COMPETITION AND EQUALIZATION OF INTER-INDUSTRY PROFIT RATES: THE EVIDENCE FOR THE BRAZILIAN ECONOMY, 1973-85.

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1 - Introduction

The Marxian theory of value and competition has been criticized on both theoretical and empirical grounds. The neo-Ricardian approach argues that Marx's theory is logically inconsistent, whereas the post-Marxist school argues that it is inconsistent with the empirical evidence of modern capitalism. One common feature of both critiques is the conclusion that Marx's theory of value and competition is wrong.

According to the neo-Ricardians, the so-called 'transformation problem' would demonstrate that Marx's theory is logically inconsistent and, as a consequence, the labor theory of value must be abandoned. However, recent works within the TSS perspective[2] have shown that Marx's theory of value and competition is, in fact, logically consistent. To demonstrate the logical consistency of Marx's theory is crucial, but so is the demonstration that it is empirically relevant in modern capitalism. The aim of this paper is precisely to examine the allegation that Marx's theory of value and competition is not consistent anymore with the empirical evidence on inter-industry profit rates.

The post-Marxist approach argues that the Marxian theory of competition was correct for the stage of competitive capitalism of the 19th century capitalism, but the process of accumulation and centralization of capital experienced by the capitalist mode of production has led capitalism to a new stage of development - the stage of monopoly capital. The formation of monopolized or oligopolized sectors has gone hand in hand with decreasing inter-industry competition. Consequently, the monopolized sectors of the economy, because they could impose barriers to competition, are able to obtain higher prices than those that would have happened under competitive conditions and therefore they are able to obtain rates of profit which are higher than the average. The competitive sectors, on the other hand, obtain lower rates of profit than that obtained by the oligopolized sectors. Thus, the level of the rates of profit are directly proportional to the degree of monopoly of the different sectors of the economy. Sweezy (1981, p. 11.) expresses this views as follows

> "The altered forms of competition which prevail in monopoly capitalism create not a tendency toward a system-wide average rate of profit which Marx analyzed in part 2 of the third volume of Capital but rather a hierarchy of profits rates, highest in

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[2]See, for example, Maldonado-Filho (1995) and Kliman and McGlone (1988).

industries which approach most closely to a monopoly status and lowest in those in which small-scale competitive enterprise continues to predominate."

The basis for the post-Marxist/post-Keynesian critique is the empirical evidence, which is claimed to exist, showing that there is a positive relationship between the levels of the profit rates and the degree of monopoly among the sectors of the economic system. This fact seems to demonstrate that Marx's

theory of competition is inconsistent with the actual phenomena of the capitalist production, and this inconsistency is due to the monopolistic character of capitalism in its actual stage of development[3]. Consequently, the post-Marxist school argued for the necessity of replacing the Marxian theory of prices of production by the notion of degree of monopoly and entry barriers in order to explain the existence of the hierarchy of rates of profit which has become a permanent feature of capitalism in its monopoly stage. This assessment has led to the development of the post-Marxist theory of competition as a substitute for the Marxian theory.

In this paper I will examine the empirical evidence on inter-industry profit rate differentials for the Brazilian manufacturing industry during the 1973-85 period. The central aim of this empirical analysis is to test whether or not Marx's theory of competition is really inconsistent with empirical evidence.

This paper is divided into five sections. In the second section I will briefly present the Marxian theory of competition and its main prediction concerning inter-industry profit rate differentials. In the next section, the empirical measures of rate of profit, concentration and entry barriers variables that are used in this empirical analysis will be presented. In section 4 I develop the dynamic model which will be applied to test the alternative hypotheses. The fifth section presents the empirical results for both inter-sector and inter-industry profit rate differentials. Finally, in section 6 I restate the main conclusions of the empirical analysis.

2 - Marx's Theory of Competition and Its Empirical Predictions Concerning Profit Rate Differentials

According to Marx, competition acts both as an equalization process and also as a disequilibrating force. Insofar as it is an equilibrating force, the process of competition between individual capitals, brings about two distinct processes of equalization. For capitals within the same industry, competition tends to establish a unique market price, even though

[3]This claim is in fact unwarranted. Recent empirical evidence on the behavior of profit rate differentials over time for the US economy is not incompatible with the prediction of Marx's theory. See, for example, Maldonado-Filho (1996).

the conditions of production for the individual capitals (firms) differ[4]. However, for capitals in different spheres of production, Marx argues that the competitive process tends to equalize the industry rates of profit, thereby transforming values into prices of production[5].

Let us now look at this second process of equalization which is brought about by competition, namely: the tendency towards the equalization of the industry rates of profit.

Capitals, in their search for the highest return, move out from those industries in which the profit rates are relatively low and enter those industries whose rates of profit are abnormally above the average level. The inflow of capital-value in the latter industries increases supply relative to demand causing, therefore, reductions in the market prices and, as a consequence, in the profit rates. The outflow of capital-value from the former industries results in a
decrease of supply relative to demand determining increases in the market prices and profit rates. The transference of capital-value between industries, by changing the "normal" level of supply relative to demand, tends to pull high or low profit rates towards the average level; that is, the mobility of capital-value between industries creates a tendency towards the equalization of industry rates of profit. Therefore, according to Marx's theory, competition of capitals between industries creates a dynamic process which brings abnormally above and below rates of profit towards the average level.

Nevertheless, it is important to point out that the Marxian approach does not assume that the competitive process tends to bring an economy to a state of equilibrium where industry rates of profit are actually equalized. Competition is not seen as establishing an uniform rate of profit across industries in any actual economy. There are several reasons to support this view. For example, in those industries where production is carried out in large scale and with a high proportion of fixed capital, the time required for pulling an abnormally high or low rate of profit towards the average level is substantially greater than in those industries where medium and small firms are the rule. These factors are, by themselves, sufficient to guarantee that for any period of time which is taken into consideration the industry-average rates of profit will be, in general, different.

Moreover, Marx does not assume that the equalization process is necessarily a smooth one. It may happen that too much capital is invested in some of those industries which have above-average rates of profit thereby causing a temporary overproduction and, as a consequence, a prolonged period of low profitability in those industries.

Consequently, even when the analysis of the competitive process is restricted only to its aspect of being an equilibrating mechanism, it is plain that the working of the adjustment process, together with all other factors which influence prices and profit rates, makes it unrealistic to assume that in an actual economy the industry rates of profit tend to be more or less uniform at any given point in time. Rather, according to the Marxian approach it

[4]Since we are not going to deal with the issue of profit rate differentials within industries in this paper, we will not pursue this issue any further here.

[5]An analysis of the "transformation problem" lies beyond the scope of this paper. In this section we are only concerned with the dynamics of the competitive process according to the Marxian analysis and with the empirical predictions which are derived from it.

is expected that, at any period of time, differentials in industry rates of profit do exist and, consequently, that the dynamic process is permanently in operation.

As I have indicated above, competition brings about not only movements towards the equalization of market prices and industry rates of profit, but also movements that create disequilibrium and differentials in profit rates between industries (Shaikh, 1979; Semmler, 1984a, 1984b). Under the pressure of competition the rival firms are driven to introduce new techniques of production, to develop new products, to enlarge their market share, etc., in order to obtain surplus profits. These actions, on their turn, react upon the industry-average rate of profit and therefore tend to create profit rate differentials between industries. In this way, the competitive process itself would bring about profit rate
differentials between industries and, thereby, it would also put into action its own equilibrating mechanism, which is the dominant force.

Therefore, Marxian theory is not necessarily inconsistent with the existence of profit rate differentials between industries, even between long run equilibrium rates of profit; rather, these differentials are expected to be observed in any empirical investigation. However, in the Marxian approach, the differentials between industry rates of profit are not expected to be correlated with the concentration ratio and entry barriers variables or, alternatively, with the hypothesis that the average rate of profit of the oligopolist sector is persistently above the average profitability of the competitive sector.

In relation to the velocity of the adjustment process, due to the existence of widely different conditions of production and circulation of commodities across industries, Marxian theory implies that the period of time required for abnormally high and low rates of profit to be pulled towards the social average may be substantially different from industry to industry. For those industries where production is mainly carried out in large scale and with a high proportion of fixed capital (and consequently where it takes a long period of time to build up new capacity or to withdraw capital-value), it is expected that the period of time during which the rates of profit stay above or below the average may be quite long. For those industries in which the labor process is carried out with low capital requirements, low capital-output ratio and which have a short turnover time, the mobility of industrial capital is relatively easy and, consequently, the period of adjustment is expected to be much shorter.

Since the existence of profit rate differentials between industries, even between long run equilibrium profit rates, is not necessarily inconsistent with the empirical predictions derived from the Marxian conception of competition - but, on the contrary, these differentials are indeed expected to be observed in any empirical investigation - how, then, can one test the empirical consistency of Marxian theory of competition?

There are, of course, many forms and methods by which one can set up an empirical test for this theory, but it seems to me that the most appropriate test is to examine the profit rate differentials between oligopolist and competitive industries over time.

The post-Marxist hypothesis that oligopolist industries are able to obtain, on the average, rates of profit which are persistently above the average profit rate of the competitive sector is clearly incompatible with the empirical predictions of Marxian theory. Consequently, the central issue of the empirical analysis below is not related to the issue of the existence of differentials in long run rates of profit between industries, but rather it is to examine whether the long run equilibrium profit rate of the oligopolist sector is significantly above the long run average level or,
alternatively, whether long run profitability differentials between industries are positively

correlated with the concentration ratio and entry barriers variables.

Thus, the central aim of the empirical analysis of the inter-industry profit rate differentials for the Brazilian manufacturing industry is to test whether or not the oligopolist industries are able to obtain, on the average, long run profit rates (r_o^*) which are "substantially" above the long run profitability of the competitive sector (r_c^*). Therefore, the alternative hypotheses to be tested may be stated as following:

$$\mathbf{H_0: r_o^* = r_c^*}$$
$$\mathbf{H_a: r_o^* > r_c^*}$$

If hypothesis $\mathbf{H_0}$ is substantiated by the empirical analysis, then the Marxian hypothesis - which asserts that competition is strong enough to create an adjustment process which brings, over time, abnormally high and low industry rates of profit to converge towards the average level - will not be inconsistent with the empirical evidence. Besides, I am also interested in testing whether the adjustment process tends to converge toward the equilibrium level and what factors may explain the speed of the adjustment process.

However, before I proceed to examine the empirical evidence on the profit rate differentials it is important to briefly discuss data sample and the measures of profit rate and concentration which I will employ in my analysis.

3 - The Data Sample and the Measures of Profit Rate, Concentration Ratio and Entry Barriers Variables

One critical issue in the empirical analysis concerns both the data sample and the measures of profitability, concentration and entry barriers variables which are used for testing the hypotheses. I shall now briefly comment on the data set and the measures used in my empirical analysis.

The data sample comes from Visão - Quem é Quem na Economia Brasileira which reports the annual accounting data by individual firms. These firms are grouped, according to the major market which they operate, into one of the 47 different 3-digit classes of industries. The accounting figures reported for each firm and which are used in the empirical study are the following ones: (i) equity (**E**), which includes firm's capital, appropriations and retained earnings; (ii) fixed capital (**F**) which is the summation of the values of the buildings, equipment and land owned by the firm, adjusted for inflation and it is reported on a net basis; (iii) profits before taxes (**P**); (iv) sales (**S**), which is the operational sales of the firm; and finally (v) the ratio of the total liabilities to total assets (**D**), which reports the percentage of the borrowed capital employed by the firm.

One important limitation of this data set, in my opinion, concerns that the amount of profits is computed as before taxes, whereas it is generally agreed that after tax profit rate is a more satisfactory proxy for the economic performance of the firms. Another important limitation is related with the fact that the data sample does not allow us to construct a meaningful proxy of the rate of return on total capital. Although it is possible to calculate a

proxy for total assets there is no information on interests available, so that it is not possible to have the ratio (profit + net interest)/total assets[6].

Although the data sample provided by Visão presents several limitations, it is important to point out that it is the most used set of data that is employed in the empirical studies on profitability for the Brazilian economy. This is the case, for example, in the empirical research done by Braga (1979), Bonelli (1980) and Bonelli and Guimarães (1981).

Given the limitations imposed by the data source, I was able to define only two measures of profitability: the rate of profit on equity, **r**, and the profit-margin, **m**. Actually, these measures are defined as follows: **r** = **P/E** and **m = P/S.**

Since the profit-margin is not an appropriate measure of the rate of return, there is in fact only one measure to test whether competition tends to equalize the profit rates between industries in the Brazilian economy, namely the rate of profit on equity. As it is well known, this is a measure widely used in empirical studies on profit rate differentials.

It should be noted, however, that more recently Fisher and McGowan (1983) and Benston (1985) have questioned the use of accounting measures to study profit rate differentials, especially monopoly profits; they argued that "accounting rates of return, even if properly and consistently measured, provide almost no information about economic rates of return" (Fisher and McGowan, 1983, p. 82). By using a set of numerical examples, they showed that a large discrepancy may exist between accounting and economic rates of return, which would imply, according to them, that "comparisons of accounting rates of return to make inferences about monopoly profits is a baseless procedure" (Fisher and McGowan, 1983, p. 89). However, as Mueller (1990, p. 9) points out, "accounting returns may deviate from true economic returns by large magnitudes. Whether they do in fact deviate by wide margin is a separate question that cannot be answered by presenting hypothetical examples." He then goes on to examine some empirical studies on economic performance which have employed Tobin's q ratio instead of the more traditional accounting profit rates, and his conclusion is that "accounting profits are not obviously inferior to market value measures of economic return like Tobin's q, at least as measure of current economic returns" (Mueller, 1990, p. 13). Moreover, other empirical studies on profitability such as Schmalensee (1989) and Duménil and Lévy (1990) have shown that the trend and fluctuations of the accounting measures cannot be dismissed, since they express, although imperfectly, those of "real economic profitability".

Insofar as the relationship between the theoretical and the empirical measures of profit rates is concerned, it is important that the empirically constructed profit rate been capable to express adequately the economic performance of the firms. After all, from the theoretical standpoint the mobility of capital between industry depends - assuming, of course, that there is no significant mobility barriers - on the existence of significant profit rate differentials and on the capitalist's knowledge of it. Therefore, the empirical measure must be

[6]However, for the Brazilian case, from the beginnings of the 1980s onwards the interest rates have been at very high levels. Thus, this ratio would give a rather inaccurate expression for firms' profitability. That is, under these circumstances it is quite possible that those firms which are heavily indebted would appear to have better economic performance than firms working only with their own capital. Therefore, for the Brazilian economy the traditional profit/equity ratio seems to be a better measure of the firms' profitability.

capable of expressing the economic performance of firms and, moreover, to be one which induce the economic behavior of the capitalists. It is generally accepted that the rate of return on total capital and the profit rate on equity are good empirical proxies for the concept of profit rate.

In relation to the actual behavior of the rate of profit on equity, the analysis of the empirical performance of several different measures of profit rate for the US economy have indicated that it is a good proxy for economic performance. As Glick (1985, p. 105) pointed out "the traditional ratios, profit/total assets and profit/equity, produce relatively small profit rate dispersions and cannot be criticized as strongly as, for example, the use of the profit margin might."

Unfortunately, due to scarcity and deficiency of the Brazilian statistics, it is not possible to make similar tests on the performance for different data samples and measures of profit rates. However, as have already indicated above, it is generally accepted that Visão provides a reliable data sample to study the economic performance of firms and sectors of the Brazilian economy.

It is also important to define how market power and entry barrier variables will be measured. There are many different ways of constructing proxies for these two variables, and different forms can be used to specify the structure of the cross-section models. Therefore, I have attempted, as far as the data base permitted me, to measure the variables as closely as possible to the traditional definitions and to make use of the statistical properties which are standard in this field.

The degree of market concentration is generally interpreted as indicating the degree of oligopolization in industries. However, since there is no information on concentration ratio in the Brazilian Census, I will use, as a proxy, the "four-firms concentration ratio" and the "eight-firms concentration ratio" (**CR4** and **CR8**, respectively) which were calculated, for each industry in each year, as follows:

Where:

S = sales;
t = 1973,...,1985;
i = 1,...,45 (number of industries);
j = 1,...,n (number of firms in the industry).

The concentration ratio is also used for classifying industries as oligopolist or competitive. For this classification I adopted the standard criteria used in the industrial economics literature, namely: those industries for which the **CR8 > 70%** every year was considered oligopolist whereas those with a **CR8 < 70%** were classified as competitive. For those industries in which the degree of concentration crossed the dividing line were not included in either sector, but were included in calculating the average level of profit rates.

The entry barrier variables are measured by the following proxies[7]:

[7]The concept of entry barriers usually includes the following variables: a measure of the economies of scale, a measure of the requirements of capital to run an optimal plant, a measure of the absolute cost advantages of the established firms, and finally a proxy for measuring the concept of product differentiation.

economies of scale (**ES**) which are defined as the ratio of the average amount of sales of those firms which represent 50% of the total sales of the industry over the total sales of the industry;

capital requirements (**KR**) which are defined by the average total assets of those firms that represent 50% of the total sales of the industry.

I have also defined as variable the relative weight of the fixed capital on the total capital, **FK**. This variable can be interpreted as a proxy for the Marxian concept of conditions of production and circulation of commodities - i.e., for the degree of capital mobility between industries. Besides, it can also serve as a proxy for the role played by depreciation allowances on profitability and as measure of the post-Marxist concept of entry barriers.

Finally, I have defined a variable to express industries' demand conditions, which is measured by the industry's rate of growth of sales in a given period of time

4 - A Dynamic Model

In this section I will develop a simple dynamic model in order to test whether there are significant differentials in long run equilibrium rates of profit between oligopolist and competitive industries; and if abnormally high and low industry profit rates are pulled toward the social average, i.e., if profit rate differentials between industries tend to equalize over time, as the Marxian theory predicts. Let me start with the following autoregressive model

[1]

where:

$\mathbf{r_i(t)}$ is the average rate of profit of some industry i at a time t (or the average rate of profit in some sector i at a time t);

μ_i is the long run equilibrium profit rate for industry/ sector i;

$\mathbf{r_i(t-1)}$ is the average profit rate of industry/sector i at a time (t-1);

$\mathbf{u_i(t)}$ is the error term at time t with classical properties;

β_i is the parameter of the equation for industry/sector i.

This autoregressive model, in which the actual profit rate is measured in terms of deviations about its mean, describes the movements of the industry (or sector) rates of profit over time. According to the standard interpretation of this type of autoregressive model (see, for example, Kessides, 1990 and Mueller, 1990), the parameter $\mathbf{1-\beta_i}$ measures the speed of the adjustment process, indicating how fast the profit rate approaches its long run equilibrium level. Consequently, the bigger the $|\beta_i|$, the slower is the speed of adjustment. Thus, the bigger is the parameter $|\beta_i|$, the slower the profit rate will converge toward its mean, whereas the smaller it is, the more rapid the adjustment process will be. If, however, β_i is equal to zero then equation [1] collapses into a pure random noise model, thus indicating that the profit rate is in long run equilibrium, except for random factors. For the adjustment process to converge toward the long run equilibrium level, it is required that $|\beta_i| < \mathbf{1}$.

In order to develop further the model, let me now define the industry (sector) specific long run equilibrium rate of profit (μ_i) in relation to the long run equilibrium profit rate for the manufacturing industry as a whole, τ^e [8]. One can write that

[2] $\mu_i = \tau^e + (\mu_i - \tau^e)$,

or, by denoting $(\mu_i - \tau^e) = r_i^*$, one have that

[3] $\mu_i = (\tau^e + r_i^*)$.

By substituting [3] into equation [1], one get

[4]

but one may define

[5]

then, by using [5] one can finally rewrite [4] as follows

[6]

Equation [6] is the first-order autoregressive model which I will use in the empirical analysis. The mean of this process, which expresses not only the intertemporal equilibrium level but also a necessary condition for stationarity, is given by the following formula

[7]

Since $\alpha_i = (1 - \beta_i)r_i^*$, it follows that $r_i^e = r_i^*$,

Consequently one have that r_i^* (which is, by definition, equal to $(\mu_i - \tau^e)$, see equation [3] above) also expresses the

[8]The long run equilibrium rate of profit for the manufacturing industry as a whole, τ^e, is given by the mean of a autoregressive process of order p. If this process is an AR(1) - which is the case for this data, as we shall see - then it is represented by the following model: $\tau(t) = a + b\ \tau(t-1) + e(t)$, and the mean of the stochastic process will be expressed by $\tau^e = a/(1-b)$.

long run equilibrium rate of profit for industry (sector) i. This long run equilibrium condition implies that if $\mu_i = \tau^e$, then $\alpha_i = 0$, which means that industry (sector) specific long run equilibrium profit rate is equal to the average equilibrium level. Otherwise, industry specific long run equilibrium will differ from the intertemporal equilibrium profitability for the manufacturing industry as a whole.

I may now sum up my discussion of the first-order autoregressive model [6]. Insofar as the intertemporal equilibrium level for industry (sector) i, r_i^*, is concerned we have the following possibilities:

(i) $r_i^* = 0$, which implies that $\mu_i = \tau^e$ or $\alpha_i = 0$,

(ii) $r_i^* > 0$, which implies that $\mu_i > \tau^e$ or $\alpha_i > 0$,

(iii) $r_i^* < 0$, which implies that $\mu_i < \tau^e$ or $\alpha_i < 0$.

For this model to have a dynamically stable equilibrium, i.e., for the time path to be convergent, it is necessary that $|\beta_i| < 1$. Moreover, it should be pointed out that this adjustment process will be non-oscillatory if $0 < \beta_i < 1$, and it will be oscillatory if $-1 < \beta_i < 0$. Finally, if $\beta_i = 0$, then model [6] is describing a pure white noise process.

5 - Empirical Results

In this section I use the autoregressive model [6] to examine the empirical evidence for the industry profit rate differentials in the Brazilian manufacturing industry, during the 1973-85 period, at two different levels of aggregation, namely the sector (competitive and oligopolist) level and the industry level.

First, I estimate the intertemporal equilibrium profit rate for the manufacturing industry as a whole, τ^e. Since there is no a priori assumption regarding the AR process for the average profit rates for the manufacturing industry, I shall determine it by examining the sample autocorrelation and the partial autocorrelation functions. The sample autocorrelation function suggests that the series is stationary[9] whereas the partial autocorrelation function indicates that it follows a stochastic process of order 1. As a consequence, this series can be modeled as a AR(1) process. I therefore estimated the following autoregressive equation:

[8]

[9]Since the time period is small (T = 13) and under this situation the power of the formal tests for stationarity, such as the Dickey and Fuller (1979) and Sargan and Bhargava (1983), are very low, we have decided not to apply them in this study.

and from it I then calculate the estimate long run equilibrium rate of profit for the whole manufacturing industry, τ^e, which is given by

I obtained the following estimate of equation [8] (t-statistic in parentheses):

[9] $\tau(t) = 6.025 + .620\,\tau(t-1) + e(t)$
(1.477) (2.631)

$R^2 = .409$ F = 6.924
$R^{a2} = .35$ DW = 2.235

Applying the Park-Glejser test for heteroscedasticity one find that the residuals are homoscedastic. From equation [9] one can calculate the estimated long run equilibrium profit rate for the industry as a whole, which is

[10]

5.1 - Inter-Sector Estimates

My main concern here, as I have already stated above, is to test whether the long run equilibrium profit rate for the oligopolist industry, $\mathbf{r_o}$, is greater than that for the competitive sector, $\mathbf{r_c}$. Secondly, I want to examine the speed of the adjustment process for each sector. More specifically, in the first case, I am interested in testing the following hypotheses:

$\mathbf{H_0: r_o^* = r_c^*}$
$\mathbf{H_a: r_o^* > r_c^*}$

If the equilibrium solution for each sector is not statistically different then the prediction of the post-Marxist theory turns out to be inconsistent with the empirical evidence. However, if the estimated long run equilibrium profit rate for the oligopolist sector turns out to be greater than that estimated for the competitive sector, then the post-Marxist theory is vindicated by the empirical analysis whereas the Marxian theory will be inconsistent with it.

I got the following results for model [6] for each sector (t-statistic in parentheses):

[11] $\mathbf{[r_o(t) - \tau^e] = -.136 + .67[r_o(t-1) - \tau^e] + u_o(t)}$
(-.123) (2.938)

$R^2 = .463$ F = 8.634
$R^{a2} = .410$ DW = 1.684

[12] $\mathbf{[r_c(t) - \tau^e] = -.106 + .52\,[r_c(t-1) - \tau^e] + u_c(t)}$
(-.081) (2.015)

$R^2 = .289$; F = 4.062;
$R^{a2} = .218$; DW = 2.425.

For both equations [11] and [12] the t-statistic indicates that one cannot reject the hypothesis that the intercepts α_o and α_c are equal to zero, which means that $\mathbf{r_o^*=r_c^*=0}$, and consequently one cannot reject the null hypothesis $\mathbf{(H_0: r_o^*=r_c^*)}$. Therefore, for this sample one have that $\mu_o=\mu_c=\tau^e$. In other words, my results indicate that one cannot reject the hypothesis that in both sectors the long run equilibrium profit rates are not significantly different from the average and, consequently, that the equilibrium profit rate for the oligopolist sector is not statistically different from that of the competitive sector. Thus, the Marxian theory of competition is not inconsistent with this empirical evidence.

5.2 - Inter-Industry Estimates

Let us now examine the profit rate differentials at the industry level. Again, we are going to use the first-order autoregressive model [6] in order to test whether or not the industry specific long run equilibrium rate of profit is equal to the average equilibrium level, τ^e, and also to examine the adjustment process for each one of these industries.

The sample is made of by 29 competitive, 13 oligopolist and by 3 ambiguous industries. Table 5 summarizes the results of the autoregressive model [6] for each of the 45 industries.

Table 1

Results from First-order Autoregressive Model [6] at Industry Level, 1973-85

Industry	Sector	α_i	β_i	r_i^*	R^2
1.0000	C	-.782	.342	-1.1880	0.1490
		(-.533)	(1.326)		
2.0000	C	-1.464	0.487	-2.8480	0.2380
		(-.538)	(1.70)		
3.0000	O	1.547	0.647[B]	4.3830	0.4200
		(.676)	(2.691)		
4.0000	O	-2.189	.546[A]	-4.8210	0.3070
		(-.936)	(2.104)		
5.0000	C	-.011	.658[B]	-0.0330	0.3880
		(-.004)	(2.516)		
6.0000	C	-.637	.584[B]	-1.5320	0.3660
		(-.285)	(2.404)		
7.0000	C	-.874	.842[C]	-5.5310	0.7280
		(-.68)	(5.172)		
8.0000	C	9.527[B]	-.082	8.8050	0.0050
		(2.507)	(-.213)		
9.0000	C	1.995	.256	2.6810	0.0710
		(1.116)	(.876)		
10.0000	C	2.117	.387	3.4540	0.1600
		(.885)	(1.378)		
11.0000	O	-.301	.579[B]	-0.7130	0.3430
		(.134)	(2.283)		
12.0000	O	-.98	.768[C]	-4.2250	0.5960
		(.361)	3.839)		
13.0000	O	-10.788[B]	-.143	-9.4370	0.0210
		(-2.769)	(-.46)		
14.0000	C	.744	.525[B]	1.5670	0.3750
		(.738)	(2.449)		
15.0000	O	-7.68	.2	-9.6000	0.0440
		(-1.002)	(.682)		
16.0000	O	-2.203	.302	-3.1550	0.0670
		(-.815)	(.845)		
17.0000	C	-.627	.573[B]	-1.4690	0.3560
		(-.31)	(2.35)		
18.0000	C	-2.602	.576[B]	-6.1370	0.49
		(-1.347)	(3.1)		
19.0000	C	-4.913[A]	.038	-5.1070	0.0010
		(-1.951)	(.12)		
20.0000	C	-1.422	-.25	-1.8950	0.0610
		(-.952)	(.806)		
21.0000	C	-.177	.541[A]	-0.3860	0.3160
		(.081)	(2.151)		
22.0000	O	.862	.71[C]	2.9740	0.503
		(.62)	(3.183)		
23.0000	O	-1.86	.697[B]	-6.1390	0.4800

		(-1.341)	(3.041)		
24.0000	C	-4.994[A]	.462[A]	-9.2650	0.2980
		(-1.979)	(2.059)		
25.0000	O	2.201	-.084	2.0290	0.0090
		(1.499)	(-.299)		
26[D]	C	1.007	.69[A]	3.2480	0.3970
		(.248)	(2.149)		
27.0000	C	-3.151	.38	-5.0820	0.1570
		(1.296)	(1.363)		
28.0000	O	-1.06	.478[A]	-2.0260	0.2560
		(-.517)	(1.856)		
29.0000	C	-1.182	-.028	-1.1500	0.0010
		(-.547)	(-.086)		
30.0000	C	1.832	.422	3.1690	0.1790
		(.688)	(1.476)		
31.0000	C	2.311	.511[A]	4.7250	0.2700
		(.778)	(1.922)		
32.0000	C	4.106[A]	.195	5.1010	0.0370
		(2.177)	(.621)		
33.0000	C	-4.469[B]	.277	-6.1800	0.1190
		(-2.76)	(1.161)		
34.0000	C	-6.283	.046	-6.5860	0.0020
		(-1.746)	(.148)		
35.0000	A	-1.927	.543[A]	-4.2170	0.2960
		(-1.192)	(2.052)		
36.0000	A	1.905	.479[A]	3.6560	0.2490
		(.602)	(1.82)		
37.0000	C	3.611	-.119	3.2280	0.0130
		(1.369)	(-.369)		
38.0000	C	2.98	.332	4.4610	0.1110
		(1.68)	(1.118)		
39.0000	C	1.672	.229	2.1690	0.0480
		(1.207)	(.712)		
40.0000	O	7.683	.76[C]	32.0110	0.5410
		(1.192)	(3.739)		
41.0000	O	-2.076	.806[C]	-10.6990	0.7020
		(-1.327)	(4.856)		
42.0000	C	.053	.521[A]	0.1110	0.2720
		(.039)	(1.933)		
43.0000	A	3.262[B]	.147	3.8240	0.0230
		(2.365)	(.485)		
44.0000	C	.25	.741[C]	0.9640	0.5850
		(.113)	(3.753)		
45.0000	C	1.564	.469	2.9460	0.2300
		(.703)	(1.726)		

Notes: Dependent variable: $[r_i(t) - \tau^e]$. t-statistic in parentheses. Number of observations for each industry (T) is 13.

[A] Significant at the .10 level.

[B] Significant at the .05 level.

[C] Significant at the .01 level.

[D] The number of observations (T) is 10.

The results obtained in Table 5 show that:

for the 45 industries in the sample one have that $\alpha_i = 0$ in 38 industries (of which 12 are oligopolist, 24 are competitive and 2 are ambiguous), $\alpha_i > 0$ in 3 industries (being 2 competitive and 1 ambiguous), and $\alpha_i < 0$ in 4 industries (being 3 competitive and 1 oligopolist)[10]. Therefore, for most industries of this sample we observe that their specific long run equilibrium profit rate (μ_i) is not statistically different from the intertemporal equilibrium profitability for the manufacturing industry as a whole (τ^e) - that is, for them $r_i^* = 0$;

- only one of the 13 oligopolist industries (namely, Ind.13 - Automobiles and trucks) has a long run equilibrium profit rate which is significantly different from the social average, but in this case $\alpha_i < 0$;
- for all industries in this sample there is and adjustment process - $|\beta_i| < 1$ -, for 23 of them we have that the process of convergence is relatively slow ($\beta_i > 0$), whereas for the other 22 industries of the sample the adjustment process is very rapid, so that $\beta_i = 0$;
- of those 23 industries whose $\beta_i > 0$ we have that 9 (out of 13) are oligopolist, 12 (out of 29) are competitive, and 2 (out of 3) are ambiguous; it is also interesting to note that for all of them (except Ind.24 - Pharmaceutical products - which belongs to the competitive sector) we have that $\alpha_i = 0$;
- of those 22 industries whose $\beta_i = 0$, we have that 4 are oligopolist, 17 are competitive, and 1 is ambiguous.

Therefore, the results obtained for the 13 oligopolist industries in the sample shows that $r_i^* = 0$ in 12 industries, which means that in these cases the industry specific long run equilibrium rates of profit are not significantly different from the intertemporal equilibrium level; whereas for just 1 industry (Automobiles and trucks) its long run profit rates is different from the average - but in this case the industry long run equilibrium profitability is below the intertemporal equilibrium level for the manufacturing industry as a whole.

One may also examine these results in a more formal way. In order to test whether the industry long run equilibrium profit rates are positively related with the market structure (i.e., market power and entry barrier variables), we will run the following type of model:

[13]

[10]It should be pointed out that the results obtained for Ind. 40 (Tobacco) are biased. This is a consequence of the fact that in 1980 the major firm of this industry (Co. Sousa Cruz) was transformed into a holding company, and this implied in a reduction in the amount of Sousa Cruz's equity, and consequently, into a significative increase in its profit rate. Nonetheless this fact, the industry profit rate afterwards tended to converge towards the average level.

Where:

is the estimated industry long run equilibrium rate of profit;

$\mathbf{CR_i}$ denotes a measure of industry concentration (I have defined two measures: **CR4** and **CR8**, the four- and eight firm concentration ratios);

$\mathbf{ES_i}$ denotes the proxy for the economies of scale;

$\mathbf{KR_i}$ stands for the absolute capital requirements to operate with the minimum efficient scale;

$\mathbf{FK_i}$ measures the degree of restriction on the mobility of capitals between industries.

Since in this model the dependent variable is itself an estimated parameter, we therefore follow the procedure suggested by Saxonhouse (1976) and weight each observation by the inverse of the standard error of the dependent variable. However, by examining the correlation matrix between these explanatory variables we found the existence of a high level of correlation between **CR4**, **CR8** and **ES**, which implies that if these variables are simultaneously present in the model multicollinearity will be also present. Table 2 gives the cross-sectional estimation results of the model [13].

Table 2

Long Run Equilibrium Profit Rates and Market Structure

Eq. no.	Const.	CR4	CR8	ES	FK	KR	R^{A2}	F
1.0000	2.470	-0.045	-	-	-	-	0.0300	2.3480
	(.421)	(-1.532)						
2.0000	5.142	-	-.046	-	-	-	0.0500	2.8180
	(.747)		(-1.677)					
3.0000	-2.176	-	-	-.066	-	-	0.0020	1.1010
	(.517)			(-1.049)				
4.0000	28.872[A]	-	-	-	-.261[A]	-	0.2970	19.1500
	(3.523)				(-4.376)			
5.0000	33.329[A]	-	-.036	-	-.241[A]	.00006	0.3210	7.7900
	(3.792)		(-1.398)		(-3.965)	(1.661)		
6.0000	31.866[A]	-	-.021	-	-.247[A]	-	0.2920	9.8830
	(3.568)		(-.858)		(-3.994)			
7.0000	32.364[A]	-.038	-	-	-.246[A]	.00006	0.3220	7.8060
	(3.795)	(-1.409)			(-4.104)	(1.638)		
8.0000	31.459[A]	-.024	-	-	-.250[A]	-	0.2940	9.9580
	(3.623)	(-.916)			(-4.085)			
9.0000	32.293[A]	-	-	-.090	-.262[A]	.00006[B]	0.3340	8.1910
	(3.883)			(-1.659)	(-4.509)	(1.720)		
10.0000	31.622[A]	-	-	-.061	-.260[A]	-	0.3020	10.3150
	(3.718)			(-1.153)	(-4.365)			

Notes: Dependent variable: long run equilibrium profit rate . t-statistic in parentheses. Number of observations is 44. [A] Significant at the .01 level. [B] Significant at the .10 level.

These equations show that market power variables (**CR4** or **CR8**) have a negative, but not statistically significant effect on the long run equilibrium profit rates. Insofar as the entry barrier variables are concerned, we see that the economies of scale variable (**ES**) present a negative and the capital requirement variable (**KR**) has a positive relationship with . But their effect on the long run profit rates is not, in general, statistically significant. Only in equation 9 the coefficient of **KR** is positive and significant, but only at the .10 level. In fact, the only variable which exerts a really significant influence on the long run equilibrium profit rate is **FK** - all estimated coefficients are negative and statistically significant at the .01 level.

This negative relationship between **FK** and industry long run profit rates are, in fact, in disagreement with the predictions of post-Marxist approach. In my opinion, this negative relationship may be partially explained by the fact that when demand and production were drastically reduced, as it happened during the Brazilian recession of 1981-83, those industries that presented a high proportion of fixed capitals were those mostly adversely affected in their profitability. They undergone the highest increased in fixed costs and therefore had their profitability significantly decreased. Moreover, a high level of **FK** may also acted as a mobility barrier. Those industries with high level of fixed capital could not rapidly withdraw capital from it in order to adjust supply to the new demand conditions, therefore their profit rates stayed for a long period below their average level. Thus, the negative effect of **FK** on long run profitability may be due to the fact that a high **FK** implied both the existence of a low degree of capital mobility and also a low profitability (due to the role played by depreciation allowances on profitability) during an significant period of the time under analysis. Then one can conjecture that the negative but statistically significant coefficients for **FK** in the equations are largely expressing the effects of the 1981-83 recession on the profitability of those industries whose capital structure possess a high percentage of fixed capital.

In sum, these results also do not support the hypothesis, at least within the sampled period, that long run equilibrium profitability differentials are associated with market power and entry barrier variables. The negative effect of **FK** on long run equilibrium profit rates seems to be explained by two factors: the deep recession of 1981-83 and the influence of the conditions of production and circulation of commodities upon the profitability of those industries with a relative high proportion of fixed capital.

Let us now examine whether there is a relationship between the speed of the adjustment process (β_i) and the variables which express the market structure. The model to be tested is the following one:

[14]

Again, since the dependent variable is itself and estimated parameter in order to estimate this model we will weight each observation by the inverse of the standard error of . The result obtained are presented in Table 3 below.

Table 3

Speed of Adjustment and Market Structure

Eq. no.	Const.	CR4	CR8	ES.	FK	KR	R^{A2}	F
1.0000	.732[B]	.005[A]	-	-	-	-	0.1310	7.4540
	(1.835)	(2.730)						
2.0000	.296	-	.005[A]	-	-	-	0.1910	11.1740
	(.660)		(3.343)					
3.0000	1.347[A]	-	-	.007	-	-	0.0270	2.1890
	(4.567)			(1.480)				
4.0000	-.665	-	-	-	.018[A]	-	0.2700	16.9290
	(-1.122)				(4.115)			
5.0000	-1.291[B]	-	.004[B]	-	.015[A]	.0000005	0.3530	8.8110
	(-2.12)		(2.458)		(3.532)	(.217)		
6.0000	-1.305[B]	-	.004	-	.015[A]	-	0.3670	13.5070
	(-2.178)		(2.734)		(3.567)			
7.0000	-1.092[C]	.004[C]	-	-	.016[A]	.000001	0.3230	7.8520
	(-1.807)	(2.012)			(3.728)	(.415)		
8.0000	-1.109[C]	.004[B]	-	-	.016[A]	-	0.3370	11.9320
	(-1.857)	(2.287)			(3.753)			
9.0000	-.924	-	-	.005	.018[A]	.000002	0.2870	6.7960
	(-1.518)			(1.362)	(4.11)	(.609)		
10.0000	-.944	-	-	.006	.018[A]	-	0.2990	10.1640
	(-1.560)			(1.646)	(4.158)			

Notes: Dependent variable: adjustment coefficient . t-statistic in parentheses. Number of observations is 44.
[A] Significant at the .01 level. [B] Significant at the .05 level. [C] Significant at the .10 level.

The results obtained show that the variables expressing the concentration ratio (**CR4** and **CR8**) and the relative weights of the fixed capital (**FK**) exert significant influence on the speed of the adjustment process. More specifically, these results show that the more concentrated is the market or the higher is the relative weight of the fixed capital, the greater is . Consequently, in those industries where production is carried out in large scale and with a high proportion of fixed capital, the speed of the adjustment process tends to be low.

As a matter of fact, these results are consistent with both the post-Marxist and the Marxian approaches.

According to the post-Marxist theory, it is expected that market structure variables will exercise a negative and significant influence on the speed of the adjustment process. It is thus expected that a high degree of concentration (**CR4** or **CR8**, which are interpreted as a proxy for market power) and high levels of barriers to entry (in this case **FK**, which can be interpreted as a measure of entry barrier) will act to prevent a rapid erosion of excess profits. The results reported in Table 3 provide then a strong support for the post-Marxist hypothesis the speed of the adjustment process depends crucially on the market structure.

For the Marxian approach, the speed of the convergence process depends mainly on the conditions of production and circulation of commodities, since these conditions may impose restrictions upon the mobility of capital between industries. Consequently, it is expected that in those industries where production is carried out in large scale and with a high proportion of fixed capital it will take a relatively long time to adjust supply to demand

conditions. If we interpreted the variables **CR8** (or **CR4**) and **FK** as expressing the degree of mobility of capital between industries, then the results reported in Table 3 can be seen as supporting the Marxian approach.

It is clear however that the empirical results strongly establish that the speed of the adjustment process is significantly slower in those industries where the degree of concentration and the relative weight of fixed capital are greater.

6 - Final Remarks

The results obtained by the dynamic model at both sector and industry levels reject the hypothesis that within the 1973-85 period the oligopolist industries obtained above average long run rates of profit. Moreover, the results also show the existence of adjustment processes that are dynamically stable and whose speed depends on the degree of concentration and the relative weight of the fixed capital. Therefore, these
results are not inconsistent with the predictions of the Marxian approach, since they are not consistent with the post-Marxist prediction that oligopolist industries are capable to obtain, over time, higher profit rates than the competitive ones.

The central aim of this empirical analysis was to test whether or not Marx's theory of competition is really inconsistent with the empirical evidence on inter-industry profit rate differentials, as the post-Marxist economists claimed. The results obtained clearly vindicate Marx's analysis.

Finally, it should be pointed out that the Brazilian economy has a modern and large industrial sector which is not only characterized by being highly concentrated, but also, at least for the period which I have examined, that it was almost shielded away from foreign competition due to the existence of many different forms of trade barriers. Therefore, it is a country in which the economic structures favor the post-Marxist hypothesis rather than the Marxian hypothesis that industry profit rates tend to be equalized over time. And even under this circumstances, the predictions of Marx's theory were consistent with the empirical evidence.

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