Do wages squeeze markups? Sectoral-level evidence for Brazil over the 2000-2013 period

Diogo Oliveira Santos
Faculty of Economics, Federal University of Minas Gerais, Brazil

Gustavo Britto
Faculty of Economics, Federal University of Minas Gerais, Brazil

Rafael S. M. Ribeiro
Faculty of Economics, Federal University of Minas Gerais, Brazil

Debora Freire Cardoso
Faculty of Economics, Federal University of Minas Gerais, Brazil

Abstract

The purpose of this work is to empirically investigate the relationship between unit labour costs and markup at the sectoral level for the Brazilian economy over the 2000 – 2013 period. Our results do not provide evidence that the rise in wages squeezed markup rates over this period. On the other hand, our findings strongly suggest that stagnant labour productivity, rising intermediate consumption of non-financial services and higher imports penetration seem to have played a major role in the compression of sectoral markups.

Keywords: Markups; Wage costs; Manufacturing industry; Brazilian crisis.

JEL: L2, D24, E24.

Resumo

O objetivo deste trabalho é investigar empiricamente a relação entre os custos unitários do trabalho e o markup em nível setorial para a economia brasileira no período 2000-2013. Nossos resultados não fornecem evidências de que o aumento nos salários pressionou as taxas de markup nesse período. Por outro lado, nossos resultados sugerem fortemente que a estagnação da produtividade do trabalho, o aumento do consumo intermediário de serviços não financeiros e a maior penetração das importações parecem ter desempenhado um papel importante na compressão dos markups setoriais.

Palavras-chave: Markups; Custos salariais; Indústria de transformação; Crise brasileira.

JEL: L2, D24, E24.

Área 6 - Crescimento, Desenvolvimento Econômico e Instituições

1. Introduction

This paper seeks to empirically assess the relationship between labour costs and sectoral markup, here defined as the spread between the selling price of a good and its prime costs. Therefore, markup is often seen as a proxy of profitability of a firm or an industry and hence identifying its main determinants may be of paramount importance to policymakers aiming to design policy tools that can effectively promote capital accumulation and economic development.

There is a vast empirical literature investigating the determinants of the markup. Marchetti (2002), Fedderke, Kularatne and Mariotti (2007) and Mazumder (2014) find that import penetration rates are the main cause behind the sectoral markup squeeze, respectively for Italy, South Africa and the U.S. These studies also found an important positive influence of sectoral concentration on markups. Moreover, Gradzewicz and Muck (2019) using sectoral data from Poland found an inverted U-shaped curve for the impact of imported intermediate inputs of exports on markups. The market share of the firms also appears as one of the main determinants of the markup, but with marked divergences across different studies. Ponikvar and Tajnikar (2011), using data of manufacturing firms in Slovenia, found that the impact of the market share on markups follows an inverted U-shaped curve. However, Weche (2018), applying the analysis of manufacturing firms for six European countries, including Slovenia, found a positive relationship between market share and markups. Lastly, Feijó and Cerqueira (2013) assess the determinants of markup for sectoral data of the manufacturing industry in Brazil in the 1990s and show that the exchange rate is the main factor exerting a downward pressure over markups.

Another issue that has been in the centre of the economic debate over the last decades is the association between labour costs and markups. This debate gains more traction after the Washington Consensus and the its set of recommendation for liberal reforms in the labour market. In that vein, the IMF (2003) report proposed that the deregulation of the labour market in European Union countries towards the pattern found in the US would result in a significant increase in GDP and a reduction in unemployment. Vergeer and Kleinknecht (2014) conducting a critical appraisal of the "labour market rigidities" approach list three modes of “flexibility”. The two most important are the flexibility of hiring and firing and changing wages to increase productivity and decrease unemployment by reducing the adjustment cost of the labour factor to the economic cycle.

Recent empirical evidence, however, does not seem to support this proposition. In this same work, Vergeer and Kleinknecht, from a sample of 20 OECD countries from 1960 to 2000, concluded that the reduction in both the share of wages in income and the rate of wage growth, resulting from labour market reforms, had a negative impact, through different channels, on labour productivity. Jaumotte and Buitron (2015), in turn, found strong evidence that in advanced economies the drop-in unionization implies an increase in the concentration of income at the top of the distribution. More recently, Dosi et al. (2018) and Brancaccio, Garbellini and Giammetti (2018) reinforce the evidence that changes in the rules governing the labour market worsen the functional and personal distribution of income.

The hypothesis that labour market deregulation increases economic performance implicitly assumes that labour costs are a crucial factor in determining the competitive capacity of firms. Under this argument, therefore, rising labour costs would be expected to be a decisive factor in compressing markups, since a firm's ability to establish higher markups expresses its competitive power. It is this hypothesis that will be evaluated in this work from the empirical analysis of the Brazilian case. As will be seen in the following section, the Brazilian case is especially relevant to the topic under analysis due to the trajectory of wage growth since the mid-2000s, in contrast to the industrial regression experienced by the country. As of 2012, business entities started to defend the deregulation of the labour market as the main instrument to recover the competitiveness of Brazilian industry and, in 2017, a wide-ranging reform was approved (CNI, 2012).

2. Trajectory of the mark-ups in the Brazilian economic sectors and possible determinants

2.1. Historical context and theoretical debate

Between 2004 and 2016, Brazil experienced its period of greatest growth since the 1970s followed by its greatest recession since the Second World War1 . In these 13 years, the Brazilian economy exhibited characteristics that make it a relevant case to analyze the relationship between sector markups and wage costs in a developing country, as will be shown below.

On the one hand, the Brazilian labour market, historically marked by great heterogeneity, has undergone a significant process of formalization and wage growth[2]. As a result, between 2002 and 2008, the purchasing power of the average labour income increased by 15.2%. More expressive, however, is the increase of 46.9% in the purchasing power of wages below the median wages between 1998 and 2008, thus showing how the population in the bottom parts of the income distribution disproportionately benefited from the socio and economic transformations in the labour market dynamics over this period (Baltar and Leone, 2015).

On the other hand, in the same period, the country experienced a marked trend of premature deindustrialization. The share of the value added of the manufacturing industry in the total value added at constant prices decrease from 15,1% to 11,7% between 2000 e 2015 (Nassif, Bresser-Pereira and Feijó, 2013) [3]. In addition, there was a fast growth in imports of industrial goods across all categories of industrial goods, especially in the medium-high and high technological sectors (Magacho, Mccombie and Guilhoto, 2015). In the aftermath of the global financial crisis of 2007-08, the deterioration of the manufacturing industry was accentuated due to increased competition in international trade (Hiratuka and Sarti, 2017).

This economic landscape has led many economists from different academic backgrounds to argue that the process of premature deindustrialization may be closely linked to the rise in wages. Economists with a neoclassical background have argued that since the industrial sector is open to external competition, domestic firms do not automatically pass on rising costs to prices (Pastore, Gazzano and Pinotti, 2013). Therefore, wages growing faster than productivity has been considered as the main cause of a squeeze in corporate profit margins, thus discouraging investment and harming industrial production.

Some heterodox economists also point to the intensification of the conflicting claims on income as the main cause of the economic crisis. The distributive conflicts would have materialized in a profit squeeze as a result of rising wages. This would have triggered, on the one hand, a reduction in private investment and, on the other hand, a political reaction of capitalists advocating a reduction in wage costs. This transmission channel, therefore, would partly explain the spillover of the economic context into the field of political dispute (Rugitsky, 2017; Martins and Rugitsky, 2018; Marquetti, Hoff and Miebach, 2020). Conversely, another set of heterodox works refute in different ways the hypothesis that there would have been a drop in investments due to a rise in wages or even that such a rise has put significant downward pressure on profits. This set of works argues that the increase in the share of profits in the total costs of companies was not so significant (Bastos, 2017); that the share of the costs with the highest growth is financial expenses (Carneiro, 2018); and that the beginning of the fall in private investment rates occurs about five years after the increase in prices (Serrano and Suma, 2018).

Regardless of the theoretical aspect, the dynamics of profits and production costs, especially wages, is a central issue for understanding the Brazilian economy in the recent period. The trajectories of these variables have both economic and political implications for the debate on the causes of the economic crisis between 2015 and 2017 and the slow recovery before the Covid-19 pandemic. However, there is no empirical analysis providing sound evidence that wages compressed mark-ups in Brazil over this period so far. Thus, although the causes and political consequences of the crisis are beyond the scope of this work, a

[1] The real annual variation of the Brazilian Gross Domestic Product in the years 2003, 2010 and 2015 was 1.13%, 6.28%, -3.15%, respectively, according to the Brazilian Institute of Geography and Statistics.

[2] On the changes in the Brazilian labour market in the 2000s, see Maurizio and Vazquez (2016) and Amitrano (2017).

[3]See Medeiros, Freitas and Passoni (2019) for further analysis of the investment performance of the Brazilian manufacturing industry.

rigorous analysis of the recent dynamics of the mark-up in the manufacturing industry as well as its determinants is of paramount importance.

2.2. The sectorial trajectories of markups in Brazil between 2000 and 2013

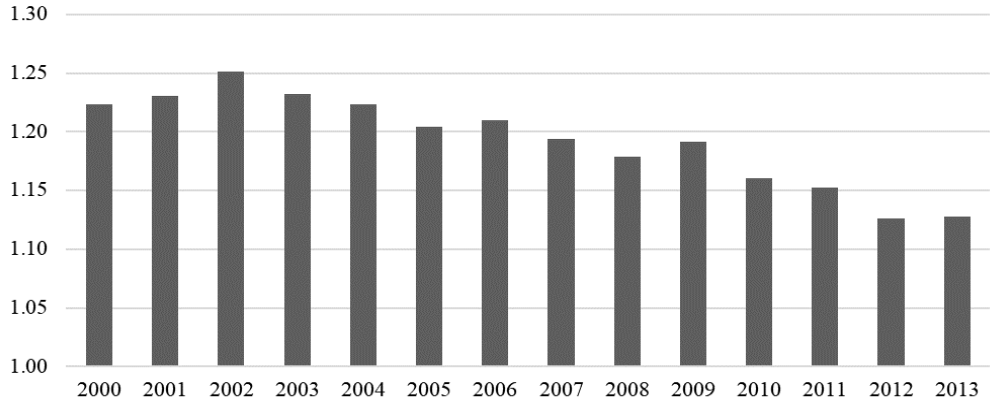
The markup ratio is calculated as follows:[4]

$$mk_{it} = \frac{PV_{it}}{(IC_{it}+W_{it}+SC_{it}+Im_{it})} \quad (1)$$

where i and t denote the sectoral unit and the time unit, respectively; *mk* is the markup ratio; PV is the production value which corresponds to the sum of remuneration, gross operating surplus and gross mixed income, intermediate consumption, other production subsidies and other taxes on production; *IC* is the intermediate consumption except imported inputs; *W* is the wage bill; *SC* are the effective social contributions; and *Im* is intermediate consumption of imported inputs.

The aggregate manufacturing industry consists of 26 sectors, according to the classification used in this work[5]. The aggregate average markup of the manufacturing industry for the full period 2000-2013 was 1.193. After growing by 2.32% between 2000 and 2002, it fell steadily over time as shown in Fig. 1, thus accumulating a 10% drop between 2002 and 2013.

Figure 1: Annual markup (mean) – Aggregate manufacturing industry



Source: Own elaboration based on Input Output Matrices (IOM) - Nereus. (Guilhoto, J.J.M .; Sesso Filho, U.A., 2010).

Table 1 presents the rates of average annual growth of macro sectorial markups by window periods according to the trajectory of the Brazilian GDP in each one[6]. Only the Agriculture and Extractive Industry sectors had a positive average annual growth rate for the entire period. The average annual markup growth rate of the total manufacturing industry between 2000 and 2013 was -0.62%. Five sectors showed even more negative growth rates than the manufacturing industry for the full period (Electricity generation and distribution, gas, water, sewage and urban cleaning; Construction; Trade; Transport, storage and mail; Real estate activities and rentals).

[4] The sectoral data of the period (2000-2013) were obtained from the estimated Input Output Matrices (IOM) by the Center for Regional and Urban Economics (Nereus) of University of São Paulo (USP), following the methodology proposed by Guilhoto and Sesso Filho (2005 and 2010). The I-O matrices from 2000 to 2009 were built by using the National Accounts System classification of the Brazilian Institute of Geography and Statistics (IBGE) that accounts for 55 activity sectors. From 2010, a new classification was adopted resulting in I-O matrices with 67 activity sectors. Because of this, to carry out a consistent analysis of the entire period 2000-2013, it was necessary to aggregate sectors of activity in order to have a single classification for each year. For more details, please see Appendix A.

[5] Which was built from the National Accounts System classification of the Brazilian Institute of Geography and Statistics (IBGE). See Appendix E.

[6] Average real annual change in GDP in selected periods: 2000-2003, 2.5%; 2004-2008, 4.6%; 2009, -0.10; 2010-2013, 2.8%

Table 1: Average annual markup growth rate in Brazil by periods

Macro sectors	Low growth	High growth	Financial crisis	Low growth	Total period
	2000-2003	2004-2008	2009	2010-2013	2000-2013
Farming	2.430	-0.935	2.102	4.520	1.753
Extractive Industry	-2.112	4.028	-16.174	9.569	2.762
Manufacturing industry	0.251	-0.878	1.101	-1.368	-0.616
Electricity generation and distribution, gas, water, sewage and urban cleaning	1.165	0.113	1.132	-4.047	-0.846
Construction	-0.481	-0.554	-5.161	-1.334	-1.131
Trade	-0.706	0.224	-1.908	-1.715	-0.751
Transport, storage and mail	-1,163	-0.272	-1,128	-1,288	-0,856
Information services	0.959	-0,791	-4.072	-0,478	-0.543
Financial intermediation	7,562	0.344	5,677	-3.106	1,358
Real estate activities and rentals	-4,153	-6,086	-6,048	7,227	-1,540
Other services	-1,508	-0.123	0.156	0.952	-0.091
Public administration	-0.481	-0,997	-0.026	-0.102	-0.528

Source: Authors' own elaboration based on –Nereus' Input-Output Matrix. (Guilhoto, JJM; Sesso Filho, UA, 2010).

It is noting a countercyclical behaviour of the manufacturing industry's markup at least until 2009: it presents a positive growth rate in the phase of low growth of the Brazilian economy (2000-2003); in the next phase, of consistent GDP growth (2004-2008), the markup presents negative growth rate, and, again, a positive growth rate in 2009, year of falling GDP.

Appendix A presents the disaggregated markup's dynamics of the 26 manufacturing industries. In general, the high sectoral markups are concentrated in the period between 2000 and 2005, starting a more significant decline between 2004 and 2006 and, thereafter, there is a relatively continuous drop in sectoral markups until 2013 in most sectors. This pattern, while retaining wide variations across sectors, suggests again an evidence that the markups exhibited approximately a countercyclical behaviour in the falling (2000-2003) and growing (2004-2008) phases of the economy, but in the years of greatest oscillation (2010-2013), the markups accentuate the fall trajectory.

After the 2008-2009 crisis, companies face a less favourable scenario for credit and higher debt levels[7]. It is, therefore, reasonable to assume that companies wishing to increase their markups to enlarge the equity financing, if they had the power to do so. Thus, the downward trend of the markups in the last subperiod indicates an undesirable and significant pressure on the ability of companies to fix prices consistent with their cyclical needs.

The classification by usage categories and technological intensity[8] (TI) allows describing with clearer contours the main characteristics of the markups trajectory of the 26 manufacturing industries (Appendix B). Twelve sectors had an average annual *markup* between 2010-2013 of 1.10 or less[9]. Seven of these are intermediate goods, three are capital goods and two are non-durable consumer goods. Of these twelve sectors, two are low TI, three are medium-low, six are medium-high, and one is high- TI.

Thus, there is a concentration of intermediate goods, capital goods and upper middle-IT goods among the sectors with lower markups in the years between 2010 and 2013, a period of intense competition with

[7] On the credit market crisis and the deepening of corporate indebtedness in the period after the outbreak of the global capitalist crisis see Freitas (2009) and Bonomo, Brito and Martins (2015).

[8] The sector classification by technological intensity used is available in Bielschowsky et al (2015). The classification by technological intensity used is available in Cavalcante (2014).

[9] The manufacturing industry's average markup in the 2010-2013 subperiod was 1.14.

imported products[10]. The highest markups of the period are concentrated on low technological intensity consumer goods.

Finally, there is a considerable difference in magnitudes between the markups of the sectors of the Manufacturing Industry and the Services sectors. There are 16 Service sectors[11] considered in this study. On average, the Service sectors have higher mark-ups than the Manufacturing sectors. Comparing the markups between both sectors is of paramount importance to the present study. Since the Manufacturing Industry demands a significant portion of Service inputs for its production process[12], increases in the average markup of the latter tend to be passed onto the costs affecting the average markup of the former. This point is further explored in the following section and in econometric models.

2.3. Exploring possible determinants of the sectoral markup

As aforementioned, rising wages has been seen by many economists in the economic debate over the causes of the compression of the markup, investment slowdown and premature deindustrialization of the Brazilian economy. However, as shown below in Figure 2, other factors[13] apparently can also be associated with the declining trajectory of the sectoral manufacturing markups in the Brazilian economy.

Firstly, there is an indication of the lower the average markup for the period, the greater the coefficient of penetration of imports in the sector. The penetration coefficient of imports in the aggregate manufacturing industry in Brazil went from 13.9% in the first quarter of 2007 to 19.1% in the last quarter of 2010 (Novais, 2014). According to Bielschowsky, Squeff and Vasconcelos (2015), the decomposition of the apparent consumption variation in its components (production, imports and exports) of the four manufacturing usage categories shows that in all categories there is a strong increase in the share of imports, especially in the period 2005-2008.

Secondly, there is also a possible negative association between the average markups and the sum of technical coefficient of financial services in the aggregate manufacturing industry. This may be an indication of the impact on industry costs of the high interest rates practised by the Central Bank of Brazil over the years plus the high spreads applied by the banking system.

Thirdly, among the manufacturing average markups and the sum of technical coefficient of non-financial services has a possible negative association. That is, industrial sectors that demand more Services as inputs in their production processes apparently have lower average markups during the period. It is not reported in the text but it is worth noting that the adjusted value line becomes considerably more negatively inclined when the oil refining and coke sector (which is an outlier[14]) is excluded from the sample. Again, this is a possible indication that industrial costs are considerably impacted by the demand for inputs from the Services sector by the manufacturing industry. Appendix D reinforces this perception because it is observed that from the acceleration phase of economic growth in Brazil, there was an increase in intermediate consumption of the manufacturing industry from the services sector.

Lastly, the markups and productivity, measured as the ratio of sectoral value added to employed persons, are negatively correlated, which is counterintuitive. However, when the oil refining and coke sector is removed from the sample, the negative correlation disappears.

[10] About competition with imported products in the Brazilian domestic market after the global capitalist crisis of 2008 to see Baltar and Prates (2014) and Jenkins (2015).

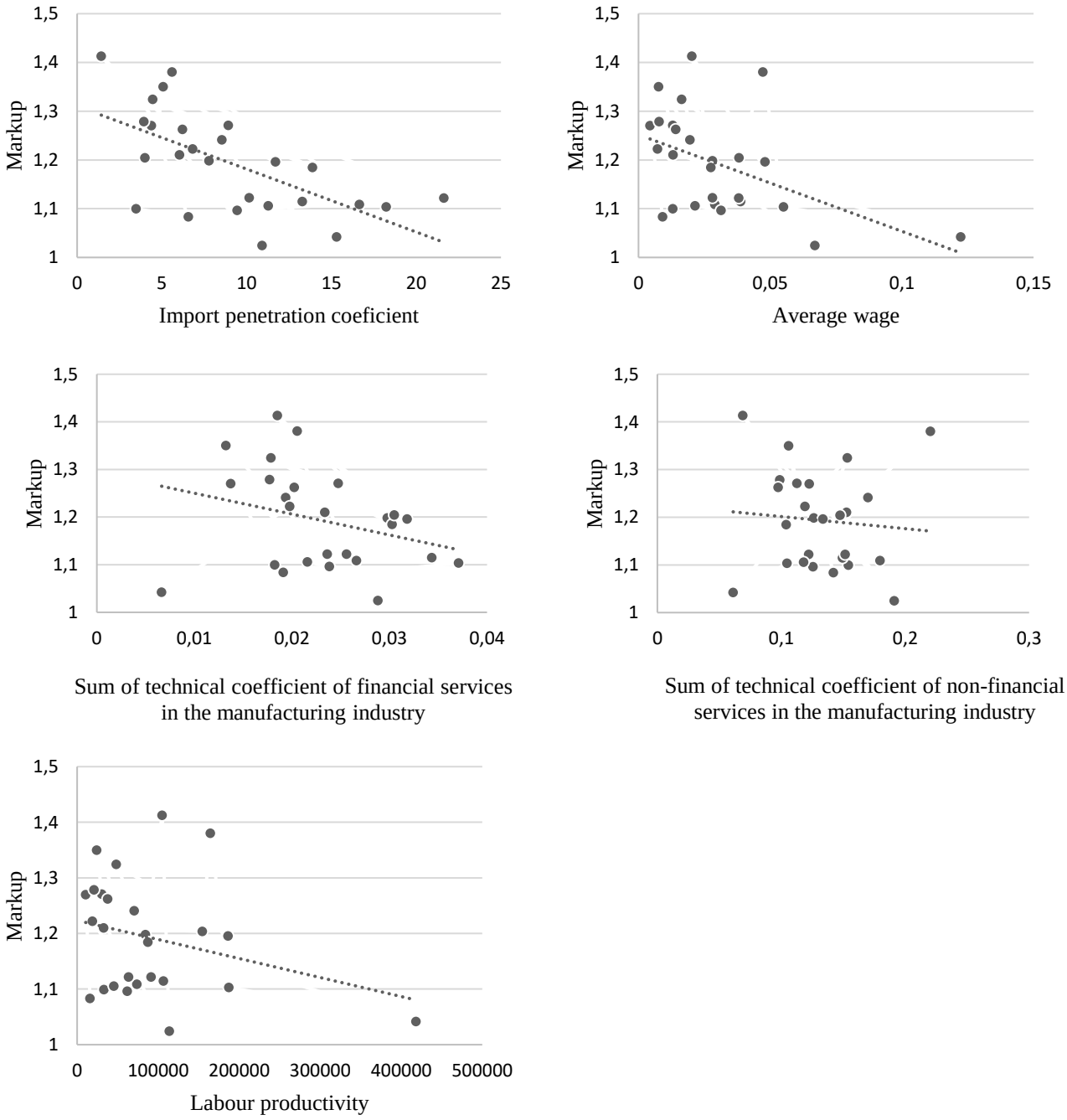
[11] The non-financial services sectors considered are Commerce, Transport, storage and mail, Accommodation and food services, Information services, Real estate and rental services, Services provided to companies, Public administration and social security, Public education, Market education, Public health, Mercantile health, Services provided to families and associations and Domestic services. Financial services are represented by the Financial intermediation and insurance sector.

[12] From the input-output matrices of the OECD countries for 2005, CNI (2014) shows that in Brazil the Services used by the Manufacturing industry represented 57% of the added value produced by the latter. For developed countries, this participation was around 65% for the same year.

[13] See Appendix C for definition and source of the variables used.

[14] Data from the oil and coke refining sector are strongly impacted by the presence of Petrobras, one of the largest oil companies in the world.

Figure 2: Correlation between average sectoral manufacturing markups and selected variables - data averaged over the 2000-2013 period



Source: Authors' own elaboration based on –Nereus' Input-Output Matrix (IOM). (Guilhoto, J.J.M. and Sesso Filho, U.A., 2010).
Note: The sum of the technical coefficients of Services indicates the total amount of Service inputs necessary for the production of a final product unit of a specific sector of the Manufacturing industry. The higher this variable, the more the industrial sector demands Service inputs in its production process. Therefore, it is a measure of productive interaction between the Manufacturing Industry and Services.

Although the trajectory of wages and markups explain the emphasis of part of the literature[16] on the role of distributive conflict in the recent crisis, it can be seen from previous considerations that it is not

[16] The association of low markups and high wages is apparently corroborated by Fig. 2. However, this association becomes very small when the outlier sector (refining and coke sector) is excluded from the sample.

sufficient to allow more than partial sectoral conclusions. In other words, the total effect of this dynamic on the economy, considering only the components of the markup, is not clear. Thus, from the evidence gathered, we proceed to an econometric investigation of the determinants of the trajectory of mark-ups to explain the main sources of pressure.

3. Dataset, methodology and empirical findings

3.1. The model

The cross-section units of the model are the economic sectors classified according to Appendix A. Estimates were made for all 46 sectors (overall sample) and with the 26 manufacturing industries separately from 2000 to 2013. The estimated model goes as follows:

$$Mk_{it} = \alpha_0 + \partial Mk_{i,t-1} + \beta_1 RW_{it} + \beta_2 RP_{it} + \beta_3 NFS_{it} + \beta_4 FS_{it} + \beta_5 IP_{it} + \mu_i + \tau_t + \varepsilon_{it} \quad (2)$$

where Mk_{it} denotes the average sectoral markup, RW_{it} represents the average real wage, RP_{it} denotes the real productivity, NFS_{it} denotes the intermediate consumption of non-financial services, FS_{it} represents the intermediate consumption of financial intermediation services, IP_{it} denotes the import penetration coefficient, α denotes the constant, μ denotes the sectoral fixed effects, τ_t represents the time fixed effects and ε_{it} represents the error term. The subscripts i and t represent the sectoral and time units, respectively. The description and source of each variable are given in Appendix C.

This work aims to test the hypothesis that wage cost is the main responsible for the pressure on corporate profitability, thus discouraging investment decisions. Therefore, the coefficient of interest is the responsiveness of sectoral markups to average real wage variations.

The inclusion of the intermediate consumption of non-financial services variable in the econometric model is unprecedented in literature, as far as we know. The goal is to investigate the existence of a specific influence of the forward chaining of the services sector, that is, as inputs, with the other activity sectors, especially the manufacturing industries. The separate inclusion of the intermediate consumption variable of financial intermediation seeks to capture the influence of financial costs on markups.

While we used the coefficient of imports penetration to account for the effect of trade openness on sectoral markups for the manufacturing industry sample, it is proposed to replace this coefficient by the exports coefficient in the model for the overall sample. This was a necessary procedure since the imports penetration coefficients are only available for the manufacturing industries.

3.2. The baseline panel model

This section will present the results of the estimates using the fixed effects method. First, the results are presented for all 46 sectors and then for the manufacturing industries (26 sectors)[17].

In the model estimated by fixed effects for the 46 sectors of economic activities (Table 3), we will focus on the interpretation of model 5 which includes the set of all control variables. The other models were estimated to check the robustness of our estimates for the wage variable to different controls. Even though the partial effect of wages on markups is significant and negatively signed in models 1, 2 and 4, in the complete model (column 5) it becomes statistically non-significant. This result suggests that, once we take many other factors out of the error term, the partial effect of wages on markups is not statistically different

[17] The choice between specifying fixed effects and random effects is made by applying the Hausman test. The null hypothesis states that individual error terms (not observed) are uncorrelated with regressors. The rejection of the null hypothesis indicates that the most appropriate specification is fixed effects, which occurred in the present work. Hausman's test in the 26-sector model showed a test statistic of 151.27 and p-value of 0.0000. In the model with 46 sectors, these values were, respectively, 17.71 and 0.0033.

from zero. Thus, rising wages are not a good predictor of falling markups over this period. In addition to the average real wage, the export coefficient was also non-significant.

Table 3: Results of fixed-effects estimations for the 46 sectors, 2000-2013, Brazil

	(1)	(2)	(3)	(4)	(5)
Average Real Wage	-0.0262*** (0.01)	-0.0269*** (0.01)	0.0022 (0.01)	-0.0277*** (0.01)	-0.0027 (0.01)
Real productivity	0.1765*** (0.02)				0.1500*** (0.01)
Intermediate Consumption of Financial Services		-0.0323*** (0.01)			-0.0439*** (0.01)
Intermediate Consumption of Non-Financial Services			-0.2177*** (0.02)		-0.1733*** (0.02)
Export coefficient				-0.0047 (0.01)	-0.0009 (0.01)
Constant	-1.7553*** (0.18)	0.0433 (0.06)	-0.1487*** (0.04)	0.1766*** (0.03)	-1.8985*** (0.16)
Observations	321	315	315	315	314
R^2 Adjusted	0.2230	-0.0789	0.2507	-0.1075	0.4916

Source: Search Results.

Notes: (i) All variables are in natural logarithm. (ii) ***, ** and * indicate significance at 1%, 5% and 10% respectively. (iii) Standard error in parentheses.

The other variables in model 5 are statistically significant at 1% of significance. The positive coefficient of real productivity and the negative coefficient of intermediate consumption of non-financial services were the largest, the latter exhibiting the highest value in absolute terms.

Next, we run the same model only for the manufacturing industry[18] and present the results in Table 4. The result of model 5 remained consistent with the previous results shown in Table 3 for the overall sample. In all specifications from (1) to (4), the coefficient of the variable of interest, real average salary, is significant and negatively signed. However, in model (5) with all control variables, this variable is no longer significant.

[18] As mentioned before, in the model with only the manufacturing industry, the variable import penetration coefficient is used and not the export coefficient.

Table 4: Results of fixed-effects estimations for the 26 sectors of manufacturing industries, 2000-2013, Brazil

	(1)	(2)	(3)	(4)	(5)
Average real wage	-0.0307 *** (0.01)	-0.0459 *** (0.01)	-0.0161 ** (0.01)	-0.0424 *** (0.01)	-0.0071 (0.01)
Real productivity	0.1597 *** (0.02)				0.1428 *** (0.01)
Intermediate consumption of financial services		-0.0280 * (0.01)			-0.0298 *** (0.01)
Intermediate consumption of non-financial services			-0.1374 *** (0.02)		-0.1186 *** (0.01)
Coefficient of import penetration				-0.0239 *** (0.01)	-0.0182 *** (0.01)
Constant	-0.6036 *** (0.06)	-0.1201 * (0.07)	-0.1800 *** (0.03)	0.0590 (0.04)	-0.7596 *** (0.07)
Comments	181	182	182	182	181
R^2 Adjusted	0.4488	0.0799	0.2989	0.1005	0.6602

Source: Search Results.
Notes: (i) All variables are in natural logarithm. (ii) ***, ** and * indicate significance at 1%, 5% and 10% respectively. (iii) Standard error in parentheses.

In model 5, except for the average real wage variable, all variables presented statistically significant coefficients at 1% of significance and with the expected signs. Unlike the results in Table 3, for the manufacturing industry trade openness, measured by the imports penetration coefficient, seems to play a major role in the determination of the markup.

This model, then, suggests that not increased wages, but declining labour productivity, rising costs of intermediate inputs and cut-throat competition from imported goods were responsible for the compression of the markup rate in the Brazilian industrial sector over this period.

3.3. Robustness check: causality

One objection to these results is that they may be biased since the fixed-effects model is not robust to reverse causality. In the baseline model, three possible sources of endogeneity may emerge. These possibilities derive from the very nature of the markup variable that condenses the conflicts between capitalists, between them and the workers, and the interdependence of the sectors. Briefly, a firm's markup expresses the relationship between its market power and that of its competitors, the relative bargaining power between capitalists and workers in defining wages and the interactions between sectors through the intermediate consumption of goods and services in each production process.

First, increases in sectoral markups can affect the wage-setting process. Secondly, markup reductions can be used by companies as a tool to deal with the competition with imports and also to preserve or expand market shares in other countries. Thus, there is a possible influence of the markup on the import penetration coefficient and the export coefficient[19]. Third, variations in the markup for a given sector affect the costs of sectors that use the goods and services produced by the former as intermediate consumption. It is concluded that the control of endogeneity is crucial to achieving robust results with the proposed model.

In other words, if the hypothesis of strict exogeneity of the other explanatory variables is not satisfied, the fixed effects estimator will not be valid. Thus, the non-significance of the average real wage variable needs to be viewed with caution until possible endogeneity problems are controlled. To deal with the presence of potentially endogenous explanatory variables, the model parameters are estimated using the Generalized Momentary Method (GMM). The objective in these specifications is to control the unobserved

[19] The evidence found in the price-to-market literature investigating the relationship between price changes chosen by firms in response to exchange rate changes in target countries of production indicates that *markup* adjustments are a relevant strategy for the preservation of market share (Dornbush, 1987; Gagnon and Knetter, 1995; Bouakez, 2005; Fitzgeralg and Haller, 2014; Caselli, Chatterjee and Woodland, 2017).

fixed effects and the endogeneity of explanatory variables through the use of first differences and instrumental variables, respectively. Ensuring control of these two issues will provide estimators robust to reverse causality. In addition, the GMM estimator allows us to include lagged observations of the dependent variable as a regressor, thus increasing the explanatory power of the model. Since the autoregressive term is correlated with the error term, the fixed-effects model yields biased estimates. Therefore, we need the instrumental variables approach employed in the GMM model to correctly estimate the effect of past values of the markup rate on the current markup rate.

The solution to the limitations cited is given by the GMM System estimator (Blundell and Bond, 1998). The solution consists in generate an additional set of lagged observations in the first difference as instruments of the endogenous variables in level in the baseline equation.

In both GMM Difference and GMM System there are two crucial hypotheses for the validity of the estimators: the exogeneity of the instruments and the absence of second-order serial correlation of the error term. The first hypothesis, which guarantees the validity of the instruments, is verified by the J statistic in the Hansen test. The null hypothesis is that the instruments are valid, so is sought not to reject the null hypothesis at 5% significance, which means that the instruments used are exogenous. The second hypothesis is verified by an autocorrelation test of the residuals of the first difference equation according to Arellano and Bond (1991). The null hypothesis states that the residuals of the difference equation have no second order correlation. First order serial correlation of the error term in difference is expected, however, the presence of second order serial autocorrelation means that the error terms in level have first order serial correlation. In this case, the instruments will not be valid either.

In the models whose results are presented in Table 5, all explanatory variables were considered endogenous. By and large, the GMM System estimates are in line with the baseline model shown in the previous section. In other words, these models also refute the argument that the decline in the markup rate was caused by rising wages. See the results in Table 5 for the overall sample.

Table 5: Results of GMM System estimations for the 46 sectors, 2000-2013, Brazil

	(1)	(2)	(3)	(4)	(5)
Lagged markup	0.9105 *** (0.20)	0.9920 *** (0.06)	1.0528 *** (0.09)	0.8678 *** (0.09)	0.6421 *** (0.14)
Average real wage	-0.0116 (0.01)	-0.0155 ** (0.01)	0.0057 (0.01)	-0.0184 ** (0.01)	-0.0131 (0.01)
Real productivity	0.0962 *** (0.03)				0.1098 ** (0.05)
Intermediate consumption of financial services		0.0252 (0.03)			-0.0401 * (0.02)
Intermediate consumption of non-financial services			-0.0643 (0.04)		-0.0811 ** (0.04)
Export coefficient				-0.0151 (0.012)	-0.0506 *** (0.02)
Constant	-1,0670 *** (0.26)	0.0314 (0.13)	-0.1216 * (0.06)	-0.0180 (0.05)	-1,4324 ** (0.60)
Observations	275	270	270	156	269
Instruments	10	10	10	13	19
AR test (2) (p-value)	0.8211	0.9788	0.8500	0.1211	0.6240
Hansen's test (p-value)	0.0029	0.3524	0.2078	0.2487	0.0911

Source: Search Results.
Notes: (i) All variables are in natural logarithm. (ii) ***, ** and * indicate significance at 1%, 5% and 10% respectively. (iii) Standard error in parentheses.

The results of the model for 46 sectors estimated by the GMM System (Table 5) remain consistent with the results of the baseline model shown in Table 3. One marked difference is that in model 5 from Table 5, the export coefficient variable became statistically significant at 1% of significance.

Now, we run the same model only for the manufacturing industry using the GMM System estimator and present the results in Table 6.

Table 6: Results of GMM System estimations for the 26 sectors of Manufacturing Industry, 2000-2013, Brazil

	(1)	(2)	(3)	(4)	(5)
Lagged markup	0.5552 ***	0.8348 ***	0.4684 **	0.8678 ***	0.1599
	(0.16)	(0.13)	(0.18)	(0.09)	(0.16)
Average real wage	-0.0277 ***	-0.0184 ***	-0.0054	-0.0184 **	-0.0099
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Real productivity	0.0457				0.0244
	(0.03)				(0.02)
Intermediate consumption of financial services		-0.0115			-0.0367
		(0.02)			(0.02)
Intermediate consumption of non-financial services			-0.1119 **		-0.1386 ***
			(0.05)		(0.03)
Coefficient of import penetration				-0.0173	-0.0201 *
				(0.01)	(0.01)
Constant	-0.2271	-0.0973	-0.1754 **	-0.0180	-0.3803 ***
	(0.15)	(0.10)	(0.08)	(0.05)	(0.13)
Observations	155	156	156	156	155
Number of Instruments	13	13	13	13	25
AR test (2) (p-value)	0.1261	0.0736	0.0562	0.1211	0.0606
Hansen's test (p-value)	0.0243	0.2712	0.3976	0.2487	0.4909

Source: Search Results.
Notes: (i) All variables are in natural logarithm. (ii) ***, ** and * indicate significance at 1%, 5% and 10% respectively. (iii) Standard error in parentheses.

Model 5 of Table 6 maintains the statistical non-significance of the average real wage in the determination of the average sectoral markup of the manufacturing industries, as in the previous models. At the same time, it sheds some light on other possible causes of the squeeze of the manufacturing markup rate in the recent period.

Model 5 in Table 6 strongly suggests that intermediate consumption of non-financial services may have been a key factor behind the compression of the markup rate in Brazil in the period 2000-2013. The model also indicates a significant influence of the import penetration coefficient on the determination of the markup rate. This result reinforces the analysis made in the previous sections regarding the negative impact of competition with imported industrial goods in the domestic market on the market power of local companies.

One marked difference between the GMM System and fixed effects estimations for the manufacturing industries is that both the real productivity and intermediate consumption of financial services variables are no longer significant in the former. A possible explanation for this result is that the sharp drop in the number of sectors used in the estimation may have increased substantially the variance of the estimators, thus making it more difficult to reject the null hypothesis.

4. Conclusion

In light of our empirical investigation, we conclude that the argument that the increase in wages during the 2000-2013 period was the main cause of the compression of the markup rate should be seen with caution. In none of our estimations including all the controls, the coefficient of the average real wage variable was statistically significant. This result sheds light on alternative explanations for the premature deindustrialization of the Brazilian economy by showing the important role of stagnant productivity, rising costs of intermediate inputs and severe competition with internationally produced goods in the declining sectoral markups in the Brazilian economy in the recent period. In terms of policy, our estimations suggest

that attempts to increase the competitiveness of Brazilian companies by cutting labour costs may be ineffective.

Second, even in specifications with fewer control variables (columns 1 through 4 of tables 3 through 6) where the average real wage variable has a significant coefficient, their impact on markup is much lesser than the impact of productivity and intermediate consumption of non-financial services in absolute terms.

Lastly, the dynamics of the services (financial and non-financial) as a determinant of the markup trajectory for all sectors also merits attention. This result points to the need to expand research on the characteristics of the service sector in developing countries and its impacts on the economy as a whole. Our results show the importance of adequate policies aimed at reducing the costs of services in the production process as a key measure to increase the competitiveness of the Brazilian economy.

References

AMITRANO, Roberto Claudio. Income distribution, productive structure and growth in South America. *Panoeconomicus*, v. 64, n. 2, p. 139-168, 2017.

ARELLANO, Manuel; BOND, Stephen. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, v. 58, n. 2, p. 277-297, 1991.

AUTOR, David; DORN, David; KATZ, Lawrence; REENEN, John Van. The fall of the labour share and the rise of superstar firms. *The Quarterly Journal of Economics*, v. 135, n. 2, p. 645-709, 2020.

BALTAR, Paulo; LEONE, Eugenia. Growth with social inclusion and labour market in Brazil. *X Global Labour University Conference*, 2015.

BALTAR, Carolina; PRATES, Daniela. *Brazilian Export Dynamism and the Threat of Chinese Exports from 2008 to 2012*. In: ENCONTRO INTERNACIONAL DA ASSOCIAÇÃO KEYNESIANA BRASILEIRA, 7., São Paulo. 2014. Anais... São Paulo: Associação Keynesiana Brasileira, 2014. Disponível em: <https://www.lai.fu-berlin.de/disziplinen/oekonomie/__ltere_Veranstaltungen/Workshop-Currency-Hierarchy/Baltar-and-Prates-_2014__vFinal.pdf>,. Acesso em: 20 jul. 2019.

BASTOS, Pedro Paulo Zahluth. Ascensão e crise do governo Dilma Rousseff e o Golpe de 2016: poder estrutural, contradição e ideologia. *Economia Contemporânea*. Rio de Janeiro, v. 21, n. 2, p. 1-6, mai./ago. 2017.

BIELSCHOWSKY, Ricardo; SQUEFF, Gabriel Coelho; VASCONCELOS, Lucas Ferraz. *Evolução dos investimentos nas três frentes de expansão da economia brasileira na década de 2000*. Texto para Discussão: IPEA. Brasília, n.2063, mar. 2015

BLUNDELL, Richard; BOND, Stephen. Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, v. 87, n. 1, p. 115-143, 1998.

BONOMO, Marco; BRITO, Ricardo D.; MARTINS, Bruno. The after crisis government-driven credit expansion in Brazil: A firm level analysis. *Journal of International Money and Finance*, v. 55, p. 111-134, 2015.

BOUAKEZ, Hafedh. Nominal rigidity, desired markup variations, and real exchange rate persistence. *Journal of International Economics*, v.66, n. 1, 2005.

BRANCACCIO, Emiliano; GARBELLINI, Nadia; GIAMMETTI, Raffaele. Structural labour market reforms, GDP growth and the functional distribution of income. *Structural Change and Economic Dynamics*, v. 44, p. 34-45, 2018.

CARNEIRO, Ricardo de Medeiros. Navegando a contravento: uma reflexão sobre o experimento desenvolvimentista do Governo Dilma Rousseff. In: CARNEIRO, Ricardo; BALTAR, Paulo; SARTI, Fernando (Orgs). *Para além da política econômica*. São Paulo: Editora Unesp Digital, 2018, cap. 1, p. 11-54.

CASELLI, Mauro; CHATTERJEE, Arpita; WOODLAND, Alan. Multi-product exporters, variable markups and exchange rate fluctuations. *Canadian Journal of Economics*, v. 50, n. 4, 2017.

CAVALCANTE, Luiz Ricardo. Classificações tecnológicas: uma sistematização. Brasília. IPEA, Nota Técnica nº 17, mar. 2014.

CNI - CONFEDERAÇÃO NACIONAL DA INDÚSTRIA. *101 Propostas para Modernização Trabalhista*. Brasília: CNI, 2012.

CNI - CONFEDERAÇÃO NACIONAL DA INDÚSTRIA. *Serviços e Competividade no Brasil*. Brasília: CNI, 2014.

DIEZ, Federico; LEIGH, Daniel; TAMBUNLERTCHAI, Suchanan. *Global market power and its macroeconomic implications*. International Monetary Fund, 2018.

DORNBUSCH, Rudiger. Exchange rates and prices. *The American Economic Review*, v. 77, n. 1, p. 93-106, mar. 1987.

DOSI, Giovanni et al. The effects of labour market reforms upon unemployment and income inequalities: an agent-based model. *Socio-Economic Review*, v. 16, n. 4, p. 687-720, 2018.

FEDDERKE, Johannes; KULARATNE, Chandana; MARIOTTI, Martine. Mark-up pricing in South African industry. *Journal of African Economies*, v. 16, n. 1, p. 28-69, 2007.

FEIJÓ, Carmem Aparecida; CERQUEIRA, Luiz Fernando. Econometric evidence on the determinants of the mark up of industrial Brazilian firms in the 1990s. *Revista Economia*, v. 14, n. 1, 2013.

FITZGERALD, Doireann; HALLER, Stefanie. Pricing-to-market: evidence from plant-level prices. *Review of Economic Studies*, v. 81, n. 2, 2013.

FREITAS, Maria Cristina Penido de. The effect of the global crisis in Brazil: Risk aversion and preference for liquidity in the credit market. *Estudos Avançados*, 2009.

GAGNON, Joseph; KNETTER, Michael. Markup adjustment and exchange rate fluctuations: evidence from panel data on automobile exports. *Journal of International Money and Finance*, v. 14, n. 2, 1995.

GRADZEWICZ, Michał; MUCK, Jakub. Globalization and the fall of markups. *Narodowy Bank Polski Education & Publishing Department*, 2019.

GUILHOTO, Joaquim; SESSO FILHO, Umberto Antonio. Estimação da Matriz Insumo-Produto Utilizando Dados Preliminares das Contas Nacionais. *Economia Aplicada*, v. 9, n. 2, pp. 277-299, abr./jun. 2005.

GUILHOTO, Joaquim; SESSO FILHO, Umberto Antonio. Estimação da Matriz Insumo-Produto Utilizando Dados Preliminares das Contas Nacionais: Aplicação e Análise de Indicadores Econômicos para o Brasil em 2005. *Economia & Tecnologia*. UFPR/TECPAR, v 23, out./dez. 2010.

HIRATUKA, Celio; SARTI, Fernando. Brazilian Industry: Recent Performance and Future Challenges. In: *The Brazilian Economy since the Great Financial Crisis of 2007/2008*. Palgrave Macmillan, Cham, p. 131-160, 2017.

JAUMOTTE, Florence; BUITRON, Carolina Osorio. (2015) Inequality and Labour Market Institutions, *IMF Discussion Note* SDN/15/14, International Monetary Fund.

JENKINS, Rhys. Is Chinese competition causing deindustrialization in Brazil? *Latin American Perspectives*, v 42, n. 6, p. 42-63, 2015.

MAGACHO, Guilherme R.; MCCOMBIE, John SL; GUILHOTO, Joaquim JM. Impacts of trade liberalization on countries' sectoral structure of production and trade: A structural decomposition analysis. *Structural Change and Economic Dynamics*, v. 46, p. 70-77, 2018.

MARCHETTI, Domenico J. Markups and the business cycle: Evidence from Italian manufacturing branches. *Open Economies Review*, v. 13, n. 1, p. 87-103, 2002.

MARQUETTI, Adalmir Antonio; HOFF, Cecilia; MIEBACH, Alessandro. Profitability and Distribution: The Origin of the Brazilian Economic and Political Crisis. *Latin American Perspectives*, v. 47, n. 1, p. 115-133, 2020.

MARTINS, Guilherme Klein; RUGITSKY, Fernando. *The Commodities Boom and the Profit Squeeze*: Output and Profit Cycles in Brazil (1996-2016). Working Paper Series: FEA-USP, n. 9, 2018.

MAURIZIO, Roxana; VAZQUEZ, Gustavo. Distribution effects of the minimum wage in four Latin American countries: Argentina, Brazil, Chile and Uruguay. *International Labour Review*, v. 155, n. 1, p. 97-131, 2016.

MAZUMDER, Sandeep. The price–marginal cost markup and its determinants in US manufacturing. *Macroeconomic Dynamics*, v. 18, n. 4, p. 783-811, 2014.

MEDEIROS, Carlos Aguiar de; FREITAS, Fabio Neves Peracio; PASSONI, Patieene Alves. Structural change and the manufacturing sector in the Brazilian economy: 2000–2014. In: *The Manufacturing Sector in Argentina, Brazil, and Mexico*. Palgrave Macmillan, Cham, 2019. p. 61-95.

NASSIF, André; BRESSER-PEREIRA, Luiz Carlos; FEIJO, Carmem. The case for reindustrialisation in developing countries: towards the connection between the macroeconomic regime and the industrial policy in Brazil. *Cambridge Journal of Economics*, v. 42, n. 2, p. 355-381, 2018.

NOVAIS, Luís Fernando. A Dinâmica do PIB Brasileiro no Período Pós-crise: da ilusão do crescimento sustentado à crise da Indústria nacional. In: NOVAIS, Luis Fernando; CAGNIN, Rafael Fagundes; BIASOTO JR., Geraldo (Orgs). *A Economia Brasileira no Contexto da Crise Global.* São Paulo: FUNDAP, 2014, cap. 5, p. 162-192.

PASTORE, Affonso Celso; GAZZANO, Marcelo; PINOTTI, Maria Cristina. Por que a produção industrial não cresce desde 2010?. In: BACHA, Edmar; BOLLE, Mônica de (Org.). *O futuro da indústria no Brasil*: desindustrialização em debate. Rio de Janeiro: Civilização Brasileira, 2013.

PONIKVAR, Nina; TAJNIKAR, Maks. Are the determinants of markup size industry-specific? The case of Slovenian manufacturing firms. *Panoeconomicus*, v. 58, n. 2, p. 229-244, 2011.

RUGITSKY, Fernando et al. The rise and fall of the Brazilian economy (2004-2015): the economic anti miracle. In: 45th *Brazilian National Meeting of Economics* (ANPEC). 2017.

SEKKAT, Khalid. Does competition improve productivity in developing countries? *Journal of Economic Policy Reform*, v. 12, n. 2, p. 145-162, 2009.

SERRANO, Franklin; SUMMA, Ricardo. Conflito Distributivo e o Fim da "Breve Era de Ouro" da Economia Brasileira. *Novos Estudos*, n. 111, p. 174-189, 2018.

VERGEER, Robert; KLEINKNECHT, Alfred. Do labour market reforms reduce labour productivity growth? A panel data analysis of 20 OECD countries (1960–2004). *International Labour Review*, v. 153, n. 3, p. 365-393, 2014.

WECHE, John P. The heterogeneous competitive effects of trade and foreign direct investment: Firm-level evidence for European countries. *The World Economy*, v. 41, n. 3, p. 801-830, 2018.

Appendix A: Markups - Manufacturing Industries, 2000-2013, Brazil

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Food and drinks	1.097	1,127	1,120	1.108	1,122	1,112	1,115	1.085	1.068	1.076	1.097	1.091	1.092	1.081
Smoke products	1.277	1.273	1.306	1,175	1,140	1.095	1,168	1,139	1,126	1,116	1.223	1.245	1.284	1.289
Textiles	1.297	1.306	1,260	1.251	1.270	1,311	1,288	1,264	1.257	1.247	1.077	1.077	1,112	1.093
Clothing artifacts and accessories	1.435	1.330	1.302	1.282	1,280	1.245	1,266	1.293	1.246	1.232	1.254	1,299	1,172	1,145
Footwear and leather goods	1.063	1,105	1,122	1.095	1.069	1.070	1.050	1.048	1.050	1.079	1,102	1.095	1,100	1,119
Timber Products	1.366	1.377	1.394	1,338	1.302	1.240	1.293	1.275	1.273	1.234	1,226	1.195	1.192	1.192
Pulp, paper and paper products	1.286	1.277	1.253	1.275	1.283	1.169	1.205	1.167	1.163	1,145	1.151	1.165	1,106	1,130
Printing and playback of recordings	1.297	1.261	1,321	1.363	1.368	1.373	1.356	1.387	1.421	1.432	1.235	1.275	1.207	1.243
Oil refining and coke ovens	1.065	1.042	1.032	1.182	1.087	1.081	1.016	1.073	0.955	1.217	1.057	0.945	0.895	0.901
Biofuels	1.419	1.555	1.838	1.862	1.530	1.517	1.580	1.453	1.394	1.277	1,128	1.094	1.071	1.062
Organic and inorganic chemicals, resins and elastomers	1.108	1.076	1.098	1.156	1.206	1.181	1.159	1,102	1.053	1.047	1.095	1.068	1.043	1.054
Pesticides, disinfectants, paints and miscellaneous chemicals	1,114	1.191	1.165	1.123	1.151	1,119	1,110	1.098	1.089	1,128	1.073	1.083	1.078	1.083
Cleaning, cosmetics / perfumery & toiletries	1,374	1.490	1.475	1.219	1,272	1,244	1.220	1.197	1,177	1.241	1.155	1,131	1.073	1,105
Pharmaceutical and Pharmaceutical Products	1.366	1.291	1,344	1.315	1.297	1.381	1,446	1.419	1,378	1.416	1.479	1.415	1.404	1.373
Rubber and plastic products	1.076	1.078	1.097	1.108	1,124	1,126	1,127	1,114	1.107	1,148	1,124	1.103	1.073	1.071
Non-Metallic Mineral Products	1.215	1.220	1,268	1.263	1.273	1.212	1.242	1.165	1.167	1.209	1.193	1.193	1.167	1.152
Manufacture of steel and pig derivatives	1,221	1,129	1,174	1.181	1,348	1,244	1,199	1.220	1,266	1,250	1.097	1,126	1,150	1,137
Non-ferrous Metal Metallurgy & Metal Casting	1.254	1,279	1,268	1.283	1.318	1.255	1.214	1.183	1,140	1,132	1.077	1.079	1.035	1.066
Metal products, except machinery and equipment	1.215	1,314	1.303	1,339	1,328	1,337	1.289	1.277	1,244	1.297	1.196	1.204	1,172	1.157
Computer equipment, electronic and optical products	1.157	1,125	1,113	1.099	1,104	1.096	1.103	1,106	1,117	1,131	1.098	1,102	1.076	1.095
Electrical machines and equipment	1.087	1.096	1,172	1.151	1,168	1,164	1,172	1.163	1,113	1,119	1.077	1.088	1.064	1.074
Cars, trucks and buses except for parts	1.012	0.956	0.946	0.956	0.996	0.972	0.997	1,003	1.019	1.016	1,174	1,104	1,102	1.088
Auto parts and accessories	1.093	1,112	1,105	1.056	1.103	1.099	1,112	1,104	1.094	1.088	1,115	1,135	1.064	1.065
Other transport equipment except motor vehicles	1,174	1,239	1.284	1.194	1.048	1.071	1.074	1.072	1.070	1.083	1,112	1,119	1.081	1.083
Furniture and products from various industries	1,350	1.363	1.403	1,322	1,334	1.341	1.357	1,346	1,334	1,337	1.377	1,372	1.343	1.320
Machinery and equipment, including maintenance and repairs	1.381	1.375	1.376	1,336	1,295	1,264	1.301	1.284	1.282	1.283	1.182	1,168	1,131	1,135

Source: Own elaboration based on IPMs - Nereus. (Guilhoto, J.J.M .; Sesso Filho, U.A., 2010).
Note: Larger markups in each sector in darker colors and smaller markups in lighter colors.

Appendix B: Medium Sector *Markup* - Manufacturing Industry - Selected Periods, Brazil

	Usage Categories	Technological intensity	2000-2003	2004-2008	2009	2010-2013
Food and drinks	Not durable	Low	1,113	1,101	1.076	1.090
Smoke products	Not durable	Low	1.258	1,134	1,116	1,260
Textile products	Not durable	Low	1,279	1.278	1.247	1.090
Clothing artifacts and accessories	Not durable	Low	1,337	1,266	1.232	1.217
Footwear and leather goods	Not durable	Low	1.096	1.057	1.079	1,104
Timber Products	Durable	Low	1.369	1.277	1.234	1.201
Pulp, paper and paper products	Not durable	Low	1.273	1.197	1,145	1,138
Printing and playback of recordings	Durable	Low	1.310	1.381	1.432	1.240
Oil refining and coke ovens	Intermediates	Low Medium	1.080	1.050	1.217	0.950
Biofuels	Intermediates	Low Medium	1,669	1.495	1.277	1.089
Organic and inorganic chemicals, resins and elastomers	Intermediates	Medium-high	1.109	1,140	1.047	1.065
Pesticides, disinfectants, paints and miscellaneous chemicals	Intermediates	Medium-high	1,148	1,113	1,128	1.079
Cleaning, cosmetics / perfumery & toiletries	Not durable	Medium-high	1.389	1,222	1.241	1,116
Pharmaceutical and Pharmaceutical Products	Not durable	High	1,329	1,384	1.416	1.418
Rubber and plastic products	Intermediates	Medium-high	1.090	1,120	1,148	1.093
Non-Metallic Mineral Products	Intermediates	Low Medium	1.242	1.212	1.209	1,176
Steel manufacturing and derivatives	Intermediates	Low Medium	1,176	1.255	1,250	1,128
Non-ferrous Metallurgy	Intermediates	Low Medium	1.271	1,222	1,132	1.064
Metal products, except machinery and equipment	of capital	Low Medium	1.293	1,295	1.297	1.182
Computer equipment, electronic and optical products	of capital	High	1.123	1,105	1,131	1.093
Electrical machines and equipment	of capital	Medium-high	1,126	1.156	1,119	1.076
Cars, trucks and buses except parts	Durable	Medium-high	0.967	0.998	1.016	1,117
Auto parts and accessories	Intermediates	Medium-high	1.091	1,102	1.088	1.095
Other transport equipment except for motor vehicles	of capital	Medium-high	1.223	1.067	1.083	1.099
Furniture and products from various industries	Durable	Low	1,359	1.343	1,337	1.353
Machinery and equipment, including maintenance and repairs	of capital	Medium-high	1.367	1.285	1.283	1,154

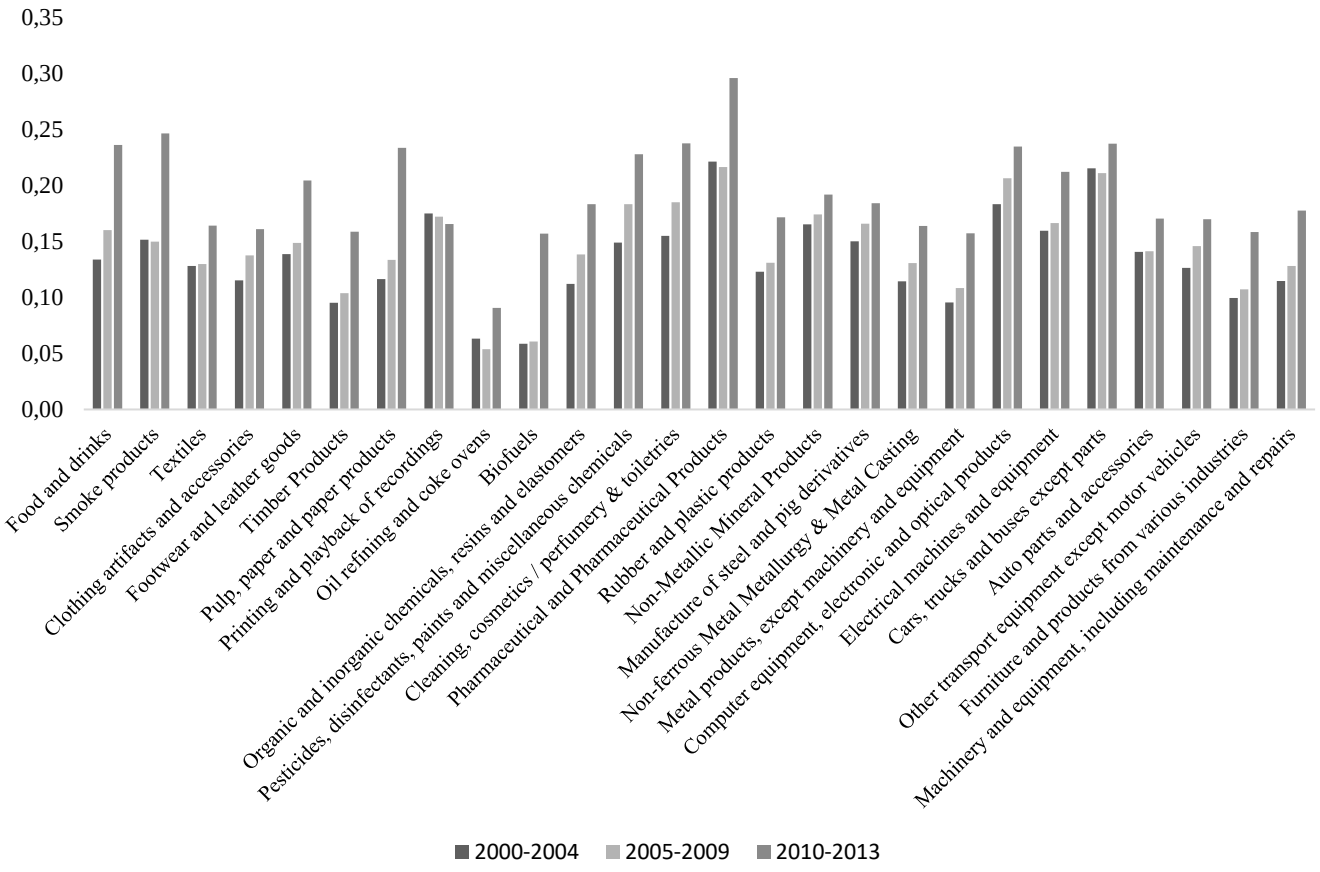
Source: Own elaboration based on IOMs - Nereus. (Guilhoto, J.J.M .; Sesso Filho, U.A., 2010).

Appendix C: Description of variables used in the model

Variable Name	description	Source
Markup sector average	The ratio between the sectoral value of production and sum of intermediate consumption excluding imports, intermediate consumption of imports, nominal wage bill and actual social contribution	Author calculation from IOM's - Nereus
Average Real Wage	The ratio between actual sector wage bill (deflated by INPC, 2010 = 100) and sectoral employed persons	Author calculation from IOM's - Nereus
Real productivity	The ratio between gross value added (deflated by IPA, 2010 = 100) and total employed persons in the sector	Author calculation from IOM's - Nereus
Coefficient of import penetration	Value of sector imports divided by apparent sector consumption (value of production plus imports minus exports)	CNI / Ipeadata
Intermediate Consumption of Non-Financial Services	In the matrix of technical coefficients, the sum of the entries in the Services sectors, except Financial intermediation and insurance, for each buyer sector (columns).	Author calculation from IOM's - Nereus
Intermediate Consumption of Financial Services	In the matrix of technical coefficients, the entry of the Financial intermediation and insurance sector for each buyer sector (columns).	Author calculation from IOM's - Nereus
Export coefficient	value of sectoral exports divided by gross value of production	Author calculation from IOM's - Nereus

Source: Authors own elaboration.

Appendix D: Manufacturing industry - Sum of technical coefficients related to Services, selected periods, Brazil



Appendix E: Correspondence between the adopted sector classification and the original I-O Matrices

CNAE 1.0 (2000-2009)	CNAE 2.0 (2010-2013)	Adopted classification	Number
Agriculture, forestry, logging	Agriculture, including support for agriculture and post-harvest	Farming	1
	Forest production; fishing and aquaculture		
Livestock and fishing	Livestock, including support for livestock		
Oil and natural gas	Oil and gas extraction, including support activities	Oil and natural gas	2
Iron ore	Iron ore extraction, including processing and agglomeration	Iron ore	3
Other extractive industry	Mining of coal and non-metallic minerals	Other extractive industry	4
	Extraction of nonferrous metallic minerals, including processing		
Food and drinks	Slaughtering and meat products, including dairy and fishery products	Food and drinks	5
	Sugar manufacturing and refining		
	Other food products		
	Beverage Manufacturing		
Smoke products	Smoke products manufacturing	Smoke products	6
Textiles	Textile manufacturing	Textiles	7
Apparel & Accessories	Manufacture of clothing artefacts and accessories	Apparel & Accessories	8
Leather and footwear artefacts	Manufacture of footwear and leather goods	Leather and footwear artefacts	9
Wood Products - Exclusive Furniture	Wood Products Manufacturing	Wood Products - Exclusive Furniture	10
Pulp and paper products	Pulp, paper and paper products manufacturing	Pulp and paper products	11
Newspapers, magazines, records	Printing and playback of recordings	Newspapers, magazines, records	12
Coke and oil refining	Oil refining and coke ovens	Coke and oil refining	13
Alcohol	Biofuel Manufacturing	Biofuels	14
Resin and Elastomer Manufacturing	Manufacture of organic and inorganic chemicals, resins and elastomers	Organic and inorganic chemicals, resins and elastomers	15
Chemicals	Manufacture of pesticides, disinfectants, paints and various chemicals	Pesticides, disinfectants, paints and miscellaneous chemicals	16
Pesticides			
Paints, varnishes, enamels and lacquers			
Miscellaneous chemical products and preparations			
Perfumery, hygiene and cleanliness	Manufacture of cleaning products, cosmetics/perfumery and personal hygiene	Cleaning, cosmetics / perfumery & toiletries	17
Pharmaceutical products	Pharmaceutical and pharmaceutical manufacturing	Pharmaceutical and Pharmaceutical Products	18
Rubber and plastic articles	Manufacture of rubber and plastic products	Rubber and plastic products	19
Cement	Manufacture of non-metallic mineral products	Non-Metallic Mineral Products	20
Other non-metallic mineral products			
Steel manufacturing and derivatives	Production of pig iron/ferroalloys, steel and seamless steel tubes	Steel manufacturing and derivatives	21
Non-ferrous Metallurgy	Non-Ferrous Metallurgy and Metal Casting	Non-ferrous Metallurgy	22
Metal products - exclusive machinery and equipment	Manufacture of metal products except for machinery and equipment	Metal products, except machinery and equipment	23
Office machines and computer equipment	Manufacture of computer equipment, electronic and optical products	computer equipment, electronic and optical products	24
Electronic material and communications equipment			
Medical, Measurement & Optical Instruments / Instruments			
Electric machines, appliances and materials	Manufacture of electrical machinery and equipment	electrical machinery and equipment	25
Home appliances			
Cars, vans and utilities	Manufacture of cars, trucks and buses except for parts	Cars, trucks and buses except for parts	26
Trucks and buses			
Auto parts and accessories	Manufacture of parts and accessories for motor vehicles	Auto parts and accessories	27

CNAE 1.0 (2000-2009)	CNAE 2.0 (2010-2013)	Adopted classification	Number
Other transportation equipment	Manufacture of other transport equipment except for motor vehicles	Other transportation equipment	28
Furniture and products from various industries	Manufacture of furniture and products of various industries	Furniture and products from various industries	29
Machinery and equipment, including maintenance and repairs	Manufacture of machinery and mechanical equipment	Machinery and equipment, including maintenance and repairs	30
Maintenance and repair services	Maintenance, repair and installation of machinery and equipment		
Electricity and gas, water, sewage and urban cleaning	Electricity, natural gas and other utilities	Electricity and gas, water, sewage and urban cleaning	31
	Water, sewage and waste management		
Construction	Construction	Construction	32
Trade	Trade and repair of motor vehicles and motorcycles	Trade	33
	Wholesale and retail trade, except motor vehicles		
Transport, storage and mail	Ground transportation	Transport, storage and mail	34
	Water transportation		
	Air Transport		
	Storage, auxiliary activities of transport and mail		
Accommodation and food services	Accommodation	Accommodation and food services	35
	food		
Information services	Systems development and other information services	Information services	36
	Editing and print-integrated editing		
	Television, radio, film and sound and video recording/editing activities		
	Telecommunications		
Financial intermediation and insurance	Financial intermediation, insurance and supplementary pension	Financial intermediation and insurance	37
Real Estate Services & Rental	Real estate activities	Real Estate Services & Rental	38
Business Services	Legal, accounting, consulting and corporate headquarters activities	Business Services	39
	Architectural, engineering, testing / technical analysis and R&D services		
	Other professional, scientific and technical activities		
	Non-Real Estate Rentals and Intellectual Property Asset Management		
	Other administrative activities and complementary services		
	Surveillance, security and investigation activities		
Public administration and social security	Public administration, defence and social security	Public administration and social security	40
Public education	Public education	Public education	41
Mercantile Education	Private education	Private education	42
Public health	Public health	Public health	43
Mercantile health	Private health	Private health	44
Family and membership services	Artistic, creative and performance activities	Family and membership services	45
	Membership organizations and other personal services		
Domestic services	Domestic services	Domestic services	46