1984 and 1988) conducted by the National Statistical Service of Greece. The concentration ratios of the industries refer to the employment base,[6] whereas our proxy for profitability is the share

[5] For further discussion see Shaikh (1982) and Semmler (1984) and for empirical tests of these propositions see Ochoa and Glick (1992) and Tsaliki and Tsoulfidis (1998).

[6] We measure the employment of the top four firms of each of the 91 large-scale industries, that is, the firms that operate in these industries employ at least ten workers, as a percentage of the total

of gross profits estimated in producer prices and therefore include no indirect business taxes to total sales of large-scale industry.[7]

The regressions between the so-estimated profit margins on sales (PMS) against the concentration ratio of the top four firms in the industry (CR) did not display a statistically significant relationship. In fact, the coefficient of determination was found to be indistinguishable from zero and the coefficient of the independent variable not statistically significant. The simple regressions with the Herfindahl Index (HI) of concentration provided similar results with those of the CR of the top four firms in the industry for the two years of the analysis. Furthermore, in non-linear regressions the results are negative for the neoclassical theory of competition. Hence, the correlation of profitability with the degree of concentration is too weak and does not lend support to the view that the concentrated industries necessarily display higher profitability as a result of their monopoly power.

An inspection of the data reveals that in the period between the years 1984 and 1988 there has not been any fundamental change in the structure of the Greek manufacturing.[8] Furthermore, the concentration index of the top four firms for the three years does not reveal any significant change, as this can be judged from the summary statistics that we report in Table 1. The results are similar for the HI.

---

employment in the industry. The data come from three censuses conducted by the National Statistical Service of Greece and refer only to employment. Unfortunately, there are no data on sales the usual base for many studies. It is recognized though that both bases (employment or sales) are highly correlated (see also Scherer and Ross, 1990 and Sawyer, 1981) and are therefore likely to give rise to qualitatively similar results.

[7] Data on profits and sales for the year 1978 are not available; thus our analysis is essentially restricted to the years 1984 and 1988. Nevertheless, we report the concentration index of the year 1978 to show that the changes in the degree of concentration are rather slow.

[8] Droucopoulos and Papadogonas (2000) using unpublished data of the year 1992 also find that the concentration indexes pretty much remain the same over the years.

Table 1. Summary Statistics of Concentration Indexes in Greek Manufacturing

	CR-78	**CR-84**	**CR-88**	**HI-78**	**HI-84**	**HI-88**
Mean	0.451	0.435	0.423	0.101	0.096	0.089
Median	0.452	0.404	0.398	0.075	0.065	0.069
Maximum	1.000	0.965	0.972	0.530	0.508	0.540
Minimum	0.040	0.049	0.045	0.002	0.002	0.002
Standard deviation	0.242	0.230	0.229	0.101	0.098	0.088
Coefficient of variation	0.536	0.528	0.542	0.998	1.015	0.981

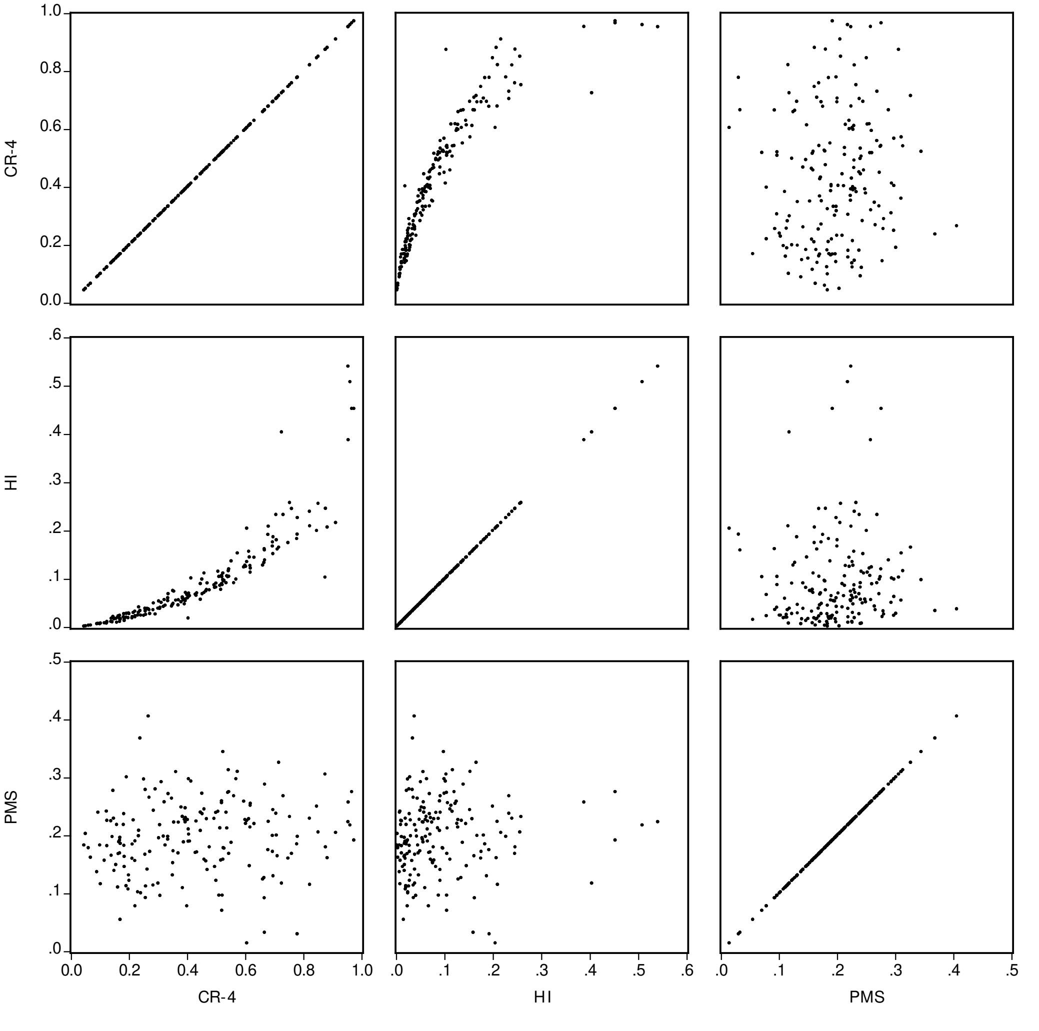
Note: 91 observations, the numbers following CR and HI are the years..

In what follows we pool together the data on CR of the top four firms and Herfindahl index along with the profit margins on sales and we present in pairs the one variable against the other. We observe that the CR and HI are too closely related and each of these two variables is not connected in any systematic way with the profit margin on sales, an absolutely acceptable measure of profitability in neoclassical analysis. The reason why we chose the profit margin on sales as an index of profitability is that the neoclassical analysis is interested in profits *per se* irrespective of the base on which these profits are being estimated. And in the absence of detailed capital stock data (available only at the 2-digit industry level) we restricted the presentation to the share of profits in total sales, *i.e.*, the profit margin on sales. The data on sales unfortunately are not available for the year 1978 and so we pooled together only the data of the years 1984 and 1988. From the scatter graphs of the combination of pairs of these variables (CR, HI and PMS presented in Figure 3) it is of great interest the horn-like pattern of the CR4 and HI which is quite usual in this type of studies.[9] The visual inspection of the concentration indexes and the profit margin on

[9] The horn-shape relationship between the CR and the HI was theoretically and empirically investigated in Kwoka (1981) and Sleuwaegen and Dehandschutter (1986). The implications of the horn-shaped relationship is that the HI is a superior measure of the degree of concentration relative to the CR of the top usually four firms. The CR4 tends to overestimate concentration of the top firms, whereas the HI as it takes into account the size distribution of all firms and squares the shares of each of these firms gives more weight to the top firms. At this point it is enough to note that the

sales reveals no relationship of the variables involved something that is supported by our statistical findings.

Figure 3. Measures of Concentration vs. Profit Margins



This lack of statistical significance is conferred in Table 2 below, where the lower triangle presents the Pearson correlation coefficients of the variables at hand along with their

two measures of concentration are not out of touch with each other and this result is also derived in our study.

statistical significance as this can be judged by their probability values shown in parenthesis, for the years 1984 and 1988. The upper triangle of Table 2 displays estimates of the Spearman's rank correlation coefficients, whose advantage over the Pearson's correlation coefficients is that they account for possible nonlinear relations. The probabilities shown in the parentheses indicate statistically insignificant correlations between profit margin on sales and concentration ratios, with the exception of the Spearman's rank correlation coefficient between the variables PMS (1988) and HI (1988) and between PMS (1988) and CR (1988) which are statistically marginally significant at the 5% and the 10% level of significance (p-values: 0.05 and 0.07, respectively).

Table 2: Pearson's and Spearman's Rank Correlation Coefficients

	CR-84	CR-88	HI-84	HI-88	PMS-84	PMS-88
CR-84	-	0.932 (0.00)	0.978 (0.00)	0.900 (0.00)	0.108 (0.30)	0.147 (0.16)
CR-88	0.928 (0.00)	-	0.915 (0.00)	0.978 (0.00)	0.180 (0.08)	0.190 (0.07)
HI-84	0.886 (0.00)	0.792 (0.00)	-	0.894 (0.00)	0.105 (0.32)	0.144 (0.17)
HI-88	0.796 (0.00)	0.871 (0.00)	0.801 (0.00)	-	0.207 (0.04)	0.204 (0.05)
PMS-84	0.052 (0.62)	0.132 (0.21)	0.037 (0.73)	0.188 (0.07)	-	-0.004 (0.99)
PMS-88	0.142 (0.17)	0.163 (0.12)	0.145 (0.17)	0.112 (0.29)	-0,041 (0.70)	-

The results of the statistical analysis are definitely negative for the neoclassical and in general the quantitative hypothesis of competition, in which the number of firms (degree of concentration) in an industry decides for the intensity of competition and by extension the level of profitability measured by the profit margin on sales.[10]

[10] P. Mason (1994) reports similar results for the concentration ratio and profit margins on sales for the US economy and this should not come as a surprise as the results that have established the idea of concentration rate were very weak from the very first study by Bain (1951) and then the literature has shown all possibilities for a summary of these studies. For a review of studies of various countries see Sawyer (1981, ch. 6) and Schmalensee (1989, p. 975).

4. Equalization of Profit Rates across Industries

The empirical analysis so far has been static, since we examined the extent to which profit margin on sales are positively correlated with the concentration indexes. The results overall show that there is no statistically significant relationship between profit margin on sales and the two measures of concentration. The next step is to test the long-run tendential equalization of profit rates in Greek manufacturing industries. For this purpose, and also due to the lack of data on for capital stock and investment for the 3-digit industries, we restrict ourselves to 2-digit industries of the Greek manufacturing. We begin with the analysis of the (weighted) average rate of profit of each industry and its deviation from the weighted average. In this analysis it is important to note that the rate of profit is usually estimated as profits over capital stock of the same time period. In reality, and also being consistent with the classical analysis, the profits must be estimated on capital advanced in the beginning of the production period, whereas profits are collected at the end of the production period with the sale of the products. Thus, a more realistic measure of profit rate should include capital advanced lagged by one period. Furthermore, in the capital advanced one must, in principle, include wage and materials along with the other capital stock (structures and equipment). However, for modern industries in general and manufacturing in particular, the wages advanced must be a limited percentage of the total capital outlays, which business people could easily raise through the credit system, and, therefore, it is not unrealistic to exclude wages from the total stock of capital. The materials advanced, usually associated with the inventories, can be in principle estimated with the use of turnover times approximated by the inventories-to-sales ratio. We think that while such estimations would be desired, nevertheless the lack of data does not allow them in the case of Greek manufacturing industries. Besides, circulating capital advanced would be of much more importance in the estimation of the profit rate of the trade rather than the manufacturing sector of the economy, where there is a constant pressure for the minimization of inventories through the just-in-time production.

In what follows, we describe the model that we employ to test the hypothesis of the interindustry tendential equalization of profit rates. A similar formulation has been used for empirical studies for the U.S.A. (Glick, 1985) and for Canada (Webber and Tonkin, 1990).[11] In the more recent studies, the same questions are being pursued with the use of various tests of stationarity and also cointegration techniques.[12] However, we opted for the autoregressive scheme for its economically meaningful properties which are discussed below.

Let $r_t^i = S_t^i / K_{t-1}^i$ be the profit rate series of industry i, for t = 1, 2, ..., n, whereas, S and K stand for profits and capital stock, respectively. If $\overline{r}_t$ is the weighted average rate of profit of the manufacturing sector at time t, and $x_t^i = r_t^i - \overline{r}_t$ is the difference of the rate of profit of industry i from the average of the entire manufacturing at time t. Let us suppose that the time series of these deviations follow an autoregressive scheme

$$x_{t+1} = a + bx_t + u_{t+1} \tag{1}$$

where for simplicity's sake we ignore the superscripts. Let us further suppose that the disturbance term u_t is white noise. The autoregressive scheme of the second period gives

$$x_{t+2} = a + bx_{t+1} + u_{t+2} = a + ab + b^2 x_t + bu_{t+1} + u_{t+2} \tag{2}$$

and for n periods we get

$$x_{t+n} = a(1 + b + b^2 + \ldots + b^{n-1}) + b^n x_t + u_{t+n} + bu_{t+n-1} + \ldots + b^n u_t \tag{3}$$

[11] There are two studies for the Greek manufacturing industries, by Lianos and Droucopoulos (1993) Droucopoulos and Lianos (1993) that pursue the question of equalization of profit rates with somewhat different methodology. Also the book by Mueller (1990) contains many contributions that use autoregression models for various countries. An autoregressive model is also used by Bahce and Eres (2010) in their study of Turkish manufacturing, while Mueller (1986) suggested running a regression of the profit rate deviations against the reciprocal of time trend raised to various powers. A similar model was employed in Tsoulfidis and Tsaliki (2005) and Vaona (2011).

[12] See for instance, A. Zacharias (2001) where the issue of tendential equalization of the average profit rates is pursued through the cointegration technique. We opted for the autoregressive schemes, which have been traditionally used in similar studies for they are simple and also economically meaningful. Furthermore, our sample size is not large enough for the efficient use of Johansen or other econometric techniques, whereas those techniques which are more suitable to small samples (and mixed order of integration) such as for example the ARDL would be cumbersome to apply in our case.

We distinguish the following three cases which are related to the three kinds of terms included in the last equation:

i. If b>1, the term in the parenthesis (in equation 3) will increase with n. If on the other hand, b<-1, the term in the parenthesis will increase in absolute prices as n increases with alternating sign. In both cases, the deviation series is not stationary, the variance of the series grows exponentially over time and thus it displays explosive behavior. Naturally, this case should be excluded from our analysis as economically implausible. In the border case that b=1, then the model is still not stationary and its long run variance increases over time as is not bounded, and the model does not have a static equilibrium solution. The values of x_t wander without any systematic pattern. This behavior is not expected with our series.

ii. If, -1<b<1, the term in the parenthesis (in equation 3) will approximate the limit 1/(1-b), while the second term $b^n x_t$ approaches zero. If, in this case, a=0 the above limit equals zero indicating that the series of profit rate deviations approaches the mean profit rate of all industries. If a>0, the rate of profit of the industry approaches a limit which is above the average of manufacturing. Finally, if a<0, the rate of profit of the industry approaches a limit which is below the average of manufacturing.

iii. Finally, the third term (of equation 3) which is the sum of error terms of the above equation. Since each term has a conditional mean equal to zero, it follows that the mean of the sum of the stochastic terms will be also equal to zero. In addition, each stochastic term is independent of the others (by assumption) and has constant variance, which we symbolize by σ^2. Consequently, the sum of errors has a bounded variance equal to $(1+b+b^2+\ldots+b^n)\sigma^2$. If -1<$b$<1 and n increases, the above expression tends to the limit $[1/(1-b)]\sigma^2$. If b>1 or b<-1, the variance of the stochastic term increases as n increases.

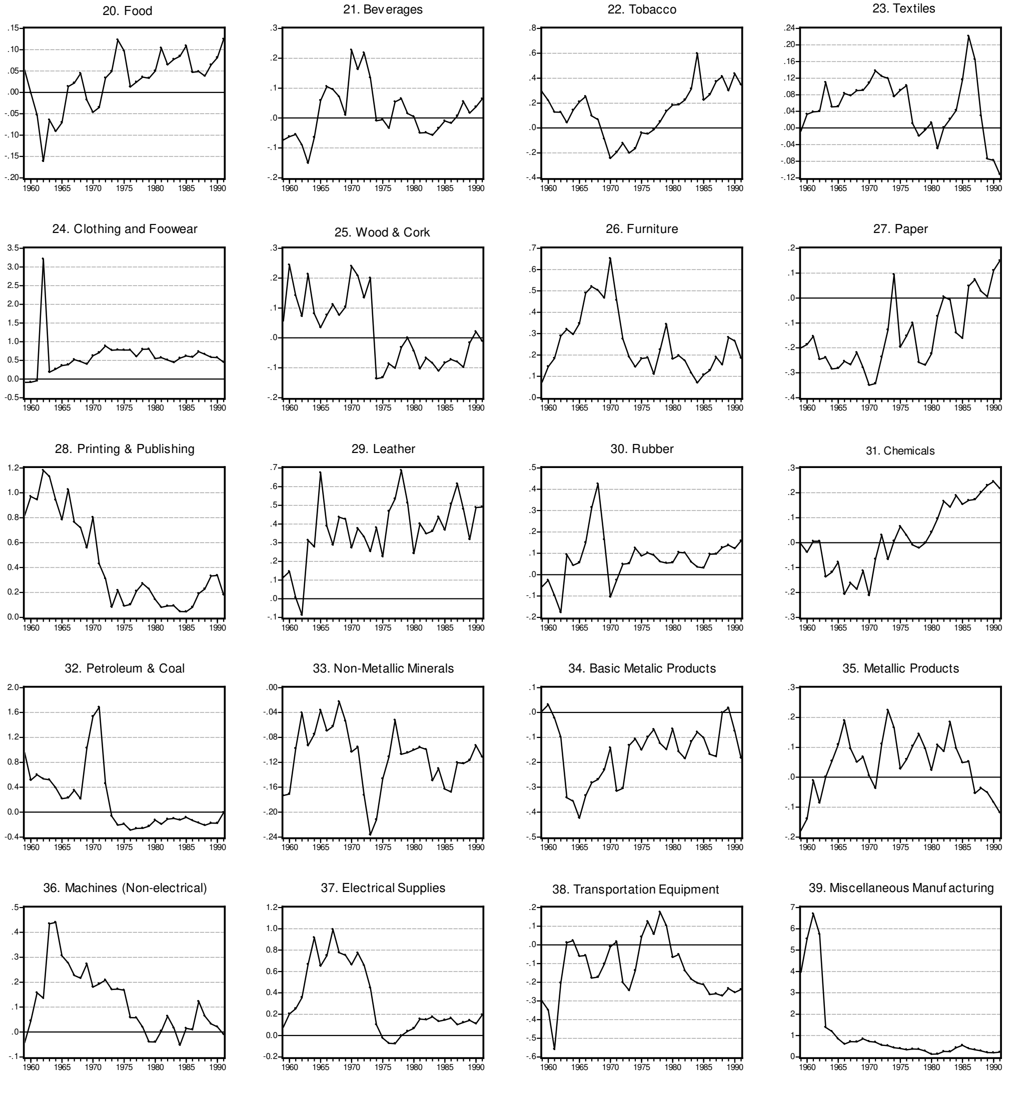
The empirical investigation about the large-scale Greek manufacturing industries has been guided by the above considerations. For each industry's deviation series an estimate of a and b was obtained from the above autoregressive equation (1) using the ordinary least squares method. The value of a/(1-b) is calculated as the best estimate of a long run projected profit rate. The significance of the difference of this limit from *zero* is the significance of the difference of a and b from zero as well as their covariance. A closer examination of the issue, however, reveals that since both the numerator and denominator of the fraction $a_i/(1-b_i)$ are estimated parameters, it follows that the standard error of the above term should be estimated from the matrix of estimated covariances of the coefficients (Kmenta, 1991, pp. 485-491 and Green, 1990, pp. 230-234). More specifically, the estimated variance of the projected returns will be:

$$Var\left(\frac{\hat{a}_i}{1-\hat{b}_i}\right) \approx \left(\frac{1}{1-\hat{b}_i}\right)^2 Var(\hat{a}_i) + \left(\frac{\hat{a}_i}{(1-\hat{b}_i)^2}\right)^2 Var(\hat{b}_i) + 2\left[\frac{1}{1-\hat{b}_i}\right]\left[\frac{\hat{a}}{(1-\hat{b}_i)^2}\right] Cov(\hat{a}_i, \hat{b}_i) \quad (4)$$

In a nut sell, we define *convergence* as the movement of actual industry profit rate deviation of an industry towards the long-run average. The mechanism through which this convergence takes place is the inflow or outflow of capital or what amounts to be the same thing the acceleration or deceleration of accumulation. In other words, starting with disequilibrium profit rates with the passage of time and in absence of stochastic disturbances, the deviations tend to approach asymptotically a common value which we expect to be zero, that is, the case with no excess profits or losses. If convergence takes place at a positive value, this may be taken as evidence of some degree of monopoly and if it takes place at negative values this might be attributed to some sort of government regulation of industry. On the other hand, the term *gravitation* is used to indicate the random oscillation of actual profit magnitudes around their projected equilibrium values. Convergence and gravitation are intertwined and the former is a prerequisite for the latter (see also Duménil and Lévy, 1987 and Vaona, 2011). In terms of our autoregressive scheme, convergence requires the slope coefficient, *b*, to have an absolute value less than one. And gravitation requires bounded fluctuations around this trend line and this is ensured by the value of *b*, being less than one in absolute value. In this context, convergence refers to the deterministic part of the model and gravitation refers to the bounded fluctuations around the trajectory of the deterministic part of a stochastic model. In this case, the model is in statistical equilibrium in the sense that the standard deviation of each series does not display any known systematic functional form (*e.g.* ARCH or

GARCH) and approaches an upper limit. In Figure 4 below, we present the deviations of the rate of profit from the economy's average for each of the twenty industries.[13]

Figure 4. Deviations from average rate of profit, Greek manufacturing industries, 1959-91



[13] The data on gross capital stock for the large scale manufacturing industries come from Handrinos and Altinoglou (1993) and profits are estimated as the difference between value added net of indirect business taxes and wages. The data are for the 2-digit large scale manufacturing industries, that is, establishments the employ more than ten workers. Both capital stock and profits are expressed in current prices.

The visual inspection of the graphs does not lend overwhelming support to the classical gravitational process and the trajectories of the profit rate deviations are far from displaying a convergent behavior towards zero. In order to use our autoregressive scheme, we need to test for the stationarity properties of each of our 20 industries. We know that in cases such as the deviation series of profit rates from the economy-wide average, there are many non-linearities developed which are not captured by the usual linear unit root tests. In fact, the results that we derived from the usual Augmented Dickey–Fuller (ADF) tests (not shown) were mixed and they are very likely to be contaminated by the presence of nonlinearities not captured by the ADF test which is based on the assumption that the deviation series of profit rates exhibit linear movements. However, in the turbulent kind of dynamics characterizing the tendential equalization of interindustry profit rates it is not unrealistic to hypothesize that the deviation series exhibit strong nonlinearities. These nonlinearities may be attributed to a host of factors ranging from uncertainty, difference in expectations, credit restrictions, patents, indivisibilities, government regulations and the like.

Under the linearity framework, whenever there is deviation in industry's profit rate from its long run mean, there arises a risk free profit opportunity through the forces of arbitrage, which in our case is reflected in the inflow or outflow of capital. However, the presence of such "impediments" as those described above gives rise to a threshold or band of "no arbitrage" on both sides of the profit rate. If the observed rate of profit deviation from the economy wide average crosses the threshold which in our case is zero, only then arbitrage is likely to occur, otherwise, the deviation series is likely that it will not tend to correct itself. More specifically, the visual inspection of the paths of deviation series shows that in most cases the rates of profits deviations series cross the zero line at least once with only a few exceptions. These are: industries 26 (furniture), 28 (printing and publishing), 33 (non-metallic minerals) and 39 (miscellaneous manufacturing) where there is no crossing of the zero line. However in no single case we observe explosive behaviour in the upward or downward direction and the paths of deviation series remain in the vicinity of the zero line. This encourages to employ non-linear stationarity tests.

A simple and at the same time powerful non linear stationarity test was developed by Kapetanios, Shin, and Snell (2003) (hereafter, the KSS), who further elaborated and expanded the well-known ADF test to detect the stationarity properties in a time series. They keep the null hypothesis of nonstationarity as in the ADF test, but the alternative hypothesis is now that the series is nonlinear but globally stationary process. In order to understand the basis of the new nonlinear unit root test, known as the KSS test, we consider a model for univariate Exponential Smooth Transition Autoregressive of order 1, ESTAR(1) given as follows:

$$x_t = x_{t-1} + \gamma[1-\exp(-\theta x_{t-1}^2)] + \varepsilon_t \quad (5)$$

where $t = 1, \ldots T$ and $\varepsilon_t \sim i.i.d.(0,\sigma^2)$. The bracketed term of (5) stands for the exponential transitional function in the KSS test designed to capture the nonlinear adjustment of the series at hand. The above equation can be rewritten as

$$\Delta x_t = \gamma_{t-1}[1-\exp(-\theta x_{t-1}^2)] + \varepsilon_t \quad (6)$$

The null hypothesis of the KSS test is that H_0: $\theta = 0$ against the alternative H_0: $\theta > 0$. However, because γ is not directly observable under the null, it becomes impossible to carry out the hypothesis testing. For this reason, Kapetanios, *et al.* (2003) reparameterize the Equation (6) using a first–order Taylor series approximation and obtained the following auxiliary regression:

$$\Delta x_t = \delta x_{t-1}^3 + \varepsilon_t \quad (7)$$

In order to rule out the possible presence of autocorrelation Kapetanios *et al*. (2003) concatenated in the above equation lagged terms of the depended variable according to the usual lag selection criteria. Thus we may write:

$$\Delta x_t = \delta x_{t-1}^3 + \sum_{k=1}^{q} \Delta x_{t-k} + \varepsilon_t \quad (8)$$

Where q stands for the number of lagged terms. The null hypothesis becomes: H_0: $\delta = 0$ against the alternative H_1: $\delta < 0$. Kapetanios, *et al.* (2003, p. 364) recognize that the test statistic does not have an asymptotic standard normal distribution, and, therefore, provide the critical values which we use to evaluate the results of these tests displayed in Table 3, below.

Table 3. The non-linear KSS unit-root test

Sector	t_{KSS_1}	t_{KSS_2}	t_{KSS_3}
20. Food	-2.84***	-2.55	-3.28*
21. Beverages	-1.97*	-2.10	-2.06
22. Tobacco	-3.17***	-3.37**	-3.42**
23. Textiles	-2.94***	-2.63	-2.82
24. Clothing & Footwear	-9.86***	-1.80	-1.79
25. Wood & Cork	-3.05***	-3.06**	3.23*
26. Furniture	-1.98*	-2.33	-2.66
27. Paper	-1.05	-1.69	-4.16***
28. Printing & Publishing	-3.82***	-3.85***	-2.18
29. Leather	-1.94*	-2.86*	-3.51**
30. Rubber	-1.44	-1.41	-2.29
31. Chemical	-1.13	-1.68	-3.14*
32. Petroleum & Coal	-4.13***	-4.33***	-4.52***
33. Non-Metallic Minerals	-1.92*	-2.16	-2.11
34. Basic Metallic Products	-1.73	-1.48	-1.49
35. Metallic Products	-2.67**	-2.54	-2.53
36. Machines (non-electrical)	-2.14*	-2.63	-0.36
37. Electrical Supplies	-1.61	-1.79	-3.93***
38. Transportation Equipment	-4.72***	-5.27***	-5.27***
39. Miscellaneous Manufacturing	-3.01***	-4.95***	-1.40

Notes: *, ** and *** denote rejection of the unit root null hypothesis at the 0.10, 0.05 and 0.01 significance level, respectively. The symbols t_{KSS_1}, t_{KSS_2} and t_{KSS_3} indicate the t- Statistic that results from the implementation of the test to the raw data, the de-meaned data and the de-trended data, respectively. The critical values have been recovered from Kapetanios *et al.* (2003).

The results of Table 3 suggest that for almost all industries the profit rate deviation series display stationarity properties for the standard confidence levels and therefore the AR1 scheme can be applied. In case where there is no stationarity in the raw data, the AR1 model can be applied in the detrended data and this is the case with industries 27 (Paper) and 31 (Chemicals). There is an open question with industries 30 (Rubber) and 34, where perhaps the AR(1) model could be used in the differences of the series. However, the visual inspection of the graphs suggests that as these two industries cross the zero line a few times they are almost stationary and in fact the ADF test lends support to this hypothesis as we found that industry 30 is stationary at the 5% probability value and industry 34 (Basic

Metallic Products) was found weakly stationary with probability value somewhat higher than 10%.[14]

Table 4 below contains the estimates of the parameters of our autoregressive scheme for the deviation series of profitability for each of the twenty manufacturing industries. The results show that the autoregressive equation (1) used in the analysis is statistically significant in all industries and that the value of R^2 is high enough indicating that in most industries the autoregressive scheme explains a pretty high proportion of the variance of industries' profit rate deviations. Furthermore, since stationarity is a requirement for the application of our AR(1) scheme for industries 27 (Paper) and 31 (Chemicals) we detrended them first and then we proceeded with the estimation of coefficients which we display along with their *t*-ratios below the raw series.

[14] When we ran regressions of differences of these two series we found that the intercept and the slope coefficients of the regressions are not statistically different from zero, whereas the R-squared is near zero.

Table 4. Profit rate deviations from the average, Greek manufacturing Industries, 1959-1991

Industry	*a*	*b*	*a*/(1–*b*)	*R*-squared
20. Food	0.01 (0.9)	0.76 (5.9)	0.03 (1.0)	0.54
21. Beverages	0.01 (0.9)	0.69 (5.4)	0.03 (0.3)	0.49
22. Tobacco	0.02 (0.9)	0.84 (8.1)	0.14 (1.1)	0.69
23. Textiles	0.01 (0.7)	0.80 (6.0)	0.04 (0.9)	0.54
24. Clothing & Footwear	0.10 (2.0)	0.84 (10.5)	0.61 (4.9)	0.80
25. Wood & Cork	0.01 (0.3)	0.70 (5.3)	0.02 (0.3)	0.49
26. Furniture	0.06 (1.9)	0.79 (7.5)	0.27 (3.8)	0.65
27. Paper	-0.02 (0.8)	0.79 (5.9)	-0.10 (1.1)	0.54
27*. Paper	-0.00 (0.1)	0.48 (2.94)	-0.00 (0.1)	0.22
28. Printing & Publishing	0.02 (0.5)	0.91 (13.1)	0.21 (0.6)	0.85
29. Leather	0.20 (3.2)	0.49 (3.2)	0.38 (7.5)	0.26
30. Rubber	0.04 (2.0)	0.58 (4.0)	0.09 (2.3)	0.35
31. Chemicals	0.01 (0.7)	0.92 (10.6)	0.10 (0.6)	0.79
31* Chemicals	-0.00 (0.4)	0.61 (4.71)	-0.01 (0.4)	0.43
32. Petroleum & Coal	0.01 (0.2)	0.78 (7.6)	0.05 (0.2)	0.66
33. Non-metallic Minerals	-0.04 (2.2)	0.66 (5.1)	-0.11 (5.5)	0.46
34. Basic Metallic Products	-0.05 (2.2)	0.70 (5.6)	-0.18 (3.7)	0.51
35. Metallic Products	0.02 (1.3)	0.65 (5.1)	0.05 (1.4)	0.47
36. Machines (non-electrical)	0.02 (1.3)	0.81 (7.6)	0.13 (1.8)	0.66
37. Electrical Supplies	0.04 (1.1)	0.90 (11.5)	0.36 (1.5)	0.81
38. Transportation Equipment	-0.04 (1.4)	0.71 (5.7)	-0.12 (1.8)	0.52
39. Miscell. Manufacturing	0.07 (0.4)	0.831 (9.6)	0.43 (0.5)	0.75

Note: Industries with an asterisk have been detrended prior to the application of AR1

From Table 4, we observe that the estimates on *b* are significantly different from zero at *p*=1% in all industries, the absolute values of *t*-ratios (shown in parenthesis) are pretty high which means that the confidence interval of the estimated parameters are in the vicinity of the estimated coefficient which is always much less than one in absolute value and only in three industries, 28 (Printing and Publishing), 31 (Chemicals) and 37 (Electrical Supplies) are in the vicinity of 0.90 which means that there is increased probability for explosive behavior as the *b* coefficient may exceed one. Thus, we have an attraction (usually weak) for the deviation series of all twenty industries towards their long-term (equilibrium) value determined by the ratio *a*/(1-*b*). However, as was mentioned above, since the limit *a*/(1-*b*) is a ratio of two estimated parameters; we must compute its standard error from the covariance matrix of the coefficients. From the results displayed in Table 4, we observe that six industries —clothing and footwear (24), furniture (26), leather (29), rubber (30), non-metallic mineral products (33) and basic metallic products (34)— out of the twenty industries display a value of *a*/(1-*b*) statistically significant at p=5%. From these six industries the profit rate deviation series of the non-metallic mineral products (33) together with the basic metallic products (34) industries are attracted to the projected rate of profit, *a*/(1-*b*) less than zero, whereas in the other four industries the difference series is attracted to a positive projected rate of profit, that is a rate of profit higher than the economy's average. From these four industries, only in three —clothing and footwear (24), furniture (26) and leather (29)— the projected rate of profit differs from zero in an empirically significant way, whereas in the rubber industry (30) the difference of the projected rate of profit from zero is statistically significant at $p<10\%$.[15] Thus, our empirical finding with respect to the rate of profit do not lend overwhelming support to the classical idea of gravitation of industry profit rates to the economy-wide average rate of profit, since in six out of twenty industries the results show gravitation to a rate of profit different from zero and in four from these cases the projected rate of profit varies from 9% to 61% and in the other two cases the projected rate of profit is negative. These results may lend support to the view that various impediments to free mobility of capital and also risk associated with some activities, government intervention and regulation of industries may give rise to profit rate (positive or negative) differences from the long-run average rate of profit.

The hypothesis of equalization of profit rates has been tested so far in terms of the average profitability of each industry against the economy's average and the statistical results were mixed with respect to the hypothesis of tendential equalization of profit rates.

[15] As noted above for industries 30 and 34, if they are non-stationary the AR1 scheme cannot be applied; on the other hand, by differencing them, the two series become stationary but also with not much economic interest.

However, it has been pointed out, that the rate of profit on regulating capitals is the relevant variable to the hypothesis of the tendential equalization of profit rates between industries. Botwinick, for instance notes: “empirical investigations attempting to utilize Marx's analysis of competition between and within industries must be careful to distinguish which profit rates are being observed - individual, regional, industry average or regulating [...]” (Botwinick, 1993, p. 154). In this sense, an industry’s average profitability that has been used in a number of studies is not necessarily the appropriate index of profitability that attracts the investment flows.[16] The idea is that the average rate of profit measures the profitability of all the firms comprising the industry and in this average are included firms using advanced technology and have excellent location and firms with outdated technology. By taking the industry’s average, we may not select the type of capital which is representative of the vitality of the industry and is targeted by prospective investors. As a result, the rate of profit of these firms (capitals) is the relevant for it sets the rhythm of capital accumulation in the industry.

5. The Incremental Rate of Profit and its Components

In the analysis of competition in Marx’s *Capital*, we stumble upon the following seemingly contradictory situation. On the one hand, the rates of profit are equalized across industries and, on the other hand, there is a stratification of the rates of profit between firms (capitals) within the same industry. How can these contradictory observations be reconciled? The idea is that the average rate of profit is the average of all firms comprising the industry, and an industry consists of firms that use the latest technology and ideal location and firms with outdated technology. Classical economists were aware of these limitations in the flows of capital, and, therefore, they considered as the relevant rate of profit not necessarily the mean rate of profit but rather the type of capital where expansion or contraction of accumulation takes place. It is interesting to note that in Ricardo for example this kind of capital is always associated with the worse or in Ricardo’s wording

[16] See Muller (1990) for a number of studies about different countries and Droucopoulos and Lianos (1993) for the Greek economy. These studies usually find that the deviations of profit rates from the average persist, a result that leads to the idea of the presence of monopolistic elements.

"[t]he exchangeable value of *all* commodities, whether they be manufactured, or the produce of the mines, or the produce of land, is *always* regulated, not by the less quantity of labour that will suffice for their production under circumstances highly favourable, and exclusively enjoyed by those who have peculiar facilities of production; but by the greater quantity of labour necessarily bestowed on their production by those who have no such facilities; by those who continue to produce them under the most unfavourable circumstances; meaning—by *the most unfavourable circumstances*, the most unfavourable under which the quantity of produce required, renders it necessary to carry on the production." (Ricardo, 1821, p. 73, emphasis added).[17] By contrast, J.S. Mill argues with that "[w]herever there are large and small establishments in the same business, that one of the two which in existing circumstances carries on the production at the greater advantage will be able to undersell the other. (J.S. Mill, *Principles*, p.131). Smith, on the other hand, in his pin factory, "a very trifling manufacturing", as he notes, is certainly not identified with the two extreme situations, but rather with a typical which is described as the one that changes take place.

Classical economists seem that they were aware of these limitations to the flows of capital. The characteristic example is the case in agriculture, where the most fertile lands are already cultivated and they are not available to new entrants who can only enter into a worse type of land that secures the normal rate of profit and in this sense is the "best" available. Ricardo (1821, p. 73 and pp. 86-87) analyzed the details of this concept of regulating capital which he identified with "the most unfavourable" circumstances in agriculture and mining and he generalized it (to our view not successfully) to the rest of the economy.

Turning to manufacturing, the regulating conditions of each sector are determined by exactly the same method; that is, by the type of capital where expansion or contraction of accumulation takes place. The concept is similar to what business people and also input-

[17] Ricardo repeats his main view also in the chapter on mineral products. He notes "the same general rule which regulates the value of raw produce and manufactured commodities, is applicable to the metals; their value depending not on the rate of profits, nor on the rent paid for mines, but on the total quantity of labour necessary to obtain the metal, and to bring it to market." (Ricardo, 1821, pp. 86-87).

output economists (*e.g.*, Miller and Blair, 1985, p. 75) call “the best-practice” method of production. This should not lead to the conclusion that all firms adopt this method of production immediately, since firms operate fixed capitals of different vintages and managers have different expectations about the future direction of demand and profitability. Consequently, firms do not easily switch from one method of production to another. However, new capitals are expected to enter into the method of production, which can be easily duplicated and, furthermore, the expected rate of profit is attractive enough. The production method which is targeted by the new entrants is usually the most recent in the industry and not the older or the most profitable. The older methods of production *ceteris paribus*, will have a rate of profit lower than the average, whereas the most profitable methods of production may not be easily reproducible or their reproduction is associated with certain degree of risk, which new entrants may not wish to undertake. Hence, over “a cycle of fat and lean years”, that is, a complete business cycle, there is a tendency for the rate of profit to equalize between regulating capitals of industries. In other words, investment flows, by and large, is attracted neither by the old type of capitals because of low profitability nor by the very new type of capitals because they are usually associated with too much risk and employ new, non tested and not easily reproducible technologies (because of patents, better location, *etc*). In manufacturing, the regulating conditions of each industry may not necessarily coincide with the average conditions but are rather determined by the type of capital associated with “the lowest cost methods operating under generally reproducible conditions” (Shaikh, 2008, p. 167).[18]

The rate of profit earned on regulating capital is, therefore, the measure of new investment's return and determines the rhythm of accumulation in industries. If two regulating capitals have different rates of profit, the investment will flow differentially and will not just stop flowing in the industry with the lowest rate of profit, because of uncertainty and differences in expectations. It is important to point out that the regulating conditions of production do not necessarily specify a single rate of profit, but rather a narrow spectrum of rates of profit. This is true even in the case of a single regulating

[18] See Bina (1985 and 2011, chs. 1 and 6) for a discussion of the concept of regulating capital within the context of agricultural rent and its specific applications to the oil industry.

condition of production, because there are still differences in management, demand, *etc.* which may give rise to profit rate dispersions. Consequently, at any given moment in time, the rate of profit between regulating capitals across industries are not equal and only in the long run there is a tendential equalization of the respective rates of profit to an average.

The problem with the concept of regulating capital is its quantification in real economies. In principle, one can distinguish these conditions by observing an industry over time and collecting data for a group of firms with certain characteristics that persist over time. Stigler's "survivor technique" might be an example that would guide such a research for the identification of the regulating capital of an industry each year spanning a sufficiently long period of time. Clearly, such a procedure requires data which are hard to come by for a few industries and a few years, and therefore it would be extremely difficult to carry out for a long-run analysis and many industries. One way out is Shaikh's (1995 and 2008) idea according to which although we may not know the regulating capitals of each industry, however, we can estimate the profitability of these capitals through the concept of "incremental rate of profit on capital" (henceforth IROP). In fact, the concept of IROP is used in the literature of corporate finance to assess the profitability of firms and forms one of the "fundamentals" that investors consider in their decisions. The argument is that the rate of profit which tends to be equalized between industries is not necessarily the mean rate of profit of the total industry but rather the rate of profit which corresponds to the regulating conditions of production within an industry. In this context, the IROP is approximated by taking into account the following considerations: investment flows are conditioned more by short-run rate of return such as the incremental rate of profit than the rate of profit over the lifetime of investment. Hence, Shaikh (1995 and 2008) expresses current profits (S_t) that accrue to a firm as the sum of profit from the most recent investment (ρI_{t-1}) and profits from all previous investments (S^*). Consequently, we write

$$S_t = \rho I_{t-1} + S^* \qquad (9)$$

If we subtract profits of the past period from both sides of the above equation we get

$$S_t - S_{t-1} = \rho I_{t-1} + (S^* - S_{t-1}) \qquad (10)$$

The term in parenthesis is expected to be very small in comparison to the term ρI_{t-1} and, for all practical purposes, it can be ignored. The justification is the view that the shorter the evaluation horizon, the closer the current profit will be on carried-over vintages S^* to the last period's profit on the same capital goods (S_{t-1}). Moreover, since uncertainty and ignorance increase with the passage of time, it is reasonable to assume that the short-run (up to a year) is the relevant time horizon. After all, current profits are fraught with many ephemeral factors, and we know that abnormally high or low profits direct investment accordingly, which in turn gives rise to new uncertainty and thus profits or losses, and so forth. With these considerations in mind, it is reasonable to assume that expectations about future returns to investment are short-sighted; that is, expectations depend on the short-run rate of return. Consequently, the current rate of profit on new investment will be:

$$\rho_t = \Delta S_t / I_{t-1} \qquad (11)$$

that is, the change in profits of each industry divided by the investment of the last period. The above configuration provides a practical way to identify the IROP=ρ since as a rule we do not have data on the best practice technique and the firm that utilize it over the years. Consequently, the motion of the IROP is the relevant index of profitability to test the hypothesis of the tendential equalization of profit rates for the regulating capitals.

Alternatively, we can derive the IROP from the simple definition of the rate of profit (Tsoulfidis, 2010) $r_t=S_t/K_{t-1}$ or $S_t=r_tK_{t-1}$, we differentiate with respect to K_{t-1} and we get:

$$\frac{\mathrm{d}S_t}{\mathrm{d}K_{t-1}} = r_t + K_{t-1}\frac{\mathrm{d}r_t}{\mathrm{d}K_{t-1}} = r_t\left(1+\frac{\mathrm{d}r_t}{\mathrm{d}K_{t-1}}\frac{K_{t-1}}{r_t}\right) = \rho_t\,. \qquad (12)$$

Where the connection between the incremental rate of profit ρ_t and the term $\mathrm{d}S_t/\mathrm{d}K_{t-1}$ is based on the usual definition of the capital stock, $K_t=(1-\delta)K_{t-1}+I_t$, where δ is the depreciation rate and I_t is the gross investment. It follows that $\Delta K_t=I_t - \delta K_{t-1}= I_{Nt}$ = net investment. Thus, $\mathrm{d}S_t/\mathrm{d}K_{t-1}\approx\Delta S_t/I_{Nt-1}=\rho_t$. The fraction in the parenthesis above stands for the elasticity of profit rate with respect to capital stock for which the following hold,

$$\text{if } \left(\frac{\mathrm{d}r_t}{\mathrm{d}K_{t-1}}\frac{K_{t-1}}{r_t}\right) \gtreqless 0 \text{ then } \rho_t \gtreqless r_t \qquad (13)$$

It can be shown that the IROR is a variable that encapsulates the operation of a series of other variables such as the wage share, productivity of labor, capacity utilization and capital-output ratio. In order to show the operation of all these variables we start from the simple definition of income (Y) and ignoring time subscripts we write

$$Y = rK + wL \tag{14}$$

whose derivative of (14) with respect to K gives

$$\frac{\mathrm{d}Y}{\mathrm{d}K} = r + K\frac{\mathrm{d}r}{\mathrm{d}K} + w\frac{\mathrm{d}L}{\mathrm{d}K} + \frac{\mathrm{d}w}{\mathrm{d}K}L = \rho + w\left(\frac{\mathrm{d}L}{\mathrm{d}K} + \frac{\mathrm{d}w}{\mathrm{d}K}\frac{L}{w}\right)$$

and solving for ρ, we get

$$\rho = \frac{\mathrm{d}Y}{\mathrm{d}K}\frac{K}{Y}\left[1 - w\frac{L}{Y}\left(\frac{\mathrm{d}L}{\mathrm{d}Y}\frac{Y}{L} + \frac{\mathrm{d}w}{\mathrm{d}Y}\frac{Y}{w}\right)\right]u\left(\frac{Y}{K}\right)^{*} \tag{15}$$

From equation (15) we observe that the IROP is directly related to the elasticity of output with respect to capital $(\mathrm{d}Y/\mathrm{d}K)(K/Y)$,[19] the rate of capacity utilization, $u=(Y/K)/(Y/K)^*$, the growth rate of productivity of labor $(\mathrm{d}Y/\mathrm{d}L)/(L/Y)$ and to the normal capacity output-capital ratio $(Y/K)^*$. In addition, the IROP is inversely related to the share of labor income (wL/Y) and the elasticity of wage with respect to income $(\mathrm{d}wY)/(\mathrm{d}Yw)$.

It is important to note that the IROP is closely related to another measure of profitability known as the internal rate of return (d) which is used in the economics of industrial organization and of corporate finance. In fact, starting from the well known formula of the internal rate of return

$$I_{t-1} = \frac{S_t}{1+d} + \frac{S_{t+1}}{(1+d)^2} + \ldots$$

Differentiation of investment with respect to d gives

$$\frac{\mathrm{d}I_{t-1}}{\mathrm{d}d} = -\frac{S_t}{(1+d)^2} - \frac{2S_{t+1}}{(1+d)^3} - \ldots$$

[19] Of course, this elasticity in the case of one-commodity world (or when the capital-labor is uniform across industries) is equal to the profit share of the economy.

If we assume that $S_t = S_{t+1} = \ldots S$, not an unrealistic assumption, then it follows that investment will be more strongly negative the more the years involved. Which is equivalent to saying that the internal rate of return systematically favors short-term projects. If we restrict the analysis to a single year, then we may write,

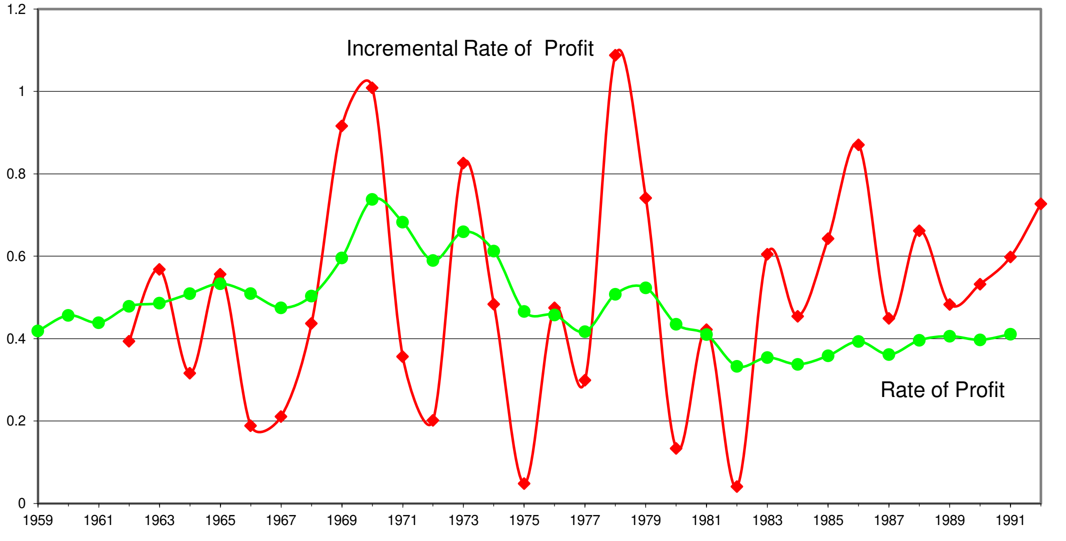
$$d = \frac{S_t}{I_{t-1}} - 1$$

Since investment is financed mainly out of profits, it follows that the two measures of profitability, that is, ρ and d are strictly related to each other, and, therefore, one does not expect to find wild differences in the evolution of these two measures of profitability.

In Figure 5 below we portray both the weighted average rate of profit and the IROP for the Greek manufacturing industries. Of course the time periods are defined by the data availability in investment and capital stock. Thus the average rate of profit begins from the year 1959 and extends until the year 1991, whereas the availability of investment data allows the estimation of the IROP from the year 1962. Past the year 1992 it is extremely difficult to extend the data set because of the change in the definitions of industries. Nevertheless, the time period is long enough to test the proposition of the long run tendential equalization of profit rates. An inspection of Figure 5 below reveals that the two rates of profit are not out of touch with each other and their difference, as expected, is the volatility of the short-run rate of profit which is the IROP reflecting all the noise and short-run behavior in the economy. Thus the IROP orbits around the average rate of profit and both share a nearly common long term average.[20]

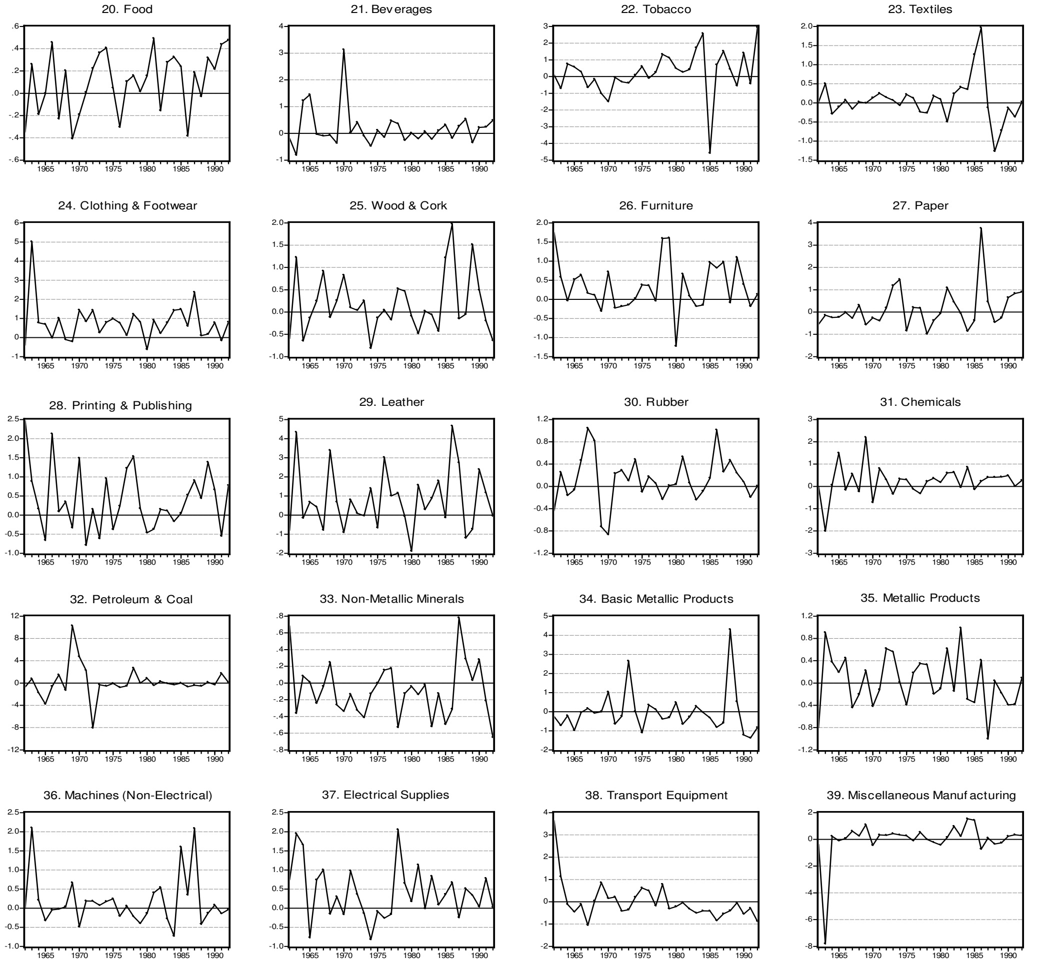
[20] The mean value of the average rate of profit is 0.47 with a standard deviation 0.10, while for the incremental rate of return the average value is somewhat higher at 51% and the standard deviation is much higher at 0.27. In short the two rates of profit share almost the same mean value although the variability of the IROP is about three times higher than that of the average rate of profit.

Figure 5. Average rate of profit vs. Average IROP



It is interesting to note that in the estimation of the IROP both numerator and denominator are expressed in current prices. It is important to use current prices especially when we refer to an inflationary period like the 1970s and 1980s, the idea is that inflation not only increases profit expectations but also actual profits, which in turn affect capital accumulation. In our previous investigation (Tsoulfidis and Tsaliki, 2005) we deflated both profits and investment by their respective price deflators. The results were supportive of the idea of tendential equalization of profit rates; however, on closer examination one might argue that the results were derived because of the removal of the effects of inflation though the deflators. More specifically the denominator of the IROP, that is, investment in constant prices, is usually an I(1) variable and real profits is also an I(1) variable, by taking the change in profits we transform the numerator to an I(0) variable and this might impose stationarity in the whole fraction. In the current study, we take the nominal values of variables and so even though we take the first difference of profits in the numerator of IROP still we have a non-stationary numerator. In Figure 6, we plot the IROP industries deviations from the average IROP for the period 1962-1992. An inspection of the graphs reveals that the deviation series gravitate toward zero indicating that over time the deviation of each industry's IROP from the economy's average dissipate. The time series data of the differences of industry profit rates from their average is obviously stationary, and therefore we need no run any particular statistical test.

Figure 6. IROP Deviations from the average IROP in Greek manufacturing Industries, 1962-1991



In order to show the long term tendency of the deviation of each industry, we use once again the same autoregressive scheme, which unlike the average rates of profit (where the deviation series did not cross over the zero line many times and we found that the center of gravitation of the individual deviation series was in some industries different from zero), we observe that the trajectories of IROP deviations cross the zero line much more frequently. The visual inspection of the graphs leaves no doubt that the IROPs are mean reverting; however, it is not clear whether this mean is zero or some other substantially different from zero and statistically significant (positive or negative) number.

In order to ascertain the mean value of each series, we need to employ our autoregressive scheme of first order (equation 1) to each of these twenty industry deviation series, whose additional characteristic is their high volatility. From this volatility, we would like to eliminate the exceptionally high or low frequencies of the data; the reason is that the noise embedded in the data may fail to give the required information of the actual behavior of the series. The task of isolating the frequencies that are of economic interest from those that are not is carried out through the use of band – pass filter and in our case we employed a Baxter-King filter with one lag and frequencies 2 and 8. In Table 5 below, we display our estimates of the intercept, a and slope coefficients, b as well as the projected rate of profit $a/(1-b)$ along with their t-statistics of the filtered times series data. The R-squared is displayed in the last column. In the regressions that we ran, we tried autoregressive schemes of various lags, however, for reasons of clarity of presentation, we restricted to the first order autoregressive scheme, provided that the autoregressive scheme with two or more lags did not change the results of the econometric analysis qualitatively.

Table 5. Tendential Equalization of IROP*s* in Greek Manufacturing Industries, 1962-1992

Industry	*a*	*b*	*a*/1–*b*	R-squared
20. Food	-0.003 (0.09)	-0.680 (5.18)	-0.002 (0.09)	0.508
21. Beverages	0.016 (0.19)	-0.654 (4.72)	0.010 (0.19)	0.462
22. Tobacco	-0.014 (-0.09)	-0.632 (3.92)	-0.009 (0.09)	0.372
23. Textiles	-0.012 (0.24)	-0.213 (1.15)	-0.010 (0.24)	0.049
24. Clothing & Footwear.	-0.022 (0.26)	-0.518 (5.18)	-0.015 (0.26)	0.508
25. Wood & Cork	-0.005 (0.07)	-0.397 (2.56)	-0.004 (0.07)	0.202
26. Furniture	-0.015 (0.19)	-0.595 (3.76)	-0.009 (0.19)	0.352
27. Paper	-0.001 (0.01)	-0.496 (2.92)	0.000 (0.01)	0.247
28. Printing & Publishing	-0.027 (0.31)	-0.754 (5.53)	-0.015 (0.08)	0.540
29. Leather	0.003 (0.01)	-0.553 (3.94)	0.002 (0.01)	0.374
30. Rubber	-0.003 (0.07)	-0.364 (2.06)	-0.002 (0.07)	0.140
31. Chemicals	0.009 (0.11)	-0.678 (5.51)	0.005 (0.11)	0.539
32. Petroleum & Coal	-0.015 (0.05)	-0.677 (4.71)	-0.009 (0.05)	0.460
33. Non-metallic Minerals	0.007 (0.22)	-0.461 (3.03)	0.005 (0.22)	0.261
34. Basic Metallic Products	-0.002 (0.01)	-0.468 (2.71)	-0.001 (0.01)	0.220
35. Metallic Products	0.000 (0.00)	-0.595 (4.18)	0.000 (0.00)	0.402
36. Machines (non-electrical)	-0.005 (0.08)	-0.657 (5.44)	-0.003 (0.08)	0.532
37. Electrical Supplies	0.008 (0.10)	-0.583 (3.66)	0.005 (0.10)	0.340
38. Transportation Equipment	-0.024 (0.47)	-0.500 (3.00)	-0.016 (0.47)	0.257
39. Miscell. Manufacturing	-0.024 (0.47)	-0.500 (7.16)	0.037 (0.74)	0.663

We observe that in all industries the constant term of the regressions (*i.e*., coefficient *a*) is not statistically significant, so we cannot reject the null hypothesis that it is zero. The slope coefficient (*i.e*., *b*) is always negative and much less than one and that the projected rate of profit, that is the term *a*/(1-*b*) is not statistically significant and different from zero. The results with respect to the intercept and the slope coefficients are therefore consistent with the hypothesis of gravitation of our deviation series of IROPs from the economy-wide average IROP should fluctuate around zero. For industry 23 the estimated slope coefficient displays relatively smaller than the other industries t-ratio, however when we reran the regression by adding a second lag the overall fit improved without affecting the projected rate of profit whose statistical significance remained not different from zero.

5. Concluding remarks

In this article, we set out to show that the notion of competition as a dynamic process that has been developed by classical economists, Marx and to a certain extent by Austrian economists (Schumpeter, 1942, Kirztner, 1987, *inter alia*) is much richer than it is usually thought. In our view, this alternative notion of competition concentrates a number of interesting characteristics that can become the foundation for the development of a realistic theory of competition. Crucial to this approach is the notion of regulating capital whose general description can be found in Ricardo and other classical economists but its detailed development is in Marx's *Capital*.

To our view what is even more essential about the notion of regulating capital is its important parallels with the established prudent business practices. Furthermore, the work of the Oxford Group of Economic Analysis and in particular P.W.S. Andrews dissatisfied by the neoclassical microeconomic theory and looking to find what actually happens in the real economy arrived at conclusions very similar to the classical approach (Moudud, 2011). The same concept has also been identified in input-output analysis and the concept of the "best practice capital or technique" (Miller and Blair, 1985). The research of a number of authors in the classical tradition starting with the works of Shaikh (1995) and continues up until nowadays have contributed if not to the more precise identification of this type of enterprises but certainly to the estimation of profitability of regulating capitals as this is reflected in the movement of the IROP.

The empirical analysis showed that there is no statistically sound positive relationship between the concentration ratio and profitability in Greek manufacturing industries, thereby casting doubt to the major proposition of the static notion of competition. Furthermore, the time series statistical analysis showed that the IROP of each of the twenty industries of the Greek manufacturing displayed gravitational behavior around the economy's average IROP, which is equivalent to saying that there is a tendential equalization of profit rates for the regulating capitals. A result which is consistent with the dynamic analysis of competition and encourages us to think that the analysis of competition as a dynamic process and the associated with it concept of regulating capital deserves further theoretical and empirical research.

References

Bahçe, S. and Eres, B. (2010) Testing for Classical Theory of Competition: Evidence from Turkish Manufacturing. Paper presented at the annual conference of *Eastern Economic Association*, Philadelphia.

Bain, J. (1951) Relation of profit rate to industrial concentration: American manufacturing, 1936-1940, *Quarterly Journal of Economics,* 65, 293-324.

Baumol, W. (1982) Contestable Markets: An Uprising in the Theory of Industry Structure", *American Economic Review*, 72, 1-15.

Bina, C. (1985) *The Economics of the Oil Crisis*. New York: St. Martin's Press.

Bina, C. (2011) *Oil: A Time Machine—Journey Beyond Fanciful Economics and Frightful Politics*. Deeer Park, New York: Linus.

Botwinick, H. (1994) *Persistent Inequalities*. Princeton: Princeton University Press.

Christidou, M., and Panagiotidis, T. (2010). Purchasing Power Parity and the European Single Currency: Some New Evidence, *Economic Modelling*, 27 (5), pp. 1116-1123.

Christodoulopoulos, G. (1995) *International Competition and Industrial Rates of Return*. Ph. D. Dissertation, Department of Economics, New School for Social Research, New York.

Clifton, J. (1977) Competition and the Evolution of the Capitalist Mode of Production. *Cambridge Journal of Economics*, 1, pp. 137-51.

Droucopoulos, V. and T. Lianos (1993) The Persistence of Profits in the Greek Manufacturing Industry, 1963-88. *International Review of Applied Economics* **7**, 163-176.

Droucopoulos, V. and Papadogonas, Th. (2000) Concentration Indices: Back to the Drawing Board. *Ekonomia* 4, 55-72.

Duménil, G. and Lévy, D. (1987) The Dynamics of Competition: a Restoration of the Classical Analysis. *Cambridge Journal of Economics*, 11 (2), pp. 133-164.

Eatwell, J. (1981) Competition. In Bradley, I. and Howard, M. (eds.) *Classical and Marxian Political Economy: Essays in Memory of Ronald Meek*. London: Macmillan.

Flaschel, P. and Semmler, W. (1987) Classical and Neoclassical Competitive Adjustment Processes. *The Manchester School*, 55 (1), pp. 13-37.

Glick, M. (1985) Monopoly or Competition in the US Economy. *Review of Radical Political Economics*, 17, 121-7.

Handrinos, S. and K. Altinoglou (1993) *Fixed Capital Stock in Large Scale Industry of Greece, 1958-1990*. Mimeo. Athens: Center of Planning and Economic Research.

Green, W. (1990) *Econometric Analysis*. London: MacMillan.

Kapetanios, G., Shin, Y. and Snell, A. (2003). Testing for a Unit Root in the Nonlinear STAR Framework, *Journal of Econometrics* **112**, 359-379.

Kaskarelis, I. and Tsoulfidis, L. (1999) Inflation, Demand, Imports Competition and Markups in Greek Manufacturing Industries. *Economia Internazionale*, pp. 151-171.

Kirzner, I. (1987) Competition: Austrian Conceptions. In Eatwell, J., Milgate, M. and Newman, P. (eds.) *The New Palgrave: A Dictionary of Economics*. London: Macmillan.

Kmenta, J. (1991) *Elements of Econometrics*. New York: Macmilan.

Krugman, P. and Wells (2006) Microeconomics. New York: Worth Publishers

Lianos, Th. and Droucopoulos, V. (1993) Convergence and Hierarchy of Industrial Profit Rates: The Case of Greek Manufacturing. *Review of Radical Political Economics,* 25: 67-80.

Marx, K. (1894 [1977]) *Capital Vol. III*. New York: International Publisher, 1977.

Mason, P. (1994) An Empirical Derivation of the Industry Wage Equation. *Journal of Quantitative Economics* 1: 155-170.

Mill, J.S. (1848 [1976]) *Principles of Political Economy*. Fairfield New Jersey: Augustus M. Kelley.

Miller, R. and Blair, P. (1985). Input-Output Analysis: Foundations and Extensions, New Jersey, Prentice-Hall.

Moudud, J. (2010) Strategic Competition, Dynamics, and the Role of the State: A New Perspective. *New York: Edward Elgar.*

Mueller, D. (1986) *Profits in the Long Run*. Cambridge: Cambridge University Press.

Mueller, D. ed. (1990) *The Dynamics of Company Profits*. Cambridge: Cambridge University Press.

Nelson, R. and Winter, N. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, Mass.: Harvard University Press.

Ochoa, E. and Glick, M. (1992) Competing Microeconomic Theories of Industrial Profits: An Empirical Approach. In Milberg, W. (ed.) *The Megacorp & Macrodynamics: Essays in Memory of Alfred Eichner*. New York: Sharpe.

Ricardo, D. (1951, [1821]) *Principles of Political Economy and Taxation*. Cambridge: Cambridge University Press.

Sawyer, M. (1981) *The Economics of Industry and Firms: Theories Evidence and Policy* (New York, St Martins Press).

Scherer, F. & Ross, D. (1990) *Industrial Market Structure and Economic Peformance.* Boston: Houghton Mifflin.

Schmalensee, R. (1989) Inter-industry studies of structure and performance, in: R. Schmalensee & R. Willing (Ed.) *Handbook of Industrial Organisation,* Vol. **I1** (Amsterdam, North-Holland).

Schumpeter, J. (1942) *Capitalism Socialism and Democracy*. New York: Harper and Row Publishers.

Semmler, W. (1984) *Competition, Monopoly and Differential Profit Rates: on the Relevance of the Classical andMarxian Theories of Production Prices for Modern Industrial and Corporate Pricing*. New York: Colombia University Press.

Shaikh, A. (1980) Marxian Competition versus Perfect Competition: Further Comments on

the So-called Choice of Technique. *Cambridge Journal of Economics,* 4, 1980.
Shaikh, A. (1995) *The Stock Market and the Corporate Sector: A Profit Based Approach*. Working Paper, No 146. New York: Jerome Levy Institute.
Shaikh, A. (2008) Competition and Industrial Rates of Return**.** In Philip Arestis and John Eatwell (eds.) *Issues in Finance and Industry: Essays in Honour of Ajit Singh*. New York: Palgrave Macmillan.
Smith, A. (1776) *The Wealth of Nations*. New York: The Modern Library, 1976.
Stigler, G. (1958) The Economies of Scale, *Journal of Law and Economics*, 1, 54-7187.
Tsaliki, P. and Tsoulfidis, L. (1998) Alternative Theories of Competition: Evidence from Greek Manufacturing. *International Review of Applied Economics* 12, 187-204.
Tsoulfidis, L. (2010) *Competing Schools of Economic Though*t. Heidelberg: Springer.
Tsoulfidis, L. and Tsaliki, P. (2005) Marxian Theory of Competition and the Concept of Regulating Capital. *Review of Radical Political Economy* 37: 5-22.
Webber , M. Tonkin, S. (1990) Profitability and Capital Accumulation in Canadian Manufacturing Industries. *Environment and Planning*, 22(8): 1051-1071.
Weeks, J. 1981. *Capital and Exploitation*. Princeton: Princeton University Press.
Vaona, A. (2011) An Empirical Investigation on the Gravitation and Convergence of Industry Return Rates in OECD Countries, *International Review of Applied Economics* (forthcoming).
Zacharias, A. (2001) *Testing Profit Rate Equalization in the U.S. Manufacturing Sector: 1947–1998*. Jerome Levy Economics Institute Working Paper No. 321.