

# The Unfinished Stabilization of the *Real Plan*: An analysis of the Indexation of the Brazilian Economy\*

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**Abstract:** The aim of this chapter is to review the discussion about price indexation in the Brazilian economy and its effects over the persistence of average long-term inflation at a moderate but still high level over the last two decades. The *Real plan*, adopted between 1993 and 1994, was successful in removing the short-term price indexation mechanisms and disarming the inflation memory effect through the introduction of an indexed currency in two different phases. However, the plan did not remove all existing indexation mechanisms in the economy. Our econometric exercises show that, in the period 1995-2020, the *Real Plan* has been required high short-term interest rates to keep inflation at moderate level. Given that, the chapter concludes that inflation stabilization in Brazil is still an unfinished process.

**Key words:** Price Indexation, Inflation Inertia, Monetary Policy, *Real Plan*, Inflation Policy

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## 1. Introduction

The literature on contemporary Brazilian economy is converging in pointing out that the success in fighting Brazilian high inflation in the 1980s and 1990s was due to a change in the diagnosis of its cause. Although the inflationary process is multi-causal and, in this sense, Brazil does not differ from other countries, its specificity lies that the introduction of price indexation instruments and contracts were able to increase the feedback effect of inertial inflation, making disinflation costly in terms of increase in unemployment and loss of real output.

The *Real plan*, adopted between 1993 and 1994, during the Itamar Franco administration<sup>1</sup>, was successful in removing the short-term indexation mechanisms and disarming the inflation memory effect through the introduction of an indexed currency in two different phases. The *Real plan* was successful in bringing down annual inflation rates in Brazil from 2,477% in 1993 to 22.4% in 1995 and lower than 10% p.y in the following years (See [www.ipeadata.gov.br](http://www.ipeadata.gov.br) ). However, the plan did not remove all existing indexation mechanisms in the economy since price indexation for periods higher one year were still allowed. The continuing existence of mechanisms of price indexation avoided to restore the *unit of account* function of Brazilian currency, being the main responsible for the resistance of inflation in Brazil to fall below 5% p.y in the long-term<sup>2</sup>.

This chapter aims to review the discussion about price indexation in the Brazilian economy and its effect over the persistence of average long-term inflation at a moderate but still high level over the last two decades. Thus, we begin in section 2 by briefly reviewing the history of inflation in Brazil, as well as the origin of indexation and the role of the *Real Plan*. In section 3, we point to the existence of remaining indexation mechanisms on prices, contracts and wages. In section 4, we carried out two econometric tests to evaluate an explanatory model for inflation in Brazil and to evaluate the evolution of inflationary inertia over time. Finally, in section 5, we bring the conclusion of the chapter.

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<sup>1</sup> Itamar Franco was the vice-president elected in the Presidential elections of 1989. After the impeachment of the President Fernando Collor de Mello on October 2 of 1992, Itamar Franco takes office as the President of Brazil until the end of the mandate of Fernando Collor.

<sup>2</sup> The average inflation in Brazil measured by annual change of IPCA (Índice de Preços ao Consumidor Amplo) was 6.82% p.y in the period 1995-2020.

## **2. Theoretical Discussion about the Main causes of Brazilian Inflation**

### ***2.1. A Briefly Discussion***

The debate around the causes of Brazilian inflation throughout the 1980s and 1990s is complex and difficult to be summarized. However, in the book entitled “Inflation and Recession” (*Inflação e Recessão*), Bresser-Pereira and Nakano (1984) organized the theoretical pillars of the discussion on the causes of inflation in Brazil in the 1980s and some particularities of the relationship between inflation and growth, which will be useful for what will be listed below regarding the unfinished process of de-indexation of the Brazilian economy.

In general terms, the authors present a very peculiar characteristic of the phenomenon of inflation in the Brazilian economy, which is the coexistence of relatively high inflation, compared to developed countries, with a situation of semi-stagnation.

According to the authors, there are three theoretical basis that could explain this characteristic of inflation, namely:

- (a) The Keynesian theory based on the imbalance between demand and aggregate supply at the height of the economic cycle;
- (b) Structural inflation caused by sectoral imbalances between supply and demand;
- (c) Managed inflation, caused by the monopoly power of firms, unions, and the state.

Thus, the inflation policy in Brazil must have at its core the corresponding diagnosis of the causes of the ongoing inflationary process. For sure, it needs to be clear and precise in order to avoid errors in the conduct of economic policy, generating side effects such as: reduced investments, deindustrialization and fall of real output.

Due to the intrinsic causal channels of Brazilian inflation, an inflation control policy with a target inflation at a lower level must know how to identify its remedies:

if inflation comes from demand, the monetary and/or fiscal control of aggregate demand will be the most suitable policy; if inflation is structural, it will be necessary to live with it while taking long-term measures to reduce structural imbalances; if inflation comes from cost or it is managed, the market will be imperfect and, therefore, price controls and income policy will be the natural path. As these causes are not mutually exclusive, a combination of these policies will likely be necessary. Emphasis, however, must always be

given to the main cause of ongoing inflation. (Bresser-Pereira and Nakano, 1984, p.76) [Translated from Portuguese by the authors].

The first and second theories are like the monetarist theory, demand theories that only partially explain the dynamics of Brazilian inflation. Therefore, the only theory that brings new elements that help to explain the persistence of inflation (relatively high compared to developed countries) with semi-stagnation of the economy is the theory of managed inflation. In this sense, economic policies must pay attention to the events that generate managed inflation, which are mainly associated with the remnants of indexation that still exist in the country.

According to the authors, the inflationary process is the result of three mechanisms or factors that act on prices:

(i) *Maintaining or inflationary inertia factors* are those that cause a certain inflation level to be maintained over time. These factors arise from the ability of economic agents to defend their relative share of income through the automatic transfer of costs caused by the increase in inflation to prices, wages, interest and exchange rates, for example, through indexation mechanisms.

(ii) *Inflation accelerating factors* are those that generate wage increases above productivity, profit margin increases, and, in an open economy, real currency devaluation and rising prices for imported inputs;

(iii) *Factors that sanction the rise in inflation* are those that put upward pressure on the accelerating factors of inflation, such as the increase in the public deficit and in the nominal quantity of money, which in an economy close to full employment.

Thus, a policy to fight against inflation in Brazil needs to be aware of the factors that maintain or cause inflationary inertia, which are those that cause the maintenance of the level of inflation, without losing sight of the accelerating and sanctioning factors of inflation.

## ***2.2. The Origin of Indexing in the Brazilian Economy***

The inflationary spiral is not a particular problem from Brazil, although the country has many peculiarities. Its main consequence is that as it accelerates, it raises the social stress regarding the distribution of national income (Bacha, 1987), which, in other words, is equivalent to intensifying the so-called distributive conflict. When we say that Brazil has particularities compared to other countries, the reason is that due the

maintenance of high levels of inflation for a long period of time, between the 60s and 90s, the economy created formal and institutional mechanisms to deal with this social conflict, through the so-called indexation of contracts, wages and prices.

Its origin dates back to 1964, when the so-called Government Economic Action Plan (*Plano de Ação Econômica do Governo - PAEG*) was implemented. In it, the legal institution of inflation indexation of public debt was created, through the Adjustable Treasury Bonds (*Obrigações Reajustáveis do Tesouro – ORTN*). These were government bonds that were issued during a period of high inflation, as a way of maintaining their attractiveness to buyers, since it corrected the amount applied by the past inflation.

At that moment, we marked the beginning of an embryo that, seen as a remedy for public financing in an environment of high inflation, would become a poison for engendering a mechanism that would be spread over other instruments, such as contracts, wages and prices.

### **2.3. The Real Plan**

The literature about the Brazilian economy points out that Brazil became a great laboratory in the 1980s and 1990s for the design of public policies to reduce high inflation. There was a sequence of plans that were not successful in taming high inflation (Cruzeiro, Verão, Bresser, Color I, Color II plans). After years of trying to stabilize inflation at lower levels, we can highlight that there were three achievements that marked the turning point on this trajectory.

The first is in the correct diagnosis that the factor that positively fed back current inflation was the degree of indexation of the Brazilian economy. Thus, one of the first designs of the *Real Plan* was to prohibit the indexation of contracts with maturity of less than one year.

The second was in the design of working with a multiphase stabilization plan, with monetary reform being just a phase, and not necessarily the most important. The objective that stands out here was to organize the expectations of economic agents, who had become accustomed to associating stabilization programs with sudden loss of rights.

The third is in the experiment of creating a single price index (*Unidade Real de Valor – URV*), making agents setting prices in this unit and avoid the repricing process (since this unit of account would be indexed<sup>3</sup>). As the most of economic agents adopted

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<sup>3</sup> In the working paper, Arida (1984) argues that under these conditions, inflation goes to zero for the simple reason that, measured in terms of the indexed currency, the prices of goods and services are constant.

this unit of account then was the time for make it also the means of payment of the economy thus removing the memory of past inflation. The intellectual origin of this idea was in a working paper of Economics Department of PUC/RJ (*Pontifícia Universidade Católica do Rio de Janeiro*) and was known as the Larida proposal<sup>4</sup>.

According to Cunha (2006), “The mechanism would work with the indexation of all contracts by the same price index and for the same time unit, this being the smallest possible. The guarantee of neutrality is given by the conversion of contracts at the average value of the previous period”.

Thus, the foundation of the *Real Plan* was in the Larida proposal. The plan would then consist of eliminating the inflationary memory by linking the total assets and prices of the Brazilian economy to a single index, which was called URV (*Unidade Real de Valor*). As a result, a complete de-indexation with the conversion of all contracts to the new currency, prohibiting the use of any indexation mechanism for contracts with a maturity of less than one year. Thus, a lower limit was created for the contract readjustment period, in an attempt to neutralize the inertial component of inflation.

Despite the success achieved in bringing Brazilian inflation to single digits over the last 25 years, there are remaining forces through contract, wage and price indexation mechanisms that at some specific moments show their ability to generate an inertial and possibly hysteresis effect on the current inflation in the Brazilian economy. Our idea and arguments aim to expose some examples of these mechanisms and point out some econometric evidences of their latent existence.

### **3. The Remaining Indexation Mechanism in the Brazilian Economy.**

#### ***3.1. Indexation Mechanism in the Public Debt***

Although in developed countries there are so-called inflation-linked bonds, these bonds have a modest share in public financing compared to other bonds, especially fixed bonds. In this sense, the majority of public debt is usually financed by fixed-rate bonds with short or medium/long maturity (Bills and Bonds).

The Brazilian case reverses this logic. Due to the long period of high inflation and the creation of mechanisms that would make government financing by public bonds

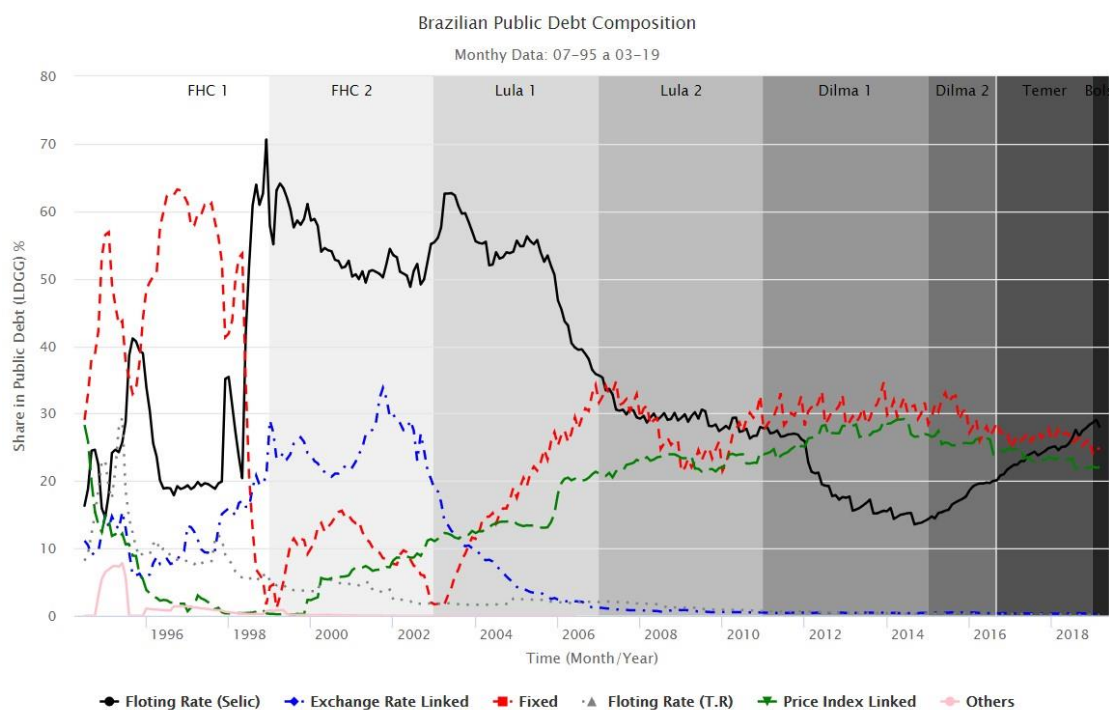
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<sup>4</sup> Nickname attributed by Rudiger Dornbusch to the proposal of the working paper co-authored by Pécio Arida with André Lara Resende in 1984 at an international conference organized by John Williamson. (Arida and Lara Resende, 1984).

viable under these conditions, we have the most common financing of short-term debt (up to 10 years) being floating rate (linked to the basic interest rate – SELIC OVER), called Treasury Financing Bills (*Letras Financeiras do Tesouro – LFT*) and part being Fixed, called National Treasury Bills (*Letras do Tesouro Nacional – LTN*). They are zero coupon Bonds. For intermediate maturity (up to 10 years), with payment of a semiannual coupon, there are the so-called National Treasury Notes – Class F (*Notas do Tesouro Nacional Classe F – NTN-F*). For long maturity (from 5 to 35 years), inflation linked bonds are used, here called National Treasury Notes – Class B (*Notas do Tesouro Nacional Classe B – NTN-B*)<sup>5</sup>.

Regarding the maturity of the Brazilian public debt, over the last 20 years, we can say that most part of the public debt is short-term (about 75% maturing in up to 5 years), the second tranche and a very modest share (about 15% maturing in up to 10 years)<sup>6</sup>. The remainder (up to 10%) matures in a period longer than that. Thus, we have the combination of the following characteristics in Brazilian public financing: it is essentially short term and non-fixed, as can be seen in Figure 1 below.

**Figure 1. Composition of Brazilian Public Debt**



<sup>5</sup> For more details on Brazilian public financing in its historical context and public bond classes, see Silva, Carvalho e Medeiros (2010).

<sup>6</sup> The table is not reported here, but the reader could visualize the data at: [https://www.bcb.gov.br/content/estatisticas/Documents/Tabelas\\_especiais/Cronop.xls](https://www.bcb.gov.br/content/estatisticas/Documents/Tabelas_especiais/Cronop.xls)

Source: Central Bank of Brazil (2021), *Séries Temporais*, available at: <http://www.bcb.gov.br>, accessed on October 25, 2021.

Figure 1 above shows the evolution of the composition of Brazilian public debt between 1995 and 2019. Some points need to be mentioned here: (a) Over the years 2000 to 2007, public bonds linked to the exchange rate were no longer issued; (b) Although between 2000 and 2006, most of the debt was financed by floating-rate bonds, due to the high level of the real basic interest rate, in later years, this space was occupied by the increase in fixed bonds (paying higher interest rate levels); (c) In moments of greater uncertainty, agents migrate from pre-fixed to floating-rate bonds; (d) Long-term debt in Brazil is fully financed through bonds that protect against inflation.

Thus, when Brazil raises its short-term interest rate, it has a direct and instantaneous positive impact over 1/3 of its public debt. The other 2/3 may be positively or negatively impacted by new bonds, depending on the current behavior of the term structure of the interest rate to the change in the short-term interest rate. A positive inflationary shock raises 1/3 of the debt by indexation and the other 1/3 rises due to the short rate adjustment rule by the inflation targeting regime and the other 1/3 is adjusted by rising as a function of the curve itself interest rate.

In relation to previous decades, specifically the 1990s and 00s, there were two other characteristics in the dynamics of public debt that are no longer present. The first is that most of the treasury financing was external, that is, bonds issued abroad in US dollars. This, of course, caused the debt dynamics to have a repricing according to the exchange rate variation. The second feature is that in the share of the domestic debt (issued in local currency) there were the Class C National Treasury Notes (*Notas do Tesouro Nacional – Classe C – NTN-C*), which were bonds linked to the IGP-M. As this index is heavily impacted by the exchange rate (a wholesale price index), even the domestic debt suffered from exchange rate fluctuations and exchange rate volatility.

Thus, Brazilian composition of public debt after the *Real Plan* was initially characterized by indexation to the exchange rate, making those periods of exchange rate crisis to be also periods of debt crisis. This phase was gradually replaced (between 2000 and 2006) as the composition of public debt profile changed. It stopped being mostly foreign (issued in foreign currency) and became mostly domestic (issued in local currency). At the end of this phase, although the link of public debt to the exchange rate



issue was partially addressed<sup>7</sup>, there was still the issue of most of the debt being indexed to inflation rates.

Therefore, the second moment is the one that marks the transition from external debt to internal debt, but with a high share of short-term price-indexed bonds (75% of it maturing in up to 5 years). It is temporally marked starting in 2006 and continuing to the present day (year 2021). In this current phase, Brazil distinguishes itself from other countries because a major share of its public debt is indexed, while other countries have a minor share of public debt indexed (developed and developing countries).

Finally, we argue here that in order for Brazil to regain similar public financing characteristics that exist in a non-inflationary environment, it must gradually replace inflation-linked bonds with fixed bonds at its long term of the interest curve. Parallel to this, it should allow the Central Bank of Brazil to operate at the long term of the curve (buying and selling bonds), so that so that the long interest rate should not be determined only by market clearing conditions, or financial agents' requests.

### ***3.2. Indexation Mechanism in the Contracts***

We previously presented that after the creation of Brazilian public debt indexation mechanisms, an avenue was opened for other indexation mechanisms to emerge, creating readjustment triggers that feed on past inflation provided by some price index.

In this section, we presented some examples of these mechanisms in the following table 1, as remaining forms of indexation in the Brazilian economy. The specific indexation for the minimum wage will be showed with next section, due to its importance and the interesting discussion about how those rules changed over time.

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<sup>7</sup> We use the partial term because despite the reduction in the participation of the external debt in the total debt, the internal debt was still indexed to the IGP-M, a wholesale price index that is strongly influenced by the exchange rate.

**Table 1. Contracts Adjusted by Past Inflation Indexes**

Contract	Indexed by	Price Group
Consumer's Energy Prices	IGP-M or IPCA	Managed Prices
Telecommunication Services Prices	IGP-M or IPCA	Managed Prices
Water Services	IPCA	Managed Prices
Individual Healthcare	80% IVDA, 20% IPCA	Managed Prices
Property Rental Contracts	IGP-M or IPCA	Housing Prices
Ceiling Price of Medicines	IPCA	Managed Prices
Retirements	INPC	Non Price
Real Estate Financing	TR, IPCA	Financial Price

Source: Author's own elaboration.

Table 1 above shows how some contracts are indexed in the Brazilian economy. In the case of consumer energy prices as well as telecommunications services, there is an annual tariff adjustment that can be indexed either by the IGP-M or the IPCA. In the case of water supply services, the readjustment is also annual, and the price is readjusted based on the IPCA. An interesting curiosity is that in 2020, real estate financing contracts became possible to be indexed by the IPCA. Prior to 2020, the only possible index was the TR (*Taxa Referencial*) plus the pre-established interest rate.

The main problem with these indexation rules is that in moments when there is no pressure on the sectorial cost, but there is an increase in any other sectors costs', there is a contamination of prices, increasing the sectorial profit margin, if the revenues remain constant. At times when the sectorial cost grows above the level of the indexed price index, it will have pressure to reduce the sectorial margin and this reflects on the sectorial activity's rate of return, if the revenues remain constant.

The second point that creates a problem is that if we are dealing with an economy in a 'strato-inflation' regime<sup>8</sup>, even in the absence of shocks, due to the indexation mechanism, a shock continues to feedback inflation more than a period ahead, creating the effect inertia. Finally, in the presence of temporary shocks, these dissipate slowly or even do not dissipate incorporating to the series trend, and this, creates difficulties to be solved through the usual instruments of monetary and fiscal policy.

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<sup>8</sup> See footnote 6 for definition of *strato-inflation regime*.

### ***3.3. Indexation Mechanism in the Minimum Wages***

The minimum wage in Brazil was established by the president of Getúlio Vargas on May 1, 1940. The value of this minimum wage should be sufficient to ensure a basic quality of life for a person, that is, enough for the worker to pay housing expenses, food, health, transport, education, clothing, hygiene and leisure.

The evolution of the minimum wage values in Brazil can be divided into eight phases, the first phase corresponding to the period 1940-1945, which instituted the provision that aimed to set a minimum value for the worker's survival. This period showed that periodic adjustments to this minimum would be necessary to maintain its purchasing power. Next, there is the period 1946-1951, characterized by the lowering of wages, which practically reached the lowest real value in its history.

In the following decades, the minimum wage policy gained importance, mainly because the majority of workers received a lower or equal value. From 1952 to 1959, it is noted that this was the period in which real gains were the most significant in the series, given that values increased fourfold. The period 1960-1964 can be considered a complex moment due to the inflation that started to rise, reducing the real earnings of workers.

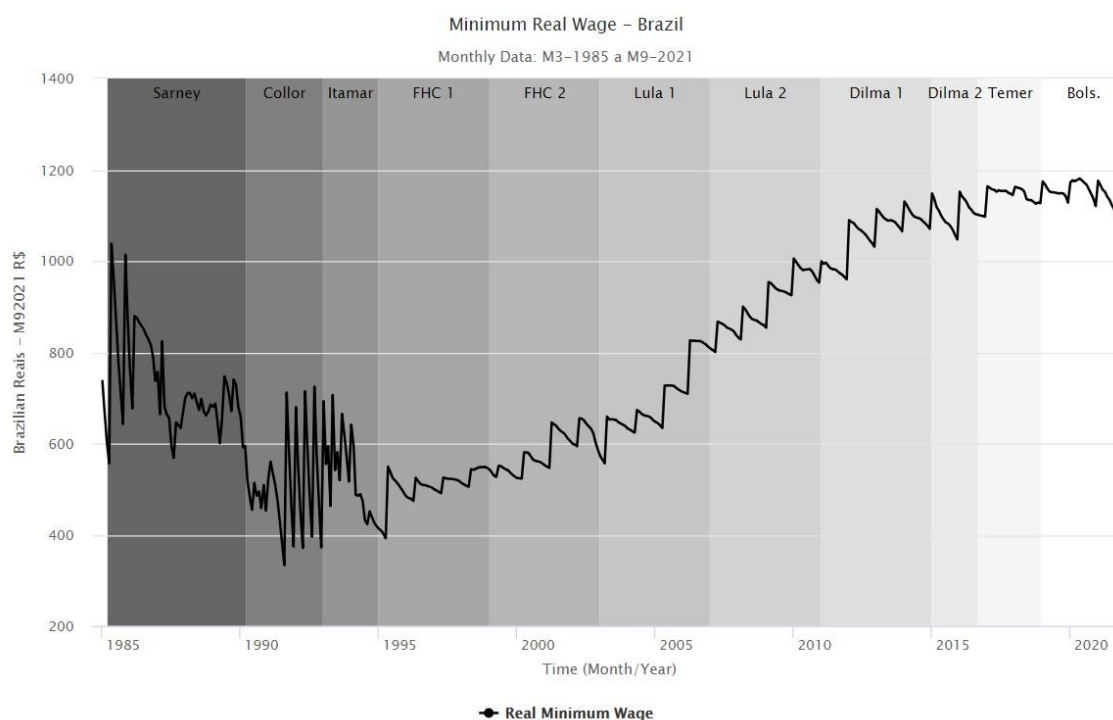
After the military coup in 1964, a policy was adopted to maintain the purchasing power of the minimum wage, but in the initial period there was a strong reduction in its real value due to the loss of bargaining power of unions. Subsequently, from 1976-1982, real wages were maintained with the rules for semiannual readjustments. The minimum wage remained relatively stable, at levels that hovered around R\$ 800, in actual value. Real increases in the minimum wage happened, but only when productivity gains were observed in the economy.

The period of high-inflation<sup>9</sup>, which covers the years 1983-1994, was a complicated phase for the Brazilian economy due to the acceleration of inflation and the failure of economic plans that caused a great erosion of the real minimum wage. Wage triggers were introduced to mitigate the effects of inflation on the value of the minimum wage in real terms, but this mechanism was not successful. Increases were calculated based on expected inflation, which were often underestimated. Thus, in this period, there was a significant drop in the real minimum wage.

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<sup>9</sup> It could also be called "strato-inflation", in the terms of Carvalho (1993) or Jackson, Turner and Winkison (1972) who define that as inflation far from the expected equilibrium of a capitalist regime. Although the term 'hyperinflation' was widely used for high inflation in the Brazilian economy in the 1980s and 1990s, we do not use this nomenclature because the concept of hyperinflation is related to the moment when the currency loses its role as a means of payment, and this has never occurred in the Brazilian case.

**Figure 2. Brazilian Real Minimum Wage**



Source: *Instituto de Pesquisa Econômica Aplicada (IPEA) (2021)*, available at: <http://www.ipeadata.gov.br>, accessed on October 25, 2021.

Although the readjustment rules improved over the following decades and the population's purchasing power increased at those times, it was only after 1994, with the *Real Plan* and the end of hyperinflation, that the minimum wage started to appreciate again, due to several factors, but it is mainly due to the policy of valuing the minimum wage and the favorable economic growth cycle observed in the 2000s.

With the consolidation of democracy in Brazil and the rise of the workers' party (*Partido dos Trabalhadores, PT*) to power, union representations gained strength and began to pressure the government to improve the rules for long-term adjustments of the minimum wage.

In this context, it was implemented a rule that started to drive the readjustment of the minimum wage in Brazil in the following way:

$$\Delta w_t/w_{t-1} = \pi_{t-1} + \max [g_{t-2}, 0] \quad (1),$$

where the calculation of the minimum wage adjustment,  $\Delta w_t/w_{t-1}$ , take into account the inflation of the previous year  $\pi_{t-1}$  plus the result of the growth rate of GDP with two

lags,  $g_{t-2}$ . Note that if GDP growth rate is negative, the value considered for this indicator in the formula is zero.

This calculation was adopted in 2008 and became law in 2011 (law 12,382, of February 25, 2011), but the current model for adjustment of the minimum wage has been applied since 2006. The rules were confirmed in 2011 and 2015, but the actual legislation (Law 13,152, of 2015) only provides for the maintenance of these criteria until 2019. Thus, Senate Bill No. 416, of 2018, is under discussion. The justification for the proposal to ensure a minimum real gain of 1% for the minimum wage every year, in order to ensure that the worker does not lose a real raise in times of crisis. Formally:

$$\Delta w_t/w_{t-1} = \pi_{t-1} + \max [g_{t-2}, 1\%] \quad (2).$$

According to logic of the proposal, it is precisely in times of economic recession that it becomes necessary to increase workers' wages so that there is an increase in aggregate demand through consumption and the economy grows again.

The problem with this proposal is its side effect, namely, the inflation caused by the distributive conflict between firms and unions for a greater share of national income and the effort that the Central Bank had to make in terms of increasing short-term interest rate in order to contain the problem.

Regarding the minimum wage adjustment policy in Brazil, Oreiro (2018, p. 267) defends the use of the *golden rule of wage policy*<sup>10</sup>, which states that wages should grow at a rate equal to the sum of productivity growth in the medium term and the target inflation rate as defined by monetary authorities, as it reduces the distributive conflict and prevents monetary policy from being used to keep this type of inflation (via distributive conflict) under control.

To mathematically demonstrate the consistency of this proposal, the author assumes that firms set their prices based on a fixed mark-up on the short unit of production, so that:

$$\hat{p}_t = \hat{w}_t - \hat{y}_t \quad (3),$$

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<sup>10</sup> See Flassback (2017) about the importance of a *golden rule of wage policy* for macroeconomic stabilization.

where:  $\hat{p}_t$  is the inflation rate;  $\hat{w}_t$  is the wage growth rate; and  $\hat{y}_t$  is the medium-term productivity growth rate.

Unions need to be convinced that wages will follow the golden rule:

$$\hat{w}_t = \hat{p}_t^T + \hat{y}_t \quad (4),$$

where:  $\hat{w}_t$  is the wage growth rate;  $\hat{p}_t^T$  is the inflation target; and  $\hat{y}_t$  is the medium-term productivity growth rate.

Replacing (4) in (3), we have:

$$\hat{p}_t = \hat{p}_t^T \quad (5).$$

In short, the adoption of the golden rule of wage policy and the removal of the current strict indexing rule makes the inflation rate equal to the inflation target set by the government, so that the control of inflation caused by distributive conflict no longer requires the use of monetary policy as a disciplining variable of the tension between the parties.

## 4. Empirical Evidence of Indexation through Inflation Inertia

### 4.1. Data

In this section, we present the data used to generate an econometric model for explaining the current behavior of Brazilian inflation. For the analysis, we used four price index that are widespread and used in the economy, namely the IPCA Free Prices, IPCA Full Prices, IGP-M and IPA. The first two represent consumer price indices while the IGP-M is a mixed index that captures the general behavior of prices, being weighted partly by consumer inflation (30% of the CPI), partly by inflation in civil construction (10% of INCC) and mostly wholesale price inflation (60% of the IPA).

Next, we define the following explanatory variables for the model: the real effective exchange rate of monthly imports; the output gap calculated by using Hodrick–Prescott (HP) and Butterworth (BW) filters in the monthly economic activity index, IBC-BR (calculated by Brazilian Central Bank); the real short-term interest rate (ex post) calculated as nominal Selic-over interest rate deflated by the consumer prices index (IPCA); the average expectation of inflation of agents obtained by the FOCUS bulletin of

the Central Bank of Brazil. All variables are monthly frequency, treated for seasonality through the X-13 ARIMA SEATS.

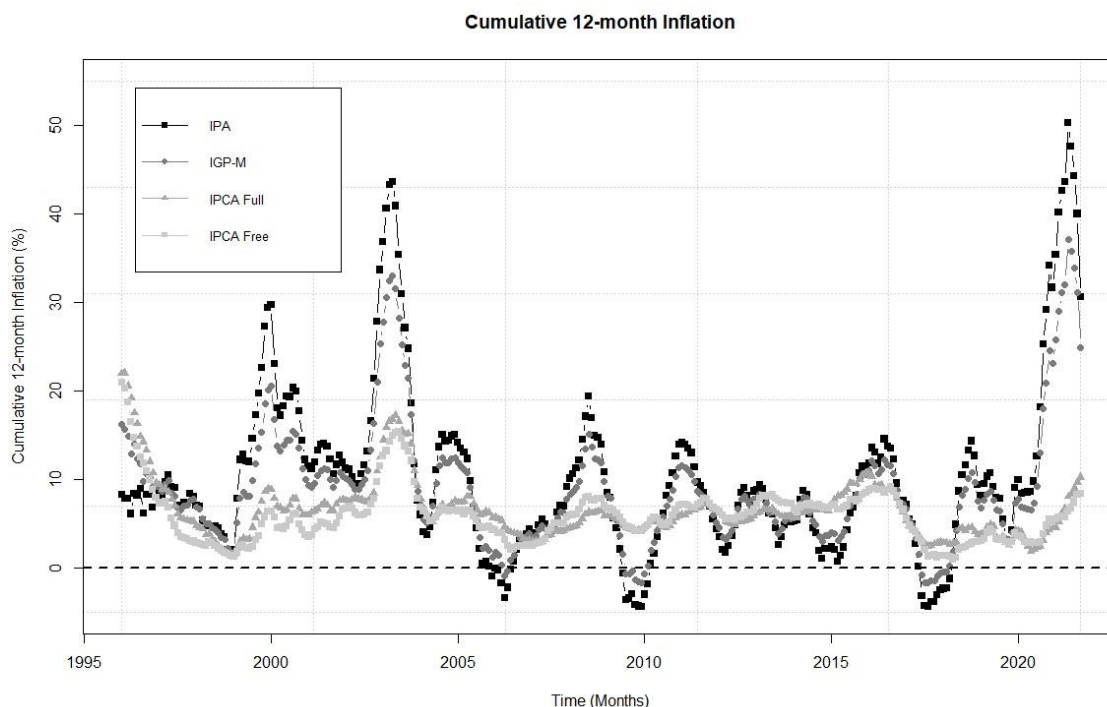
Finally, the direct measurement of the degree of indexation of the economy and its effect on inflationary inertia is not easy to measure. Thus, we will use the autoregressive component of inflation as a measure of the inertial effect and we will use this as a proxy for the discussion about the presence of indexation. The limitation of this methodology is well defined by De Carvalho (2014): The presence of inflationary persistence can be the result of a numerous range of elements. Among them, it is worth highlighting the presence of price rigidity, informational failures, the possibility of indexing contracts, the adoption of a permanently expansionist fiscal policy and, finally, the occurrence of adverse shocks — from the external sector, for example —, which make the exchange rate volatile, causing transitory effects on prices.

#### ***4.1. An econometric model for Inflation in the Brazilian Economy***

The empirical analysis of Brazilian inflation has been investigated in different ways and methods over time. Discussions more focused on policy making have used models with distributed lags (such as VAR, BVAR, SVAR) to capture the temporal effect of a shock on other variables, as well as the sensitivity of a variable to the contemporary effects of another variable and on its lags. Our idea here is simpler than that. We just want to visualize the contemporary effects of the main macroeconomic variables on the following price indices: IPCA free prices, IPCA full prices, IGP-M and IPA. Figure 2 below shows the behavior of inflation accumulated in 12 months of these indices mentioned.

As can be seen in Figure 3 below, the four inflation indices exhibit different pattern of behavior over time. The most volatile are the IPA and IGP-M, the first being a part of the composition of the second index. This volatility is mainly due to two factors: the fluctuation of tradable goods prices and the effect of exchange rate variation, considering that the IPA is a wholesale price index. In the case of IPCA Free, we are talking about a share of goods in the IPCA basket that does not have price control by the government (whether through regulation or another instrument). Both IPCA Free and IPCA Full show similar behavior in terms of variability. These are consumer price indices with less variance than that observed in the wholesale price index.

**Figure 3. Cumulative 12-month Inflation (IPCA Free, IPCA Full, IGP-M, IPA)**



Source: *Instituto de Pesquisa Econômica Aplicada (IPEA)* (2021), available at: <http://www.ipeadata.gov.br>, accessed on October 25, 2021.

The proposed models are estimated using the GMM method and for each model the choice of the set of instruments that generates the possibility of accepting the null hypothesis of the J-test of instrument overidentification (in general, the first, second and third lag of model variables as instruments in the GMM). The choice to use the GMM estimation is due to the possible endogenous relationship between the contemporary variables of the model (such as Inflation Indices and REER, Real Basic Interest Rate, Output GAP and so on)<sup>11</sup>. We used parsimony principle to choose the models and numerous attempts at specification were made trying to find the best fit, considering the economic sense.

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<sup>11</sup> Of course, other econometric forms of estimation would also be possible: (a) ARDL, for example, could be used with the advantage of accepting the use of a simultaneous set of variables  $I(1)$  and  $I(0)$ , but at the cost of not being consistent for endogeneity; (b) VAR, for example, could be used to model distributed lags but we would lose information about the effect of a single lag.



**Table 2. Unit Root Tests**

Variable	Level	
	ADF	PP
IPCA (Free Prices)	-3.88***	-7.31***
IPCA (Full Prices)	-3.48***	-7.53***
IGP-M	-4.58***	-3.77***
IPA	-4.58***	-4.35***
Real Basic Interest Rate (Selic)	-2.085**	-3.20**
Output Gap (Filter BW)	-2.036**	-2.24*
REER (Growth Rate)	-4.77***	-11.14***
Inflation Expectation (CB Focus)	-5.93***	-13.82***

*Notes:*

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

Thus, the series were previously treated for seasonality and deflated. Next, stationarity tests were performed via augmented Dickey–Fuller test (ADF), Phillips-Perron test (PP). All series in level showed stationary behavior with p-value below 0.05 (table 2). In this way, we can use the GMM to estimate without need to deal with the first difference of the series.

**Table 3. Regression Results for Brazilian Inflation Models**  
**Econometric Estimations for Monthly Brazilian Inflation Indexes**

	IPCA (Free Prices)		IPCA (Full)		IGP-M		IPA	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IPCA Free Prices(-1)	0.304*** (0.082)	0.305*** (0.083)						
IPCA Full (-1)			0.288*** (0.060)	0.357* (0.200)				
IGP-M(-1)					0.848*** (0.055)	0.852*** (0.059)		
IPA(-1)							0.806*** (0.053)	0.809*** (0.055)
Real Basic Interest Rate (Selic)	-0.253*** (0.049)	-0.253*** (0.049)	-0.296*** (0.048)	-0.188* (0.113)	-0.127 (0.084)	-0.097 (0.077)	-0.253* (0.150)	-0.196 (0.139)
Output Gap (Filter BW)	0.003 (0.003)	0.003 (0.003)	0.005 (0.006)	0.007 (0.009)	-0.006 (0.006)	-0.005 (0.006)	-0.013 (0.010)	-0.011 (0.010)
REER Growth Rate	-0.013*** (0.004)	-0.013*** (0.004)	-0.009*** (0.003)	-0.020 (0.013)	0.014*** (0.004)	0.009*** (0.003)	0.028*** (0.007)	0.018*** (0.007)
REER Growth Rate (-1)		-0.0001 (0.003)		0.053 (0.056)		0.017*** (0.004)		0.036*** (0.010)
Inflation Expectation (Mean - CB Focus)	0.084*** (0.011)	0.084*** (0.011)	0.098*** (0.009)	0.074*** (0.027)	0.027** (0.011)	0.024** (0.011)	0.045** (0.020)	0.039** (0.018)
J-test	0.805	0.823	3.306	1.106	0.879	0.948	0.581	0.678
J-test (p-value)	0.37	0.364	0.191	0.293	0.348	0.33	0.446	0.41
N	217	217	217	217	217	217	217	217

Notes:

\*\*\*Significant at the 1 percent level.

\*\*Significant at the 5 percent level.

\*Significant at the 10 percent level.

Accordingly, the common specification for the four index was how current inflation is a function of lag inflation, the short-term real interest rate, the output gap (via BW filter), the real effective exchange rate, the growth rate of real output, the 1st rate lag exchange rate growth and agents' average expectations for inflation in the next 12 months, via the Focus bulletin.

The results obtained show that all inflation index have a significant inertial effect, which highlights the presence of indexation as a memory factor for current inflation.

This evidence found in our chapter is in line with results obtained by other methodologies for the Brazilian case, such as: Figueiredo and Marques (2011); Reisen, Cribari-Neto and Jensen (2003). The former used MS-ARFIMA to capture the long-memory component of inflation in Brazil. They found values between 0.72 and 0.82 for the parameters related to the long run inflation memory; The second paper used an ARFIMA model to analyze Brazilian inflation. The result is like the former one. For other countries, there is the paper of Loungani and Swagel (2001) who used the VAR methodology for different levels of data aggregation. The author found that for South American countries, through the variance decomposition, only 9% of the past inflation variance (inertial) can explain the variability of current prices. Therefore, it is suggestive to conclude that the results reported here for the *inflation indices in Brazil have an inertial effect greater than that observed in other countries*.

The effect of the interest rate on current inflation was negative and with strong statistical significance for the IPCA Free Prices and IPCA Full Price indexes. The effect of the Output Gap on current inflation proved to be weak and without significance (it was tested until the third lag and this remained independent of the specification).

Nevertheless, we ran tests using the exchange rate level. However, the exchange rate level is the variable that does not pass all stationarity tests and when specified in the model, it shows low statistical significance. Thus, we use the growth rate of the real exchange rate and its first lag. The idea is that there may be a lag effect in price readjustments given a shock to the REER due to price rigidity via contracts. Another point to mention is: in order not to incur in a relevant variable omission bias, we use a variable that captures the market consensus on the average expectation of future inflation.

Finally, we see that in all models we accept the  $H_0$  of the  $J$  test, showing that the instruments are suitable for the proposed model. Next, we will present the result of the

Rolling Regression (ROL) estimation, to obtain the evolution of the estimation of the inertial parameter for the models in a 5-year moving window.

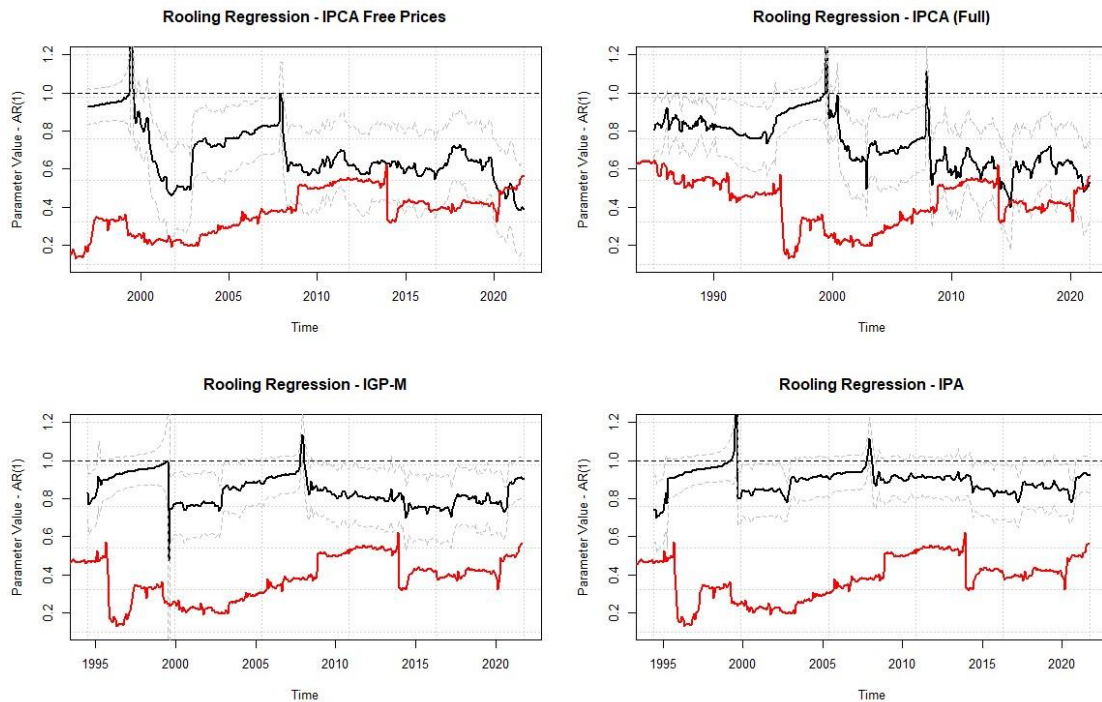
#### ***4.2. The Autoregressive effect in the Brazilian Price's Indexes***

One of the natural questions that arise regarding the impacts of indexation on the inertial effect of inflation in Brazil is how this autoregressive component has evolved over time. It is already well established in the Brazilian economics literature that the *Real Plan* had the main effect of unlocking the degree of indexation of the Brazilian economy and, in consequence, disarming the inertial component of inflation. That said, a second econometric test is carried out here with a view to evaluating the trajectory of this inertial component over time (mainly in the last three decades).

In this sense, the subject of inflationary persistence over time is not unique to Brazil. There are also papers in the literature about inflation dynamics showing that the persistence effect still occurs today in the CPI indices in other countries. The paper of Devpura *et. al* (2021) makes it clear that, using a unit root test with endogenous structural break, Asian countries have the inertial effect of inflation (inflation persistence) still present today.

Thus, we perform tests here comparing the first-order autoregressive effect of inflation indices in Brazil with the first-order autoregressive effect of the US economy CPI. More specifically, we used the Rolling Regression (ROL) technique to estimate the first-order autoregressive component in a 60-month rolling window. It should be noted that their interpretation is that the current estimate represents the average effect of the last 5 years. We plot the upper limit of this component on the Figure 4 as being equal to one. This mark is important because it represents the threshold level above which creates an explosive dynamic (also recognized as a trajectory of explosive inflation).

**Figure 4. Time varying autoregressive - AR (1) - Parameter Estimation by Rolling Regressions.**



Note: The dashed grey line = Confidence Intervals (95%); black line is the AR(1) estimated for the Brazilian price index and the red one is the AR(1) estimated for the US Consumers Price, as a benchmark.

The results for the inflation indices are that despite the period before the *Real Plan* we had an autoregressive component oscillating around 0.8 and 1.0, after the reform we had a drop and, in some moments, a new acceleration. Two obvious points in time are: in the period of the 1999 crisis in emerging countries (which even culminated in the abandonment of the exchange rate band regime and adoption of the inflation targeting regime) and in this period there was a sudden drop in expectations due to the risk of exchange rate crisis, which implied a strong acceleration of inflation. The second point was the American subprime crisis (around 2007/8), which also generated a drop in expectations, a sudden exchange rate depreciation due to the outflow of capital flows and, consequently, an acceleration of inflation.

Still in relation to the previous figure, we used a dark grey line to show the similar estimation for the same period using the American Consumer Price Index (CPI) data, as a benchmark. We can see that although time series like that, by construction, may have autoregressive components, the four Brazilian inflation indices always have a higher level than the one showed by the U.S economy.

Thus, as mentioned above, the increase in the inertial effect does not exactly mean an increase in the degree of indexation of the economy, but the still high degree of indexation of the economy implies a rigidity in the reduction of the inertial effect. The year 2021 is a good example of the case. Due to the Brazilian economic scenario and deteriorating expectations about economic growth, we had a strong currency devaluation. This currency devaluation and the boom in commodity prices accelerated inflation in the wholesale price index (IPA). This rise in wholesale inflation had a major impact over the general price index, IGP-M. It so happens that the value of residential rents in Brazil is readjusted based on the IGP-M. Thus, a shock that impacted the IPA spread to the general price index, IGP-M, and ultimately impacted the consumer price index, IPCA.

However, in times of economic recession, it is common among agents of the Brazilian economy to enter into a compromise between the sides so that the complete transfer of the price adjustment does not occur. This can be seen with what happened with the inflation of residential and commercial rents<sup>12</sup>.

## 5. Final Remarks

Throughout this chapter we analyzed the effects of persistence of price indexation mechanisms over the dynamics of Brazilian inflation after the implementation of *Real Plan*. Although the plan was successful in bringing down inflation rates in Brazil to moderate levels in the first years after its implementation, long-term average inflation showed a remarkable resistance to fall below 5% p.y due to the continuing existence of price indexation for periods higher than one year.

As were showed by our econometric exercises, although the auto-regressive component of Brazilian inflation had fallen after the implementation of *Real Plan*, it remained at high levels compared to the Benchmark case, which is the U.S consumer price index. This result clearly highlights the role of price indexation in the long-term rigidity of inflation in Brazil which makes inflation control by means of monetary policy much more difficult, since it requires very high short-term interest rates to keep inflation at moderate levels in face of the continuous external shocks faced by Brazilian economy in the period 1995-2020<sup>13</sup>. Since Brazil had a very open capital account, high interest rates result in overvaluation of real exchange rate, having as a side effect the *premature*

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<sup>12</sup> <https://www.globalpropertyguide.com/Latin-America/Brazil/Price-History>.

<sup>13</sup> About the high levels of interest rates in Brazil see Oreiro and De Paula (2021, chapter 2).

*deindustrialization* of the Brazilian economy (Oreiro, Martins da Silva and Dávila-Fernandez, 2020; Oreiro, D'Agostini and Gala, 2020).

Since *Real Plan* did not eliminate all price indexation mechanisms in the Brazilian economy and thus restore the unit of account function of Brazilian currency, it can be said the inflation stabilization in Brazil is still an unfinished process.

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