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

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Abstract

This paper aims to empirically investigate the relationship between sectoral unit labor costs and markups for the Brazilian economy from 2000 to 2013. The underlying hypothesis is that labor costs are the sole determinant of a firm's competitiveness, a notion that has been widely accepted as conventional wisdom despite the lack of empirical evidence. Our analysis of the Brazilian economy does not provide evidence that the rises in wages squeezed markup rates over this period. Conversely, our study suggests that the compression of markups was influenced by a set of factors, including the costs of service sector inputs, stagnating labor productivity, and international trade pressure. Therefore, our study highlights the need for a more nuanced understanding of the relationship between unit labor costs and markups by shedding some light on the asymmetric impact of different sources of cost pressures and competition on sectoral markups in the Brazilian economy.

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

JEL: L2, D24, E24.

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1. Introduction

This study aims to empirically evaluate for Brazil the relationship between sectoral markup—here defined as the difference between a good's selling price and its prime costs—and labor costs. Markups are frequently used as a proxy for a company's or an industry's profitability. So, pinpointing its primary drivers may be of utmost significance to decision-makers creating policy instruments that might successfully encourage capital accumulation and economic growth.

Many empirical studies addressing the factors influencing markups have been conducted. For Italy, South Africa, and the United States, respectively, Marchetti (2002), Fedderke, Kularatne, and Mariotti (2007), and Mazumder (2014) find that import penetration rates are the primary factor causing the sectoral markup pressure. Also, these researchers discovered a significant positive impact of sectoral concentration on markups. Moreover, Gradzewicz and Muck (2019) discovered an inverted U-shaped curve for the effect of imported intermediate inputs of exports on markups using sectoral data from Poland. Although there are significant differences between studies, the market share of the companies also appears to be one of the key factors affecting the markup. Using information from Slovenian manufacturing companies, Ponikvar and Tajnikar (2011) found that the impact of market share on markups follows an inverted U-shaped curve. Ho Weche (2018), using data from manufacturing companies in six European nations, including Slovenia, discovered a favorable correlation between market share and markups. Lastly, Feijó and Cerqueira (2013) evaluate the sectoral data of the manufacturing industry in Brazil throughout the 1990s and find that the exchange rate is the primary factor driving markups decrease.

The relationship between labor costs and markups is another important topic that has been at the center of economic discussion over the past few decades. Following the Washington Consensus and its set of suggestions for labor market liberal changes, this discussion has gained considerable traction. Thus, the IMF (2003) report made the case that the liberalization of the labor market in European Union nations in the direction of the US model would lead to a considerable boost in GDP and a decrease in unemployment. Three types of "flexibility" are listed by Vergeer and Kleinknecht (2014) in their critique of the "labor market rigidities" approach. The two most important ones are hiring and firing flexibility and (ii) revising wages to reduce the labor factor's adjustment cost throughout the economic cycle.

Yet, recent empirical findings do not appear to support the idea that labor market reforms and economic performance are positively correlated. Using a sample of 20 OECD countries from 1960 to 2000, Vergeer and Kleinknecht (2014) came to the same conclusion that labor market reforms had a detrimental effect on labor productivity through many channels by lowering both the percentage of wages in income and the pace of wage growth. According to Jaumotte and Buitron (2015), there is

substantial evidence that the decline in unionization in industrialized economies is associated with a rise in the concentration of income at the top of the distribution. Recently, studies by Dosi et al. (2018) and Brancaccio, Garbellini, and Giammetti (2018) reinforce the idea that the weakening of labor market regulations results in worsening functional and individual income distribution. The stagnation of productivity in industrialized countries during the mid-2000s is attributed, according to Kleinknecht (2020), to the detrimental effects of a labor market with greater flexibility to lower wages and fire employees. According to Fontanari and Palumbo (2022), the deterioration of institutions that control the labor market results in a loss of bargaining power for workers, which lowers wages and encourages businesses to increase production by using lower-cost labor instead of taking on the greater risk of investing in labor-saving innovation.

The belief that labor market deregulation increases economic performance implicitly relies on the assumption that labor costs are a crucial factor in determining firms' competitiveness. In this empirical investigation of the Brazilian case, this supposition has gained the rank of common wisdom—will be assessed. The Brazilian experience is instructive for this topic, as will be seen in the section that follows, because of the trajectory of wage rise since the mid-2000s, in contrast to the manufacturing regression that the country has undergone. Business associations began to advocate for the deregulation of the labor market as the primary tool to restore the competitiveness of the Brazilian economy, and a wide-ranging reform was passed in 2017.

2. The Brazilian economic context, sectorial markups behavior, and their possible theoretical determinants

2.1. Historical context and the emergence of a theoretical debate on the relationship between rising wages and industrial slump

Brazil's economy grew at its fastest rate since the 1970s between 2004 and 2016, followed by its worst recession since World War II[1] . As will be addressed below, throughout these 13 years, the Brazilian economy displayed traits that make it a pertinent case to examine the connection between sector markups and wage costs in a developing country.

Table 1: Brazilian economy dynamics - selected variables

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
GNP (annual variation rate)	3.6	1.2	5.7	3.0	3.7	5.8	4.7	-0.1	7.0	3.7	1.6	2.9	0.5	-3.1	-2.9

[1] The real annual variation of the Brazilian GDP in the years 2003, 2010 and 2015 was 1.13%, 6.28%, -3.15%, respectively, according to the Brazilian Institute of Geography and Statistics (IBGE, 2022).

Labor market degree of informality	58.4	57.6	56.6	55.5	54.3	53.4	50.9	50.4	-	47.1	46.3	45.4	46.5	-	-
Main job average nominal income (annual variation rate)	-	2.2	4.6	7.6	7.3	7.4	9.9	8.5	9.1	9.4	9.8	8.1	9.0	5.5	-
Manufacturing industry share in GDP	14.5	16.9	17.8	17.4	16.6	16.6	16.5	15.3	15.0	13.9	12.6	12.3	12.0	12.2	12.5

Sources: IBGE for GNP and Main job average nominal income; Ipeadata for labor market degree of informality; and Morceiro (2021) for Manufacturing industry share in GDP.

On the one hand, the traditionally highly heterogeneous Brazilian labor market has experienced a major formalization and wage growth process. Table 1 demonstrates a 20% decline in the level of informality in the labor market between 2002 and 2014. The income of workers increased at a 7.8% average yearly growth rate between 2003 and 2015. As a result, between 2002 and 2008, the average labor income's purchasing power 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. This shows how the population in the bottom parts of the income distribution disproportionately benefited from the socio and economic transformations in the labor market dynamics over this period (Baltar and Leone, 2015).

On the other hand, the country underwent a clear deindustrialization tendency throughout the same period. According to figures provided by Morceiro (2021) and shown in Table 1, the Manufacturing industry's proportion of GDP declined by 33% between 2004 and 2014. Moreover, imports of manufacturing items increased quickly across all categories, particularly 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 decline of the manufacturing industry was worsened due to greater competition in international trade (Hiratuka and Sarti, 2017).

What theoretical mechanisms have economists suggested to account for these facts? Several economists with different academic backgrounds have suggested that the deindustrialization process may be directly related to wage growth. Orthodox economists have claimed that because the manufacturing industry is exposed to foreign competition, domestic firms do not always pass on increased costs to pricing (Pastore, Gazzano, and Pinotti, 2013). The fundamental reason for compression in corporate profit margins, which discourages investment and hurts industrial production, has thus been attributed to wages growing faster than productivity.

As the primary source of the economic crisis, some heterodox economists also refer to the escalation of conflicting claims on income. As a result of increased wages, distributive conflicts would have arisen in a profit squeeze. As a result, there would have been a decline in private

investment on the one hand and a public reaction from businesspeople calling for wage cost reductions on the other. So, this transmission mechanism would help to partially explain how the economic situation has impacted the political conflict. (Rugitsky, 2017; Martins and Rugitsky, 2018; Marquetti, Hoff and Miebach, 2020).

In contrast, a second group of heterodox works challenges in many ways the idea that a rise in wages would have caused a decline in investments or even that such a rise would have significantly pressured profits downward. According to this collection of works and studies, the increase in the wage share of a company's total costs was not as significant (Bastos, 2017); financial expenses are the costs that are growing at the fastest rate (Carneiro, 2018); and the decline in private investment rates starts about five years after the wage increase (Serrano and Suma, 2018).

Regardless of the theoretical component, understanding the trajectory of the Brazilian economy in the first two decades of the twenty-first century requires an understanding of the dynamics of profits and production costs, particularly wages. The discussion regarding the reasons for the economic crisis that lasted from 2015 to 2017 and the gradual recovery before the Covid-19 outbreak is affected by the trajectories of these variables in both economic and political terms. Yet, no empirical study has offered solid proof that Brazil's markups were constrained by wages during this time. The Brazilian case may account for an illustration or even a caricature of how the topic has been handled elsewhere. Hence, although the origins and political ramifications of the crisis are beyond the scope of this paper, a comprehensive investigation of the current dynamics of the sectorial markup as well as its determinants is of crucial relevance.

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

The markup ratio is calculated as follows:[2]

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

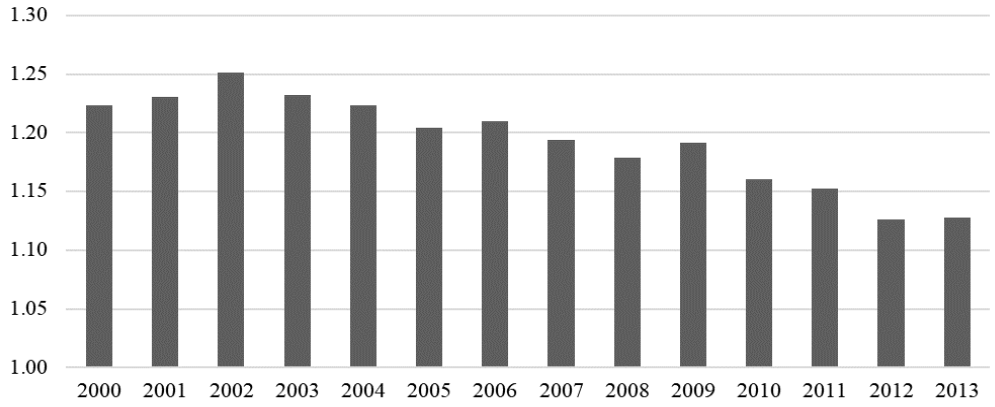
where i and t denote the sectoral unit and the time unit, respectively; *mk* is the markup ratio; *PV* is the production value which corresponds to the sum of remuneration, gross operating surplus, and gross mixed income, intermediate consumption, other production subsidies and other taxes on

[2] 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 (provided upon request).

production; *IC* is the intermediate consumption except imported inputs; *W* is the wage bill; *SC* is 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[3]. The aggregate average markup of the manufacturing industry for the full period 2000-2013 was 1.193. After growing 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 - Brazil



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

Table 2 shows the rates of average annual increase of macro sectoral markups by window periods based on the trajectory of the Brazilian GDP in each one, taking into account the entire economy, not only the Manufacturing sector. Comparing the manufacturing sector to other sectors will help you better understand its characteristics. According to the trajectory of the Brazilian GDP in each window period, Table 2 shows the rates of average annual increase of macro sectoral markups for each period[4]. Over the whole period, only the sectors of Agriculture and the Extractive Industry experienced positive average annual growth rates. From 2000 and 2013, the total Manufacturing industry's average annual markup growth rate was -0.62%. Throughout the entire period, five sectors displayed even more negative growth rates than the manufacturing sector (Electricity generation and distribution, gas, water, sewage, and urban cleaning; Construction; Trade; Transport, storage, and mail; Real estate activities and rentals).

Table 2: Sectorial 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

[3] Which was built from the National Accounts System classification of the Brazilian Institute of Geography and Statistics (IBGE). See Appendix E (provided upon request).
[4] Average real annual change in GDP in selected periods: 2000-2003, 2.5%; 2004-2008, 4.6%; 2009, -0.10; 2010-2013, 2.8%

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 worth noting that the Manufacturing industry's markup exhibits a countercyclical behavior, at least up until 2009: it exhibits a positive growth rate during the Brazilian economy's low growth phase (2000–2003), a negative growth rate during the subsequent period of consistent GDP growth (2004–2008), and then a positive growth rate once more in 2009.

Appendix A (provided upon request) presents the disaggregated markup dynamics of the 26 Manufacturing Industries. The majority of the high sectoral markups are typically concentrated between 2000 and 2005, with a more noticeable fall beginning between 2004 and 2006 and continuing until 2013 in most sectors. Despite remaining highly sector-specific, this pattern once more suggests that markups displayed somewhat countercyclical behaviour during the economy's falling (2000-2003) and growing (2004-2008) phases. However, during the years of greatest oscillation (2010-2013), markups demonstrated a more pronounced downward trajectory.

Companies also confront a less favorable financing environment and increased debt levels as a result of the 2008–2009 crisis[5]. So, it is reasonable to believe that if given the option, businesses would have raised their markups to boost their internal financial resources. As a result, the declining trend in markups over the most recent subperiod denotes an unfavorable and severe pressure on enterprises' power to set prices in line with their cyclical requirements.

The classification by usage categories and technological intensity[6] (TI) allows for describing with clearer contours the main characteristics of the markup trajectory of the 26 manufacturing industries (Appendix B, provided upon request). Twelve sectors had an average annual markup between 2010

[5] 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).

[6] The sector classification by technological intensity used is available in Bielschowsky et al (2015). The classification by technological intensity was based in Absal, Torres-Freire and Challil (2016).

and 2013 of 1.10 or less[7]. 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 imported products. The highest markups of the period are concentrated on low-TI consumer goods.

Finally, there is a considerable difference between the markups of the sectors of the Manufacturing industry and the Services sectors[8]. There are 16 Service sectors included in the sample. Ten of them show an average markup between 2000 and 2013 above 1.3, which is higher than the average aggregate markup of the Manufacturing industry in the same period (1.19). The sectors Electricity and gas, water, sewage, and urban cleaning sectors; Trade; Financial intermediation and insurance; and Real estate and rental services presented an average markup for the full period even higher, above 1.50. Comparing the markups between both sectors is particularly relevant to the present study. Since the Manufacturing industry demands a significant share of Service inputs for its production process[9], increases in the average markup of the latter tend to be passed on to 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 other possible determinants of sectoral markups

Some economists believe that the compression of the markup, the slowing of investment, and the early deindustrialization of the Brazilian economy are all results of rising wages, as was previously mentioned. However, as shown below in Figure 2, other factors[10] apparently can also be associated with the declining trajectory of the sectoral manufacturing markups in the Brazilian economy[11].

Firstly, there is an indication that 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 the components (production, imports,

[7] The Manufacturing Industry's average markup in the 2010-2013 subperiod was 1.14.
[8] See Appendix G (provided upon request) to the list of all Service Sectors and their markups by selected periods between 2000 and 2013.
[9] From the input-output matrices of the OECD countries for 2005, it is showed that in Brazil the Services used by the Manufacturing industry represented 57% of the added value produced by the latter.
[10] See Appendix C (provided upon request) for variables' definition and source.
[11] The Oil and Coke Refining sector is affected by Petrobras, one of the largest companies in the world in this economic sector. So, this sector shows discrepant values, and therefore, was excluded from the sample shown in Figure 2.

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.

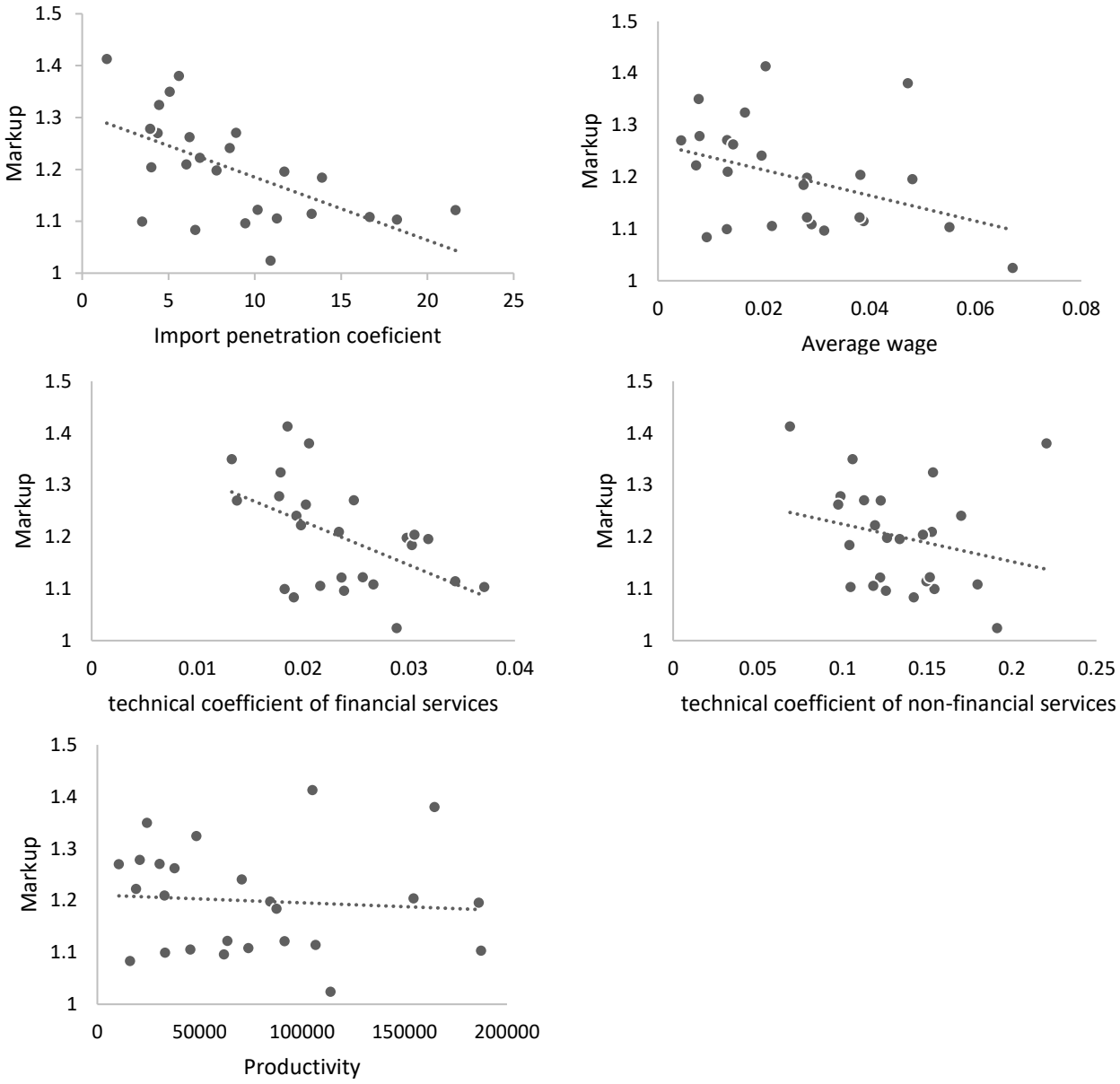
The prolonged exchange rate overvaluation in Brazil proved to be more harmful to local production due to the intensification of international competition after the 2008-2009 financial crisis. Because of the effects of the global financial crisis, advanced economies are experiencing low dynamism. As a result, the global growth of industrial goods prices has been restrained, and sales are being directed towards countries with higher aggregate demand, like Brazil, increasing the penetration of imports (NOVAIS, 2014). Trade competition with China also increased after the international financial crisis, which can be observed in the reduction of Brazilian exports to South American countries and the growth of Chinese exports to these countries (BALTAR and PRATES, 2014; JENKINS, 2015).

Secondly, there is also a possible negative association between the average markups and the sum of the technical coefficient of financial services[12] in the aggregate manufacturing industry. This may be an indication of the impact on industry costs of the high interest rates set by the Central Bank of Brazil over the years plus the high-profit margins applied by the banking system.

Thirdly, the manufacturing average markups and the sum of the technical coefficient of non-financial Services are inversely related. That is, Manufacturing sectors that demand more Services as inputs in their production processes apparently have lower average markups during the period. Appendix D (provided upon request) reinforces this perception because it is observed that after the acceleration phase of economic growth in Brazil, there was an increase in intermediate consumption of the manufacturing industry from the services sector.

[12] In Input-Output Tables methodology, the technical coefficient is a value that indicates the share of a given input supplied by a sector necessary for the production of a unit of the product of another sector. Thus, the sum of technical coefficients of the Service Sectors in relation to the Manufacturing Industry, indicates how much of services are used as input for each unit of product of each Manufacturing Industry Sector.

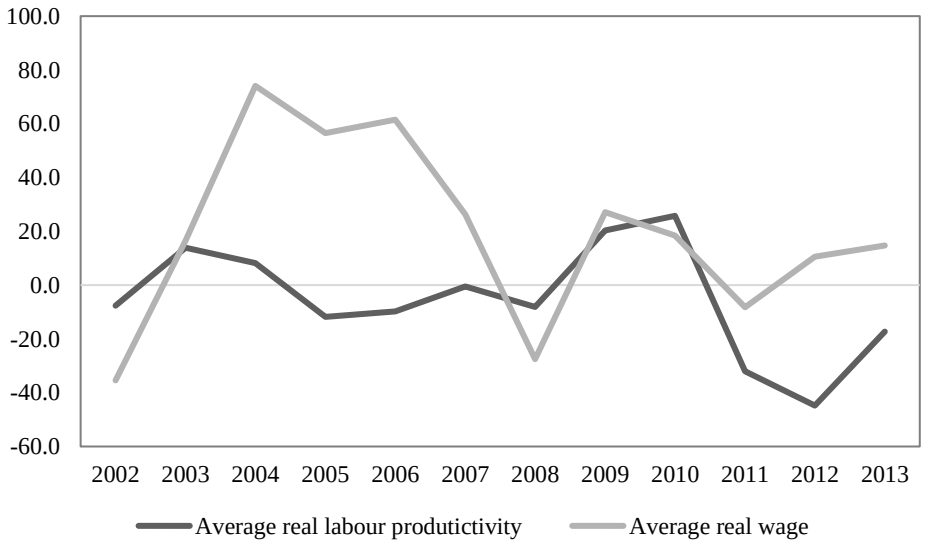
Figure 2: Correlation between average sectoral manufacturing markups and selected variables - data averaged over the 2000-2013 period



Source: Authors' own elaboration.

Lastly, markups and labor productivity do not show a clear correlation. However, since the relationship between productivity growth and wage growth is pointed out as one of the causes of the drop in profitability of Brazilian companies in the period, a few more words should be said about this relationship. Figure 3 displays the annual variation trajectory of the average real productivity growth rate and average real wages in the Aggregate Manufacturing industry.

Figure 3 - Labor productivity and Real wage - Annual variation rates (two-period moving mean) - Manufacturing industry



Source: IBGE

As can be seen, wages did grow above labor productivity in most years during the period under analysis. However, it must be noted that labor productivity is a measure of value-added per worker. Value-added, in turn, is calculated as the sum of workers' remuneration (wages and social security contributions), capital remuneration (gross mixed-income and gross operating surplus), and taxes and subsidies on production. Thus, wages also make up labor productivity. This implies that wage growth above productivity is not a sufficient condition to cause a profit squeeze, as productivity can grow precisely because of wage growth. In other words, it is not possible to say that profit margins are being squeezed by wage growth, only by comparing wages and labor productivity trajectories. Hence, an empirical analysis of markup determinants makes is needed to clarify this point by showing which factors other than wage growth may explain markup changes. In addition, Bastos (2017) reports that the growth of the share of wages in the total costs of companies in the 2000s rather was small. Labor costs were at 12.2% in 2004, rose to 13.3% in 2006, and fell back to 12.2% in 2008. In 2009 it reached 14.0% and maintained this level growing slightly in the following years until 2012. This trend

reinforces the perception that it is necessary to explore other variables that impact firms' costs to determine the contribution of each one to markup shifts.

Finally, another special characteristic of wages must be considered when discussing the possible theoretical channels linking rising wages and declining markups. Wages work both as a production cost and a source of aggregate demand. Therefore, increasing wages increase prime costs while simultaneously increasing overall consumption and demand, giving firms room to raise prices to maintain their markup level. As a result, firms should be able to pass-through wage increases more easily onto prices (since higher wages tend to expand the market) than increases in either input costs (which normally just influence costs without extending the market) or import penetration (that increases competition within the same market).

Although some of the literature places a lot of attention on the role that distributive conflict played in the recent crisis, the trajectory of wages and markups does not provide enough support to allow for more than partial sectoral inferences, as can be seen from prior considerations. In other words, it's unclear how this dynamic will affect the economy overall when looking at just the markup's components. To explain the primary sources of pressure, we conduct an econometric examination of the factors influencing the trajectory of mark-ups based on the evidence acquired.

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 (provided upon request). 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 (provided upon request).

This work aims to test the hypothesis that wage cost is the main item 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 import penetration to account for the effect of trade openness on sectoral markups for the manufacturing industry sample, we propose to replace this coefficient with the export coefficient in the model for the overall sample. This was a necessary procedure since the import penetration coefficients are only available for the manufacturing industries.[13]

3.2. Methodology and results

In the specified 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 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[14]. 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. One concludes that the control of endogeneity is crucial to achieving robust results with the proposed model. Thus, the non-significance of the average real wage variable needs to be viewed with caution until possible endogeneity problems are controlled.

[13] Market concentration would also be a relevant variable to explain markup variations. However, this study is carried out at sectoral level and not at firm level. Unfortunately, firm-level data that would allow the calculation of industry concentration, such as the Hirschman-Herfindahl index (HHI) or the share of companies with the highest market share in total industry sales, are not available.

[14] 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).

To deal with the presence of potentially endogenous explanatory variables, the model parameters are estimated using the Generalized Momentary Method (GMM). The objective of these specifications is to control the unobserved fixed effects[15] 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, producing biased estimates, 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 is given by the GMM System estimator (Blundell and Bond, 1998). The solution consists in generating 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 one seeks to not 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 first difference is expected, however, the presence of second-order serial autocorrelation means that the error terms in level have a first-order serial correlation. In this case, the instruments will not be valid either.

Next, we will present the results of the estimates using GMM-System method. All explanatory variables were considered endogenous. Firstly, the results are presented for manufacturing industries (26 sectors) and then for all 46 sectors. The result of the model applied is found in column 5 which is the focus of the analysis. Columns 1 to 4, in which the explanatory variables were gradually included in the model, are presented as a robustness check for the wage variable to different controls. Also as a robustness check, the model was estimated using Fixed Effects Method[16] with the same sample sets.

[15] The GMM estimation considers the institutional characteristics that affect the set of economic sectors through the control of fixed effects of panel units. Any variables at the country level that may or may not have an impact across all the sectors of the economy are accounted for in the inclusion of fixed effects in the model. Likewise, the model captures fixed time effects, that is, salient features that occurred in a specific year.

[16] 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.

Results are presented in Appendix F (provided upon request). The model result using the GMM System estimator for the Manufacturing Industries sample only is shown in Table 3 below.

Table 3: Results of GMM System estimations for the 26 Manufacturing industry Sectors, 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.

The key outcome of model 5 in Table 3 is that it demonstrates the statistical non-significance of the average real wage in determining the average sectoral markup of the Manufacturing Sectors. At the same time, it gives some light on other likely sources of the manufacturing markup rate squeeze.

It is strongly suggested 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. With the expected negative sign and significance level at 1%, this explanatory variable presents the largest effect on the sectoral markup of Manufacturing Industries.

It also indicates a potential negative impact of import penetration on sectoral markups, although this relationship is weaker compared to the previous variable. It is important to note that the statistical significance of this finding is only at 10%, and caution should be exercised in its interpretation. Despite the low statistical significance, this finding is consistent with the arguments put forth by

several previous studies of the Brazilian economy over the period under analysis (NOVAIS, 2014; BIELSCHOWSKY, SQUEFF, and VASCONCELOS, 2015; BALTAR and PRATES, 2014; JENKINS, 2015). Therefore, it may be considered an important finding, albeit one that should be viewed with some caution. However, it is essential to emphasize that our main conclusions do not rely on this finding. While the relationship between import penetration and markups warrants further investigation, our study primarily focuses on assessing the impact of unit labor costs on markups in the Brazilian economy from 2000 to 2013.

Both the real productivity and intermediate consumption of financial services variables did not present significant coefficients in this estimation[17]. A possible explanation for this result is that the relatively small number of economic sectors used in the estimation may have increased substantially the estimators' variance, thus making it more difficult to reject the null hypothesis. This explanation is supported by the model estimation results with 46 economic sectors, to which we turn next.

In the model whose results are presented in Table 4 column 5 below, the GMM System estimates are in line with the previous estimates and strengthen the evidence against the assertion that wages are the main cause of markups squeezing in the period considered. The average real wage remains non-statistically significant and is, moreover, the only variable in this condition. The estimation model result also makes clearer the impact of the other variables on markups.

Table 4: Results of GMM System estimations for the 46 sectors, 2000-2013, Brazil

	(1)	(2)	(3)	(4)	(5)
Lagged markup	0.9105 ***	0.9920 ***	1.0528 ***	0.8678 ***	0.6421 ***
	(0.20)	(0.06)	(0.09)	(0.09)	(0.14)
Average real wage	-0.0116	-0.0155 **	0.0057	-0.0184 **	-0.0131
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Real productivity	0.0962 ***				0.1098 **
	(0.03)				(0.05)
Intermediate consumption		0.0252			-0.0401 *
of financial services		(0.03)			(0.02)
Intermediate consumption			-0.0643		-0.0811 **
of non-financial services			(0.04)		(0.04)
Export coefficient				-0.0151	-0.0506 ***
				(0.012)	(0.02)
Constant	-1,0670 ***	0.0314	-0.1216 *	-0.0180	-1,4324 **
	(0.26)	(0.13)	(0.06)	(0.05)	(0.60)
Observations	275	270	270	156	269

[17] It is noted that in the model estimated by the Fixed Effects method, these two variables presented significance at 1%, as can be seen in Appendix F (provided upon request).

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 Real Productivity variable shows the more salient impact on markups (positive as expected) and is statistically significant at a 5% significance level. Intermediate consumption of the non-financial services variable is in second place in terms of quantitative impact on markups, also at a 5% significance level. This reinforces the result found in the model estimated for the Manufacturing Industries sample about the negative impact of this variable on markups. At 1% significance level, the export coefficient variable has the third largest impact on markups, which is a proxy for the import penetration variable of the previous model[18].

One could argue that rising wages should reduce profit margins since they may enhance import penetration through increasing aggregate consumption. However, given that this effect has already been considered in equation (5), our results show that the detrimental effects of external competition on markups are not indirectly impacted by changes in wages.

Another point that could be made is that the overvaluation of the exchange rate[19], which lowers the price of imported goods, is contributing to the pressure on markups. It is important to note in terms of the model that the inclusion of time-fixed effects accounts for changes in exchange rates as well as other variables that have an overall macroeconomic impact on all sectors. In other words, we already account for the impact of exchange rate fluctuations on sectoral markups in our estimations.

The Intermediate consumption of financial services variable is also statistically different from zero, although only for a 10% significance level. This model, then, suggests that not increased wages, but declining labor productivity, rising costs of intermediate inputs, and competition in international trade were possibly responsible for markup rate compression in Brazilian economic sectors over this period.

4. Conclusion

The claim that wage increases are the reason for the compression of markup should be viewed with caution considering our empirical analysis. In none of the estimations from 2000 to 2013 in Brazil, the average real wage variable's coefficient was statistically significant. The findings point to

[18] As mentioned earlier, in the model with the full sample, the import penetration coefficient variable was replaced by export coefficient due to the data unavailability.

[19] Variable that could not be explicitly included due to lack of real exchange rate data at the sectoral level.

potential alternative explanations for the decline in Brazilian companies' profitability by highlighting the significant roles played by stagnant productivity, rising intermediate input costs, and a potential detrimental effect of competition from internationally produced goods on the declining sectoral markups. Hence, despite the clear social costs of such an alternative, our estimates show that attempts to boost the competitiveness of Brazilian enterprises by reducing labor costs may be unsuccessful.

The evidence that wage cuts may not be beneficial in boosting the competitiveness of Brazilian businesses supports previous research that claims labor market reforms lead to lower productivity, especially in knowledge-intensive and technological-intensive sectors. Furthermore, the potential negative effect of increased international trade pressure on markups points to a future line of investigation that connects the consequences of the Dutch Disease (Palma, 2014) with the challenges that firms confront in setting markups at the desired levels.

Finally, it is important to pay attention to how the dynamics of Services Sectors - both financial and nonfinancial - affect the trajectory of markups across all sectors. This finding emphasizes the need for more research on the features of the Service Sector in emerging economies and how it affects the economy. The Brazilian economy may be more competitive by reducing the cost of Services provided during the production process.

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