Econometric Evidence on the Determinants of the Mark Up of Industrial Brazilian Firms in the 1990s

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Abstract

Our aim in this paper is to investigate in econometric terms the determinants of mark up in the Brazilian industrial firms in the 1990s. Several regressions using panel data were tested to describe the behavior of the mark up of industrial firms. All models considered microeconomic and macroeconomic variables. A negative relation was found between demand variation and mark up variation, suggesting that it evolved in an anticyclic way. This behavior is explained based on the increase degree of uncertainty that surrounded changes in the macroeconomic scenario in the 1990s.

Keywords: Estimation with Panel Data, Pricing, Mark Up Determination

JEL Classification: L11, L16

Resumo

O objetivo deste artigo é investigar em termos econométricos os determinantes do mark up em firmas industriais brasileiras nos anos 1990. Foram testados vários modelos de regressão com dados em painel para descrever o comportamento do mark up industrial. Os modelos consideraram tanto variáveis microeconômicas como macroeconômicas. A variação da demanda correlacionou negativamente com a variação do mark up, sugerindo que o mark up evoluiu de forma anticíclica no período. Este comportamento foi interpretado como uma reação das firmas ao aumento do grau de incerteza no ambiente macroeconômico dos anos 1990.

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1. Introduction

Despite significant changes in the institutional environment of the Brazilian economy in the 1990s, caused mainly by economic and financial deregulation, price stabilization and privatizations, growth rates were modest along the decade (Hermann 2002). Contrasting with this result, industrial productivity recovered from a long period of stagnation since mid-1980s. This recovery can be largely attributed to the external deregulation and exchange rate appreciation after the stabilization plan in 1994.

Microeconomic literature points out that the increase in production efficiency as a result of more flexible commercial relations should result in, at least, two positive effects on the economy. On one hand, a greater exposure to foreign competition should positively influence firms to improve their product quality and productivity by employing more efficient inputs. Thus, an increase in economic growth rates should be expected, encouraged by the acceleration in incorporating technological change. As has been mentioned, economic growth rates were low in the 1990s. On the other hand, the reduction in tariff and non-tariff barriers should imply in broadening the market for more firms, increasing competition and contributing to a reduction in mark ups. Reduction in industrial mark ups was not observed either. In the 1990s the average mark up of industrial firms moved from 1.22, in 1993, to 1.30 in 1996 and 1.38 in 1999 (see Table in Annex), so, mark ups had changed and increased. [1]

Our main explanation for such evidence is that the macroeconomic scenario in the 1990s did not reduce the degree of uncertainty in the economy, inducing industrial firms to a defensive behavior when setting their prices. In this sense, this text briefly discusses theoretically causal links among micro and macroeconomic variables that can be identified as having influence in price formation in the 1990s, through the determination of the mark up of industrial firms in Brazil. In more detail it investigates econometric models that better explain mark up behavior of industrial firms in the 1990s. It is assumed that price formation is a key variable to explain the production and accumulation behavior of the firm, because it largely determines the generation of firm's profits. Also, pricing strategies of firms are fundamental to the understanding how monetary policy affects the real side of the economy. [2] In spite of the relevance of the subject, empirical studies about mark up determination in Brazil in recent time are scarce and not conclusive, and so the

[1] This is in sharp contrast with the findings of Ferreira and Guillén (2004, p. 527), for whom industrial mark ups showed little change in the 1990s and did not decrease, as they would have expected The authors, when presenting the results of their econometric estimates about the effect of economic deregulation on the Brazilian productivity and production framework, concluded that: "The channel to this increase in productivity is not, apparently, the increase in competition, since there is no statistical evidence of mark up reduction. This is perhaps the most surprising result in the article, the fact that the mark up does not change significantly after commercial deregulation."

[2] For an empirical study on mark up formation in industry in Brazil in the 1970s, in line with the theoretical assumptions in this paper, see Calabi and Luque (1985). See also Camargo and Landau (1983) and Considera (1981) for investigation on mark up behavior. In Marquetti (1994) an extensive survey on empirical evidences on price formation with reference on Brazil can be found.

contribution of this paper is to model mark up behavior for industrial Brazilian firms in the 1990s, relating micro and macroeconomic variables.

This paper develops in the following way. In the next section we briefly present theoretically how the price formation process takes place in the context of an oligopolistic firm deciding under uncertainty. Then we discuss how changes in the macroeconomic scenario of the Brazilian economy in the 1990s affected the industrial firm's behavior regarding the determination of the mark up. Then, we present the econometric results of the model for the industrial mark up determination in industrial Brazilian firms in the 1990s, testing several different econometric specifications. The results found in the econometric exercise confirmed the main conclusions of our economic analysis, and also, we found out that the more simple specifications presented the more robust the result. A last section summarizes our conclusions.

2. Main Theoretical Elements for the Determination of the Mark Up Under Uncertainty: The Post Keynesian Pricing Theory

Our main theoretical reference to model the mark up of industrial firms in Brazil in the 1990s is the seminal work by Hall and Hitch (1939), which set the roots of the non-marginalist theory of prices developed by post Keynesians (Lee 1984). The authors found in their empirical investigation that firms in their pricing policy apply a 'rule of thumb' which they called full cost pricing, that is, a price based on full average cost '...the one which 'ought' to be charged... which had been proved acceptable to consumers' (Hall and Hitch 1939, pp. 18–19). [3]

Given this insight, post Keynesians contributed to the pricing theory in oligopolistic markets arguing that, as prices are set in advance, expectations about the future behavior of costs and demand play an important role in their determination. Also post Keynesians consider that pressures from the environment, that is to say, from competing groups of products, may impact pricing decision. In other words prices are assumed to be set by following standard rules and procedures – indicated by cost-plus pricing mechanisms – but these prices can be adjusted as changes in the environment are perceived by firms. These assumptions imply that mark up to average cost may not be fixed or unchanging along the time, meaning that price changes not only occur because costs and and demand varies, but also because mark up may change. In this sense, mark ups may show an anticyclical pattern.

In the post Keynesian literature the mark up behavior is the result of the interaction of a complex set of economic forces that involves decisions made under non-probabilistic uncertainty on production, price and investment. [4] In such a

[3] Since Hall and Hitch's work, several authors implemented field research in order to discuss how firms set their prices. For a recent survey, see, Greenslade and Parker (2012).

[4] See, for example, the contributions of Eichner (1973, 1976, 1985), Harcourt and Kenyon (1976), Davidson (1978), Kenyon (1979), Shapiro (1981), Feijó (1983), Arestis and Milberg (1993), Lee (1984),

context, firms cannot fully evaluate the consequences of their actions, and therefore determine for sure the price that maximizes their profits. So, the mark up becomes the strategic variable firms manipulate in search of their maximization targets.

In oligopolistic markets operating under full capacity when demand varies it is expected that production varies, and not prices. However, given the market power of the firms, they may decide that when demand changes, price changes according to their strategy of capital accumulation in the long run. The point to highlight is that, by assumption, there will be no automatic mechanism linking price changes due to changes in demand.

Under the same token, changes in costs may not be fully passed on prices. Although prices depend on costs, there is no automatic transmission mechanism in costs to prices, either. This means to say that prices depend on the mark up (a strategic decision), as well as on costs. [5] The concept of cost that matters is the 'normal' cost, defined as the one that is considered under the assumption of a 'normal' level of capacity utilization. Temporary changes in costs or in demand do not influence prices, and as mentioned, the level of demand determines the level of production, under full capacity.

Competition among firms should set the limits that mark up could vary and it is in this analysis that the interaction between micro and macroeconomic aspects becomes relevant. Assuming that rivalry between firms that constitute an industry is enough to ensure that no investment opportunity is wasted, the strategic variable in the study on mark up behavior is the level of expenses with investment by the firms. Investment decision are guided mainly by market growth expectations and the desire to maintain or broaden markets share. Profit generation provides the means that firms need to pursuit their long run growth target and increase their market share. In this sense, in the post Keynesian literature it is assumed that firms aim at maximizing growth in the long run, and so emphasis should be put on the process of accumulation and competition among firms as the main force behind accumulation.

Minsky (1986), contributed to expand the understanding of the interaction process between the microeconomic and macroeconomic spheres by showing how mark up decisions are also influenced by the need to generate cash flow to pay for financial commitments taken on. In this context, the process of price formation and mark up determination by firms should be aimed at generating enough profits (or cash flows) to provide resources for the investment financing process. Firms should, therefore, include in their supply prices an amount that, besides exceeding their costs, should also generate enough funds to sustain or value their capital assets.

In this perspective, price formation process reflects how diversified firms build their growth strategies according to how they perceive the future behavior of demand, costs, and competition. In an environment where expectations about the

Shapiro and Saeyer (2003) among others.

[5] As presented by Sylos-Labini (1969), the price equation can be written as: $p = v + qv$, where p is the unit price, v represents direct operational costs, and qv represents the overhead (over a standard production volume) and an acceptable profit margin per product unit.

future are low, firms with market power will probably adopt defensive postures, postponing long term invesment plans and keeping their assets more liquid. In the opposite case, firms might adopt more aggressive postures, aiming at gaining market share. In either cases, mark up should be adjusted according to the firm's strategy of growth. Following the Kaleckian tradition, the supply price in oligopolized markets reflects the firm cost structure and market power. [6] According to Eichner, it is also assumed that it reflects the internal fund requirements to realize the firm's investment plans.

Kenyon (1979) proposes a sequence of arguments to explain the determination of the mark up by an oligopolistic firm. First, the firm decides about the future investment plans based on the relation between the observed capacity utilization rate and some desired rate – this desired rate being such that the firm will be capable of meeting a sudden increase in demand for its product. Next, the firm chooses the mark up that will allow it to retain the profits required to fulfill its obligations and meet its strategic objectives. These objectives, as mentioned, are largely influenced by long term expectations, and given the assumption of decisions taken under non-probabilistic uncentainty, by the degree of confidence in the expectations. The firm then chooses the mark up that will provide the expected profit level. The firm will maintain this price as long as demand conditions indicate that the productive capacity is adequate, and as long as production costs do not deviate from their normal level. Assuming this sequence of events, when expectations are optimistic and the degree of confidence is high, it is clear that investment plans and the size of the mark up are linked through the supply and demand for funds as retained profits.

To sum up, since mark ups are understood as a strategic variable to the firms, prices are determined by production, and not by demand. Costs, on the other hand, are the second major determinant of prices. Prices, in this sense, cannot be treated as functions of the resource allocation and income distribution process only, they must also be related to:

a) the need to generate funds that will make the capital accumulation process possible,
b) make payments of debts feasible,
c) induce and partly finance investments and
d) make the acceptance of new financial obligations possible.

Changes in the mark up are influenced both by market conditions and decisions made by firms to meet their targets over time. Those targets are established considering the evaluation they make about future prospects of gains, given their perception of the present and future evolution of the macroeconomic context. Under this perspective, micro and macroeconomic variables should be considered in order to explain mark up behavior along the time. The next section describes the main

[6] According to Kalecki (1971) the firm's mark up is determined by the degree of competition between firms in an industry $(p_i - u_i)/u_i = f_i(p^*/p_i)$, where p^* is the weighted average price in an industry, u is the direct cost, and i represents the firm's subscription.

features of the Brazilian development in the 1990s in order to inform the main micro and macroeconomic variables that should be considered to model mark up behavior of industrial firms in the period.

3. The Macroeconomic Scenario in Brazil in the 1990s: Main Issues

The 1990s is a decade marked by deep changes in Brazilian macroeconomic scenario. Two economic reforms are the most important to explain the changes in the economic environment: the end of the high inflation regime after the success of the stabilization plan known as the Real Plan, in June 1994, and the commercial and financial deregulation with the end of tariff and non-tariff barriers, which started at the end of the 1980s.

The end of the high inflation regime implied the end of contract indexation, a practice that pervaded all economic transactions. In a highly inflationary context in the 1980s and beginning of the 1990s and with widely diffused contract indexation rules, the high level of effective protection allowed firms to informally index their prices on the expected inflation, estimated according to the official exchange rate or the overnight interest rate variation. This defensive behavior by firms aimed at ensuring adequate profit margins and cash flows to preserve their financial capacity toward unexpected cost changes, and to finance investments required to keep their market share.

Commercial and financial deregulations were being processed since late 1980s. At the time of the Real Plan was launched, the country had rejoined the international financial market, which allowed for a significant accumulation of international reserves. The success of the Real Plan in keeping prices under control relied, in a great extent, on the use of the fixed exchange rate as an anchor for domestic prices. Excess of external liquidity, together with high domestic levels of interest rate, caused a strong appreciation of the internal currency (*real*). So, on one hand, the opening of the economy increased competition, what contributed positively to restrict mark ups, and it was an important factor to stop the process of passing on costs pressures to final prices. On the other, the appreciation of the *real* aided to keep domestic prices under control.

Thus, from 1994 onwards the economic environment was one of a low indexation level, a permanent and successful inflation control policy, but with low growth rates. Economic policy showed a stop and go pattern, signaling to economic agents that inflationary threats would be fought by strict demand control. The main threats came from the speculative attacks against the Brazilian exchange rate. As emerging markets are more affected by changes in moods and opinions concerning the sustainability of their respective exchange rate, the Brazilian stabilization process was intrinsically vulnerable in direct proportion with the dependence on the entrance of foreign resources. In those conditions, the stabilization that was attained was placed under permanent threat of rupturing, and so was perceived by economic agents.

A combination of appreciated real exchange rate in a context of open economy contributed to the production of permanent current transactions deficits. Moreover, the liberal economic policy followed, adopted as the main instrument of control of the macroeconomic policy the interest rate, which was kept at high levels, with negative impact on public and external deficits and on investment decisions in fixed capital.

Lastly, the same exchange rate appreciation that supported fast deflation, broaden the component that in the formation of the interest rate was correlated with the expectation of exchange rate devaluation. So, to keep credibility on the parity of the exchange rate, the manipulation of the interest rate was the only instrument of monetary policy used every time the real underwent a speculative attack. To contain the outflow of capital in the face of foreign crisis, domestic interest rate suffered sharp increases, and this happened in 1995, 1997 and 1998 after the Mexico the Asian and the Russian crisis, respectively. In January 1999, the exchange rate regime was changed to a floating exchange rate regime, and in June an inflation target regime started being implemented.

From the firms' point of view, with the commercial deregulation process, they were induced to focus their activities to become more competitive. Privatizations, in turn, opened up opportunities for buying and selling companies. The sensible broadening of domestic markets brought by monetary stabilization and the overvaluation of the *real* created favorable conditions for a number of firms to respond to the competitive pressure produced by imports, through modernization and improving quality of their products. However, the new more competitive scenario did not stimulate investment and growth.

Modernization implied more imports, allowing for a renewal of the Brazilian industrial structure. In this sense, the real exchange rate appreciation played a dual, contradictory, role. On one hand it increased domestic competition lowering the price of foreign competing products. On the other it lowered relatively the price of inputs and capital goods responsible for the productive modernization and diversification of production lines.. It should be remarked that Brazilian industry reacted positively to the new opportunities and challenges, as the effects were shown in the industrial productivity growth. Indeed, from 1991, prior to the commercial deregulation, and 1999 labor productivity grew 8.8% per year. [7] Because the level of investment in fixed assets was very low, industrial employment severely decreased – the rate of gross capital formation as a percentage of the GDP was around 17% between 1991 and 1999. In sum, in spite of the punitive macroeconomic environment, the significant growth in productivity, opened space to the drop in production costs. [8]

[7] According to the monthly industrial surveys of the Brazilian Statistical Office.

[8] This finding suggests the hypothesis that although the real exchange rate dropped 48.4% between 1985 and 1998 (this result is obtained when the deflators used are the wholesale prices, when consumer price indexes are used, this drop is of 67.1%.) the drop in real prices perceived by the exporting sector was compensated by the reduction in unit costs, which in this way preserved the profit margin/mark up. Perhaps this fact explains why exports grew non-stop between 1991 and 1998, leaping from US$31.6 to US$51.1 billion in appreciated exchange rate context.

The constant threat of a sharp devaluation of the currency added more uncertainty in the macroeconomic context, affecting negatively long run expectations. Overvaluation of the currency discouraged projects aimed at exporting, promoted a shrinking of important chains of production – also affected by predatory imports – and increased foreign property share in the domestic capital stocks.

To sum, financial and commercial deregulation and price stability significantly changed the price formation process in Brazil from mid-nineties on. The commitment to maintain operational revenue, current profitability and profit margin, in a context of high uncertainty, given the vulnerability of the economy to foreign crisis and high exposition to international competition, required from firms changes in production and pricing strategies, technological restructuring, and very often the acquisition of new assets or the sale of existing ones.

Given this macroeconomic scenario in the 1990s, the objective of the next section is to empirically investigate the influence of microeconomic and macroeconomic variables on the industrial firms' determination of the mark up. In this sense, at the macroeconomic level, it is assumed that inflation, interest and exchange rate variables, the level of commercial and financial deregulation and the domestic aggregate demand performance delimited the firms' potential cash-flows. At the microeconomic level, it is assumed that the supply price reflects the firms cost structure and market power. Given these conditioning factors, firms sought to define current mark ups to their direct average costs which, by ensuring their business profitability, generated income flows and profit margins capable of securing their expansion strategies. Hypothetically, such strategies are basically aimed at defining the adequate level of barriers against the new entrants, and ensure an adequate mix of self-financing and external financing for investment funding.

4. Determinants of Mark Up in the Manufacturing Industry in the 1990s: An Econometric Model

In the mark up determination model for the Brazilian industry in the 1990s, both macroeconomic and microeconomic variables were considered. Given the availability of data, the mark ups were constructed for industrial sectors, and not firms, considering prices and average production costs as references. In this sense, changes in terms of monopoly power and changes in intra-firm cost structure were not captured.[9] We believe that even with such limitation, the exercise undertaken presented interesting results that are widely consistent with

[9] It is interesting to observe that along the nineties the mark up dispersion increased among the industrial sectors. From 1990 to 1992 the dispersion was around 0.073; in 1994 it jumped to 0.131 and then stabilized in 0.100, between 1994 and 1997; in 1999 it achieved 0.177. We can suggest that the increasing in dispersion is an indicative of the defensive behavior of bigger firms, with more market power, in setting their mark ups. Also it is an indicative that, in spite of augmented competition due to commercial opening of the economy and exchange rate overvaluation, big firms chose to maintain their market share. These considerations are to be confirmed in our next econometric study.

the theoretical discussion presented. The effect of the macroeconomic context was captured through the behavior of the real exchange and the interest rate, and the sectors relative prices, opening degree and sectors GDPs level. The microeconomic variables were captured through sectors profit margin, investment profitability and leverage degree.

In this paper we chose to analyze the period 1990-1999 because data are available for all variables of interest (8) with the highest possible number of sectors (26). Furthermore, as mentioned in third section, this is a period characterized by significant changes in the Brazilian economy, that influenced the way firms fixed their prices.

In this way we built up a balanced panel data, combining microeconomic and macroeconomic variables, following the theoretical considerations on Section 2, containing 260 observations. Our panel model is specified as follows:

$$Y_{it} = \beta_{ix} X_{it} + \beta_{iz} Z_{it} + \eta_i + \delta D_t + u_{it}$$

$$u_{it} = \rho_i u_{it-1} + \varepsilon_{it} \qquad \text{with} \qquad \varepsilon \sim N\left(0, \sum\right)$$

for $i = 1, \ldots, M$ cross-sectional units observed for dated periods $t = 1, \ldots, T$. And where Y_{it} is the mark up vector, X_{it} is a vector of macroeconomics variables, Z_{it} of microeconomics regressors, while η_i represents cross-section fixed effects and D_t a vector of policy dummies. u_{it} are the disturbances following an autoregressive process of order one, where $|\rho| < 1$ (i.e. strictly stationary) and ε_{it} is a white noise process. The $\sum$ is the variance-covariance matrix of order M. $\beta_{ix}, \beta_{iz}, \delta$ are vectors of coefficients. We consider the following explanatory variables:

$$\mathbf{X}_{it} = [SGDP_{it}, OPEN_{it}, RPI_{it}, RER_{it}, RIR_{it}] \qquad \text{and}$$

$$\mathbf{Z}_{it} = [PM_{it}, IP_{it}, LD_{it}]$$

The mark ups (**MU**) were constructed as the quotient of the production value of one sector by the sum of its respective intermediate consumption, salary and contributions. [10] The profit margin (**PM**) was obtained by dividing the sector net profit by the net operational revenue. Investment profitability (**IP**) was computed by the relation between asset equivalence result and asset balance value; and the sector leverage degree (**LD**) by the relation net debt/net worth. The sector GDP (**SGDP**) was computed by the value added methodology. The opening degree sector (**OPEN**) was obtained as the quotient between the value of imports and the difference between the value of production and net exports. The relative annual sector price index (**RPI**) was calculated as the sector producer price by the aggregated price industry. The real exchange rate (**RER**) was defined by the value of the dollar in domestic currency times the USA producer price index (PPI), divided by Brazil PPI (IPA-DI). Finally, the real interest rate (**RIR**) was obtained

[10] The methodology describing the whole set of data is in Annex.

considering the basic interest rate of the Central Bank discounted by the inflation rate measured by the general price index.

The variables SGDP, RER and RIR account for the aggregate behavior of demand and costs that, according to Section 2, influence the mark up decisions as they confirm the macroeconomic environment where decisions are made. The variables OPEN and RPI were introduced to capture the impact of the economic opening in the 1990s on competion of industrial firms and their cost structure. The variables PM, IP and LD were introduced to account for the microeconomics effects on mark up decision related to the demand of internal funds by firms to sustain their long term growth.

5. Econometric Procedures

Our objective is to estimate econometric models which highlight economic and intuitive arguments that explain the determination of the mark up in the Brazilian industrial firms in the 1990s and are in line with the hypotheses of the econometric theory. For this purpose, we pick up models in which a greater number of the explanatory variables presented the expected signs, as suggested by the outlined theory presented. However, it should be observed that models, in which the regressors presented different signs from the expected, were also reported. In general the reported models presented residuals closer to be NIID.

We first carried out tests for the presence of common unit roots to all cross-sections, as well as tests with individual unit root process. [11] We employed Levin, Lin and Chu test (LLC) which assumes common unit root process. [12] Also we preformed Im, Pesaran and Shin W-test, (IPS) and ADF – Fisher test. Both assume individual unit root process. But, the power of these tests as of their size distortions are strongly affected by the size of the sample (the large of M and T). Moreover, there is the potential risk of concluding that the whole panel is nonstationary even when there is a large proportion of stationary series in the panel (Baltagi, 2007). Then careful analysis of both the individual and panel unit root test results is required to fully assess the stationary properties of the panel.

Tests were specified with individual terms or none effects. The lag length selection was based on asymptotic t-statistic (with p-value equals to 0.1), Andrews' bandwidth estimator and quadratic spectral kernel. The unit root tests results are in Table 1. There are series I(0) and I(1) and the panel cross sections may have or not a common unit root. The presence of fixed effect is crucial and tests are

[11] However, this test is very restrictive in the sense that it requires that all cross-sections have or do not have a unit root. Further the test crucially depends upon the independence assumption across cross-sections and is not applicable if cross-sectional correlation is present (see Baltagi, 2007, p. 241–250).

[12] The small sample performance of IPC is reasonably satisfactory and has generally better performance than the LLC test. By the other side, IPS has more stable size than Fisher test for small M while in terms of the size-adjusted power the Fisher test seems to be superior to the IPS (Baltagi, 2007).

inconclusive. For these reasons we assume that the series are not cointegrated and let the search of cointegrating panel for furthers studies.

We then tested several econometric models. We first look at a specification with no fixed effects ($\eta = 0, \forall i$), using FGLS estimators, and with the errors being modeled as an autoregressive process of first order and with the estimator for the covariance matrix robust on the presence of generically forms of serial correlation and heterocedasticity of the residuals. In this group the variables are in level and one of the equations is specified in logs.

Then we estimated models with fixed effects and in first differences, with and without logs. We also examined an ADL model with fixed effects and the series in levels. Two other ADLs models were estimated, one with part of the series in levels and the other part in first differences – those that are conclusively I(1), such as pointed out by the unit root tests- with and without fixed effects.

A fourth group of models were estimated through the two least squares process, with and without fixed effects, assuming that all series are I(0) and that the regressors opening degree sector (**OPEN**), real exchange rate (**RER**) and the real interest rate (**RIR**) are strictly exogenous. Finally, several GMM models were estimated, including DPD specifications.

In general, the models specifications followed the criterion of starting from the more general to the more parsimonious specification following the analysis of common factors. Since the preliminary experiments indicated the presence of a strong serial correlation, the error term has been specified as a first order autoregressive process – AR(1). This, however, was not sufficient to eliminate the entire autocorrelation for several models. Also, a dummy for economic policy was included to reduce the size of the outliers present in the period, and this way obtain residuals closer to being Gaussian ones. The choice of the intervention periods has been done looking at each sector considering the specified model without dummies.

It should be observed that the selection criterion of choosing the estimated equations which residuals presented the least serial correlation eliminated all specifications with random effects, as well SURE models. So, the models were estimated by FGLS and the coefficient of the variance matrix was estimated with the White robust estimate version, designed to accommodate arbitrary serial correlations and time-variant variances of the disturbances and, corrected by the degrees of freedom. The non-significant variables were deleted from the equations.

Table 1
Panel Unit Root Tests

SERIES	TESTS	FIXED EFFECTS P-VALUES	DECISION	NONE TERM P-VALUES	DECISION
MU	LLC	0.0013	REJECT	0.9566	ACCEPT
	IPS	0.0030	REJECT	—	—
	ADF - FISHER				
		0.0017	REJECT	10.000	ACCEPT
SGDP	LLC	0.0000	REJECT	0.3825	ACCEPT
	IPS	0.0000	REJECT	—	—
	ADF - FISHER				
		0.0000	REJECT	0.9999	ACCEPT
OPEN	LLC	0.9969	ACCEPT	10.000	ACCEPT
	IPS	10.000	ACCEPT	—	—
	ADF - FISHER				
		10.000	ACCEPT	10.000	ACCEPT
RPI	LLC	0.0000	REJECT	0.0000	REJECT
	IPS	0.0000	REJECT	—	—
	ADF - FISHER				
		0.0000	REJECT	0.0012	REJECT
RER	LLC	0.0000	REJECT	0.9970	ACCEPT
	IPS	0.0000	REJECT	—	—
	ADF - FISHER				
		0.0000	REJECT	10.000	ACCEPT
RIR	LLC	0.0000	REJECT	0	REJECT
	IPS	0.0000	REJECT	—	—
	ADF - FISHER				
		0.0000	REJECT	0.0000	REJECT
PM	LLC	0.0000	REJECT	0	REJECT
	IPS	0.0000	REJECT	—	—
	ADF - FISHER				
		0.0000	REJECT	0.0000	REJECT
IP	LLC	0.9999	ACCEPT	0.0026	REJECT
	IPS	0.9998	ACCEPT	—	—
	ADF - FISHER				
		0.9222	ACCEPT	0.3708	ACCEPT
LD	LLC	0.9944	ACCEPT	10.000	ACCEPT
	IPS	0.9998	ACCEPT	—	—
	ADF - FISHER				
		0.9071	ACCEPT	10.000	ACCEPT

Table 1: Panel Unit Root Tests (cont.)

Mark up and	LLC	0..0000	REJECT	0.0004	REJECT
Macro Variables	IPS	0.0003	REJECT	—	—
	ADF - FISHER				
		0.0000	REJECT	0.4480	ACCEPT
Mark up and	LLC	0.0000	REJECT	0.9215	ACCEPT
Micro Variables	IPS	0.0516	REJECT	—	—
	ADF - FISHER				
		0.0039	REJECT	0.0038	REJECT
Macro Variables	LLC	0.0000	REJECT	0.0000	REJECT
	IPS		REJECT	—	—
	ADF - FISHER	0.0002			
		0.0000	REJECT	0.0344	REJECT
Micro Variables	LLC	0.0000	REJECT	0.1687	ACCEPT
	IPS	0.1298	ACCEPT	—	—
	ADF - FISHER				
		0.0100	REJECT	0.0000	REJECT

6. Results

The estimated models are presented in Table 2, 4, 6 and 8. Tables 3, 5, 7 and 9 contain reports of residuals diagnostics. [13] In Table 10 we summarize all estimates performed.

The equations on Table 2 contain an autoregressive term to reduce the residual serial correlation. Although the autoregressive term coefficients are high, they are all statically smaller than 1. By observing the AR(1) process impulse-response functions – not reported – in the models, they are found to be stable, that is, converge to zero. The residuals are near Gaussian.

The models specified with fixed effects (Table 4) are more stable than the models of the first group, however they showed a high serial correlation, what in part is corrected by the FGLS estimation and the use of the White robust matrix. In fact, the effects are highly significant (p-value near to zero). However, some of the microeconomic variables lost their explanatory importance; for this reason in equation 6 we re-specified the model to deal with the serial correlation through a lagged dependent variable. As a drawback the real interest rate has a positive signal.

[13] The reports on the models presented contain the R^2 statistics, standard regression error (SER), F statistic p-value, Durbin-Watson (DW) statistic together with its p-value The asymmetry coefficient (sk) and the excess residuals Kurtosis (ek) are also reported. Besides the Ljung-Box statistics p-values [Q(p)] for the second, fourth, sixth and eighth order to test for the presence of serial correlation in the residuals; Bera-Jarque (BJ) to test the normality; Goldfeld-Quandt [GQ(h)] for the heteroskedasticity; and the BDS (bootstrap) test for independence of residuals specified with dimension 6 and distance of 0.7.

When the model is specified in first differences, what implies to remove the unobserved effects, the problem of serial correlation is, in part, solved what strengths inference procedures, making the estimates closer to be efficient. This finding suggests the hypothesis that the errors should be specified as a random walk across time. Nonetheless, equation 7 shows the profit margin with a non-significant signal.

The ADL models, on their turn, seem to be in the track of solving the problem of high serial correlation; however this specification without fixed effects presents an explosive nature. Moreover, the signs of the real exchange rate and of the investment profitability are negative, what contradicts our theoretical interpretation. Therefore we did not report these estimates.

In the estimation of the two stages least squares FGLS (3SLS) models we used as instruments all variables of this study. We employed instruments of period $t-1$ and the variables openness, real exchange rate and real interest rate also in period t. Although the diagnosis of the residuals were good, in the model with fixed effects the real interest rate variable and the relative price did not show statistical significance, while in the DGLS-fixed effect specification the real exchange rate has negative signal. By other side, equation 8 estimated without unobserved effect with 3SLS procedure has clear results with residuals near to be NIID. Their estimates are also comparable with those from models 1 and 2.

In the GMM FGLS specifications we employed as before instruments of period $t-1$, variables OPEN, RER and RIR as strictly exogenous. Models were estimated without and with observed effects. The DPD models were performed with normal ($\triangle x_{i,t-1}$) instruments and GMM-type instruments ($y_{t-i}, i = 1, 2$), in first and orthogonal difference. The DPD model estimated with orthogonal difference (Eq. 14) has poor diagnostics results and should not take into consideration. While in the DPD model with first difference (eq. 13) the relative price present negative signal. As in general the model without fixed effect has the better results with residuals near to be NIID.

Table 2
Estimated Models with FGLS (Cross-section Weights) and **No Fixed Effects** Dependent Variable: Mark-up (White consistent covariance matrix computed)

VARIABLE	EQUATION 1		EQUATION 2		EQUATION 3	
	Coef.	*t*-Statistic	Coef.	*t*-Statistic	Coef.	*t*-Statistic
		P-Value		*P*-Value	LOGS	*P*-Value
Constant	1.5235	7.5938	1.3982	8.1394	0.7001	4.0186
		0.0000		0.0000		0.0001
PM	0.0858	2.0689	—	—	—	—
		0.0397				
IP	0.0153	3.7252	0.0116	2.5466	0.0180	2.0967
		0.0002		0.0116		0.0371
LD	-0.0904	-4.2573	-0.0589	-3.2923	-0.0657	-2.8379
		0.0000		0.0012		0.0050
SGDP	-0.0014	3.2334	-0.0009	2.5030	-0.0546	-1.8577
		0.0014		0.0130		0.0645
OPEN	-0.3450	-2.5890	-0.3386	-2.5122	-0.2908	-1.9932
		0.0103		0.0127		0.0475
RPI	0.0604	2.2358	0.0870	2.5104	0.0782	2.7476
		0.0264		0.0128		0.0065
RER	0.1096	4.8219	0.1426	6.2717	0.1030	5.1437
		0.0000		0.0000		0.0000
RIR	-0.0357	-1.9988	-0.0810	-5.2958	-0.0630	-4.6370
		0.0468		0.0000		0.0000
Dummy	0.0357	4.6150	0.0257	3.3554	0.0195	2.9246
	Dum02	0.0000	Dum02yc	0.0000	Dumo02yc	0.0038
AR(1)	0.9483	30.7473	0.9384	28.9869	0.9348	29.9240
		0.0000		0.0000		0.0000

Table 3
Residuals Diagnostics

Equation 1					
Iterat= 16	R^2=0.7468	SER=0.0739	F=0.0000	DW=1.7951/0.1171[1]	Q(2)=0.0334
Q(4)=0.0865	Q(6)=0.0729	Q(8)=0.0967	GQ(75)=0.5216	Sk=0.3824	Ek=0.2878
BJ=0.0386	BDS=0.1112				
Equation 2					
Iterat= 17	R^2=0.7566	SER=0.0751	F=0.0000	DW=1.8135/0.1459	Q(2)=0.2351
Q(4)=0.4497	Q(6)=0.3684	Q(8)=0.4380	GQ(75)=0.	Sk=0.0513	Ek=0.3290
BJ=0.5606	BDS=0.0472				
Equation 3					
Iterat= 14	R^2=0.7641	SER=0.0535	F=0.0000	DW=1.8116/0.1158[2]	Q(2)=0.2406
Q(4)=0.4659	Q(6)=0.4190	Q(8)=0.4570	GQ(75)=0.	Sk=0.0236	Ek=0.1597
BJ=0.8736	BDS=0.1452				

[1] Q(1)=0.9072; [2] Q(1)=0.8187.

Table 4
Estimated Models with FGLS (Cross-section Weights) and **Fixed Effects**
Dependent Variable: Mark-up (White consistent covariance matrix computed)

VARIABLE	EQUATION 4		EQUATION 5		EQUATION 6		EQUATION 7	
	Coef.	*t*-Statistic	Coef.	*t*-Statistic	Coef.	*t*-Statistic	Coef.	*t*-Statistic
		P-Value		*P*-Value		*P*-Value	difference	*P*-Value
Constant	1.2738	12.2637	1.3140	13.3644	0.8007	5.5036	0.0112	4.6935
		0.0000		0.0000		0.0000		0.0000
PM	—	—	—	—	0.2619	5.5640	-0.0046	-0.2099
						0.0000		0.8340
IP	0.0059	1.4822	0.0074	1.9125	0.0266	36.265	0.0090	1.6555
		0.1399		0.0572		0.0004		0.0992
LD	—	—	—	—	-0.0475	-1.4708	-0.0692	-4.2812
						0.1429		0.0000
SGDP	-0.0014	-2.3381	-0.0015	-3.1101	-0.0015	-2.3301	-0.0005	-1.7584
		0.0204		0.0021		0.0208		0.0800
OPEN	-0.3130	-1.9126	-0.3575	-2.4731	-0.2608	-2.8319	-0.4801	-3.3770
		0.0572		0.0142		0.0051		0.0009
RPI	0.1184	3.0040	0.1221	3.0429	0.0509	2.4042	0.0755	1.9661
		0.0030		0.0027		0.0171		0.0505
RER	0.1062	4.1825	0.0809	2.4577	0.0607	2.2078	0.1397	6.2532
		0.0000		0.0148		0.0284		0.0000
RIR	-0.1193	-6.6827	-0.1279	-7.9513	0.0259	0.8552	-0.0755	-5.4373
		0.0000		0.0000		0.3935		0.0000
DUMMY	0.0398	5.0966	0.0389	6.0481	0.0598	6.6855	0.0491	4.5025
	Dum2xc	0.0000	Dum02yc	0.0000	Dum02	0.0000	Dum02yc	0.0000
AR(1)	0.5150	8.3289	0.4896	8.0172	0.4245	5.0663	——	——
		0.0000		0.0000	Mu(-1)	0.0000		

Table 5
Residuals Diagnostics

Equation 4					
Iterat= 16	R^2=0.8237	SER=0.0713	F=0.0000	DW=1.8113/0.1489	Q(2)=0.0000
Q(4)=0.0000	Q(6)=0.0000	Q(8)=0.0000	GQ(75)=0.9196	Sk=0.2242	Ek=0.3538
BJ=0.2039	BDS=0.0000				
Equation 5					
Iterat= 15	R^2=0. 8367	SER=0. 0708	F=0.0000	DW=1.8454/0.2370	Q(2)= 0.0000
Q(4)=0.0000	Q(6)=0.0000	Q(8)=0.0000	GQ(75)=0.9834	Sk=0.3021	Ek=0.3466
BJ=0.0940	BDS=0.0000				
Equation 6					
Iterat= na	R^2=0.8249	SER=0.0690	F=0.0000	DW=1.8014/	Q(2)= 0.0016
Q(4)= 0.0052	Q(6)= 0.0214	Q(8)= 0.0090	GQ(75)=0.3991	Sk=0.3312/0.1288	Ek=0.0020
BJ=0.1178	BDS= 0.2808				
Equation 7					
Iterat= na	R^2=0.4369	SER=0.0755	F=0.0000	DW=1.8129/0.1524	Q(2)=0.1561
Q(4)=0.2324	Q(6)=0.2483	Q(8)=0.3239	GQ(75)=0.5326	Sk=-0.2777	Ek=0.4808
BJ=0.0720	BDS=0.0056				

*Q(1)=0.9428.

Table 6
Estimated Models with Two-Stage FGLS (Cross-section Weights), **without Fixed Effects and with Fixed Effects** Dependent Variable: Mark-up (White consistent covariance matrix computed)

VARIABLE	EQUATION 8		EQUATION 9		EQUATION 10	
	Coef.	*t*-Statistic	Coef.	*t*-Statistic	Coef.	*t*-Statistic
		P-Value	*P*-Value		*P*-Value	*P*-Value
Constant	1.7469	9.0108	0.5568	4.0860	1.5214	11.1106
		0.0000		0.0001		0.0000
PM	—	—	0.5892	69.386	—	—
				0.0000		
IP	0.0242	3.8317	0.0383	4.2754	0.0314 Differ.	5.3184
		0.0002		0.0000		0.0000
LD	-0.2008	-3.5228	-0.0683	-2.2978	—	—
		0.0005		0.0226		
SGDP	-0.0027	-3.4334	-0.0011	-1.5981	-0.0019	-1.6475
		0.0007		0.1116		0.1013
OPEN	-0.3222	-2.7262	-0.3006	-3.9703	-0.7448	-4.6378
		0.0069		0.0001	Lag. Differ.	0.0000
RPI	0.0706	2.5488	0.0654	1.5540	0.2408	53.952
		0.0115		0.1218		0.0000
RER	0.1091	3.7525	0.2281	4.3759	-0.2397	-5.3386
		0.0002		0.0000		0.0000
RIR	-0.0920	-3.0688	0.0381	1.2299	-0.2263	-4.0431
		0.0024		0.2202		0.0001
DUM	0.0335	4.1180	0.0275	2.6796	0.0645	4.9865
	Dum02	0.0001	Dum02yc	0.0080	Dum02yc	0.0000
AR(1)	0.9401	30.09710	0.4545	4.8349	—	—
		0.0000	Mu(-1)	0.0000		

Table 7
Residuals Diagnostics

Equation 8					
Iterat= 18	R^2=0. 7162	SER=0. 0768	F=0.0000	DW=1.8923/0.4101	Q(2)= 0.0787
Q(4)=0.2011	Q(6)=0.1363	Q(8)=0.1602	GQ(75)=0.5214	Sk=0.1725	Ek=0.1585
BJ=0.4761	BDS=0.0072				
Equation 9					
Iterat= NA	R^2=0. 7975	SER=0.0721	F=0.0000	DW=2.0357/0.7448	Q(2)=0.0436
Q(4)=0.0479	Q(6)=0.1111	Q(8)= 0.0397	GQ(75)=0.3731	Sk=0.2846	Ek=0.0764
BJ=0.2004	BDS=0.2256				
Equation 10					
Iterat= NA	R^2=0.8811	SER=0.0814	F=0.0000	DW=1.6814/0.0015	Q(2)=0.1468
Q(4)=0.0769	Q(6)=0.0380	Q(7)=0.0635	GQ(75)=0.4860	Sk=0.4350	Ek=0.1236
BJ=0.0352	BDS=0.068				

*Q(1)=0.9428.
Eq. 8 Inst. Spec.: C MU(-1) PM(-1) IP(-1) LD(-1) SGDP(-1) OPEN(-1) RPI(-1) RER(-1) RIR(-1) OPEN RPI RER RIR DUM02(-1).
Eq. 9 Inst. Spec.: C MU(-1) PM(-1) IP(-1) LD(-1) SGDP(-1) OPEN(-1) RPI(-1) RER(-1) RIR(-1) LD SGDP OPEN RPI RER RIR DUM02yc.
Eq. 10 Inst. Spec.: c MU(-1) d(IP(-1)) d(LD(-1)) d(OPEN(-1)) RIR(-1) d(OPEN) RPI RIR DUM02yc

Table 8
Estimated Models with GMM FGLS (Cross-section Weights), **without Fixed Effect and with Fixed Effect**
Dependent Variable: Mark-up (White consistent covariance matrix computed)

VARIABLE	EQUATION 11		EQUATION 12		EQUATION 13		EQUATION 14	
	Coef.	*t*-Statistic *P*-Value	Coef. difference	*t*-Statistic *P*-Value	Coef. DPD difference	*t*-Statistic *P*-Value	Coef. DPD orthogonal	*t*-Statistic *P*-Value
Constant	2.0300	4.9237	—	—	—	8.5104	—	—
		0.0000				0.0000		
PM	—	—	—	—	0.5899	9.7292	0.4036	6.4951
						0.0000		0.0000
IP	0.0386	5.5098	0.0259	4.2099	0.0720	11.8420	0.0237	3.9748
		0.0000		0.0000		0.0000		0.0001
LD	-0.2994	-4.5101	—	—	-0.3154	-8.2908	—	—
		0.0000				0.0000		
SGDP	-0.00323	-3.5590	-0.0009	-2.3871	-0.0046	-3.2514	-0.0016	-2.4257
		0.0005		0.0179		0.0013		0.0162
OPEN	-0.2955	-3.2184	-0.5753	-6.2283	-0.5797	-7.0216	-0.4362	-3.8258
		0.0015		0.0000		0.0000		0.0002
RPI	0.0688	2.4836	0.0516	2.6554	-0.2576	-5.7917	0.0822	2.2784
		0.0137		0.0086		0.0000		0.0238
RER	0.0457	1.4562	0.0648	3.1670	0.0807	1.8579	0.0748	2.2752
		0.1467		0.0018		0.0647		0.0240
RIR	-0.0771	-2.2976	0.0907	3.5484	0.1931	6.7491	0.0719	2.4619
		0.0225		0.0005		0.0000		0.0147
DUM02	0.0623	6.2254	0.0623	8.4948	0.1114	8.3408	0.0546	3.7849
		0.0000		0.0000		0.0000		0.0002
AR(1)	0.9610	32.4090	—	—	0.2743	8.5104	0.5546	3.7912
		0.0000			Mu(-1)	0.0000	Mu(-1)	0.0002

Table 9
Residuals Diagnostics

Equation 11					
Iterat=85/25[a]	R^2=0.6722	SER=0.0824	F=0.0000	DW=2.0190/0.8845	Q(2)=0.0630
Q(4)=0.1747	Q(6)=0.1698	Q(8)=0.1759	GQ(75)=0.4165	Sk=0.1017	Ek=-0.0814
BJ=0.7912	BDS=0.0256	J-Stat.=15.9370	Inst. Rank=15		
Equation 12					
Iterat= 12[b]	R^2=0.3447	SER=0.0827	F=0.0000	DW=1.9691/0.8132	Q(2)=0.0608
Q(4)=0.1287	Q(6)=0.2067	Q(8)=0.2310	GQ(75)=0.5038	Sk=0.3704	Ek=0.0571
BJ=0.09715	BDS=0.	J-Stat.=10.2128	Inst. Rank=8		
Equation 13					
Iterat= 60[c]	R^2=NA	SER=0.1003	SSR=1.9928	DW=NA*	Q(2)=0.4363
Q(4)=0.5210	Q(6)=0.2880	Q(7)=0.3074	GQ(75)=0.9525	Sk=0.9209	Ek=2.6961
BJ=0.0000	BDS=0.0352	J-stat.=19.7833	Inst. Rank=26		
Equation 14					
Iterat= 2[d]	R^2=NA	SER=0.0744	SSR=1.1018	DW=NA**	Q(2)=0.0000
Q(4)=0.0000	Q(6)=0.0000	Q(8)=0.0000	GQ(75)=0.8424	Sk=0.8991	Ek=1.8727
BJ=0.0000	BDS=0.0000	J-stat.=12.4000	Inst. Rank=14		

[a)] 85 Coef iterations and 25 weight iterations; [b)] 12 weight iterations; [c)] 60 weights iterations; [d)] iterate to convergence 2-steps. *Q(1)=0.3275; **Q(1)=0.0000

Eq. 11 Inst. Spec.: C MU(-1) PM(-1) IP(-1) LD(-1) SGDP(-1) OPEN(-1) RPI(-1) RER(-1) RPI(-1) OPEN RPI RER IPR DUM02

Eq. 12 Inst. Spec.: C d(MU(-1)) d(RER(-1)) d(SGDP) d(OPEN) d(RPI) d(RER) d(RIR)

Eq. 13 Inst. Spec.: levels: C MU(-1,-2) DUM02; difference: PM(-1) IP(-1) SGDP(-1) OPEN(-1) RPI(-1) RER(-1) RIR(-1) OPEN RPI RER RIR

Eq. 14 Inst. Spec.: levels: MU(-1,-1); difference: RER(-1) SGDP OPEN RPI RER RIR

7. Interpreting the Results

The most interesting finding in the econometric exercises is that the sector GDP (SGDP) presented a negative sign in the 14 select specifications, suggesting that the mark up behavior showed a counter-cyclic behavior in the studied period. Considering that mark ups did not show a trend to fall after the opening of the economy, this can be interpreted as an important indication of the defensive behavior of firms that were exposed to greater uncertainties as the macroeconomic context changed significantly in the 1990s. Higher uncertainty, in spite of the stabilization of prices from 1994 onwards, might explain why industrial firms in a more competitive scenario and showing significant productive gains did not lowered their mark ups, neither did increase their capital accumulation. In a macroeconomic context of slow growth and high uncertainties about the future, given mainly the high degree of external vulnerability of the economy, the rational choice for firms was to use their market power to preserve their market share. In equation 2, for example, a 1% increase in the sector GDP induces to a drop in the mark up of approximately 0.001%.

Besides this evidence, in all the equations the signs of the relevant variables are coherent with the economic intuition. Starting with the macroeconomic variables, we observe that when the real exchange rate (RER) rose, it increased the domestic protection degree in relation to imports, also implying an increase of the mark up. So, because a large part of the analyzed period the exchange rate was appreciated it contributed to contain the firms' mark up. [14]

Changes in the relative producer price (RPI) – a variable that captures the firm pricing power – contributed to increase in the mark up. The positive sign confirms the hypothesis that firms with market power used it to keep or broaden their market share.

In general, the rise in the real interest rate (RIR) increases the burden of loans, stock loading and reduces the aggregate demand and, therefore, induces the reduction in the sector mark ups. During the 1990s, the real interest was kept at high levels and the aggregate demand constrained most of the time, a fact which also contributed to compress the mark ups. However, the estimated equations with fixed effects and by 3SLS and GMM in first difference (6, 9, 12, 13, 14), [15] indicate a positive sign to this variable, what suggests that the interest rate could have an ambiguous signal because costly loans tend to decrease the leverage degree and then the mark up. If this is the case, we would observe that income effect would be more important than the substitution effect. This reasoning would contradict the well-known hypothesis that the substitution effect dominates the revenue effect.

[14] Silva and Vernengo (2009) observe that the pass-through of the exchange rate in Brazil had dropped substantially after the opening in the 1990s.

[15] Notice that in equations 6 and 9 this variable has non- significant coefficients. Meanwhile, equation 14 has residuals with strong serial correlation and in equation 13 the relative prices has positive signal. So the fact that the real interest rate may have a positive signal must be taken with cautions.

The OPEN coefficients capture the importance of foreign competition to control inflation. In all specifications the signs were negative, confirming the importance of foreign competition through the process of economic opening in containing tradable goods price increases. In equation 3, for example, the sector opening degree has the highest impact, that is, a 10% increase in this variable implies a 3% drop in the sector mark ups.

Table 10
Estimated Models with FGLS (Cross-section Weights), **without Fixed Effects and with Fixed Effects**

Variable	FGLS			FGLS			
	EQ. 1	EQ. 2	EQ. 3	EQ. 4	EQ. 5	EQ. 6	EQ. 7
	NO FE	NO FE	NO FE LOGS	FE	FE	FE	difference
Constant	15.235	13.982	0.7001	12.738	13.140	0.8007	0.0112
PM	0.0858	—	—	—	—	0.2619	-0.0046
IP	0.0153	0.0116	0.0180	0.0059	0.0074	0.0266	0.0090
LD	-0.0904	-0.0589	-0.0657	—	—	-0.0475	-0.0692
SGDP	-0.0014	-0.0009	-0.0546	-0.0014	-0.0015	-0.0015	-0.0005
OPEN	-0.3450	-0.3386	-0.2908	-0.3130	-0.3575	-0.2608	-0.4801
RPI	0.0604	0.0870	0.0782	0.1184	0.1221	0.0509	0.0755
RER	0.1096	0.1426	0.1030	0.1062	0.0809	0.0607	0.1397
RIR	-0.0357	-0.0810	-0.0630	-0.1193	-0.1279	0.0259	-0.0755
DUM	0.0357	0.0257	0.0195	0.0398	0.0389	0.0598	0.0491
	Dum02	Dum02yc	Dumo02yc	Dum2xc	Dum02yc	Dum02	Dum02yc
AR(1)	0.9483	0.9384	0.9348	0.5150	0.4896	0.4245	—
						Mu(-1)	

Table 11
Estimated Models with TSGLS and GMM FGLS (Cross-section Weights), **without Fixed Effects and with Fixed Effects**
Dependent Variable: Mark-up (White consistent covariance matrix computed)

Variable	Two-Stage GLS			GMM			
	EQ. 8	EQ. 9	EQ. 10	EQ. 11	EQ. 12	EQ. 13	EQ. 14
	NO FE	FE	FE LE-DIFF	NO FE	difference	difference DPD	orthog. DPD
Constant	17.469	0.5568	15.214	20.300	—	—	—
PM	—	0.5892	—	—	—	0.5899	0.4036
IP	0.0242	0.0383	0.0314 Differ.	0.0386	0.0259	0.0720	0.0237
LD	-0.2008	-0.0683	—	-0.2994	—	-0.3154	—
SGDP	-0.0027	-0.0011	-0.0019	-0.00323	-0.0009	-0.0046	-0.0016
OPEN	-0.3222	-0.3006	-0.7448 Lag. Differ.	-0.2955	-0.5753	-0.5797	-0.4362
RPI	0.0706	0.0654	0.2408	0.0688	0.0516	-0.2576	0.0822
RER	0.1091	0.2281	-0.2397	0.0457	0.0648	0.0807	0.0748
RIR	-0.0920	0.0381	-0.2263	-0.0771	0.0907	0.1931	0.0719
DUM	0.0335 Dum02	0.0275 Dum02yc	0.0645 Dum02yc	0.0623	0.0623	0.1114	0.0546
AR(1)	0.9401	0.4545 Mu(-1)	—	0.9610	—	0.2743 Mu(-1)	0.5546 Mu(-1)

Finally, variables that represent microeconomic relations explaining the mark up behavior – profit margin (PM), investment profitability (IP) and the degree of leverage (LD) – presented the expected sign. Profit margin directly affects mark up determination (equations 2 and 3). Investment profitability variable (equations 2 to 4) showed a positive effect on the mark up, which indicates that the mark up behavior is related to the investment decision. The degree of leverage presents a negative relation with the mark up, which means that a smaller leverage power pressures the demand to generate internal funds to finance investments. [16] About this evidence we should remark that Pereira and Carvalho (2000) observed growing industrial firm leverage levels after monetary stabilization in Brazil. However, according to the authors, these levels would be relatively low when compared to

[16] We notice that no material multicolinearity was detected. We achieve this conclusion by running each independent variable against the others and computing the correspondent R^2.

the average for Asian countries in the 1990s, for example. The observation that there was an increase in the leverage power and that the investment level in fixed assets was relatively low reinforces the anticyclic behavior of the mark up, which aimed at preserving firm's market share.

As a last observation, we would mention that the main conclusions of our analysis were supported by the large majority of the models tested. So, the links among the variables proposed by our theoretical interpretation that supported our economic analysis were confirmed by most of the econometric equations. In particular, the main conclusion about the anticyclic behavior of the industrial mark up during the 1990s was established in all econometric specifications. It should also be observed that the less sophisticated specifications in econometric terms, as equations 1 and 2, produced the main results that were confirmed with the more sophisticated modeling.

8. Conclusion

This paper discussed the determinants of the mark up in the Brazilian industrial firms in the 1990s. This discussion has been empirically supported by an econometric model, which has been tested in 14 different specifications. The econometric model showed great robustness as the expected signs of the variables were confirmed and the main results were observed in almost all econometric specifications.

According to the theoretical approach, we assume that the mark up is the strategic variable that firms rule according to the perception regarding their opportunities of growth. In this perspective price changes depend primarily on decisions about the mark up, and it is the need to accumulate internal resources aimed at financing growth that it is understood as the main motivation to the determination of the mark up. Thus, there is no automatic mechanism to explain how costs and demand pressures are passed through on prices; the process of pricing depends on a complex set of interactions among micro and macroeconomic variables to explain price changes in monetary economies.

With this analytical perspective in mind, we presented the macroeconomic scenario of the Brazilian economy in the 1990s. This scenario was set off by price stabilization and economic opening. A combination of domestic high interest rate, fixed exchange rate regime most of the time and high uncertainty in the external environment lead the economy to a stop-and-go pattern of growth. Opening of the economy and exchange rate overvaluation had a dual contrary effect on pricing decisions of industrial firms: it lowered production and investment costs, but it increased competition. The result was modernization of the productive structure on one side and price stabilization, on the other. Modernization and the recovery of productivity growth occurred with low levels of investment in fixed capital. So price stability, productivity growth and increased competition did not result in sustained economic growth pushed by an investment boom.

In this context, mark ups did not show a trend to decrease, signaling that firms were able to preserve their profit margins, in spite of increased competition due to economic openness. We identified this behavior as defensive in the sense that the accumulation of internal funds were kept in more liquid assets.

In our empirical analysis we developed several econometric exercises exploiting how micro and macroeconomic variables affected the determination of the mark up in the 1990s. An interesting result that was confirmed in all econometric specifications is that mark up showed an anticyclic pattern. This finding confirms our hypothesis of a defensive behavior by firms. Among the macroeconomic variables, the real exchange rate was the most important to explain the determination of the mark up. Appreciation of the exchange rate after the Real Plan reduced domestic production protection degree and therefore the exchange rate contributed to contain the firms' mark up. Other macroeconomic variables, as changes in relative price, real interest rate and economy opening showed the expected signal, however not all of them were confirmed in all econometric specifications.

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Table .1. ANNEX: TABLE A1 – MARK UPS – MANUFACTURING INDUSTRY

Sectors	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Avg.	DP
1)NON-METALLIC MINERALS (MNM)	1.33	1.41	1.38	1.40	1.49	1.46	1.40	1.39	1.42	1.69	1.44	0,1
2)NON-FERROUS METALLURGY (MNF)	1.24	1.27	1.25	1.23	1.34	1.34	1.29	1.28	1.26	1.40	1.29	0,05
3)SIDERURGY (SID)	1.17	1.20	1.24	1.27	1.25	1.26	1.25	1.23	1.21	1.34	1.25	0,06
4)OTHER METALLURGICAL (OSI)	1.09	1.13	1.14	1.16	1.22	1.19	1.18	1.16	1.14	1.30	1.17	0,06
5)MACHINES AND TRACTORS (MTR)	1.31	1.31	1.42	1.63	1.55	1.51	1.56	1.47	1.47	1.60	1.48	0,12
6)ELECTRIC MATERIAL (MEL)	1.21	1.22	1.30	1.26	1.25	1.25	1.24	1.17	1.17	1.19	1.23	0,04
7)ELECTRONIC EQUIPMENT (EQE)	1.37	1.38	1.38	1.41	1.47	1.49	1.51	1.39	1.34	1.24	1.40	0,08
8)AUTOMOBILES, TRUCKS AND BUSES (VAL)	1.16	1.21	1.20	1.23	1.27	1.29	1.31	1.29	1.23	1.20	1.24	0,05
9)OTHER VEHICLES AND PARTS (OUP)	1.16	1.14	1.19	1.22	1.24	1.23	1.21	1.14	1.10	1.12	1.17	0,05
10)PAPER AND PRINTING (PAG)	1.16	1.25	1.16	1.10	1.13	1.20	1.17	1.13	1.11	1.48	1.19	0,11
11)RUBBER INDUSTRY (BOR)	1.25	1.25	1.28	1.30	1.31	1.32	1.37	1.32	1.28	1.46	1.31	0,06
12)CHEMICAL ELEMENTS (ELQ)	1.30	1.36	1.40	1.67	1.60	1.54	1.50	1.53	1.48	1.93	1.53	0,18
13)PETROLEUM REFINEMENT (RPE)	1.33	1.28	1.46	1.79	1.64	1.56	1.45	1.49	1.66	2,14	1.58	0,25
14)MISCELLANEOUS CHEMICALS (QDI)	1.25	1.27	1.23	1.25	1.24	1.21	1.27	1.21	1.20	1.50	1.26	0,09
15)PHARMACEUTICS AND PERFUMERY (FAR)	1.36	1.24	1.41	1.49	1.48	1.42	1.39	1.47	1.49	1.48	1.42	0,08
16)PLASTIC ARTICLES (PLA)	1.36	1.32	1.29	1.36	1.33	1.38	1.46	1.30	1.30	1.46	1.36	0,06
17)TEXTILE INDUSTRY (TEX)	1.29	1.23	1.23	1.25	1.23	1.25	1.26	1.23	1.19	1.17	1.24	0,03
18)CLOTHING ARTICLES (VES)	1.30	1.25	1.29	1.25	1.26	1.25	1.29	1.25	1.26	1.17	1.26	0,04
19)FOOTWEAR MANUFACTURING (CAL)	1.08	1.11	1.24	1.23	1.18	1.17	1.22	1.14	1.07	1.00	1.14	0,08
20)COFFEE INDUSTRY (CAF)	1.15	1.16	1.12	1.24	1.25	1.25	1.20	1.15	1.16	1.28	1.19	0,06
21)PROCESSING OF VEGETABLE PRODUCTS (BE)	1.19	1.25	1.29	1.29	1.25	1.20	1.32	1.22	1.21	1.23	1.25	0,05
22)ANIMAL SLAUGHTER (ABA)	1.10	1.10	1.09	1.14	1.15	1.16	1.18	1.13	1.13	1.29	1.15	0,06
23)DAIRY INDUSTRY (LAT)	1.14	1.13	1.13	1.14	1.14	1.18	1.22	1.19	1.23	1.23	1.17	0,04
24)SUGAR INDUSTRY (ACU)	1.15	1.14	1.11	1.16	1.16	1.11	1.10	1.05	1.04	1.32	1.14	0,08
25)VEGETABLE OILS MANUFACTURING (OVE)	1.14	1.18	1.26	1.17	1.17	1.15	1.14	1.21	1.23	1.25	1.19	0,04
26)OTHER FOODSTUFFS (ALI)	1.14	1.16	1.20	1.21	1.20	1.21	1.23	1.22	1.23	1.30	1.21	0,04
Average	1.22	1.23	1.26	1.30	1.30	1.29	1.30	1.26	1.25	1.38	1.30	0,07
Standard Deviation	0,09	0,08	0,1	0,17	0,15	0,13	0,12	0,13	0,15	0,25		
Variation Coefficient	0,07	0,07	0,08	0,13	0,11	0,1	0,1	0,1	0,12	0,18		

Source: Brazilian Statistical Office (IBGE) Input-Output Matrix (1985, 1990 a 1998);

Getulio Vargas Foundation (FGV) Wholesale Price Index (IPA);

Foreign Trade Foundation (FUNCEX) cost indicators. Own calculations.

Methodological Annex – Definition of the Variables

MU = mark up, constructed as the quotient of the value of production of one sector by the sum of its respective intermediate consumption, salary and contributions, obtained from the input-output matrix of Brazil from 1985 and 1990 to 1998. For the year of 1999 mark up was estimated using the quotient of the variation of the sector IPA – the Brazilian wholesale price index from the Getulio Vargas Foundation (FGV) – and the sector cost variation index from the Foreign Trade Foundation (FUNCEX). Table in the Annex contains the annual mark up estimates for the 26 sectors. The last line and column contain the annual and sector averages and standard deviations, respectively.

SGDP = sector GDP, obtained from the National Accounts computed by the Brazilian Statistical Office (IBGE).

OPEN = imports penetration coefficient, calculated as the quotient of the value of imports by sector and the difference between the sector value of production and its net exports, all estimates obtained from the input-output matrix produced by IBGE.

RPI = relative annual sector producer price index, calculated by dividing the sector wholesale price index (IPA) by the manufacturing industry index. The monthly indexes were aggregated by the annual average. For the petroleum refinement sector (RPE) it was constructed an index based on the annual prices of petroleum, computed by the National Agency of Petroleum (ANP).

RER = real exchange rate, defined by the value of the dollar in domestic currency times the USA producer price index (PPI), divided by the FGV wholesale price index, both indexes, August 1994=100. The real exchange rate was calculated for the month and aggregated by the annual average.

RIR = annual real rate of interest; obtained considering the nominal basic rate of interest (SELIC) determined by the Brazilian Central Bank, discounted by the inflation rate obtained through the monthly general price index (IGP-DI) from FGV.

PM = profit margin; calculated as Net Profit/Net Operational Revenue available at *Gazeta Mercantil Annual Balance*.

IP = investment profitability, calculated as Asset Equivalence Result/Asset Balance Value from *Gazeta Mercantil Annual Balance*.

LD = sector leverage degree, calculated as Net Debt/Net Worth from *Gazeta Mercantil Annual Balance* considering the relation.

Finally, it should be added that the primary data used in this paper was obtained from a survey originally developed for ECLAC – Economic Commission for Latin America (Miranda et al, 2001). Despite the availability of the mark up series for the period from 1985 to 2000 we chose to analyze in this paper a shorter period (1990-1999) that contained data for all variables of interest (8) and the highest possible number of sectors (26). In this way we built up a database of balanced panel (balanced panel data), containing 243 observations.