Title: Conflict inflation in open economies with administered prices: a proposed decomposition for Brazil

Área 6. Economia Monetária e Financeira e Dinâmica Inflacionária

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Abstract:

In this paper we build on a previous analytical result by Haluska et al (2023) that inflation is not neutral for functional income distribution when we separate between administered and non-tradable domestically produced goods and services. Here we also incorporate tradable goods which price is determined abroad and depend, for the domestic market, on the nominal exchange rate, and check the consequences both for inflation and distribution. We adapt our analytical model to encompass the cost structure of the sectors producing goods and services that is used to calculate the deflator of aggregate household consumption in the national accounts system. The model thus captures the cost structure based on the input–output matrix of the Brazilian economy. Our exercise is to decompose inflation between the main exogenous cost-push factors – changes in nominal wage, nominal exchange rate and international prices in US$, and monitored prices – as well as to changes in taxes, productivity and mark-ups. We also propose a second exercise by endogenizing monitored prices – i.e. to decompose them between the already mentioned cost-push factors and changes in the mark-up of the administered goods and services sector. The latter is important to discuss the impact of such goods and services on distribution.

Keywords: Cost-push inflation; Distributive conflict; Administered prices

Resumo:

Neste artigo, partimos de um resultado analítico anterior de Haluska et al. (2023), segundo o qual a inflação não é neutra para a distribuição funcional da renda quando se distingue entre bens e serviços administrados e bens e serviços não comercializáveis produzidos domesticamente. Aqui também incorporamos bens comercializáveis, cujos preços são determinados no exterior e dependem, para o mercado doméstico, da taxa de câmbio nominal, e verificamos as consequências tanto para a inflação quanto para a distribuição. Adaptamos nosso modelo analítico para abarcar a estrutura de custos dos setores produtores de bens e serviços utilizada no cálculo do deflator do consumo das famílias agregado no sistema de contas nacionais. O modelo, assim, capta a estrutura de custos com base na matriz insumo-produto da economia brasileira. Nosso exercício consiste em decompor a

inflação entre os principais fatores exógenos de pressão de custos — mudanças no salário nominal, na taxa de câmbio nominal e nos preços internacionais em dólares americanos, bem como nos preços administrados — além de mudanças em impostos, produtividade e mark-ups. Também propomos um segundo exercício, endogeneizando os preços administrados — isto é, decompondo-os entre os fatores de pressão de custos já mencionados e mudanças no mark-up do setor de bens e serviços administrados. Este último ponto é importante para discutir o impacto desses bens e serviços sobre a distribuição de renda.

Palavras-chave: Inflação de custos; conflito distributivo; preços administrados

1) Introduction

In this paper we build on a previous analytical result by Haluska et al (2023) that inflation is not neutral for functional income distribution when we separate between administered and non-tradable domestically produced goods and services. Here we also incorporate tradable goods which price is determined abroad and depend, for the domestic market, on the nominal exchange rate, and check the consequences both for inflation and distribution.

The Brazilian economy provides a particularly suitable case study to apply this model. Brazil combines both an important share tradable goods and administered goods and services in the consumer basket. Tradable goods constitute an important component of production costs, making inflation sensitive to exchange rate movements and global price cycles. Meanwhile, adjustments in monitored prices changed in different governments, affecting not only in inflation dynamics but also income distribution.

We adapt our analytical model to encompass the cost structure of the sectors producing goods and services that is used to calculate the deflator of aggregate consumption in the national accounts system. The model thus captures the cost structure based on the input–output matrix of the Brazilian economy. Our exercise is to decompose inflation between the main exogenous cost-push factors – changes in nominal wage, nominal exchange rate and international prices in US$, and monitored prices – as well as to changes in taxes, productivity and mark-ups. We also propose a second exercise by endogenizing monitored prices – i.e. to decompose them between the already mentioned cost-push factors and changes in the mark-up of the administered goods and service sector. The latter is important to discuss the impact of such goods and services on distribution.

The paper is organized as follow: in the next section, we present we main theoretical foundations of cost push inflation and explain how our work is related to other recent studies on the subject. Then (section three), we present the main characteristics of the model (the complete model with the equations is presented in the Appendix). In the fourth section, we present the database used and the methodology to classify the industries among industries with free prices, international prices

and administered prices. Section five contains the results from the decomposition and a discussion of these results. The paper ends with some final remarks.

2) Theoretical foundations of cost push inflation

In this section, we are reviewing the theoretical foundations of cost push inflation and some contributions from recent works on this issue. We assume that output is determined by effective demand both in the short and in the long run, and that productive capacity and the labor supply adjust to the trend of effective demand. (Freitas and Serrano, 2015, Haluska et all, 2020, Fazzari et al, 2020; Fazzari e Gonzalez, 2025). Therefore, the core of inflation is not the result of excess demand on a given productive capacity, but rather the result of conflicting claims over the distribution of national income, when the different social groups try to increase their share in national income, causing increases in nominal costs of production. Attempts by workers and capitalists to increase their real wages and their markups results in increases in prices (Rowtorn, 1977; Stirati, 2001).

Wage increases are one of the main sources of cost push inflation, and this process can arise even when there is large unemployment. Depending on the circumstances, workers may have bargaining power to obtain increases in their nominal wages. This bargaining power depends both on the rate of unemployment and on institutional elements, such as the power of unions, the fear of unemployment, labor laws and social rights, as well as on the government policy regarding the minimum wage. Therefore, lower rates of unemployment may strength workers bargaining power, increasing their ability to obtain large increases in their nominal wages. According to this framework, in this case inflation is still a cost push phenomenon, not a demand one.

In an open economy, prices will be affected by the prices of imported goods, whether they enter directly in workers' consumption basket or in production costs. Some papers, when dealing with a small open economy, assumes an economy that is price taker for several tradable goods, independently if they are imported of produced domestically. In these cases, international prices not only affect costs of production, but also determines directly the prices of all (or a large portion of) tradable goods. (Morlin, 2023; Dvoskin, 2025).

Another element which may be important to inflation in several countries are prices administered by the government or by legal authorities. These prices usually encompass natural monopolies, such as electricity and water services, but can also include public transportation and other goods or services, depending of political and institutional characteristics of each country. One important feature of these industries with administered prices is that, usually, they are not subject to free competition and capital mobility, so there are no automatic mechanisms that equates the rate of profit obtained in these industries to the rates of profits of the other industries, where prices are formed under free competition. Haluska et al (2023) develops a theoretical model with administered prices

(although considering a closed economy), to demonstrate how the policy regarding these administered prices may affect inflation and distribution.

In this paper, we intend to advance on the research from Haluska et al (2023), extending the model from that paper to include not only free prices and administered prices, but also tradable goods, technical progress and taxes. We develop an Input-Output price model and apply this model to explain the causes of inflation in Brazil from 2001 to 2021. Although the our empirical exercise is applied to the Brazilian case, this model can be applied to explain the inflation patterns of other countries as well.

The Input-Output price model developed here inspires in other Input-Output price models, such as in Weber et al (2024), Morlin et al (2025) and Gomes and Freitas (2026). Compared to those models, our contributions brings two different kinds of advances. First, we include industries with administered prices. Second, while most price models consider basic prices, the model being presented focus on market prices (i.e, including taxes) for household consumption, so our results are more closely related to Consumer Price Indexs (CPI).

3) The model

Our purpose here is to explain the determinants of consumer price inflation. To this end, we develop two models (with some slight differences) that allows us to decompose the household consumption deflator at market prices from the National Accounts. The complete models, along with their respective equations, are presented in Appendix A[1]. Here, we outline the general features of the models, present a few expressions, and explain how we interpret the decomposition results in order to explain the causes of inflation.

3.1) The model with exogenous administered prices.

We begin by presenting the first version of the model. Prices are set in different ways, according to the origin of the products and to the producing industry. All imported goods have their prices set on global markets, so they have an 'international price', and each of the domestic industries are classified according to how its prices are set. We consider three types of industries: a) industries in which prices are set domestically under free competition among firms, referred to as 'free prices'; b) industries in which prices are fixed by the government or legal authorities, referred to as administered prices; and c) industries in which prices are set in global markets, referred to also as 'international prices'.

[1] Due to lack of space, this Appendix was not included in this version of the paper, otherwise it would surpass the limit of 25 pages. If the paper is to be approved, we intend to include it in the version to be published.

Expression (1) below represents total household consumption inflation in terms of market prices, as a weighted sum of the contributions of the different price components. In this expression, π_t^C denotes the scalar value of the total consumer price inflation, $\pi_{n,t}^{F,C}$, $\pi_{n,t}^{A,C}$ and $\pi_{n,t}^{X,C}$ are, respectively, the column vectors of market prices inflation of free, administered and international branches of domestic industries, while $\pi_{m,t}^C$ is the vector of market inflation of imported international prices. Each inflation vector is premultiplied by its corresponding row vector of weights, whose elements represent the proportion of each industry products in the total consumption in the last period, illustrated here by $\theta_{n,t-1}^F$, $\theta_{n,t-1}^A$, $\theta_{n,t-1}^X$ for domestic free, administered and international prices and by $\theta_{m,t-1}$ for the imported international prices.

$$\pi_t^C = \theta_{n,t-1}^F \pi_{n,t}^{F,C} + \theta_{n,t-1}^A \pi_{n,t}^{A,C} + \theta_{n,t-1}^X \pi_{n,t}^{X,C} + \theta_{m,t-1} \pi_{m,t}^C \qquad (1)$$

The prices of imported goods and those of industries with international or administered prices are treated as exogenous. More specifically, we assume that the basic prices are exogenous, while market prices also depend on taxation. Thus, the rate of inflation of household consumption at market prices depends on both inflation at basic prices and changes in tax rates over household consumption. This relationship is illustrated in the expression (2) for the market prices inflation in free prices industry, $\pi_{n,t}^{F,C}$, in terms of the basic prices inflation $\pi_{n,t}^{F,B}$ and changes in the tax rate of free prices described by $\left(\hat{\phi}_{t-1}^F\right)^{-1} \Delta\hat{\phi}_t^F$, in the second term of the right hand side of the expression[2], while $P_{n,t}^{F,B}$ is the vector of basic prices of domestic free prices industry.

$$\pi_{n,t}^{F,C} = \pi_{n,t}^{F,B} + \left(\hat{\phi}_{t-1}^F\right)^{-1} \Delta\hat{\phi}_t^F P_{n,t}^{F,B} \qquad (2)$$

Prices in free-prices industries are set by applying a markup over production costs, which consists of the wage bill and intermediate consumption. It is also necessary to include the other taxes on production, that is a portion of value added, to get to market prices. Importantly, production costs in each branch depend on the intermediate consumption at market prices, so costs – and therefore, prices, – depends not only on the basic prices of the inputs, but also on the taxes over them. Intermediate consumption also can be separated between a) imported inputs with international prices, b) domestic inputs with free prices, c) domestic inputs with administered prices, e d) domestic inputs with international prices.

Accordingly, the basic prices of free prices industries are determined as described by expression (3). From right to left hand side, the term $\hat{L}_t^F W_t^F$ represents the labor cost, while the matricial sum between the brackets is the intermediate consumption as, for instance, $A_{n,t}^{FF'}$ is the

[2] $\left(\hat{\phi}_{t-1}^F\right)^{-1}$, $\Delta\hat{\phi}_t^F$, and $\hat{\phi}_t^F$ represent, respectively, the inverse, the variation and the diagonal matrices of the consumption tax rate in relation to the total domestic and imported household' consumption.

technical coeficient matrix of domestic inputs from free price industries, and $\hat{\lambda}_t^F$, $\hat{\mu}_t^F$ and $\hat{\tau}_t^F$ are the diagonal matrices for other taxes, the markups and taxes over intermediate consumption, respectively.

$$P_{n,t}^{F,B} = \hat{\lambda}_t^F \hat{\mu}_t^F \left[\hat{\tau}_t^F \left(A_{n,t}^{FF'} P_{n,t}^{F,B} + A_{n,t}^{XF'} P_{n,t}^{X,B} + A_{n,t}^{AF'} P_{n,t}^{A,B} + A_{m,t}^{F\prime} P_{m,t}^{B}\right) + \hat{L}_t^F W_t^F\right] \quad (3)$$

Besides the prices of inputs with international or administered prices, which we already established as exogenous, we also take as given, for each period, the technology in the free prices industries, as well as the nominal wages, the markups, the tax rates over their inputs and the share of other taxes on production on gross production, seen in the expression (3) above. As a result, the inflation at basic prices in the industries with free prices will depend on: a) the inflation of international prices, b) the inflation of administered prices, c) the rate of change of nominal wages, d) changes in technology, e) changes in the markups, and f) changes in tax rates, whether it is taxes on inputs or in the other taxes on production.

The Input-Output methodology allows us to measure the intersectoral effects of any given change in exogenous variables. For example, an increase in international prices will have direct and indirect effects on consumer prices. The direct effect depends on the weight of these products in household's consumption. Since this rise in international prices will increase production costs in the free prices industries, there will also be indirect effects. In this case, the rise in international prices will increase costs in the free prices industries, and since the products from the latter are also used as inputs for other free prices industries, this will result in further rounds of costs increases for these sectors. To give another example, an increase in wages in just one industry can increase prices in several other industries, since the goods from the industry where wages have increased increases are used as inputs in other industries, and so on. However, an increase in wages in the industries with international prices or with administered prices will have no effect on prices and will only pressure the markup in these sectors.

Changes in technical coefficients of inputs or of labor also influences production costs. Therefore, if there is technical progress, it can help to mitigate the effects of increases in the prices of inputs or in nominal wages on costs, reducing inflation of free prices. However, technical progress in the industries with international or administered prices will also have no effect on prices and will only contribute to increase the markup in those branches. Finally, changes in taxes on intermediate consumption or on other taxes on production also affect prices, but here again, its effects are only in the industries with free prices, while changes in taxes on industries with international or administered prices will influence their markups.

Based on this decomposition model, we calculate the contributions to household inflation. To present and discuss the results, the contributions are classified into six groups. The expression (4) below symbolizes each scalar component of the calculated household inflation, denoted by π_t^C, where

the term INT_t refers to the contribution of international prices, ADM_t for the administered prices, $WAGE_t$ reflects the changes of nominal wages, $TECH_t$ measures the contribution of technical progress, the term MK_t describes the changes in the markups and TAX_t represents the contribution from changes in the tax rates.

$$\pi_t^C = INT_t + ADM_t + WAGE_t + TECH_t + MK_t + TAX_t \quad (4)$$

The first one, denoted by INT_t is the contribution from changes in international prices. This includes the contribution from price increases in imported goods, represented by $\pi_{m,t}^B$ in the expression[3] (5), below, and from the increases in prices of domestic goods from the industries with international prices, symbolized by $\pi_{n,t}^{X,B}$, where D_t^X and D_t^m are vectors that premultiply, in that order, the inflation of domestic and imported goods. This contribution consists in a) a direct effect, which depends on the weight of these goods in households' consumption basket, and b) and indirect effect, to the extent that it increases costs in the free prices industries.

$$INT_t = D_t^X \, \pi_{n,t}^{X,B} + D_t^m \, \pi_{m,t}^B \quad (5)$$

The second component captures the contribution from increases in prices in the industries with administered prices, called by ADM_t, above. Just like in the previous case, it includes a) a direct effect, to the extent that the products from these industries are a portion of household consumption, and b) an indirect effect, which measures the effect of the increase in administered prices on the prices of the industries with free prices. The third type of contribution, $WAGE_t$, measures the effects of increases in nominal wages in the industries with free prices. The fourth type of contribution is the contribution from technical progress in the industries with free prices, called $TECH_t$ in (4). The fifth type of contribution, MK_t, is the contribution from changes in the markups in the free prices industries. Finally, the sixth type is the contributions from changes in tax rates, represented by TAX_t. This contribution is divided between the contributions from three types of taxes. The first one are taxes on household consumption, which will affect market prices regardless of how the prices are set (that is, regardless of whether they are charged on products international, administered or free prices). The second type of tax are taxes on intermediate consumption, and the third type are other taxes on production, which are a portion of value added. In these last two cases, changes in tax rates will only affect prices in the industries with free prices, as discussed above.

3.2) The model with exogenous markup in the administered prices industries

We now turn to the second version of the model. We continue classifying the industries among free prices, international prices and administered prices. The main difference is that, instead of

[3] The specifications for the other contributions, as variations on wages, technical progress or taxes are omitted here and can be found in the Appendix A.

assuming that the administered prices are exogenous, as in the version presented above, now we assume that these prices are set taking into account their production costs and adding a markup over these costs. This price setting process is similar to the way free prices are set, but in the free prices industries, the markups are determined under free competition, while in the administered prices industries, the markups are determined directly by the government authorities or in the process of bidding for public utilities concessions.

This second version of the model takes into account the fact that the trend of administered prices cannot be completely independent from their production costs, although the government has some political space to determine the markups in these sectors. Therefore, this second version of the model allows us to see how this changes in the markups of administered prices, which are decided – to a large extent – by the government, affect prices and income's functional distribution. Anyway, both the markups of the free prices industries and the administered prices industries are taken as exogenous, but the effects of their changes will be analyzed separately.

The decomposition results are again classified into six groups, with some slight differences from the groups of contributions used in the first version of the model, as illustrated by the expression (6), below, for the consumers' inflation $\pi_t^{C\prime}$.

$$\pi_t^{C\prime} = INT_t' + WAGE_t' + TECH_t' + MK_t^{Free} + MK_t^{Adm} + TAX_t' \qquad (6)$$

The first component, INT_t', is the contribution from international prices. Here, the direct effect of an increase in international prices will be the same as in the first version of the model, but the indirect effects will be different, since it encompasses the effect of international prices on the production costs of both the free prices and administered prices industries. Therefore, the contribution from international prices will be higher, on average, than in the first version of the model. The second type of contributions is the contribution from increases in the nominal wages in the industries with free prices and administered prices, denoted by $WAGE_t'$ in (6), so the contribution of increases in nominal wages will also be higher, on average, than in the first version of the model. The third group of contribution is the contribution from technical progress in the industries with free prices and administered prices, $TECH_t'$. The fourth type of contribution is the contribution from changes in the markups in the free prices industries, symbolized by MK_t^{Free}, while the fifth group consists in the contribution from changes in the markup in the administered prices sectors, called MK_t^{Adm}. Notice that this last contribution will usually be lower than the contribution from changes in the administered prices obtained in the first version of the model, since usually a small portion of increases in prices will be explained by increases in the markups, and the largest portion will be explained by increases in costs. Finally, the sixth group of contributions are from changes in taxes, expressed by TAX_t'. Again, taxes are classified into three types: a) taxes on household consumption, b) taxes on intermediate consumption, and c) other taxes on production. The difference from the former version

of the model is that the contributions from changes in the tax rates on intermediate consumption and on other taxes on production now include their effects not only in the free prices industries, but also the industries with administered prices.

4) Data

The official data released by IBGE (the institute that realease most of Brazilian economic data and responsibl for the System os National Accounts) provides Input-Output Matrices (IOM) only for every five years, while the decomposition methodology requires IOM for every year. However, the Group of Industry and Competitiveness from UFRJ (GIC/IE-UFRJ) calculates input-output matrices for every year, combining the strutucture from the IOM from IBGE with the data from the Supply and Use Tables (SUT). Alves-Passoni and Freitas (2022, 2023) presents the methodology and the entire database.

The data from Alves-Passoni and Freitas (2022, 2023) cover the period from 2000 to 2021, which is the period for which there are Supply and Use Tables available under the same methodology and classification. Therefore, the decomposition calculation will be made for the inflation from 2001 to 2021. The data available for this period contain 42 activities and 91 products. We opted to work directly with the square matrices, so the calculations are made under the level of 42 industries. The calculations were made in the software R.

Each industry was classified according to the way their prices are formed. In Gomes and Freitas (2026), the industries are classified in two categories: a) prices set internationally and b) prices set domestically. The classification of industries with 'international prices' was retrieved from the classification from Gomes and Freitas (2026). The remaining industries were classified as industries with free prices or with administered prices. Brazilian Central Bank classifies 24 products from the Consumer Price Index (CPI) as administered prices, so this list of products was used as a starting point. Next, it was necessary to determine the IOM product that corresponds to each of the CPI products which has administered prices. This correspondence between the CPI products to the IOM products has to be done in two stages, since there is no direct correspondence between them released by IBGE. First, the CPI products were classified according to the product classification from the Household Budget Survey (POF, from the Portuguese acronym), and then, the POF products were classified to IOM product. As a result, we determined which IOM product has some portion with administered prices, which does not mean that all the production of these products have their prices set by legal authorities. Therefore, it was also necessary to evaluate, for each of these cases, if the prevailing form of price setting is through administered prices or free prices. Finally, once we know the form of price setting of each product, we determine the form of price setting for each industry.

According to the final classification (which can be seen in Appendix B) 18 industries have international prices, 21 industries have free prices and 3 industries have administered prices.

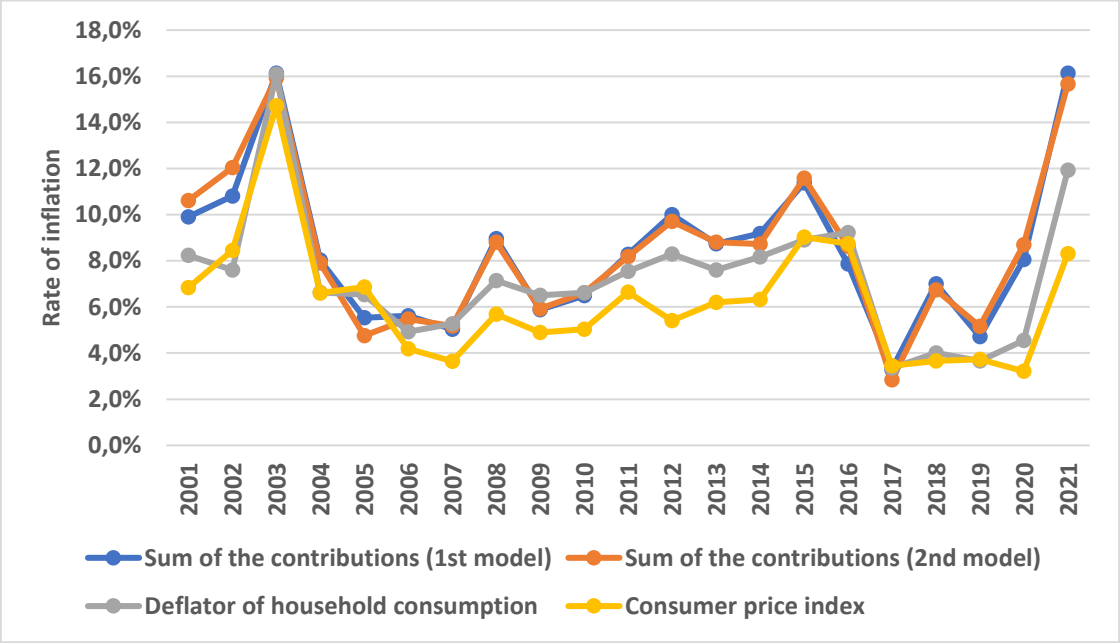
5) Results

Let us discuss the results from the decomposition exercise. Figure 1 compares the sum of the contributions from the two versions of our model with the actual deflator of household consumption at market prices and with the Consumer Price Index (CPI)[4]. As can be seen, the sum of the contributions tracks closely the actual deflator of household consumption, which by its turns, has a similar trend to the CPI. The sum of the contributions does not equal exactly the actual deflator. The reason for that is that the present model assumes that the price of the products from each industry is the same for every industry that uses its output as intermediate consumption and for household consumption. The same holds for the imported products, i.e., we assume that the price of each imported product is the same in the intermediate consumption of all industries and in household consumption. However, in actual data, this assumption does not hold, and price deflators of the same product may be different when they enter into the intermediate consumption of different industries and in household consumption, which ends up generating some difference between the sum of the contributions and the actual deflator. One possible explanation for these discrepancies in actual data is the fact that these products are not homogeneous, being in fact and aggregation of several subproducts with difference prices and different deflators.[5]

[4] The annual inflation from the CPI considered here is the average price of the 12 months of each year compared with the average price of the 12 months of the previous year, in order to be comparable with the deflator of household consumption, which consists in the average price of one year compared to the previous one.

[5] Just to give an example: soybeans, corn, sugarcane, and raw coffee accounts for 72% of the production of agriculture products. However, these products are mainly exported or processed by other industries, accounting for only 8% of household consumption of agriculture products. In fact, household consumption of agriculture products consists in fruits and vegetables, essentially (which are accounted as other products from perennial and non-perennial crops), which represents 91% of household consumption of these products. In 2021 (when there was a large global inflation of commodities), the prices of the production of agriculture products increased 36.3%, while the price of household consumption of agriculture products increased just 17.9%.

Figure 1: Sum of contributions of the decomposition, actual deflator and CPI.



Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

To discuss the causes of inflation in Brazil, we are comparing two periods: a) from 2004 to 2014, and b) from 2015 to 2021. Tables 1 and 2 presents the contributions from each of the six groups to inflation that were presented in section 2, according to the first and the second version of the model, respectively. Out interpretation will consider the first version of the decomposition as our main benchmark, and the results from the second version of the model will be used specially to discuss the contribution from administered prices. As can be seen, the annual average of inflation was very similar among the two periods considered (6.8% in 2004-2014 and 6.5% in 2015-2021). However, the contributions from each variable differs considerably. From 2004 to 2014, the increases in international prices in domestic currency (considering the first version of the model) had a contribution of 2.8 percentage points (pp), on average per year, to the increase in the deflator of household consumption (from now on, we will name the deflator of household consumption just as 'inflation'). In the period from 2015 to 2021, the contribution of international prices to inflation increased to 4.7 pp a year. The contribution from administered prices were of 0.8 pp from 2004 to 2014, and it increased to 1.4 pp in 2015-2021. The increases in nominal wages, by their turn, had a contribution of 4.1 percentage point (pp) to inflation in 2004-2014, and this contribution fell to only 2.1 pp in 2015-2022. Therefore, despite the increase in the contribution from international prices and administered prices in the latter period, average inflation was roughly the same in these two periods, which was only possible due to a lower contribution from nominal wages. These two pattern of inflation also indicates that the distributive outcomes were much different in these two periods: the wage share in income increased until 2016 and started to decrease after that.

Table 1: contributions to inflation, according to the first version of the model

Group of contribution	2004-2014	2015-2021
International prices	2,8%	4,7%
Administered prices	0,8%	1,4%
Nominal wages	4,1%	2,1%
Technical progress	-1,0%	0,6%
Taxes	0,3%	0,0%
Profit margins (free prices)	0,5%	-0,4%
Actual deflator of household consumption	6,8%	6,5%
Error	0,6%	1,8%

Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

Table 2: contributions to inflation, according to the second version of the model

Group of contribution	2004-2014	2015-2021
International prices	3,4%	5,4%
Nominal wages	4,5%	2,3%
Technical progress	-1,0%	0,6%
Taxes	0,2%	0,1%
Profit margins (free prices)	0,5%	-0,4%
Profit margins (administered prices)	-0,4%	0,5%
Actual deflator of household consumption	6,8%	6,5%
Error	**0,4%**	**2,0%**

Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

From 2004 to 2021, technical progress contributed (with 1.0 pp a year) to mitigate the effects of cost increases to the rate of inflation. However, these technical progress seems to have been interrupted after 2015 by the economic stagnation (at least in the industries with free prices), and after that, technical progress not only did not contribute to decrease prices, by it actually contributed to increase prices. Changes in taxes gave a small, but positive, contribution to inflation in 2004-2014, followed by a null contribution in 2015-2021. Finally, profit margins in the free prices branches have increased, on average, from 2004 to 2014, contributing with 0.5 pp to inflation. In 2015-2021, profit margins in these sectors decreased, on average, helping to reduce inflation by 0.4 pp a year.

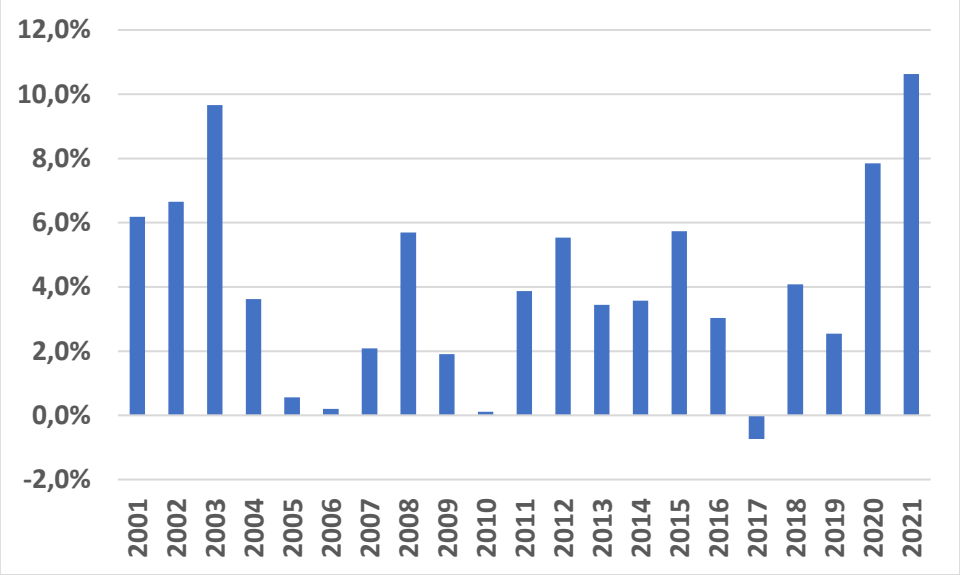
In the next subsections, we will discuss in more detail the contributions from each of these groups to inflation.

5.1) International prices

We start by discussing the contribution from international prices (see figure 2 with the annual contributions). After a period of large devaluations in the exchange rate from 2000 to 2003, the Brazilian Economy entered in a period marked by substantial improvements in the external financial conditions after 2004, with increases in the capital flows to developing countries growing exports (see Freitas, Serrano, and Medeiros 2015), which also improved the balance of current account. The

high interest rate differential (already adjusted for the sovereign spread, measured by the EMBI+) kept by the Central Bank also contributed to attract capital flows to the country. All these factors resulted in a process of appreciation of the domestic currency. As a result, the contribution from international prices was low, particularly from 2005 to 2010, in a process that was temporarily interrupted only in 2008, due to an increase in the prices of commodities in US Dollars before the Global Financial Crisis (see Figure 3).

Figure 2: Contribution of international prices to inflation



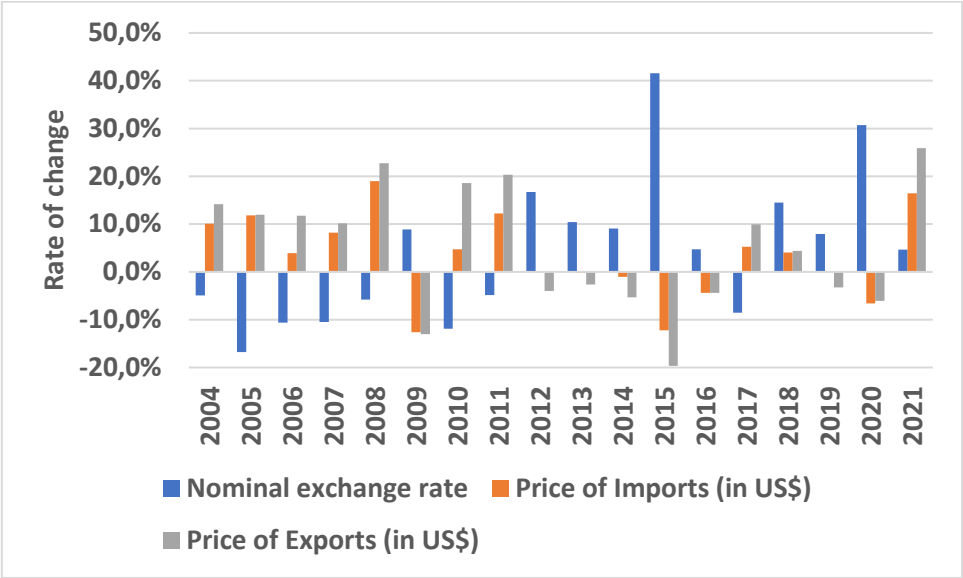
Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

By the end of 2011, the exchange rate stated to depreciate, in a long process that last until 2021. Figure 3 shows that, from 2012 to 2021, the exchange rate depreciated every year, with the exception of 2017[6]. Initially, the authorities did not fight this depreciation process, and actually encouraged it, since they believed that the real exchange rate was too appreciated, blaming the economic slowdown on the lack of competitiveness of Brazilian products.

By the end of 2016, the Central Bank started a process of several cuts in the base nominal interest rate, which resulted in a decrease in the interest rate differentials. In 2020 and 2021, this differential remained negative for several months. This fact, combined with the devaluation of the currencies of most developing economies, resulted in an accumulated depreciation of the Brazilian currency of 36.8% from 2019 to 2021. This period also coincided with the highest inflation of commodities in US Dollars since the 1970's, resulting in a large inflation of international prices (see Haluska et al, 2026). Therefore, the contribution of international prices to inflation was larger after 2011, increasing dramatically in 2020 and 2021, as can be seen in Figure 2.

[6] Notice that in 2015, for example, the effect of the large exchange rate devaluation was partially offset by a decrease in international prices in US Dollars.

Figure 3: Rate of change of nominal exchange rate and of the prices of Brazilian imports and exports in US$.



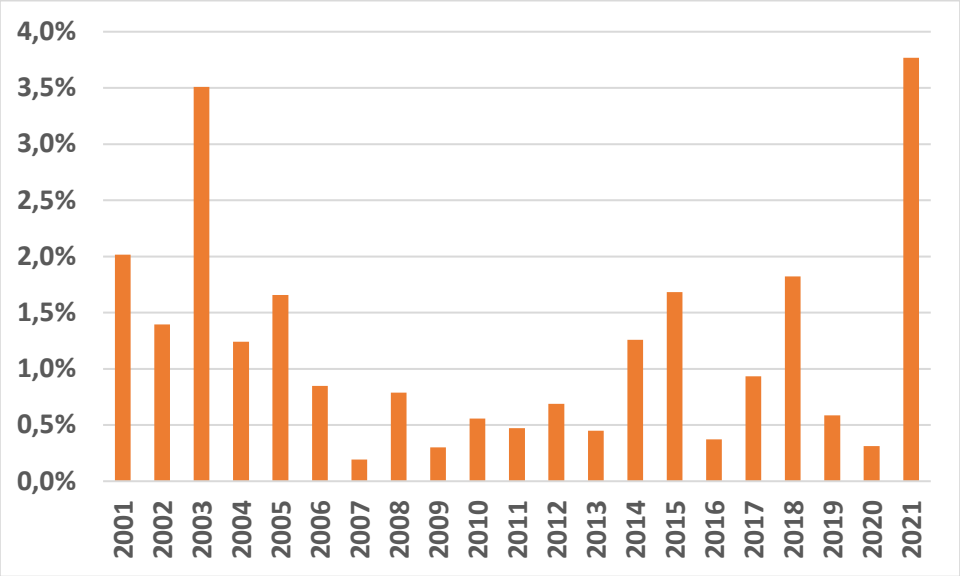
Source: IBGE. Elaborated by the authors.

5.2) Administered prices

The contribution of administered prices to inflation was relatively high by the beginning of the first decade of the 2000's, but started to decrease from 2004 onwards and remained relatively low until 2013[7] (see Figure 4). As Summa and Serrano (2017) explain, until approximately the mid-2000's, most monitored prices were indexed to the IGP-M index, an index where wholesale prices have an important weight, being strongly affected by the exchange rate and by changes in the prices of tradable goods. Therefore, the large exchange devaluations from the early-2000's ended up affecting the inflation of administered prices. However, the inflation of administered prices started to change for two reasons: a) first, the process of exchange rate devaluations was interrupted in 2004, and b) second, the government changed the rules of indexation for several administered prices, making them less dependent on IGP-M index and on tradables prices.

[7] The industries classified as industries with administered prices are the refined petroleum products, pharmaceuticals products, Electricity and water supply.

Figure 4: Contribution of administered prices to inflation



Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

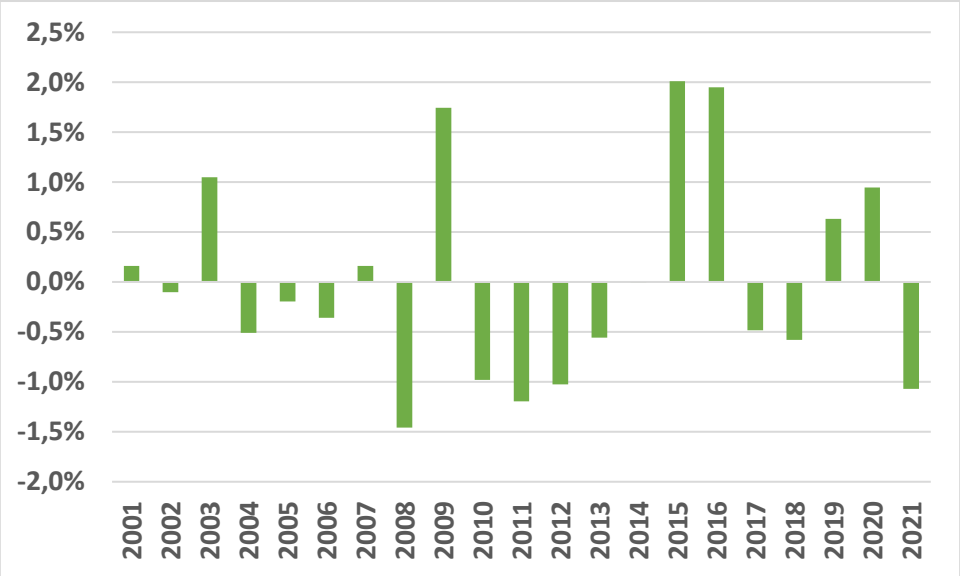
After 2010, the government took some more discretionary measures to keep the inflation of administered prices low, specially fuels and energy. The prices of fuels remained fairly stable from 2006 to 2012, and the government tried not to pass-through the increases in international prices to the domestic market. In some occasions, increases in the prices in the refineries (which in our model, correspond to basic prices) were compensated by reductions in the tax rates (Barbosa, 2018). In 2013, the government promoted a large decrease in the prices of electricity, both through regulatory changes and tax exemptions. As a result, the contribution of administered prices was quite low between 2006 and 2013.

In 2015, the government promoted large increases in the prices of fuels and energy, reverting the measures taken in the previous years that helped to keep inflation low. The most important change in the policy for setting monitored prices was in the rule for determining the prices of fuels. After 2016, Petrobras (Brazil's public oil company) started to fix its price according to the price of fuels in the international market, adjusting its prices much more often and automatically whenever there was a change in international prices or in the exchange rate. In practice, during that time, the prices of fuels behaved like an international price, passing through changes in the exchange rate and in international prices. Therefore, the large exchange rate devaluation the occurred after the outbreak of the pandemic, combined with the worldwide increase in energy prices, resulted in a large inflation of fuels. Severe droughts also affected the energy prices by that same time, since Brazilian supply of energy relies strongly in hydroelectric power. Consequently, the contribution of administered prices to inflation was higher in the period from 2015 to 2021, reaching 3.5 pp in 2021.

The main difference between the first and the second version of our model regards to how the prices of administered prices are set. In the second version of our model, instead of assuming that the

authorities fix those prices exogenously, we assume that the prices are set adding a markup over production costs. Figure 5 presents the contributions of the changes in the markups in the administered prices industries according to the second version of the model. As can be seen, the years when the contribution of administered prices were low coincided with decreases in the markups of these sectors, such as in the period from 2004 to 200 7and from 2010 to 2013. After that, the government promoted a recomposition of the markups from those industries (especially in 2015 and 2016).

Figure 5: Contribution of changes in the markups of administered prices

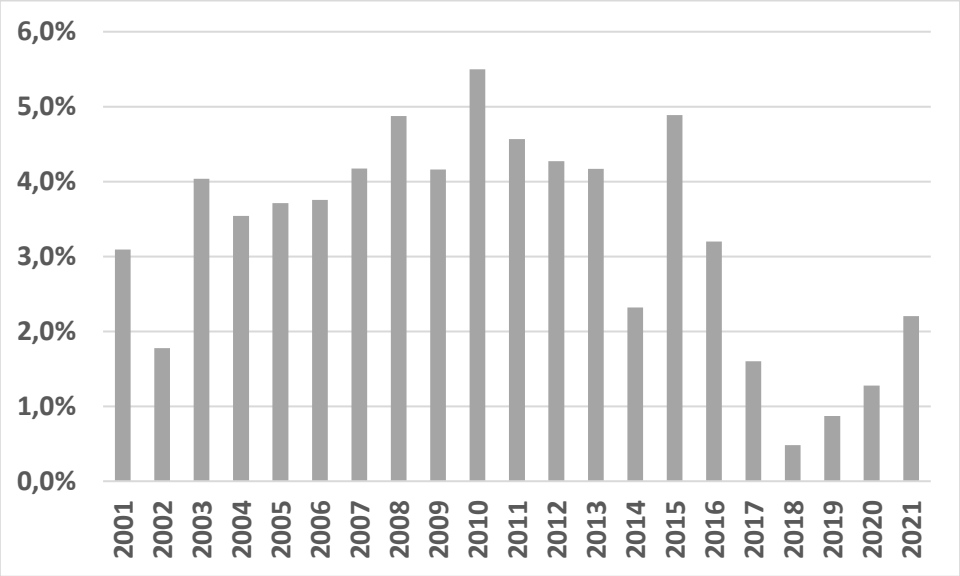


Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

5.3) Nominal wages

Let us now move to the contribution of the nominal wages, which can be seen in Figure 6. A series of factors explain the increase in the bargaining power of the workers after 2004 and until 2014, which resulted in the capacity to obtain larger increases in their nominal wages (see Summa and Serrano, 2018; and Serrano and Summa, 2022). The first one the is the policy to increase the real (and also nominal) minimum wage, which affects the wages in the economy through several channels. The minimum wage affects directly the wages in the public sector and in the formal workers in the private sector, and also have a positive effect in wages in the informal sector, through the so called "lighthouse effect". In Brazil, several social benefits are indexed to the minimum wage, so when it increases, it improves the poverty rates and social security conditions of low-income households, which by its turn affects the level of the acceptable wages to enter in the labor market. These higher wages and social benefits contributed to increase household consumption and aggregate demand, increasing employment and the bargaining power of workers, which also feedbacks into a capacity to obtain larger wage increases.

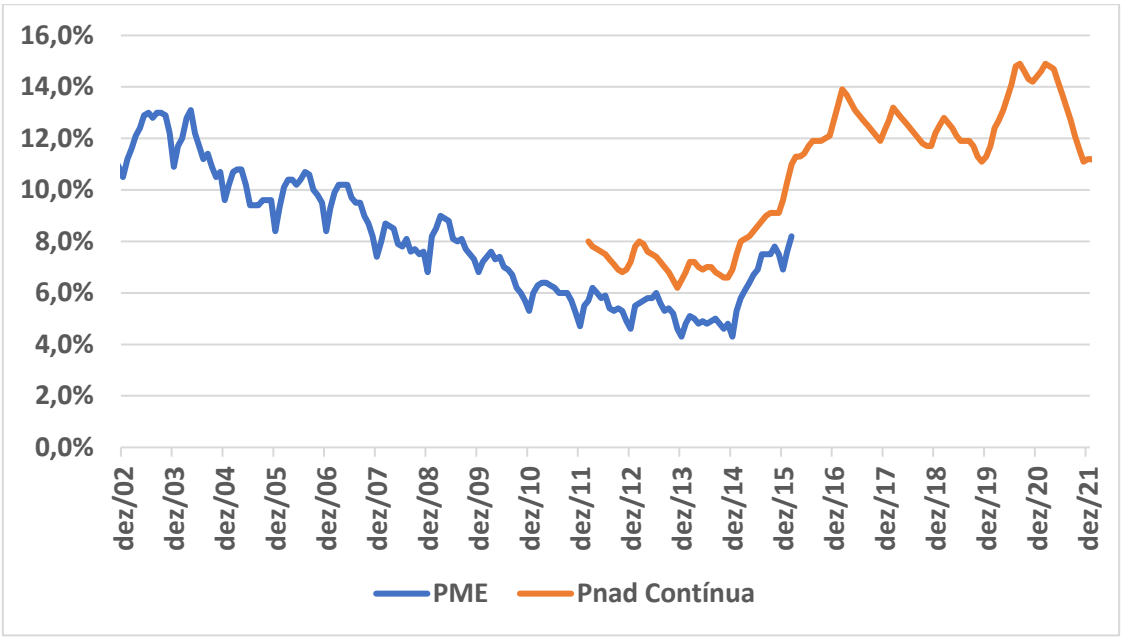
Figure 6: Contribution of nominal wages to inflation



Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

The process of decrease in the unemployment rate that started in 2004 and lasted until 2014 is another important factor to explain the increase in worker's bargaining power (see Figure 7), a process that was also reinforced by an increase in the share of formal jobs in total employment.

Figure 7: Rate of unemployment[8]



Source: IBGE. Elaborated by the authors.

This decreasing trend in the rate of unemployment occurred not only due to the higher rates of growth of GDP and employment, but also because of a decrease in the growth rate of the working age population and due to a decrease in the share of the working age population in the labor market.

[8] PME was a household survey carried only in six of the main metropolitan areas of the country and was extinguished in 2016. Pnad Continua is another household survey created in 2012, where the sample represents all the country's territory.

The last one is related to the improved social security conditions, and also to a larger portion of young adults who went to college, postponing their entry in the labor market (Serrano and Summa, 2022).

A data that illustrated this improved bargaining power of workers is the increase in the number of strikes and in the number of hours lost due to strikes (DIEESE, 2025).

After 2015, the increases in nominal wages had a much lower contribution to inflation. This result is explained by a worsening of worker's bargaining power, and several factors contributed to it. The fiscal austerity practiced in 2015 and 2016, combined with other measures such as a tight monetary policy and increases in administered prices, resulted in large fall in GDP and a fast increase in the rate of unemployment. The regime of economic policy adopted after that resulted in very slow processes of economic recovery and decreases in the rate of unemployment (interrupted during the covid pandemic). By 2021, the rate of unemployment was still 6.3 percentage point above its 2014 level, and this increase in the rate of unemployment occurred simultaneously to a decrease in the share of formal occupations.

Besides the increase in unemployment, other institutional elements help to explain this worse bargaining power and the lower contribution of wages to inflation. One of them is the fact the after 2017, there were no increases in the real minimum wage, interrupting all the aforementioned effects to increase average wages in the labor market. Another factor that contributed to worsen workers bargaining power was the decrease in unionization rates. As show by IBGE data, the share of unionized workers decreased from 15.7% in 2014 to 9.2% in 2022[9]. Additionally, a labor reform approved by the congress in 2017 made the labor market more flexible, worsening the labor conditions for the workers. The most important changes promoted by this reform were a) the possibility that some agreements between firms and workers prevailed over the labor laws, b) the rules for the labor court were changed in a manner very favorable to employers, increasing the risks and costs of litigation for the workers, and c) it allowed more flexible contracts regarding the number of days or of hours worked. This process of worsening of workers bargaining power led to a large decrease in the number of strikes and of hours lost due to strikes. (DIEESE, 2025).

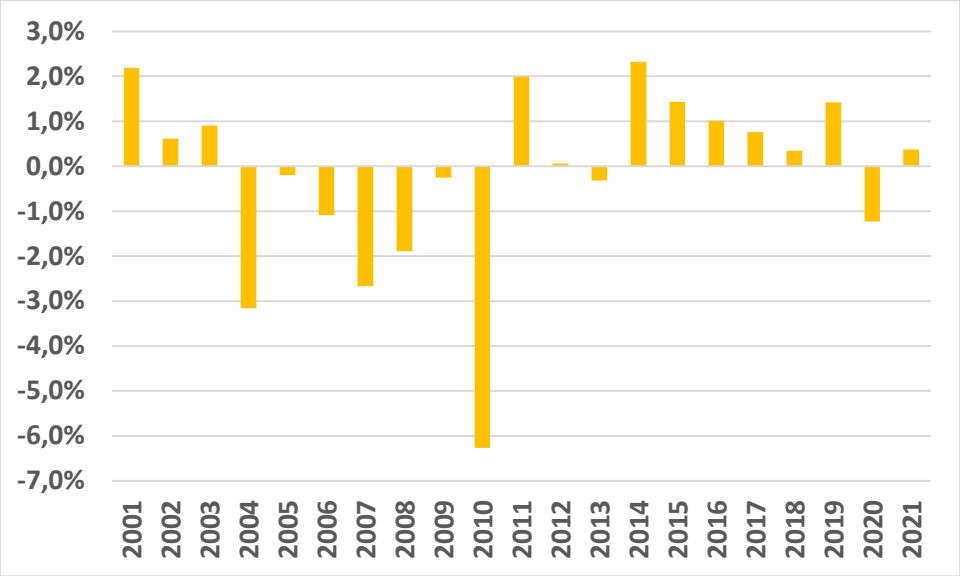
5.4) Technical progress, tax rates and markups

The combined contribution of technical progress, changes in taxes and changes in the markups were very small in both periods considered, and it is more difficult to identify some clear trends in these contributions. However, it is possible to make a few comments on these issues. First, the period of relatively high growth rates, from 2004 to 2010, led to a faster technical progress, which consistently contributed to decrease inflation during those years (see Figure 8). The period of

[9] There is no data available for unionization rates for 2020 and 2021.

stagnation that started in 2014 seems to have interrupted that process, and productivity in the free prices sectors actually seems to have decreases, so technical progress contributed to increase prices, instead of decreasing them, as would be expected.

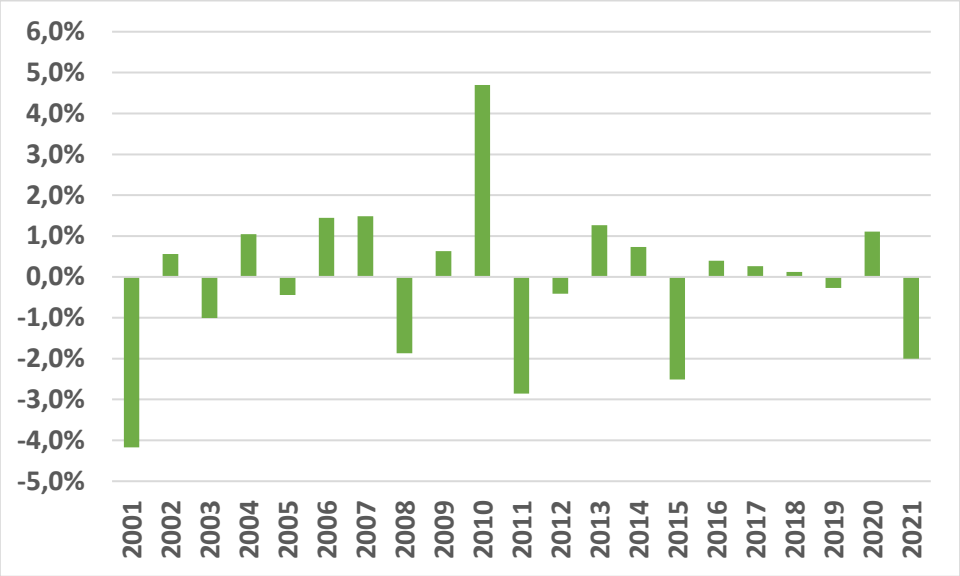
Figure 8: Contribution form technical progress



Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

The contribution from changes in the markups does not present a clear trend (Figure 9). However, it is possible to notice that the markups in the free prices industries seems to decrease (and therefore, to have a negative contribution to inflation) when there are large costs increases. See, for example, that in years when the contribution from international prices increased (such as in 2008, 2011, 2015 and 2021), the contribution from the changes in the markups in the free prices industries were negative. This suggests that, when there is some relevant cost shock, these industries cannot pass through all the cost increases to prices in the same period and that this process occurs with some lags.

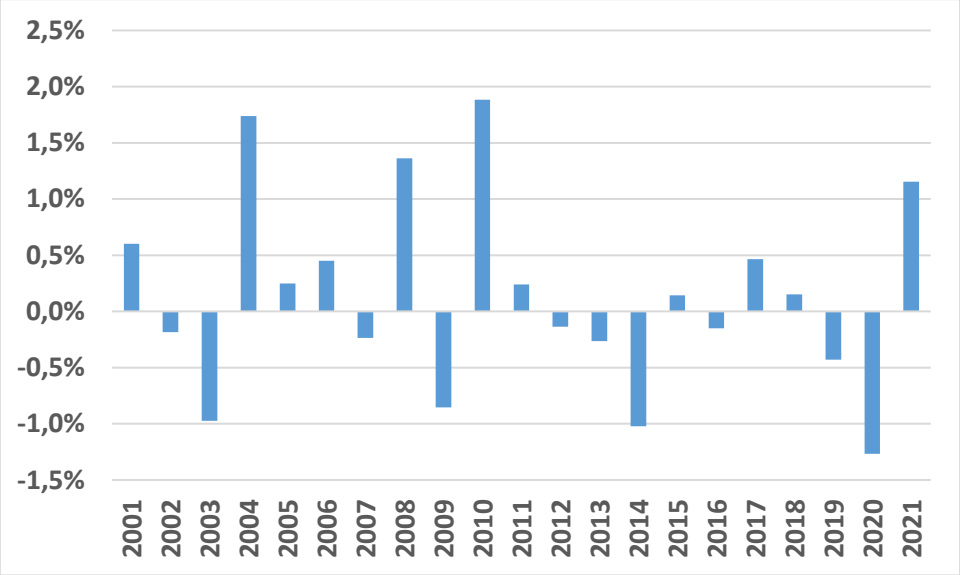
Figure 9: Contribution form changes in the markups in the free prices industries



Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

Finally, Figure 10 presents the contribution from changes in tax rates to inflation. These results still required some further investigation in order to explain the relatively large contributions observed in some years.

Figure 10: Contribution form changes in the tax rates



Source: Alves-Passoni and Freitas (2022, 2023); IBGE. Elaborated by the authors.

6) Final remarks

In this paper we decompose inflation between the main exogenous cost-push factors – changes in nominal wage, nominal exchange rate and international prices in US$, and monitored prices – as well as to changes in taxes, productivity and mark-ups. We also propose a second exercise by endogenizing

monitored prices and decompose them between the already mentioned cost-push factors and changes in the mark-up of the administered goods and service sector.

The decompositions showed two different patterns of inflation and distribution. One in which inflation is controlled with exchange rate appreciation and tamed monitored prices, and nominal wage growth translates into real wage growth. The other in which nominal wage is controlled via "discipline effect", and real mark-ups in the tradable and administered goods and services' sectors increase. The Brazilian economy in the 2000s exhibited these two distributive patterns.

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Appendix B: Classification of industries according the categories of price setting.

GIC Sector code	Description of the sector	Price setting
AT01	Agriculture, forestry, livestock and fisheries	International price
AT02	Extraction of oil and gas, including support activities	International price
AT03	Extraction of iron ore, including processing and agglomeration	International price
AT04	Other mining and quarrying	Free price
AT05	Food and drinks	International price
AT06	Manufacture of tobacco products	International price
AT07	Manufacture of textiles	International price
AT08	Manufacture of footwear and leather goods	International price
AT09	Manufacture of wearing apparel and accessories	International price
AT10	Manufacture of wood products	Free price
AT11	Manufacture of pulp, paper and paper products	International price
AT12	Printing and reproduction of recordings	Free price
AT13	Oil refining and coking plants	Administered price
AT14	Manufacture of biofuels	Free price
AT15	Manufacture of other organic and inorganic chemicals, resins and elastomers	International price
AT16	Pharmaceutical products	Administered price
AT17	Perfumery hygiene and cleaning	International price
AT18	Manufacture of pesticides, disinfectants, paints and various chemicals	International price
AT19	Rubber & Plastics	International price
AT20	Cement and other non-metallic mineral products	Free price
AT21	Manufacture of steel and its derivatives	International price
AT22	Metallurgy of nonferrous metals	Free price
AT23	Metal products - exclusive machinery and equipment	International price
AT24	Furniture and products of various industries & Machinery and equipment	Free price

AT25	Household appliances and electronic material	International price
AT26	Automobiles trucks and buses	International price
AT27	Parts and accessories for motor vehicles	International price
AT28	Other transportation equipment	Free price
AT29	Electricity generation and distribution gas water sewage and urban cleaning	Administered price
AT30	Construction	Free price
AT31	Trade	Free price
AT32	Transporting warehousing and mail	Free price
AT33	Accommodation and food services	Free price
AT34	Information services	Free price
AT35	Financial intermediation insurance and supplementary pension and related services	Free price
AT36	Real estate activities and rentals	Free price
AT37	Business and family services and maintenance services	Free price
AT38	Public administration, defense and social security	Free price
AT39	Public education	Free price
AT40	Private education	Free price
AT41	Public health	Free price
AT42	Private health	Free price

Source: Elaborated by the authors based on GIC-UFRJ, IBGE and Gomes and Freitas (2026)