The Broken link between demand and production: Demand leakages in Brazil's 21st-century economic development

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Abstract: This paper evaluates the development strategy behind the PT governments in Brazil by analyzing the interplay between income distribution, consumption patter and the production structure and have showed the country have passed by a process of demand leakages, especially after 2008, that was responsible to break the link between demand and production in the country, link which were detrimental for the long-term sustainability of the model. First, it analyzes several economic policies implemented by the government – including distribution policies – that were responsible for expanding consumption and changing consumption patterns, and analyzed their effects on investment, employment and production. Secondly, it uses input-output methodologies to calculate trade in value added to build an original indicator of demand leakages and used the Inter-Country Input-Output matrixes of OECD to calculate the demand leakages of Brazil to 67 countries, in 14 industries plus the modern services. Descriptive statistics show the sharp increase in demand leakages after 2008, which was predominantly in medium and high technological sectors and mostly to China. Moreover, it shows how domestic and external components of demand contributed to the process of regressive specialization of the country. Finally, the paper builds a panel dataset and uses a dynamic panel data analysis (System GMM) to investigate the determinants of the demand leakages in Brazil. Results suggest that the long-term appreciation of the exchange rate and weak investment dynamics comparatively with competitors were the major determinants of demand leakages in the country. It has been shown that in the period in which the exchange rate was at the beginning of the appreciation cycle and only modestly appreciated, the cumulative causation process between demand expansion and production was reasonably effective – specifically due to the utilization of existing capacity, the timeframe needed for the substitution between imports and domestic goods, and investment opportunities. Nevertheless, the commodity boom and the international financial cycle pushed for a strong and permanent appreciation of the exchange rate – which the government didn't dislike due to its role in controlling inflation – which ultimately generated a stout and durable process of demand leakages that broke the link between demand and production so necessary for the long-term sustainability of the strategy. A discussion about the necessity, the challenge and the political viability of implementing a model that promotes a sustainable interplay between structural change and income distribution ends the paper.

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Introduction:

Brazil's economic development in the 21st century was characterized by a sharp shift from high growth with social inclusion and unprecedented optimism to a deep and prolonged fall, very well captured on the covers of the magazine The Economist that pronounced 'Brazil takes off' in 2009 and 6 years later highlighted 'The crash of a titan'[†]. Indeed, Brazil has grown in the first two Lulas mandates more than twice as much as it had grown in the nineties. More importantly, growth had been accompanied by poverty reduction and social inclusion, which would be a particular case in Brazilian economic history, and which could be interpreted as part of a greater pattern of growth cum-distribution in progressive South America (SA) governments. The optimism soon was over by a considerable reduction in the country's rate of growth and macroeconomic and political turmoil. After the global financial crisis, Brazil had a fantastic performance in 2010 but in the next years the country's growth rate started to fall (growing only 2,35 on average) and from 2015 to 2018 the country was in recession, growing 3.41 percent points on average less than SA countries.

What have been the reasons behind such a sharp switch in the country's economic dynamics? Can this shift be attributed to exogenous factors and changes in economic policies, or it is possible to underline internal inconsistencies in the development strategy and growth dynamics that the country was experiencing? Was the short-lived success of growth cum social inclusion a history condemned to fail from the beginning or there were changes in policies or flawed structures that weaken the model but bring us directions for future policymaking? As much as unquestionably nuanced these questions are, their understanding is crucial in building knowledge and insights for inclusive and sustainable development projects. This paper illustrates the importance of an analysis that comprehends the interconnected layers of structural change, income distribution, and fiscal and external sustainability, particularly, the analyzing the dynamics and interrelations between demand and production.

This paper follows Rugitsky (2017) and Loureiro (2020) to understand the strategy and the growth dynamics of Brazilian development as a cumulative causation process in which government policies of income distribution and demand expansion foster domestic production and employment, which, in turn, would increase wages and subsequently raise demand reinitiating the process. However, the authors argue that the income distribution

[†] Please see the first cover at: The economist (https://www.economist.com/leaders/2009/11/12/brazil-takes-off and the second cover at: https://www.economist.com/finance-and-economics/2015/02/28/the-crash-of-a-titan

resulted in a demand pattern concentrated in a consumption basket that demanded less sophisticated products which demanded low-skill employees and pushed low-skill wages – that combined with an appreciated exchange rate – resulted in a regressive specialization that would jeopardize long-term consistency of the process of growth cum-redistribution. Differently, it will be argued that the regressive structural change was not caused by changes in consumption patterns but by the missing link between demand and production, in other words, by the considerable process of demand leakages – particularly in high technological industries and mostly to China - observed in the country largely after 2008.

It will be shown that in the period in which the exchange rate was at the beginning of the appreciation cycle and only modestly appreciated, the cumulative causation process between demand expansion and production was reasonably effective – specifically due to the utilization of existing capacity, the timeframe needed for the substitution between imports and domestic goods, and investment opportunities. Nevertheless, the commodity boom and the international financial cycle pushed for a strong and permanent appreciation of the exchange rate – which the government didn't dislike due to its role in controlling inflation and because the policymakers didn't believe in its negative effects on the productive structure – which ultimately generated a stout and durable process of demand leakages that broke the link between demand and production so necessary for the long-term sustainability of the strategy.

To corroborate this argument the article follows the tradition of empirical studies that aim to investigate the interaction between income, consumption pattern, and production structure as the influential work of Baumol (1967) and Chenery *et al.* (1986) and, in Brazil, the valuable works of Bonelli and Cunha (1981), Almeida and Guilhoto (2006) and Medeiros (2015), by extending and complexifying the important work of Rugitsky (2017) and Loureiro (2020) and bringing new empirical evidence to the fore. Particularly, this article builds an original indicator that captures Brazil's demand leakages at the industry level from 2000 to 2018. Demand leakages are the share of foreign value-added embodied in domestic demand – both final and intermediary demand. To make a consistent estimation of this indicator in an era of globalization and Global Value Chains (GVCs) which makes traditional trade measures problematic, it is used trade-in-value added techniques by manipulating interregional input-output matrixes from TiVA OECD to estimate Brazilian demand leakages to 67 countries and disaggregated at 17 industries. Descriptive statistics is used to show the start of demand leakages from around 2008, its sectoral heterogeneity, the role of China in accessing the Brazilian market, and to build an original indicator of domestic and foreign contributions to regressive structural change. Later, dynamic GMM econometric methodology is used to investigate the role played by the exchange rate and investment dynamics in determining demand leakages in Brazil.

Apart from this brief introduction, section 2 extends the cumulative causation framework proposed by Rugitsky (2017) and Loureiro (2020) by highlighting the dynamics of two

different subperiods and explaining the role of demand leakages in breaking the cycle of the income distribution, consumption patterns, and structural change. Section 3 presents the methodology for constructing the indicator of Demand Leakage and presents descriptive statistics that corroborate the argument. Section 4 presents the econometric methodology and results from the investigation of the determinants of Demand Leakages in Brazil. Section 5 concludes the paper and presents some policy recommendations.

Section 2 – Development Models in Brazil 21st Century

2.1 Theoretical debate

Bielschowsky (2012, 2014) summarizes the main strategy behind the PT government development model. It became popularly known as social developmentalism[‡] and aimed at dynamically reaching growth with income distribution mainly through the mechanism of mass consumption. The model proposed by Bielschowsky (2012) consisted of three expansion vectors – mass consumption, natural resources, and infrastructure investments – that would be 'turbinated' by technological innovation and strengthening of production linkages. Increases in income distribution would be the main driver of mass consumption that would raise consumption and change consumption patterns that would boost demand, which, in turn, is the main driver of productive private investment that would lift domestic production. This dynamic in private investment would be reinforced by strong domestic and foreign demand for commodities and by the increase of public investments in infrastructure. These three expansion vectors if met with increased production linkages and innovation could generate a virtuous development process.

The author does highlight that for this dynamic to be successful investment must be realized and requires production to catching-up with demand, and despite being aware of the existing leakages (some unavoidable) they were optimists with the results obtained (Bielschowsky, Squeff, and Vasconcelos, 2015). Authors more aligned with Sraffian strands also argued that Brazil was in a sustained dynamics of investment and growth – but highlighting the role played by government expenditure – that only broke down due to a sharp change in economic policy of reducing autonomous demand starting in 2011 and then the sharp shift to fiscal adjustment in 2015 (Serrano and Summa, 2015, 2018).

Alternatively, the main criticism of the model from a heterodox perspective came from structuralist scholars who were arguing the model was not efficient in breaking the process of premature deindustrialization and regressive specialization of the country (Marconi and Rocha, 2012; Nassif and Castilho, 2020a; Nassif *et al.*, 2020). As Brazil has been going through a strong process of deindustrialization since 1980 (Morceiro and Guilhoto, 2023), a

[‡] Bielschowsky does not uses this term, which was used by authors such as (Bastos, 2012; Carneiro, 2012; Biancarelli, 2013)

development model that would not tackle this issue would be condemned to fail. Without structural change, increases in wages would reach a limit, and balance of payment constrain would eventually subdue growth potential. However, the government and the development strategy were not ignoring this issue and several industrial policies have been implemented in the PT government, such as PITCE, PDP, and Plano Brazil Maior. Nevertheless, these industrial policies were not effective in blocking this regressive structural change, be it by its own flaws – such as the lack of consistent conditionalities (Machado, 2022), lack of selectivity (Arbix, 2017), etc.[§] – and/or because it was implemented in a macroeconomic context that hindered its effectiveness (Bresser-Pereira *et al.*, 2016; Bresser-Pereira and Rugitsky, 2018; Nassif, Bresser-Pereira and Feijo, 2018).

Exchange rate appreciation – associated with high-interest rates – has been the main macroeconomic explanation for the premature deindustrialization and regressive specialization process. Although admitted by authors from several lines in heterodox economic thought[**], the New Developmentalism School has been the main proponent of this argument (Bresser-Pereira, 2012, 2020b; Bresser-Pereira, Oreiro and Marconi, 2014; Bresser-Pereira, Araújo and Peres, 2020). The outcome of regressive specialization from an appreciated exchange rate may have different mechanisms (Guzman, Ocampo and Stiglitz, 2017; Demir and Razmi, 2021) but ND scholars normally highlight the fact that currency appreciation reduces margins that hinder competition, especially in tradable non-commodities (that often have lower profit margin compared with sectors in which the country has comparative advantages such as commodities) up to the point of making their investments inviable (Marconi, G. Magacho, *et al.*, 2020; Marconi *et al.*, 2021) and their access to existing demand impractical (Bresser-Pereira, 2014). There is substantive empirical evidence that corroborates this argument both at the world level (Gala, 2008; Rodrik, 2008; Rapetti, Skott, and Razmi, 2012; Razmi, Rapetti, and Skott, 2012; Missio, Araujo, and Jayme, 2017; Caglayan and Demir, 2019)[††] and in Brazil (Bresser-Pereira *et al.*, 2022; Marconi, Porto and Araujo, 2022)[‡‡].

[§] There is extensive literature on the role of Industrial Policies implemented in Brazil in the 21st century: Almeida, Lima-de-Oliveira and Schneider (2014) and Ferraz and Coutinho (2019) analyzed the role played by BNDES, Salerno and Daher (2006) performed a detailed analysis of the PITCE, Guimarães (2021) a great review of the major plans implemented in Brazil and a synthesis of several flaws and fields for improvement, and De Toni (2013) and De Toni (2015) focused its analysis in the institutional arrangements and public-private governance.

[††] There is also some literature, although a minority, that puts this view into question. Ribeiro, McCombie and Lima (2016, 2017) argue that the relationship between the Exchange rate and economic growth is invalidated once the impact of currency depreciation on income distribution is considered. Bottega and Romero (2021) and Magacho, Ribeiro and Rocha (2021) highlight that the relationship between export performance and structural change varies depending on the technological intensity of the sectors and differentiate the role of price and non-price competitiveness.

[‡‡] Baltar, Hiratuka and Lima (2016) shows that there is sectoral heterogeneity in the relationship between investment and the exchange rate in Brazil, arguing not all manufacturing industries are affected by it.

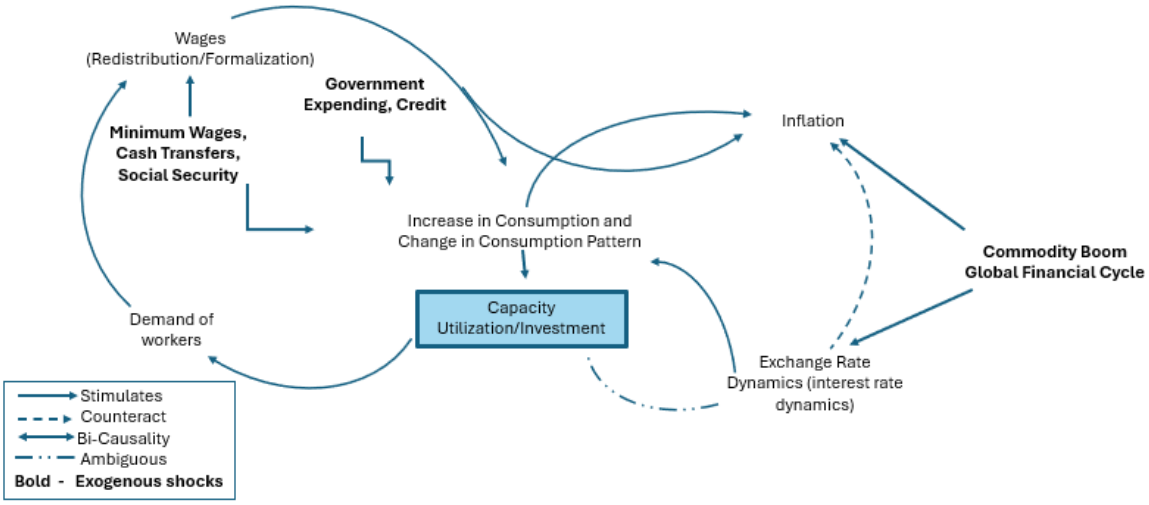
A different standpoint comes from authors such as Carvalho and Rugitsky (2015), Rugitsky (2017), Carvalho (2018), Loureiro (2019), and Brenck and Carvalho (2020) that besides agreeing to the role played by the exchange rate, emphasize that the regressive specialization was a result of growth dynamics initiated by the interplay between income distribution and consumption pattern. Redistribution policies changed consumption patterns in the direction of less complex products and especially services leading to a transformation in the job structure towards low-skills and low-wage jobs, which, in turn, pressures low-skills wages upwards restarting the cycle and promoting a regressive structural change. Rugitsky (2017) called this endogenous process Brazilian 'anti-miracle' contrasting the experience with the growth spurt that took place during Brazilian dictatorship between 1968 and 1973 which was characterized by a growth process cum structural change and income concentration, the so-called "Economic Miracle".

This paper tries to extend and complexify the interpretation proposed by Rugitsky (2017) and Loureiro (2019) by arguing that the development model is better understood by analyzing it in two different subperiods, from 2003 to 2008 and from 2009 to 2014. It will be argued that the regressive structural change was not caused by changes in consumption patterns but by the missing link between demand and production, or, in other words, by the considerable process of demand leakages – particularly in high technologic industries - observed in the country mostly after 2008 that jeopardizes the sustainability of the model proposed by Bielschowsky (2012). Income increases, as discussed by Baumol (1967) and Chenery *et al.* (1986), can lead to a rise in demand for more sophisticated products and complementary goods and services following Engel's law that can shift sectoral investment composition towards sectors with higher technological content, which, in turn, elevates demand for the skilled labor force that can trigger a cumulative causation process of economic growth cum structural change. As it will be argued, this process did not take place in Brazil mainly because of the demand leakages and the broken link between demand and production that arose from it.

The dynamics of the Brazilian growth model in the first period can be seen in Figure 1 below. In this period, the model worked reasonably well as redistribution policies and other governmental policies (credit, public expenditure, BNDES) led consumption to diversify towards a broader basket of goods that included complex products such as electronics, household appliances, vehicles, pharmaceuticals, etc., which indeed generated some spillovers to domestic production, increased investment, capacity utilization, and employment in different skills, which generated necessary income to reinitiate the cycle.

Figure 1: Growth dynamics in Brazil from 2003 to 2008:

(Oreiro, Basilio and Souza, 2014) show that exchange volatility has a negative and significant impact on investment.

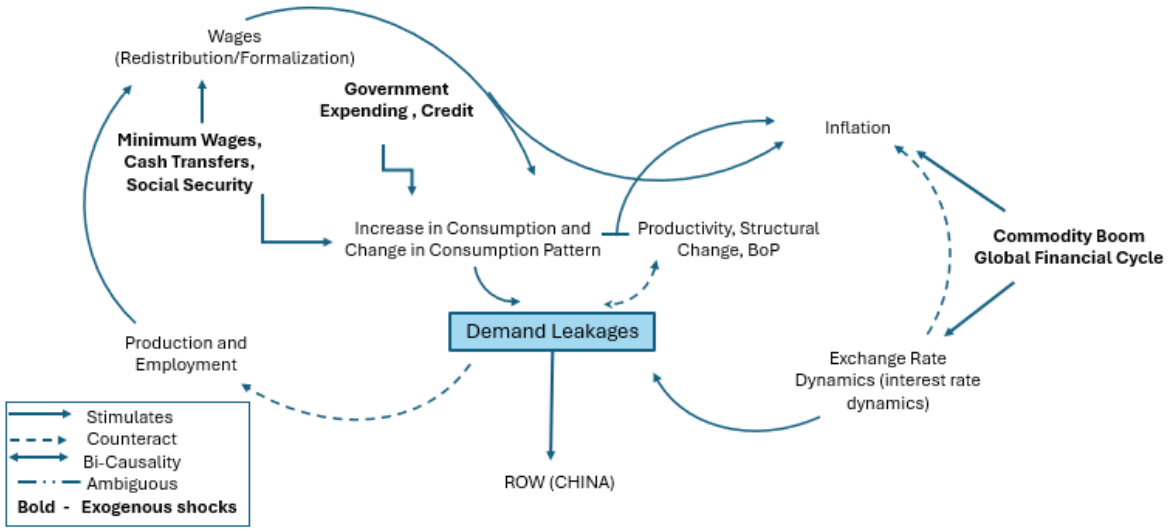


Note: Authors elaboration based on (Loureiro, 2020)

In this period, the Brazilian economy was also being affected by the commodity boom and the global financial bonanza which pushed up commodity prices considerably and raised financial inflows to the country resulting in a process of currency appreciation and accumulation of international reserves. The government overlooked the problem of currency appreciation because it was helping to curb inflation and reinforcing consumption dynamics by increasing income gains (known as exchange rate populism (Bresser-Pereira, 2008, 2021)) and because it was convinced in a strategy of growth with foreign indebtedness (Bresser-Pereira and Nakano, 2003; Bresser-Pereira, Oreiro and Marconi, 2017). In some parts of the first period, the current account was positive but with a declining trend already indicating possible effects of currency appreciation on Brazil's trade competitiveness. Nevertheless, in this short period from 2003 to 2008, production, investment, and employment were growing, and leakages were reasonably controlled[§§], probably because there was underutilized production capacity, because it takes time for the substitution between imported inputs and final goods for domestic production, and because in the short term some currency appreciation may benefit businessman projecting new investment that demanded imported capital goods and technology. However, as currency appreciation became stronger and persistent, leakages started to increase significantly, and the link between demand and production was lost, as represented in Figure 2 below:

Figure 2: Growth dynamics in Brazil from 2009 onwards:

[§§] It is important to note that leakages existed before 2008 and throughout the entire period, but some leakages are expected in an open economy, opened to world trade. Our indicator is quite 'conservative' in the sense that it considers leakages only when the share of domestic value-added embodied in domestic demand is reducing, or in other words, only when more than 50% of new demand has leaked to foreign competitors/countries.



Source: Authors' elaboration based on Loureiro (2020)

Note: ROW = Rest of the World

With the domestic demand and consumption leaking to competing countries, particularly China, the most important link for the sustainability of the model was broken. The trade deficit deteriorated and became permanently negative, which was not a big problem due to huge capital inflows that maintained the balance of payment controlled, and inflation was kept reasonably stable due to exchange rate appreciation that reinforced the sharp fall in the relative prices of tradable non-commodities goods that had been pressured by fierce global competition in manufacturing particularly coming from Asia. However, domestic demand leakage disincentivizes investment and domestic production, and thus, employment and income generation. Since leakages were predominant in high technological sectors, this process also contributed to the long-term problem of premature deindustrialization that the country had been suffering since the 80ts.

The next subsection details the argument put forward above by describing the behavior of the main macroeconomic variables during the periods of interest. A specific section (section 3) will be regarded to analyze the evolution and sectoral characteristics of Demand leakages in Brazil.

2.2 **Income distribution, consumption patterns, and production structure**

2.2.1 Exogenous Shocks

In this subsection, the Brazilian growth dynamics will be analyzed in three different subperiods, from 2003 to 2008, from 2009 to 2014, and from 2015 to 2018, but the analysis here is centered in the first two cycles. The choice has three main reasons: a) demand leakages, despite some sectoral heterogeneity, start around 2008; b) it is compatible with the

economic growth cycles proposed by IBRE-FGV[***]; c) it helps in highlighting a structural shift in demand and growth dynamics observed in data and several studies (Medeiros, Freitas and Passoni, 2019; Braga, 2020). By doing so we extend the works of Rugitsky (2017) and Loureiro (2020) to evaluate the possibility of two different dynamics within Brazilian growth under the PT government, which, in turn, highlight different mechanisms that explain endogenous facets that jeopardized its long-term sustainability.

Let us start by analyzing the exogenous shocks and policy variables during the period to later analyze the endogenous dynamics that it has engendered. Table 1 shows the average annual real growth rate of several policy variables such as Minimum Wage, social transfers (Bolsa Familia), BNDES disbursements, government expenditure, credit[†††], and an exogenous shock such as the commodity price boom.

Table 1: Policy and exogenous shocks

Exogenous Shocks (Average Real Growth Rate)	2003-2008	2009-2014	2015-2018
Minimum Wage (total real variation)	50.1%	25.4%	-1.9%
Bolsa Familia	23.93%	10.68%	-2.80%
Credit	6.33%	-2.34%	-5.21%
BNDES	10.2%	14.8%	-20.2%
Gov Expenditure	6.3%	6.7%	0.3%
All Commodities Price Index	20.0%	1.4%	-3.3%

Sources: Authors elaboration based on various sources. Minimum wages based on IPEA; Dada on *Bolsa Familia* based on dados.gov (https://dados.gov.br/dados/conjuntos-dados/bolsa-familia---mi-social); Credit data from Brazilian Central Bank (BCB); BNDES expenditures data from BNDES; Government Expenditure based on *Observatório de Política Fiscal* from IBRE FGV (https://observatorio-politica-fiscal.ibre.fgv.br/series-historicas/despesas-primarias/despesas-primarias-do-governo-federal-1986-2022); and Commodity Index based on IMF (All commodities price Index - https://data.imf.org).

The two main mechanisms to tackle inequalities and reinsert households into economic life were the sharp increase in the minimum wage (MW) and cash transfers (Bolsa Familia). The first increased by approximately 50% from 2003 to 2008 and about another 25% from 2009 to 2014. The robust rise in the minimum wage has also important implications for the wage dynamics of the bottom deciles of income because it became a wage floor in many segments and pressured wages in the informal and autonomous segment (Medeiros, 2015, p.105). Moreover, MW increases effects beyond the labor market as several social security benefits and state pensions are indexed to it (Orair and Gobetti, 2010). The second, the Bolsa Familia (BP) program, was implemented in 2004 and grew annually at an average rate of

[***] https://ciclo-economico-ibre.fgv.br/

[†††] Even toe credit is not always considered as exogenous, different set of public policies in the period were used to foster credit and the mechanism known as consigned credit (Credito Consignado')

approximately 23% between 2004 and 2008, and another 8% from 2009 to 2014. Both the BF and the MW only reverted its rising tendency after 2015.

Credit has increased yearly by approximately 6% on average between 2003 and 2008 before its fall after the global financial crisis. This robust increase up to 2008 can be attributed to the growth process itself but also from a government policy such as the *Credito Consignado* which is a legal authorization implemented in 2004 that allowed credit with automatic repayments from paycheck and due to reduced credit constraints, that resulted from the process of income distribution itself as well as by the employment formalization of the period (Dos Santos *et al.*, 2012; Carvalho and Rugitsky, 2015; Serrano and Summa, 2015; apud Rugitsky, 2017).

Government expenditure was also expanding, which included an increase in public sector employment and wages. It grew annually by close to 6% on average between 2003 and 2008 and nearly 7% annually between 2009 and 2014. The public sector also increased its role in coordinating the economy through the use of its development bank the BNDES that increase substantially its financing role and increased disbursements at an annual rate of 20% between 2003 and 2008 and another 14.8% between 2009 and 2014, reaching close to 315 billion reais in 2024 (in December of 2023 constant prices). Ferraz and Coutinho (2019) empirically demonstrated how it impacted production capacity and employment generation.

Finally, last but not least, the commodity boom, especially derived from the huge demand for commodities coming from China had several effects in LA countries and Brazil. It represented a sharp increase in demand, thus, pushing up commodity prices – at an annual rate close to 20% between 2003 and 2008 - which benefited immensely commodity and commodity-related sectors by raising sales, margins, and profitability. Moreover, it signified an immense export market and dollar revenues which would indeed alleviate and eliminate the possibility that the balance of payment could constrain economic growth. Together with the commodity boom the global scenario was of huge capital liquidity and financial bonanza in which low interest rates in the advanced world would push investors to search for greater returns in the emerging markets (Ocampo and Arteaga, 2017). Both trends were directly responsible for the huge accumulation of international reserves and for the strong appreciation of the exchange rate – which generated consequences that will be analyzed below.

For now, it is interesting to attain the fact that these exogenous shocks and economic policies pressure altogether in the same direction of increasing consumption. Due to the high propensity to consume out of wages and in lower income deciles, and due to heterogeneous consumption patterns between income groups, income distribution policies such as MW and BP raise consumption and alter consumption patterns. The credit increase would reinforce this trend, especially since a greater amount of this credit expansion was directed to household consumption. Government expenditure expansion by itself represents a demand extension but also indirectly affects consumption by increasing the mass of wages of public

sector employees. Moreover, as companies expand through BNDES financing they increase intermediary and capital goods consumption. A commodity boom increases commodity prices but also appreciates the exchange rate which would make imported products cheaper and, as a consequence, also reinforce consumption. In addition, the relative price of tradable goods was falling sharply compared to non-tradables benefiting the consumption of durables and semi-durable goods.

Not surprisingly, with all these shocks and policies boosting consumption it is reasonable to expect it to be the main driver of economic growth in the period. Table 2 shows the growth rate of GDP, the contribution of different sources of demand[‡‡‡] to the growth rate of GDP, and the apparent consumption by different economic activities. Household consumption represented the main source of demand contributing to the growth rate of GDP. Between 2003 and 2008 it was responsible for almost half of the GDP growth rate, followed by exports, investments, and government expenditures. Between 2009 to 2014 it represented around 70%, followed by investment, government expenditure, and exports, the latter contributing close to zero.

Table 2: GDP and consumption patterns

GDP (Average Real Growth Rate) and the contribution of different sources of demand to the growth rate of GDP	2003-2008	2009-2014	2015-2018
GDP gr South America	5.63	4.15	2.48
GDP gr	**4.20**	**2.80**	**-0.93**
Household Consumption	47.9%	71.4%	-
Gross Fixed Capital Formation	15.3%	21.0%	-
Government Expenditure	11.6%	13.8%	-
Exports	22.4%	1.6%	-
Apparent Consumption (Average Real Growth Rate)			
Durable Goods	11.7%	1.7%	-6.5%
Capital Goods	9.8%	2.1%	-5.6%
Consumer goods	3.7%	1.8%	-2.9%
Intermediary goods	3.6%	1.0%	-3.0%
Semi and nondurable goods	1.6%	1.7%	-1.9%

[‡‡‡] Fevereiro and Passoni (2018) propose a new input-output methodology to estimate contributions to economic growth that take especially care of distortions derived from the increasingly considerable imports of intermediary goods – a character of Globalization and global value chains. As they explain, the standard practice of demand-side growth accounting typically only considers the growth rates of each expenditure component when calculating contributions to growth. This approach fails to recognize that imports are not a demand variable, leading to inaccurate assessments of individual contributions to economic growth. With the rise of global value chains, the majority of imports now consist of intermediate goods that are incorporated into exports or final goods for consumption or investment. However, the increase in import content varies greatly across different final demand components, causing conventional growth accounting methods to potentially produce distorted results and provide misleading information for policy discussions.

Sources: Authors elaboration based on various sources. GDP data from World Development Indicators of the World Bank; The contribution of different sources of demand to the growth rate is based on data calculated by Fevereiro and Passoni (2018) and their original methodology to apply structural decomposition method to growth accounting in Brazil; Data on Apparent consumption from IPEA.

Table 2 also shows the patterns of consumption and consumption expansion in the subperiods analyzed. Contrary to what has been argued by Loureiro (2019)[§§§] demand was not concentrated in typically wage goods such as products and services of low complexity but consisted of a broad expansion in which durable goods – especially electronics, household appliances, vehicles, and with a lesser extent pharmochemical, pharmaceutical and capital goods - increased at the highest rates. The data on apparent consumption[****] is consistent with the Monthly Commercial Survey (PMC, IBGE) and recent studies on consumption patterns (Medeiros, 2015; de Carvalho *et al.*, 2016). Medeiros (2015) describes the evolution of the consumption patterns of the first subperiod quite detailed, arguing: a) the exogenous shocks in income from income redistribution policies fostered the demand for basic and processed food and drinks, Public Utility Industrial Services, transportation, and personal services; b) the increase in production of such basket represented increase in employment, wages and formalization, including in the middle-income brackets, which combined with the complementary economic policies such as credit and government expenditure expansion (including wages and employment) led to a widespread demand among all income brackets for household appliances and electronics. We add that to a lesser extent but still significant was the increase in consumption of vehicles, pharmaceuticals, and capital goods. The consumption level and pattern continued until 2014 but its growth rate was much smoother and after 2015 it started to decrease.

The question that remains is whether this boost in consumption had a considerable impact on investment, production, and employment. Table 3 shows selected indicators of investment, capacity utilization, and employment to illustrate the main argument. Investment has, since the crisis of the 80ts, represented a very small share of GDP, roughly 16% of GDP in 2003. It started to rise in 2004 and from 2004 to 2008 there was a rise of about 8.3% annually on average, reaching 19.4% of GDP (+2.78pp). In 2003, besides investment, capacity utilization was also at a very low level. Transformation industry capacity utilization was 83% (of which the electrical equipment industry was operating at about 78% and the chemical industry at close to 70%) and reached around 88% in 2008.

Besides increasing the utilization capacity there are signals that businessmen also expanded capacity and invested in several sectors from 2003 to 2008, which included many sectors in

[§§§] Loureiro (2019) may have concentrated its analysis on the very first cycle between income distribution, consumption, and employment, in which, demand was concentrated in low-complexity goods and services. However, the evolution of these dynamics and the complementary policies of demand expansion created demand for products and services from all ranges of complexity.

[****] Indicators of apparent consumption of goods by Brazilian industry correspond to domestic industrial production plus imports and minus exports (de Carvalho and Ribeiro, 2015)

which demand had increased the most. The important work of Miguez and Freitas (2021) in building Investment Absorption Matrices for Brazil allows us to analyze investment dynamics disaggregated by economic activity, which shows that the exception from the upward trend in investments in the period from 2003 to 2008 is high-tech industries such as investments in Office Machines, Appliances, and Electronic Equipment, in which investment took some time to materialize, but grew at an annual rate of around 4% between 2006 and 2013 (with only two years of retraction during the global financial crisis, 2008 and 2009), and Investment in the Pharmaceutical industry that started to grow only after 2006. Apart from these activities, most other economic activities had their investment growing in the first period of analysis. Medium-high, medium, and medium-low technological industries grew at an annual real rate of 4.7%, 8%, and 3.1%, respectively, between 2003 and 2008. From the service activities, investment grew mostly in services provided to companies (thus with mixed characteristics, close to 22%), but also grew in modern services and low modern services, around 6.2% annually each. Investments in Health and education, commerce, and construction were the predominant investments in the second period, between 2009 and 2014., growing more than 10% annually, on average. After 2014, apart from the extractive industry, extraction and refining oil, and agriculture, all remaining economic activities reduced their investments. [††††]

Table 3: Investment, Capacity Utilization and Employment

	2003-2008	**2009-2014**	**2015-2018**	
GFCF (Average Real Growth Rate)	6.23	4.2	-5.85	
Industry Capacity Utilization (var p.p.)	4.93	-3.21	1.99	
Share in total employment variation				**Relative Wages**
Agriculture	-3.7%	-18.3%	-3.2%	0.16
Manufacturing - medium-low technology	9.7%	5.7%	-10.2%	0.98
Manufacturing - medium technology	3.4%	2.3%	-8.2%	1.42
Manufacturing - medium-high tech	5.0%	2.7%	-6.5%	2.73
High-tech manufacturing	0.6%	0.4%	-1.1%	3.38
Construction	9.9%	21.5%	-50.7%	0.55
Commerce	15.5%	22.6%	3.8%	0.62

[††††] All this information about sectoral investment is based on data provided by Miguez and Freitas (2021) and can be seen in appendix 1.

Slightly dynamic services	19.5%	3.9%	41.4%	0.44
Modern services	2.5%	5.4%	-3.1%	4.04
Services with mixed characteristics	16.1%	22.7%	17.7%	1.13
Public administration	5.2%	2.4%	-14.7%	3.70
Education and health	14.7%	27.8%	36.2%	1.72

Source: For investment, wages, and employment, IBGE, *Diretoria de Pesquisas, Coordenação de Contas Nacionais* (Table 7, 15.1, 15.2 and 15.3 from back-polled series, and TRU); For capacity Utilization, CNI.
Notes: CNAE according to ISIC - International Standard Industrial Classification. Technologic classification based on OECD classification. Some adjustments were necessary to guarantee consistency over the years: Furniture entered as medium technology manufacturing. Alcohol production enters medium-low technology, Repair and maintenance is medium technology but entered together with machinery and equipment in medium-high technology. Data goes only until 2017.

It is not to say that the country had an incredible performance in terms of investment as it was still less than 20% of GDP, much less than the level observed in high-growing countries from Asia (in which Gross Fixed Capital Formation was close to 30% of GDP in average)[‡‡‡‡]. It is not from one day to the other that we observe investment surges, and the investment level has been kept low for more than 20 years, together with a very weak growth performance since the 80s. Nonetheless, the strategy of growth with foreign indebtedness and the macroeconomic tripod generated implications such as very high-interest rates, currency appreciation, and primary surpluses, which, in one way or another hindered private and public investment projects. In the first period, there were some government initiatives to revert this trend, such as the Growth Acceleration Program (*Programa de Aceleração do Crescimento—PAC*), but it wasn't sufficient to put public investment close to the levels reached before the 80ts and was short-lived as we will see below.

Nevertheless, the increase in utilization capacity and the expansion of investment – even if modest - had effects on the labor market. Employment grew at a rate of approximately 15% on average every year from 2003 to 2008. From that, 47,6% was in sectors that pay above the average wages and the other 52.4% grew in low-wage sectors. Services indeed were the sector that grew the most, and low-dynamic services were responsible for 20% of the total employment growth rate during the period. Services with mixed characteristics – such as services to companies (which include also call centers) – were responsible for 16%. From manufacturing, which contributed to a total of around 20%, half was composed of low-wage jobs in medium-low technologic industries and the other half was distributed in medium (3.4%), medium-high (5%), and high (only 0.6%). It is important to notice that the average

[‡‡‡‡] Calculation based on WDI-WB; countries considered are China, India, Indonesia, Thailand, South Korea, and Malaysia.

growth rate of high-technologic industries and medium-high technological industries was very high, but they represent a very small share of total employment so in absolute terms their weight is very small.

In general, if we bind low dynamic services and low technological manufacturing together, they were indeed the sectors that grew the most, but there were still some rise and linkages to medium, medium-high, and high technologic segments, as well as to services with a mix characteristics and education and health services that pay above the average wages. What these numbers suggest is that at least part of the consumption and demand increase was captured by domestic entrepreneurs. Of course, there were already demand leakages (which are inevitable) but we will show that for manufacturing in general more than half of it was remaining within the country. Moreover, it is interesting to see that the increase in consumption impacted more directly investment compared to employment. In other words, not all the investment expansion in higher technological sectors was translated into better jobs. This may be due to increasing capital intensity and investment focus on technology advancements to increase productivity and/or most probably a result of subordinated integration in the global value chain, in which despite production increases domestically, the skilled tasks remain in the 'parent' countries and headquarters.

In the second period, investment dropped in the crisis of 2009 (-2.1%) but anti-cyclical fiscal policies such as the government housing program MCMV and the Investment support program (PSI-BNDES)[§§§§] boosted investments in 2010, which, grew an incredible 17.9% but was short-lived and from 2011 to 2014 investment growth rate dropped to 2.3% annually and capacity utilization of transformative industry fell 3.21 pp from 2009 to 2014. In 2011 there was a change in strategy in which policymakers tried to boost private investment through subsidies substituting what hitherto was satisfied by public direct investment. This strategy was unsuccessful since reducing costs did not guarantee access to demand and since the multiplier effect of subsidies is smaller than that of public investments, especially in recessions (Orair and Siqueira, 2018).

The worst performance in investment also reflected a worse scenario in terms of employment, but the impact was smoother since subsidies required in return the mantainance of employment. Employment continued to grow, but this time mostly centered on Commerce (22.6%), construction (21.5%), services with mixed characteristics (22.7%), and education and health services (14.7%). Finally, from 2015 to 2018 investments dropped sharply to a negative rate of 5.9% and capacity utilization recovered only partially from the fall of the last period. In this period, employment dynamics started to fall, especially in manufacturing, construction, and public administration.

[§§§§] Some studies argue that PSI program may have generated some anticipation of the investments, but were not enough to guarantee sustained levels of investment (Ellery, Nascimento and Sachsida, 2018).

Besides stimulating consumption, the policies of income distribution, government expenditure, credit, and the commodity cycle had important implications for two macroeconomic variables. Inflation and the exchange rate. As we have argued all these shocks have boosted consumption, and also heated the labor market. Moreover, the increase in the minimum wage had its effect propagated in many segments, particularly in wages of the service sector and low-skill workers. Both effects influence the rate of inflation, which, as we can see in Table 4 below, remained permanently between the inflation target and its superior band. The literature focused on the determinants of inflation in Brazil has focused its studies on inflation in the service sector and in the inflation of the non-durable goods, which indeed are the segments in which inflation grew the most in the three periods combined.

A great part of the debate was centered on investigating whether service inflation consisted of demand or cost-push inflation. On the one hand, the Brazilian Central Bank (BCB, 2011) argued that their study shows pressures from both demand and supply, the latter being explained by productivity increasing much slower than average wages which had been impacted by the rise in minimum wages[*****]. On the other hand, different econometric studies have found that cost-push inflation was the main determinant of inflation in the period (Braga, 2013; Giovannetti and Carvalho, 2015; Summa, 2016). In general, Wage inflation in the service sector and inflation, and commodity prices (increase) in non-durable goods were found to be the main determinants of inflation.

Table 4: Inflation and Exchange Rate Dynamics

	2003-2008	2009-2014	2015-2018
Meta	4.31	4.5	4.5
Meta + Banda Superior	6.71	6.5	6.0
Inflation (Average Growth Rate)	5.84%	5.66%	5.73%
Non-durable goods	5.9%	6.9%	5.3%
Semi-durable goods	7.1%	5.2%	3.1%
Durable goods	2.3%	0.1%	1.3%
Services	6.1%	7.9%	5.5%
Exchange Rate			
Industrial Equilibrium Exchange Rate	2.54	2.92	4.33
Nominal Bilateral Exchange Rate (R$/US$)	2.1	1.98	3.42
Misalignment (%)	-17.2%	32.10%	5.8%

[*****] The work of (Santos *et al.*, 2018) also demonstrate the empirics and theories behind the debate about supply and wage inflation in Brazil during the period.

Note: Authors elaboration based on several sources. Data on Inflation based on Brazilian Central Bank BCB); Data on Exchange rate based on the methodology of CND-FGV (https://eaesp.fgv.br/centros/centro-estudos-novo-desenvolvimentismo/projetos/taxa-cambio-equilibrio-industrial).

From Table 4, it is also interesting to note the sharp fall in the relative prices of durable goods during the entire period, which remained consistently below the target and helped to put inflation below the superior band. The competition coming from Asia and especially China, and the exchange rate appreciation put the burden of tackling inflation on the tradable non-commodity goods, especially the durable segment. Exchange rate appreciation was a result of the commodity boom – by the Dutch disease problem, the huge capital inflows which were reinforced by a policy choice of growing with current account deficits and the necessary high-interest rate necessary to attract foreign capital. Nonetheless, the exchange rate was kept appreciated because the government was using it to control inflation.

Table 4 shows the exchange rate appreciation during the periods analyzed by comparing the nominal observed exchange rate with the nominal exchange rate necessary for industrial entrepreneurs to become competitive – the so-called industrial equilibrium exchange rate (IEER) (Marconi, 2012; Marconi *et al.*, 2021)[†††††]. In the first period, the exchange rate was close to the IEER around 2005 and then started to appreciate and became appreciated on average by around 17% between 2005 to 2008. Between 2009 and 2014 the observed exchange rate appreciation persisted and became appreciated on average by more than 30% compared to the IEER. Hence, it is possible to see that the country passed through a clear long-term appreciation of its exchange rate, which we will show in section 4 helps to explain demand leakages, and which the empirical literature has been showing impact negatively investment and growth. In fact, Bresser-Pereira (2024) asserts that the only condition for the investment rate to be influenced by the exchange rate is that the national currency must be consistently overvalued in the long term. If the exchange rate only fluctuates around the current equilibrium, it becomes irrelevant for investment decisions as entrepreneurs and top managers will only consider the average exchange rate. To make the exchange rate a determinant variable in the process of capital accumulation, it must remain overvalued for an extended period. The exchange rate became persistently and substantially appreciated, reducing competitiveness and profit margins of the industrial sectors, which reduced investments and subdued their potential access to the demand being created – or in other words – caused the initiation of a process of demand leakages that started by around 2008 and remained until 2018.

Demand leakages broke the link between demand and production so necessary for the sustainability of the model proposed by the PT government and defended by many scholars. A great part of the increased consumption, especially in high technological sectors, started to leak to foreign competitors, especially China. Therefore, the elevated consumption stopped

[†††††] For the methodology and estimation please also look at https://eaesp.fgv.br/centros/centro-estudos-novo-desenvolvimentismo/projetos/taxa-cambio-equilibrio-industrial .

to stimulate production, investments, and employment in these sectors – which include modern services that are associated with those high technological industries. In sectors in which the country has some comparative advantage or less comparative disadvantage, such as commodity and medium-low technological industries, respectively, the effect of exchange rate appreciation on competitiveness may be considerably reduced. Exchange rate appreciation has also a very limited impact on non-tradable sectors. Hence, demand leakages also reinforced premature deindustrialization, regressive structural change, and export diversification.

Section 3: Demand leakages in Brazil from 2000 to 2018

Section 3.1: Methodology

Several studies have tried to capture some type of demand leakages in Brazil by using different proxies. Magacho, McCombie, and Guilhoto (2018) extended structural decomposition analysis (SDA) to consider the substitution between domestic and imported inputs. Their study highlights the importance of analyzing the role played by the substitution between domestic and imported inputs and finds that in Brazil there was a substantial increase in imported inputs, especially in highly technological industries. Bielschowsky, Squeff, and Vasconcelos (2015) also analyze the increase in the import coefficient, sounding an alarm by showing how this coefficient was increasing in Brazil during Lula's first two governments. Castilho, Torracca, and de Freitas (2019) also provide an interesting analysis of this problem using different indicators such as the Import Penetration Ratio, import content in intermediary and final production, and foreign value-added content of gross exports. Medeiros, Freitas, and Passoni (2019) analyzed two important indicators - the market share of domestic exports in world exports by industry (export ratio) and the market share of imports in total supply by industry (import ratio) - and showed that there was a significant loss of competitiveness of Brazilian enterprises in domestic and in external markets after the 2008 world crisis. All these important works are already good proxies that indicate some type of leakages even if they do not use this nomenclature.

In this section, we tried to advance and contribute to this literature by proposing a new indicator that explicitly measures total demand leakages of intermediary and final demand to foreign competitors. We calculated it as the share of value-added embodied in domestic demand that is captured by foreign competitors/countries. To calculate such market share in terms of value-added is extremely relevant in the context of the Global Value Chains and production fragmentation in which part of the final production has been generated outside the country, and which distorts traditional trade measures (Los; Timmer; De Vries, 2015, 2016; Timmer; De Vries, 2015). Moreover, it is also useful to account for the rise in trade in final goods at the wholesale level - goods whose production is complete except for marketing and retailing[‡‡‡‡‡] (Milberg and Winkler, 2013) in which the value added by the lead - multinational - firm comes from its design, marketing, retailing, or financial activity.

[‡‡‡‡‡] Milberg and Winkler (2013, p.19) illustrate, for the case of the USA: "These goods are imported by large retailers (Wal-Mart and the Gap, for example) or by so-called "manufacturers without factories" or "fab-less" firms, such as Nike, Calvin Klein, or Fisher-Price, who import goods fully assembled – but containing the lead firm label or package – from a foreign producer or middle man".

We calculated demand leakages in Brazil by modifying the indicator proposed in Chapter 1: the Indicator of Access to Demand. For this chapter, we want to analyze how domestic demand has leakage to outside countries and to investigate to which country and of which industry demand has leakage. To do so, we calculate the inverse of the indicator Access to Domestic Demand, in which now domestic demand means demand from Brazil, captured by domestic producers and/or by producers from 68 countries and in 16 different industries plus modern services (See annex 2 for industry classification and annex 3 for the list of countries).

To build this indicator we applied input-output methodologies in the Interregional Input-Output Matrixes available at the Inter-Country Input-Output Database (ICIO) (OECD, 2023)[§§§§§]. According to Miller & Blair (2009), if we denote by *x_i* the total output of industry *i* of a country, z_{ij} the production of industry *i* that is used as intermediary input for industry *j*, and by *f_i* the total final demand for the product of industry *i*, we can write the equation that represents how each industry *i* of a country distributes its product through sales to other industries and to final demand[******] as:

$$x_i = \sum_{j=1}^{n} z_{ij} + f_i \ (1)$$

The technical coefficient, that indicates the ratio between inputs of industry *i* sold to industry *j* with respect to the total production of industry *i*, would be $a_{ij} = \frac{z_{ij}}{x_j}$ and, therefore, considering all industries, we can, by matrix notation, describe the total production as:

$$X = Ax + f \ (2)$$

where A is the technical coefficient matrix and *f* the column vector of final demand. Alternatively:

$$X = (I - A)^{-1} f \ (3)$$

where $(I - A)^{-1}$ is the leontief matrix.

Sectoral value-added per unit of production (*v*) is:

$$v = \frac{VALU_i}{x_i} \ (4)$$

where *v* is a column vector of the value-added coefficient and $VALU_j$ is the total value-added of a country by an industry.

The countries value-added embodied in the Brazilian demand (Leakages) is:

$$fva\_fb = v^{ID}(I - A)^{-1} F_{Brazil} \ (5)$$

where

$$v^{ID} = (v \odot D) \ (6)$$

D is a dummy diagonalized matrix of ones for the industry *i* of country *p* and zero elsewhere, and $\odot$ denotes element wise multiplication. F_{Brazil} is the column vector of the Brazilian final demand. v^{ID} *is a* matrix of zeros beside the diagonal that is equal to *v* in the dimension

[§§§§§] **http://oe.cd/icio**

[******] Final demand is composed by families' domestic consumption, government domestic consumption, investment, and exports.

representing the industry of country p, fva_fb is a column vector with countries value-added embodied in Brazilian Demand in USD current prices.

We propose to call Demand Leakages the share of value-added embodied in the domestic demand that has leakage abroad, and thus, we need to calculate the total value-added embodied in domestic demand of Brazil:

$$tva\_fb = \sum_{p=1}^{n}[v^{ID}(I - A)^{-1}F_{Brazil}](7)$$

where

n is an index for countries (Brazil included) and tva_fb is a column vector of the total value-added embodied in domestic demand of Brazil, by industry. Thus, by dividing equation 5 by equation 7, we could measure the demand leakages in Brazil (and the domestic demand that has been captured by domestic production), as outlined in equation 8, below:

$$Leakages = fva\_fb \oslash tva\_fb \ (8)$$

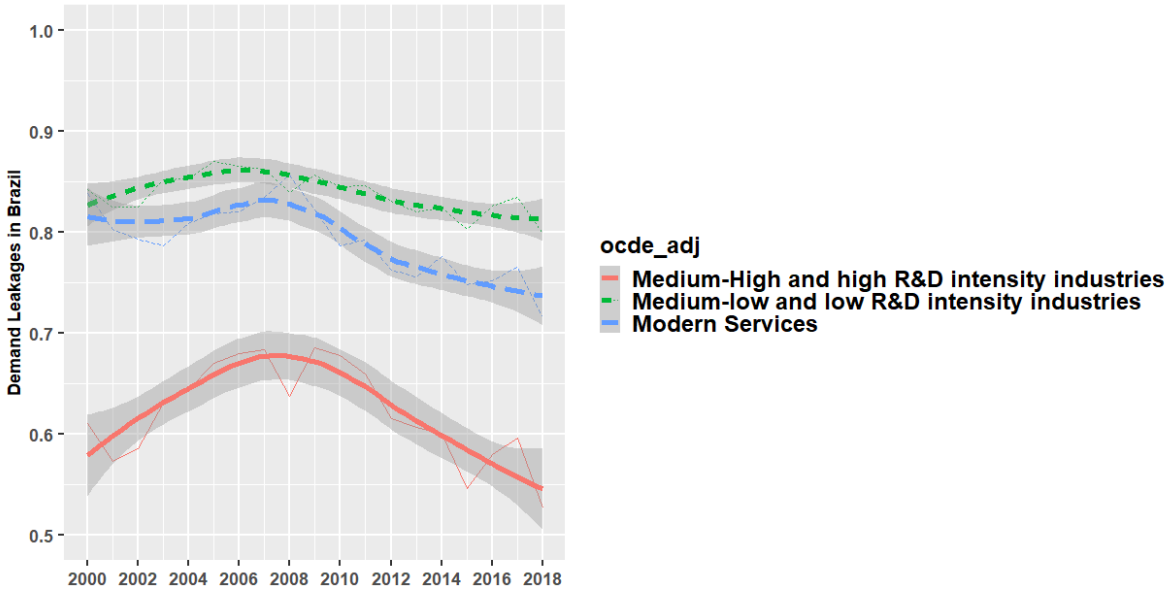
Where $\oslash$ is element-wise division operator and Leakages is a column vector of demand leakages of Brazil to all countries (included itself, thus, in this case, instead of leakages is demand captured at home) by sector. Appendix 3 illustrates how to calculate this indicator in a representative model of 3 countries and 1 industry. The indicator is calculated for 68 countries and 16 industries + modern services. We will analyze demand leakages in steps, first at a more aggregated level, then disaggregating step by step to analyze sectoral heterogeneity and investigate which countries are capturing the demand that has leaked.

Section 3.2: Descriptive Statistics of demand leakage by industry and industry groups

As we have argued in section 2, the development model implemented by the PT government became fragile because of the process of demand leakages that started around 2008, breaking the link between the massive demand – which a wide range of policies and exogenous shocks were stimulating - and domestic production. It is important to note that leakages existed before 2008 and throughout the entire period, but some leakages are expected in an open economy, opened to world trade. In this sense, our indicator is quite 'conservative' in the sense that it considers leakages only when the share of domestic value-added embodied in domestic demand is reducing, or in other words, only when more than 50% of new demand has leaked to foreign competitors/countries. Later, in this section, and as argued in the first chapter 1, it will be shown that differently from countries that benefited the most from globalization and compensated for the domestic leakages by increasing their share of external demand, Brazil lost market share both at the domestic and foreign markets, especially in high-technological sectors. Figure 4 illustrates the evolution of demand leakages in Brazil by industry classification based on R&D intensity. For illustration purposes, we grouped medium and medium-low technological activities and medium-high and high technological activities based on OECD classification (Galindo-Rueda and Verger, 2016). We also included in the analysis tradable services - modern services - which included IT and information

services based on the IMF World Trade in Services database and classification (Loungani *et al.*, 2017). Please see Annex 2 for the detailed classification.

Figure 3: Evolution of Demand Leakages in Brazil by group of activities



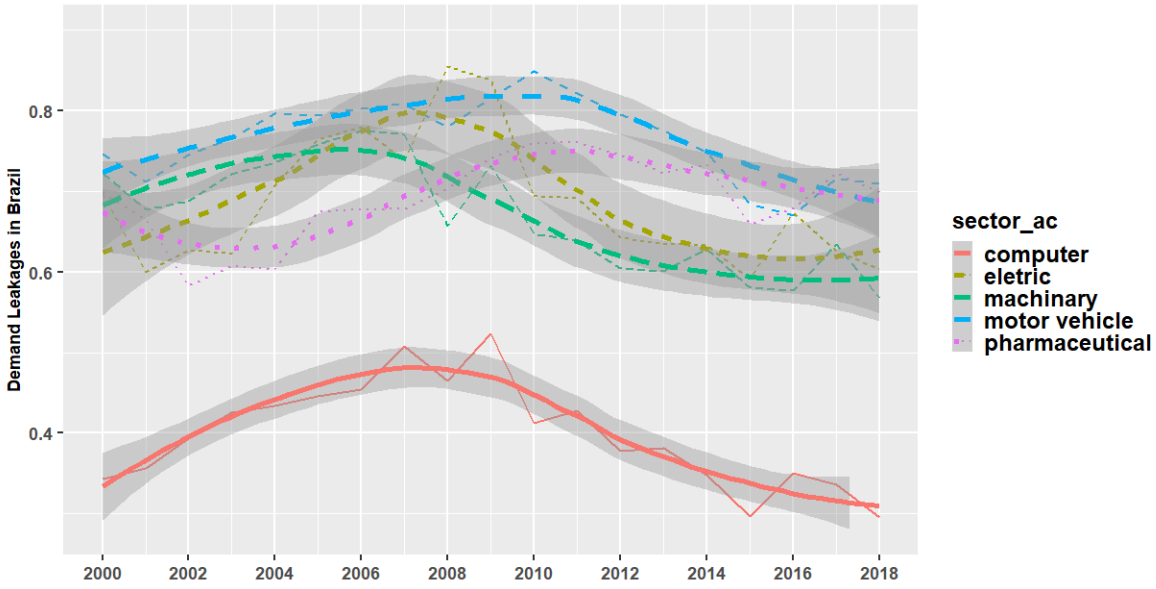
Source: Author's elaboration based on ICIO OECD.

In Figure 3, if the line is increasing means the domestic production is increasing its share in total value added embodied in domestic demand. If the line is decreasing, leakages are becoming stronger to the point in which more than 50% of the new demand is captured from production coming from competing countries. It is clear that around 2008 demand leakages started to rise considerably in all sectors, but more profoundly in medium-high and high technological industries and in modern services. The level of the series also shows how the country is much more exposed to competition in medium-high and high technological industries. Before 2008 greater share of domestic demand had been captured by domestic producers, but the leakages between 2009 and 2018 were intense to the point that in 2018 Brazil's share of its domestic demand was considerably below the level of 2000.

For medium and medium-low technological activities, the small increase in demand leakages after 2008 is mainly pushed by Manufacturing repair and installation of machinery and equipment, Textiles, textile products, leather and footwear, and Other non-metallic mineral products, but the remaining domestic industries maintained or increased their market share from 2000 to 2018. Figure 4 shows a detailed evolution of demand leakages in medium and medium-high technological industries. Two sectors were more resilient to demand leakages: a) Pharmaceuticals, medicinal, chemical, and botanical products, in which leakages started only after 2011 and were modest, probably because of the innovative and effective program 'Parcerias para o Desenvolvimento Produtivo' (PDP) which begun in 2008 and were very important in developing a Health Industrial Complex in the country (Gadelha and Temporão,

2018; Guimarães et al., 2019; Augusto Grabois Gadelha et al., 2021; Fernandes, Gadelha and Maldonado, 2023); b) Motor vehicles trailers and semi-trailers, in which leakages have started to increase mainly after 2011.

Figure 4: Evolution of Demand leakages in medium-high technological industries

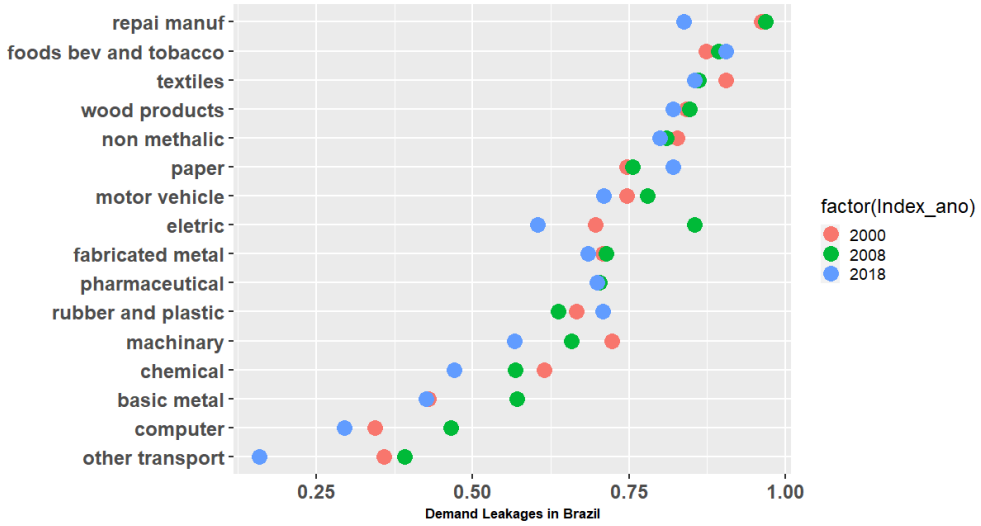


Source: Author's elaboration based on ICIO OECDE.

Note: Computer = Computer electronic and optical equipment; Electric = Electrical equipment; machinery = Machinery and equipment, motor vehicle = Motor vehicles trailers and semi-trailers; pharmaceutical = Pharmaceuticals, medicinal, chemical, and botanical products.

All remaining industries from medium-high and high technological industries passed by a strong process of demand leakages, of which Machinery and equipment started around 2006 and Electrical equipment and Computer electronic and optical equipment started around 2007. These three domestic industries lost around 15% each of their market share of value-added embodied in domestic demand. Figure 5, below, shows the domestic producers' market share of valued-added embodied in domestic demand in three different periods, 2000 (dots in red) - the first year of the database – 2008 (dots in green)- the year of the structural break in demand leakages - and 2018 (dots in blue) – the last year of the database. If the green line is to the left of the red line, there are demand leakages in the industry from 2000 to 2008. Likewise, if the blue line is to the left of the green line, there are demand leakages in the industry from 2008 to 2018.

Figure 5: Domestic producer's market share of value added embodied in domestic demand in 2000, 2008, and 2018



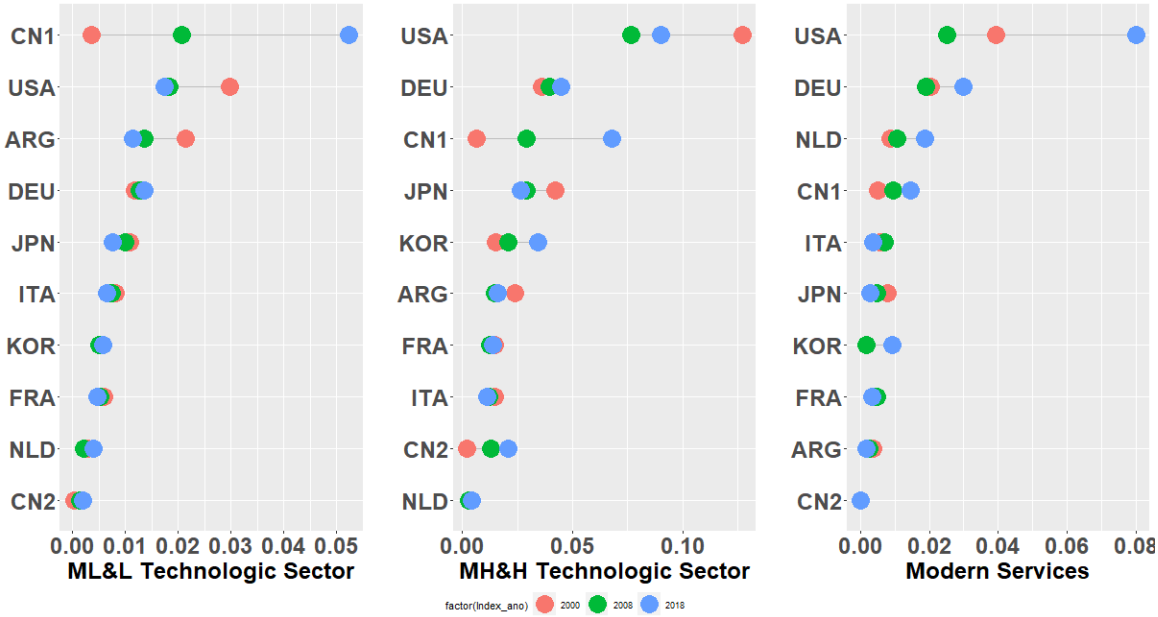
Source: Authors elaboration based on ICIO OECD.
Note: Computer = Computer electronic and optical equipment; Eletric = Electrical equipment; machinery = Machinery and equipment; motor vehicle = Motor vehicles trailers and semi-trailers; pharmaceutical = Pharmaceuticals, medicinal, chemical and botanical products; other transport = Other transport equipment; basic metal = Basic metals; rubber and plastic = Rubber and plastics products; fabricated metal = Fabricated metal products, paper = Paper products and printing; non methalic = Other non-metallic mineral products; wood products = Wood and products of wood and cork; foods bev and tobacco = Food products beverages and tobacco; repai manuf = Manufacturing repair and installation of machinery and equipment; textiles = Textiles textile products leather and footwear; chemical = Chemical and chemical products.

Figure 5 shows that besides Chemical and chemical products, Machinery and equipment, Rubber and plastics products, and textiles, the majority of domestic industries had increased their market share of domestic demand. However, after 2008 demand had leakage considerably, as we can see by the position of the blue dot on the left side of the green dot in most of the industries. The distance between the green and the blue dot indicates that the most affected industries were those with greater technological content. Domestic production of Electrical equipment lost around 25 percent points (p.p.) of market share, Computer electronic and optical equipment lost close to 17 p.p., Other transport equipment lost 23 p.p., Machinery and equipment around 9 p.p., Motor vehicles trailers and semi-trailers around 7 p.p. Etc.

Besides analyzing the demand leakages by industry, it is also crucial to understand which competing countries are accessing domestic demand. There is a great literature on China catching up foreign markets (Torreggiani and Andreoni, 2023), including in Latin America (Gallagher and Porzecanski, 2010; Jenkins, 2010) and Brazil (Barbosa and Mendes, 2006; Jenkins, 2015). Our indicator of demand leakages contributes to shed light on this phenomenon and corroborates the empirical literature showing how domestic production has been substituted by production in China. From 2000 to 2018 China increased its share of Brazilian domestic demand for manufacturing products by close to 6% percentage points, which would represent close to 70% of total leakages. From 2008 to 2018 it captured more than 4 percent points, which would represent more than 40% of total leakages in the period. The only segment China that did not represent the country which absorbed the greater part of the leakages is modern services, which leakages are mostly to the USA, which increased

its share close to 5pp after 2008 and accounted for close to 35% of total leakages in the period from 2000 to 2018. Figure 6, below, shows leakages to selected countries[††††††] comparing three different years 2000, 2008, and 2018. The interpretation is analogous to Figure 5 above, but this time moving to the right-hand side means leakages are increasing.

Figure 6: Leakages to selected countries and technological intensity



Source: Authors' elaboration based on ICIO-OECD.
Note: China is decomposed by all Activities excluding export processing (CN1) and export processing activities/zones (CN2).

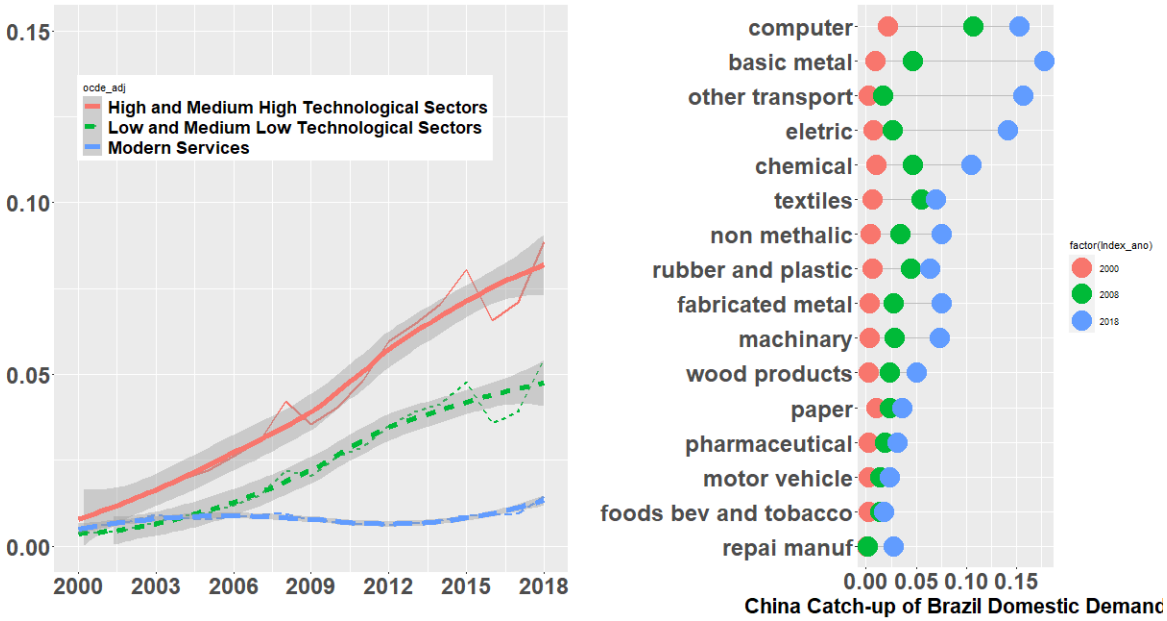
Figure 6 shows how Leakage is predominantly going to China in Manufacturing activities, and to the USA in modern services. The USA had a bad performance in all activities before the global financial crisis, but after 2009 it recovered some market share in High and medium-high technological industries and increased sharply its share in Modern Services. Japan lost market share in all activities, while South Korea gained market share in High and medium-high technological industries and modern services. Argentina lost market share in all activities but mainly in medium and medium-low technological industries. India, which is not in the graphic increased around 2.5% of its market share in modern services, being the second after the USA the country in which more demand has leaked. Germany also increases its market share, but only modestly close to 1pp in High and medium-high technological industries and in Modern services.

Since Figure 6 (above) corroborates the empirical literature on the role played by China, it is important to take a close look into the leakages to this country. Figure 7 below shows the

[††††††] It was selected the main trade (share of exports and imports between Brazil and the country over total exports and imports) partners of Brazil in the period from 2000 to 2018.

evolution of demand leakages by group of activities, and the demand leakages by industry in 2000, 2008, and 2018. The left-hand side graph shows that Leakages to China increased permanently between 2000 and 2018, in both low and medium-low technological industries and High and medium-high technological industries, but more intensively in the latter: (5.03 p.p. and 8.03 p.p., respectively). The inclination of the graph shows also that leakages increased between 2009 and 2014. The right-hand side graph shows that leakages increased in every single industry but with great heterogeneity. Electrical equipment, Other transport equipment Basic metals leakages increased by more than 10 p.p., Chemical and chemical products, Fabricated metal products, Computer electronic and optical equipment, and Machinery and equipment, close to 5 p.p. each.

Figure 7: Demand Leakages to China



Source: Authors elaboration based on ICIO OECD.

Note: Computer = Computer electronic and optical equipment; Eletric = Electrical equipment; machinery = Machinery and equipment; motor vehicle = Motor vehicles trailers and semi-trailers; pharmaceutical = Pharmaceuticals, medicinal, chemical and botanical products; other transport = Other transport equipment; basic metal = Basic metals; rubber and plastic = Rubber and plastics products; fabricated metal = Fabricated metal products, paper = Paper products and printing; non methalic = Other non-metallic mineral products; wood products = Wood and products of wood and cork; foods bev and tobacco = Food products beverages and tobacco; repai manuf = Manufacturing repair and installation of machinery and equipment; textiles = Textiles textile products leather and footwear; chemical = Chemical and chemical products.

In summary, this section has shown that indeed there was considerable demand leakages in Brazil, that this trend was enormously intensified after 2008, and that it was concentrated in medium-high and high technological sectors. Moreover, it has been shown that a great part of this leakage was to China, particularly in the medium-high and high technological sectors but also in medium and medium-low technological sectors, and demand leakages in modern services were mainly to the USA, but also to India, South Korea, Germany, and the

Netherlands. This highlights some possible inconsistencies in the strategy and model proposed by the PT government and economists because important share of the domestic demand that was stimulated by multiple policies and shocks was not absorbed by domestic production. This represents a break in the link between demand and production, between the endogenous cycle of stimulating consumption to stimulate production and employment, which in turn, would generate pressures to raise wages and income that would reinitiate the cycle. Moreover, it has been argued in section two that demand leakages also contributed to a regressive structural change. The next subsection will show the regressive structural change in Brazil using the indicator of demand leakages. Later, the next section econometrically investigates the determinants of demand leakages in Brazil.

Section 3.3: The contributions of Access to demand and Demand Leakages to the Regressive Structural change in Brazil

Structural change literature has emphasized the importance of analyzing and understanding the particular characteristics of each economic activity and industry, in terms of productivity, export elasticity, wages, backward and forward linkages, etc., and more recently, greenhouse gas (GHG) emissions. This line of economic thought was originated by authors from the classical developmental school and structuralist school highlighting the role played by the manufacturing sector as the main engine for development (Rosenstein-Rodan, 1943; Prebisch and Cabañas, 1949; Lewis, 1954; Furtado, 1965; Kaldor, 1966). More recently, it has been expanded and complexified by analyzing the role played by modern services (Evangelista, Lucchese, and Meliciani, 2013; Nordås and Kim, 2013) and great heterogeneity within the manufacturing sectors, which in turn, reinforces the discussion about developing activities with greater technological and productive capacity (Cimoli and Porcile, 2014; Cimoli, Porcili and Pereima, 2018), and to increase the economic complexity of countries economic structure (Hidalgo and Hausmann, 2009; Hausmann and Hidalgo, 2010).

Several important empirical studies corroborate these arguments, and various indicators can address the issue of structural change. A very important indicator of structural change is the reallocation of labor from low to high-productivity sectors (McMillan and Rodrik, 2011; McMillan, Rodrik and Sepulveda, 2017; Diao, McMillan and Rodrik, 2019). Nonetheless, there is important literature that tries to study structural change looking at trade patterns and how countries are inserted in international trade. For example, the post-Keynesian strand, influenced by the structuralist school, analyzes structural change by looking at the income elasticities of demand for exports and imports (Araujo and Lima, 2007), and recent literature on structural change under the scenario of trade globalization and GVCs highlight the role played by vertical specialization (Timmer, Vries and Vries, 2015; Pahl and Timmer, 2019; Timmer and Pahl, 2021). Alternatively, some studies focus on looking at how production and export structures are strongly oriented to goods of low technological sophistication (Nassif and Castilho, 2020b)

We propose to use the indicators developed in this thesis to build a new and original instrument to analyze the impact of demand leakages and access to foreign markets on structural change and product specialization in Brazil. A contribution of market access to the structural change process would mean that medium-high and high technological industries and modern services share in domestic and foreign demand has to grow faster than the share

of medium and low technological industries and commodities. The opposite trend would mean regressive structural change. Access to foreign demand is the share of domestic value added embodied in foreign demand (in the case of Brazil, the share of world demand (discounted the demand of Brazil) that has been captured by Brazilian domestic production). Access to domestic demand (the inverse of demand leakages) is the share of domestic production (in terms of value-added) embodied in total domestic demand. Since trade globalization means opening domestic markets to foreign trade, decreasing Access to Domestic Demand may not be a bad thing if the country can compensate for this loss by increasing market share in foreign markets. That is why we should look at these two trends to understand the performance of a country in terms of structural change.

We will call *domestic_struc_change* the contributions to a structural change of accessing the domestic market, and, *international_struc_change* the contributions to a structural change of accessing the foreign market, formalized as:

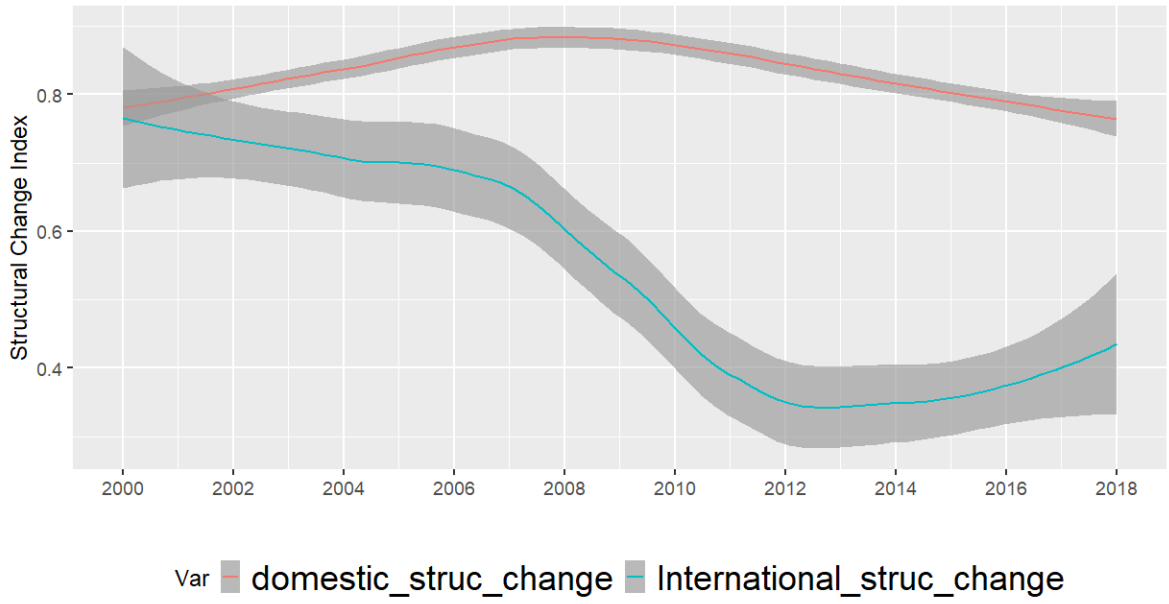
$$\text{domestic\_struc\_change} = \frac{\frac{dva_{MH\&H}{}^{F}{}_{Brazil} + dva_{modenServices\text{-}}{}^{F}{}_{Brazil}}{tva_{MH\&H}{}^{F}{}_{Brazil} + tva_{ModernServices}{}^{F}{}_{Brazil}}}{\frac{dva_{M\&ML}{}^{F}{}_{Brazil} + dva_{commodities\text{-}}{}^{F}{}_{Brazil}}{tva_{MH\&H}{}^{F}{}_{Brazil} + tva_{ModernServices}{}^{F}{}_{Brazil}}} \quad (9)$$

$$\textit{international\_struc\_change} = \frac{\frac{dva_{MH\&H}{}^{F}{}_{World} + dva_{modenServices}{}^{F}{}_{world}}{tva_{MH\&H}{}^{F}{}_{World} + tva_{ModernServices}{}^{F}{}_{World}}}{\frac{dva_{ML\&L}{}^{F}{}_{World} + dva_{commodities\text{-}}{}^{F}{}_{world}}{tva_{MH\&H}{}^{F}{}_{World} + tva_{ModernServices}{}^{F}{}_{World}}} \quad (10)$$

Where *dva* is domestic value-added, tva is total value-added (domestic and foreign), *F* is final demand, *dva_F* is domestic value-added embodied in final demand, and tva_F is total value-added embodied in demand. $MH\&H$ and $M\&ML$ are medium-high and high technological industries and medium and medium-low technological industries, respectively.

In Figure 8 below, the red line represents the 'Domestic structural change', and the green line represents the 'International structural change'. The figure clearly shows a process of regressive structural change, particularly after 2008. Before 2008 regressive structural change was mainly concentrated on how the country was inserted in international trade, with exports highly concentrated in commodities and the context of the commodity boom. Since commodities are mainly directed to external markets, this segment didn't reflect on the 'domestic structural change', which showed a good performance until 2008. Nevertheless, the inclination of the two lines clearly shows that the net effect was negative: The country regressed its productive structure during the period but mainly due to its subordinate insertion in international trade, and not because of domestic dynamics, such as the role played by consumption patterns as argued by Rugitsky (2017) and Loureiro (2019). The stabilization of the green line after 2012 is due to the start of the decrease in commodity prices. Creating the indicator as a ratio solves only partially price changes as it does not solve the problem of relative prices when comparing different economic activities.

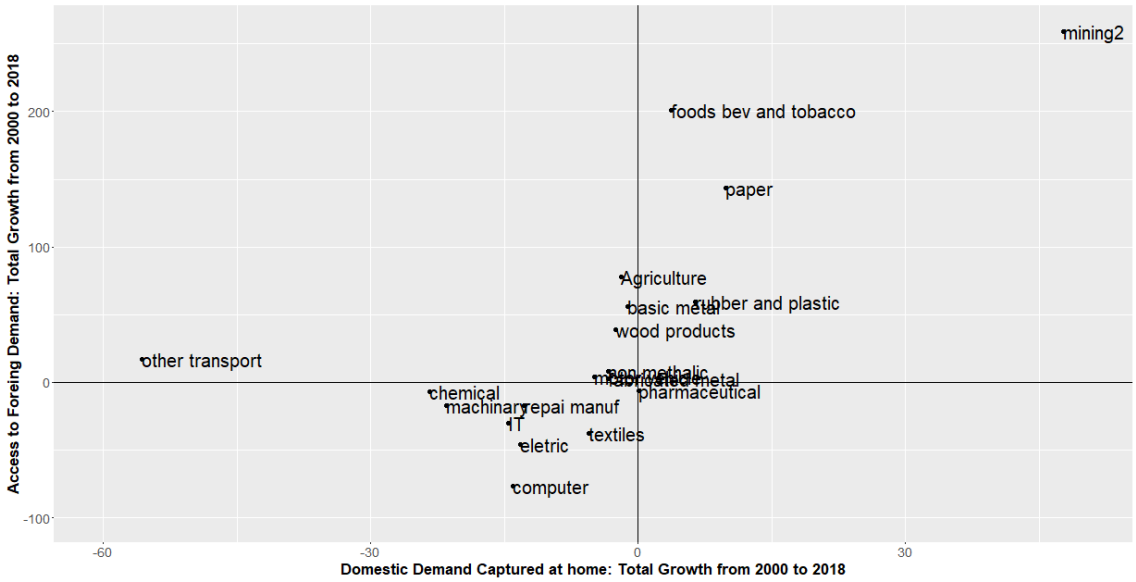
Figure 8: Types of contributions to Regressive Structural change in Brazil



Source: Authors elaboration based on ICIO OECD.

Figure 9 below compares the market share of Brazilian producers – in terms of value-added – in domestic (x-axis) and foreign (y-axis) demand between 2000 and 2018. If the industry is to the left (right) of the vertical line means the industry lost (gained) domestic market share in this period. If the industry is below (above) the horizontal line means the industry lost (gained) foreign market share in this period. The industries that are in the quadrant on the left and in the bottom are the domestic industries that lost market share in both the domestic and foreign markets. These are composed mainly of medium-high and high technological industries such as Computer electronic and optical equipment, Electrical equipment, Machinery and equipment, Chemical and chemical products, Manufacturing repair and installation of machinery and equipment, besides modern services and textiles. The industries that are in the quadrant on the right and at the top are the domestic industries that gain market share in both the domestic and foreign markets. These are composed mainly of mining activities and medium and medium-low technological industries such as Food products beverages and tobacco, Paper products and printing, and Rubber and plastics products.

Figure 9: Types of Regressive Structural change in Brazil by economic activity



Source: Authors elaboration based on ICIO OECD.

Note: Computer = Computer electronic and optical equipment; Eletric = Electrical equipment; machinery = Machinery and equipment; motor vehicle = Motor vehicles trailers and semi-trailers; pharmaceutical = Pharmaceuticals, medicinal, chemical and botanical products; other transport = Other transport equipment; basic metal = Basic metals; rubber and plastic = Rubber and plastics products; fabricated metal = Fabricated metal products, paper = Paper products and printing; non methalic = Other non-metallic mineral products; wood products = Wood and products of wood and cork; foods bev and tobacco = Food products beverages and tobacco; repai manuf = Manufacturing repair and installation of machinery and equipment; textiles = Textiles textile products leather and footwear; chemical = Chemical and chemical products.

Some industries lost some share of domestic demand but more than compensated for this loss by increasing their market share in foreign demand, such as Agriculture activities, Basic metals Wood, and products of wood and cork. Pharmaceuticals, medicinal, chemical, and botanical products maintained their share of domestic demand but lost slightly on external markets. Overall, Figure 9 corroborates existing findings that there is a regressive structural change in process in the country between 2000 to 2018.

Section 4: Determinants of demand leakages in Brazil

We investigate how exchange rate appreciation and sectoral investment affected demand leakages in the Manufacturing Sector in Brazil from 2000 to 2018. We collected data from various sources to build the variables of main interest as well as different control variables to control for possible omitted variable bias and increase robustness. The dataset consists of selected data for the manufacturing sector for 67 countries (see annex below) from regions from 2000 to 2018. The three main variables of interest are demand leakages, our dependent variable, and the exchange rate and investment rate, our explanatory variables.

Demand leakages, as explained in section 3 equation 8, is the share f foreign value-added embodied in the domestic demand of Brazil. $Leakages = fva_{fb} / tva\_fb$ *where* fva_fb

is foreign value-added embodied in the domestic demand of Brazil and tva_fb *is the t*otal (domestic and foreign) value-added embodied in the domestic demand of Brazil.

We use two different indicators to calculate the effect of the exchange rate on demand leakages: The bilateral real exchange rate (rer_b) and the exchange rate depreciation index (underval) developed by Rodrik (2008) that corrects the exchange rate index to the Balassa Samuelson effect[‡‡‡‡‡‡]. We use two different indicators to capture the effects of the exchange rate to increase the robustness of the empirical investigation. The bilateral real exchange rate (rer_b) is calculated by:

$$lnrer\_b\_{ct} = \ln \frac{(\frac{xr_{ct}}{ppp_{ct}})}{(\frac{xr_{Brazil\_t}}{ppp_{Brazil\_t}})} (11)$$

In which xr_{it} is the nominal exchange rate in national currency per US dollar, ppp_{it} is the purchasing power parity conversion factor also expressed in national currency per US dollar, *c* is the country index and *t* is the corresponding year (period). The increase in $lnrer\_b$ means the country is depreciating its currency compared to the Brazilian Real.

As a variable to measure exchange rate Depreciation, we followed the methodology developed by Rodrik (2008), based on data from the Penn World Table 10.0 (Feenstra, Inklaar, and Timmer, 2015) and calculations carried out in the Stata 15.0 software. According to the methodology presented by Rodrik (2008) we first estimate the "real" exchange rate (rer_{ct}) in the natural log using Equation 12:

$$lnrer_{ct} = ln\,(\frac{xr_{ct}}{ppp_{ct}})(12)$$

We then estimate Equation 13 to find the Balassa-Samuelson effect on the real exchange rate. In this equation, $lnrgdpch_{ct}$ corresponds to GDP per capita in natural log, *ft* to the fixed effect for each period and *uct* the regression error term.

$$lnrer_{ct} = \alpha + \beta lnrgdpch_{ct} + f_t + u_{ct}(13)$$

[‡‡‡‡‡‡] Leão (2022) explains this effect quite didactically. The appreciation of the real exchange rate resulting from the stage of economic development of a given economy is an "expected" phenomenon, as postulated by the Balassa-Samuelson effect (Balassa, 1964; Samuelson, 1964). This phenomenon stems from the empirical observation that developed countries - or those with higher incomes - have higher relative labor productivity in the tradable goods sector compared to the non-tradable goods sector than less developed countries, or those with lower incomes (Rapetti, 2016, p.12) . This is because wages in less developed countries are lower and purchasing power parity (PPP) is somewhat valid. In other words, economic growth is expected to appreciate the exchange rate Rodrik 2008. However, the real exchange rate can break away from this trend and remain depreciated or appreciated in relation to the level expected for its economic development, which we can call overdepreciation or overappreciation of the real exchange rate.

To calculate the exchange rate depreciation indicator *(lnunderval*), the result obtained from the values estimated in Equation 12 is subtracted from those obtained in Equation 13, as expressed below:

$$lnunderval_{ct} = lnrer_{ct} - \widehat{lnrer_{ct}} \quad (14)$$

The indicator is centered on zero, but when it is above zero, it means that the real exchange rate is deviating in the direction of exchange rate depreciation, while when it is below zero, the real exchange rate is appreciating.

Finally, to investigate investment effects on demand leakages we follow Dehn (2000), Arestis, González, and Dejuán (2012), and Lee, Syed, and Xueyan (2012) by expressing the investment variable as a ratio of output. As a robustness check, we also ran all the regressions using investment to value-added ratio, and the results remained analogous. The investment was also transformed to a relative index to access how the countries were investing in such industry compared with the same industry in Brazil, ass:

$$lnInvRate\_r = \ln \frac{\left(\frac{InvRate_{c,i,t}}{Output_{c,i,t}}\right)}{\left(\frac{InvRate_{Brazil\_it}}{Output_{Brazil\_it}}\right)} \quad (15)$$

The acronym, variables description, and sources of these 3 main variables of interest as well as the other control variables can be found in Table 5 below: Descriptive statistics can be found in Table 6 below:

Table 5: Data description and sources

Acronym	Variable	Source
Leakages	Foreign Value-Added embodied in Domestic Demand of Brazil, as a share of total value added embodied the Domestic Demand in Brazil (Access to Demand)	ICIO, OECD
Trade_openess	Trade Openness is the sum of industries' exports and imports divided by the total output	ICIO, OECD
InvRate	Is the industry gross fixed capital formation over industry output	ICIO, OECD
GDP_pc_constUSD	Gross Domestic Product per capita at 2015 USD dollars	WDI, WB
gov_educ_gdp	Government Expenditure in Education over Gross Domestic Product	WDI, WB
patent_pop	Patent of residents and non-residents divided by total population	WDI, WB
RER	Real Exchange Rate	pwt
ln_underval	Rodrik (2007) index for exchange rate misalignment.	pwt
rer_stab	Exchange Rate Stability Index	The Trilemma Indexes
i_ifs	Interest Rate (Central Bank Policy Rate)	International Financial Statistics

Source: Authors own elaboration.

Table 6: Descriptive Statistics

	obs	mean	sd	max	min
Leakages	1254	0.01	0.09	0.78	0.00
Trade_openess	1254	1.32	0.72	4.87	0.00
InvRate	1254	0.05	0.04	0.46	0.00
GDP_pc_constUSD	1235	23977.32	21533.28	112417.88	318.01
gov_educ_gdp	1071	4.75	1.37	8.56	0.85
patent_pop	1254	0.00	0.00	0.00	0.00
RER_b	1254	1.96	1.08	7.11	0.55
ln_underval	1254	-0.04	0.34	0.93	-0.87
rer_stab	893	0.58	0.32	1.00	0.05
i_ifs	638	4.53	8.88	183.20	0.05

Source: Authors own elaboration.

The effort to build a rich dataset that captures the relationship between Brazil and each trading partner, for a considerable time frame helps to perform robust econometric estimations as panel data analyses offer several advantages by allowing the use of a wider

sample of information, thereby increasing the variability and degrees of freedom of the model, and reducing collinearity between the variables, thus, thus improving the quality of parameter estimation (Baltagi, 1995). Econometric methodologies for panel data are also very suitable for dealing with models that suffer from simultaneity bias, as in the case of the investigation we are performing. Demand Leakages may be contemporaneously correlated with the exchange rate. The exchange rate impacts the capacity of countries to capture demand abroad, but the latter also explicitly affects bilateral real exchange rates as leakages mean inflow and outflows of US dollars which directly influence the exchange rate. Moreover, demand leakages may be quite persistent, meaning that demand leakage today is influenced by its past values. Therefore, including an autoregressive term may improve estimations considerably.

Hence, the dynamic panel data methodology is then very suitable for investigating the relationships behind our model. We use a Generalized Method of Moments (GMM) dynamic panel data model, developed by (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). The advantages of using panel data methodology, which combines cross-section data and time series, are: (a) as we have argued above, dynamic panel models allow series to be related to each other by controlling the potential endogeneity of all variables in the model, in addition to taking into account the persistence of the dependent variable over time; b) exploring the temporal relationship and adjustment dynamics between the explanatory variables and the dependent variable, in addition to other effects not detectable in purely cross-section or time series data. (c) controlling for unobservable specific individual effects that affect the dependent variable and that are potentially correlated with the explanatory variables, which could generate biased estimates.

Hence, we use the following model specification to perform our econometric investigation:

$$leakages_{i,t} = \delta_i + leakages_{i,t-1} + rer_{b_{i,t}} + invRate_{s,i,t} + Macro\_Controls_{i,t} + \varepsilon_{i,t} \quad (16)$$

Where *leakages*, *rer_b*, *invRate,* and Macro level controls – estimated at the country level – (Macro_countrols) are known from Table 5. ε is the idiosyncratic error term. The subscripts i and t refer to the countries and the period, respectively. We also add time dummies — for simplicity, not presented in the equations and the results — to control for global conditions that vary over time and affect the performance of sectors in the different countries in the sample – and because time dummies make the assumption of no correlation across individuals in the idiosyncratic disturbances, key for the autocorrelation test and the estimates of the standard errors, more likely to hold (Roodman, 2009).

We also added other variables as controls, to reinforce the role of our explanatory variables and to avoid omitted variables biases. That includes:

a) Trade_openess capturing countries' relations and integration in international trade, which is expected to have a positive sign since countries more open to trade would be more prepared to absorb foreign demand such as the domestic demand of Brazil.

b) GDP per capita to account for countries' development stage and productivity differentials, which is expected to be positive since increasing productivity and climbing the development stage would mean becoming more competitive.

c) Expenditure on education, which is expected to have a positive sign as a more educated workforce and population is supposed to generate productivity and innovative gains.

d) exchange rate stabilization which captures uncertainty problems related to the exchange rate which became very volatile in the context of financial globalization. We expect it to have a positive sign as increasing stabilization (reducing) volatility reduces uncertainty and the costs related to it, thus increasing competitivity and the formation of more precise expectations.

e) Interest Rate (Central Bank policy rate) is the variable used to capture the user cost of countries. Increases in the interest rate can reduce investment either by increasing the financial investment opportunity cost comparatively with real investments, or by diminishing retained profits and internal funds. In turn, this would reduce production and technological capability, and, as a consequence, competitiveness. This might be particularly important for developing countries for whom maintaining the interest rate substantially superior to the international rate became a common characteristic of the financial deepening of developing countries, resulting in growth through foreign indebtedness and an appreciated exchange rate (Bresser-Pereira, 2020b; Bresser-Pereira, Araújo and Costa Peres, 2020). We expected that this variable would show a small but negative and significant sign in demand leakages.

g) Patents divided to the total population, it’s a common proxy used to capture countries' productive and technological capacity and competitiveness (Fagerberg, 1988; Amable and Verspagen, 1995; Lee, 2024), which, in turn, would reinforce capacity to adapt to changes in demand patterns (Palma, 2009).

Tables 7 show the results of the dynamic panel model which included our first indicator of the exchange rate (lnrer_b) and Table 8 shows the results of the dynamic panel model which included our second indicator of the exchange rate (lnunderval). To assess robustness, we also perform the same models using a different methodology; the difference GMM estimator, and results remained analogous (see Annex 5 and 6). All variables are in natural logarithm so can be interpreted as elasticities.

Table 7: The role of Bilateral Real Exchange rate and Investment rate in determining demand leakages

VARIABLES	(1) demand_ leakages	(2) demand_ leakages	(3) demand_ leakages	(4) demand_ leakages	(5) demand_ leakages	(6) demand_ leakages
L.demand_leakages	0.721***	0.650***	0.841***	0.512**	0.875***	0.662***
	(0.073)	(0.105)	(0.112)	(0.256)	(0.049)	(0.207)
lnRER_b	1.061***	1.473***	0.949*	2.909*	0.610**	1.462*
	(0.397)	(0.481)	(0.577)	(1.651)	(0.273)	(0.828)
lnInvRate_r	0.376**	0.331*	0.356**	1.132**	0.198***	0.602*
	(0.167)	(0.193)	(0.163)	(0.562)	(0.066)	(0.345)
lnGDP_pc_constUSD	0.431**	0.652***	0.339	1.016	0.184*	0.680
	(0.178)	(0.237)	(0.247)	(0.728)	(0.110)	(0.511)
lngov_educ_gdp	0.269	0.376	0.042	0.351	0.107	0.272
	(0.268)	(0.291)	(0.389)	(0.868)	(0.139)	(0.556)
lnTrade_openess		-0.316				-0.542
		(0.250)				(0.542)
lnrer_stab			0.139			-0.094
			(0.138)			(0.241)
lni_ifs				0.013		-0.040
				(0.131)		(0.092)
L2.lnpatpop					0.006	-0.120
					(0.037)	(0.131)
Constant	0.000	-9.302***	0.000	0.000	0.000	0.000
	(0.000)	(2.979)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,010	1,010	759	527	892	391
Number of Country	64	64	47	41	63	35
AR(1)	0.00154	0.00227	0.00445	0.0364	0.00317	0.0308
AR(2)	0.281	0.345	0.452	0.330	0.536	0.291
Hansen	0.0929	0.179	0.103	0.574	0.152	0.306

Note: a) standard errors robust to the Windmeijer (2005) heteroscedasticity correction were reported in parentheses (*** p<0.01, ** p<0.05, * p<0.1); b) the instruments were collapsed to limit their number (Roodman, 2009); c) the lagged dependent variable and the lags of Relative Real Exchange Rate (in Table 7) and lnunderval index (in Table 8) serve as instruments for the endogenous variables in both the System and difference GMM approaches; d) Besides including time dummies in the estimations, as explained above, time dummies and the other control variables are included in the model as instrumental variables (IVs).

Table 8: The role of currency Depreciation (Underval) and Investment rate in determining demand leakages

VARIABLES	(1) demand_ leakages	(2) demand_ leakages	(3) demand_ leakages	(4) demand_ leakages	(5) demand_ leakages	(6) demand_ leakages
L.demand_leakages	0.816***	0.713***	0.910***	0.793***	0.799***	0.693***
	(0.052)	(0.106)	(0.046)	(0.117)	(0.069)	(0.166)
ln_underval	0.447**	0.725**	0.641**	1.290**	0.572*	0.995
	(0.223)	(0.314)	(0.250)	(0.573)	(0.337)	(0.615)
lnInvRate_r	0.205**	0.283	0.180*	0.536*	0.231**	0.545*
	(0.103)	(0.178)	(0.097)	(0.283)	(0.114)	(0.312)
lnGDP_pc_constUSD	0.091	0.210*	0.074	0.247	0.039	0.314
	(0.064)	(0.122)	(0.087)	(0.191)	(0.105)	(0.331)
lngov_educ_gdp	0.111	0.224	0.098	0.001	0.023	0.281
	(0.219)	(0.199)	(0.209)	(0.332)	(0.218)	(0.482)
lnTrade_openess		-0.236				-0.675
		(0.157)				(0.541)
lnrer_stab			0.099			-0.078
			(0.094)			(0.238)
lni_ifs				-0.015		-0.044
				(0.041)		(0.089)
L2.lnpatpop					0.059	-0.098
					(0.063)	(0.112)
Constant	0.000	0.000	0.000	-1.701	0.000	0.000
	(0.000)	(0.000)	(0.000)	(1.542)	(0.000)	(0.000)
Observations	1,024	1,024	759	530	906	391
Number of Country	65	65	47	42	64	35
AR(1)	0.00124	0.00229	0.00363	0.00338	0.00382	0.0134
AR(2)	0.240	0.269	0.470	0.589	0.508	0.418
Hansen	0.0992	0.111	0.141	0.294	0.337	0.295

Note: a) standard errors robust to the Windmeijer (2005) heteroscedasticity correction were reported in parentheses (*** p<0.01, ** p<0.05, * p<0.1); b) the instruments were collapsed to limit their number (Roodman, 2009); c) the lagged dependent variable and the lags of Relative Real Exchange Rate (in Table 7) and lnunderval index (in Table 8) serve as instruments for the endogenous variables in both the System and difference GMM approaches; d) Besides including time dummies in the estimations, as explained above, time dummies and the other control variables are included in the model as instrumental variables (IVs).

Results show that exchange rate depreciation (appreciation) positively and significantly impacts demand access (leakages). If Brazil had an appreciated currency compared with the competing country, leakages increased. This result remained akin to different specifications, different econometric methodologies, and different proxies for currency appreciation (depreciation). According to the estimations (On average, from models 1 to 6 of Table 7), a 10% appreciation of the Brazilian currency compared to the competing country generates a leakage of 1.35 p.p., other things remaining constant. Likewise, according to the estimations (On average, from models 1 to 6 of Table 8), a 10% depreciation of the exchange rate of the competing country measured by the *underval* index increases the capacity to capture demand in Brazil by 1.5 p.p. The sizes of the coefficients are quite substantial as Brazil passed by a cycle of over-appreciation in which – according to the calculus of CND-FGV presented in table 4 - from 2005 to 2008 the currency remained on average 17% overvalued, from 2009 to 2014 close to 32% overvalued, and from 2015 to 2018 around 6%. The sign of the coefficient varied a little probably because of the loss in the number of observations depending on the control variables used.

Likewise, the variable capturing relative investments – if the competing country was investing more or less in the manufacturing sector compared to Brazil – also showed to be relevant (positive and significant) in explaining demand leakages. According to the estimations (On average, from models 1 to 6 of Table 7), investing 10% more than Brazilian producers generated on average a capture (leakage) of close to .5 p.p. of the domestic market for manufacturing in Brazil, other things remaining constant. This is also substantial as it is well recorded that our most important trade partner – China - invests considerably more than Brazil. For example, from 2003 to 2018 Investment as a share of GDP in China was twice as more than Brazil (China invests around 41% of GDP on average every year, and Brazil around 18% of GDP).

From the control variables, the only variable that remained consistently significant was GDP per capita, which presented a positive coefficient, as expected. The more the country is developed and productive, the more it is prepared to capture demand abroad and compete in the international market. Alternatively, less developed countries normally find it difficult to access foreign markets under extreme competition. The Exchange Rate Stabilization Index was significant only in the models in which we used the difference GMM approach (see annexes 5 and 6). Expenditure on education as a % of GDP was not significant, probably because having a good education does not necessarily mean there is good employment being generated, and/or it is not the best indicator to capture labor skills. We expected to find small but significant positive coefficients for the impact of the interest rate on leakages. However, in all models, this variable did not show significant coefficients. This unexpected result may be either because our database has missing values for this variable, or because the interest rate has no direct effect on leakages but only impacts leakages indirectly by influencing the exchange rate and investment decisions. Trade openness had an insignificant coefficient,

suggesting that its effect may depend on other elements, such as whether countries opened to trade have implemented competitiveness policies simultaneously with the opening to trade and whether this process was implemented gradually or abruptly (Bresser-Pereira, Araújo, and Peres, 2020).

The estimates' consistency depends on the instruments' validity and the error term's absence of second-order serial correlation. Thus, we use two specification tests recommended by (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). In those tests, we should not reject the null hypothesis. The first test is the Hansen test for overidentification restrictions, and the null hypothesis is that the model is correctly specified and the instruments together are valid. The second is the Arellano-Bond AR (2) test, whose null hypothesis is the absence of second-order serial correlation of the error term since it assumes a first-order correlation in AR (1) but not in higher order. Tests for all models presented reveal that they are consistent. The robustness of the model was also tested by including the control variables progressively, maintaining analogous specifications in all models: a) standard errors robust to the Windmeijer (2005) heteroscedasticity correction were reported in parentheses; b) the instruments were collapsed to limit their number (Roodman, 2009); c) the lagged dependent variable and the lags of Relative Real Exchange Rate (in Table 7) and lnunderval index (in table) serve as instruments for the endogenous variables in both the System and difference GMM approaches; d) Besides including time dummies in the estimations, as explained above, time dummies and the other control variables are included in the model as instrumental variables (IVs).

Final thoughts and policy implications

This chapter proposed to investigate possible internal inconsistencies of the development model proposed by the PT government and several recognized researchers in Brazil by analyzing the interrelation between income distribution, demand patterns, and structural change. Particularly, it analyses the interplay between several demand policies and shocks and domestic production, showing that it can be observed in Brazil, especially after 2008, a considerable increase in demand leakages that broke the link between demand and production, crucial for the sustainability of the model proposed. It has been shown that the economic policies for income distribution (MW and BF) and demand expansion (Credit, BNDES, Government Expenditure, etc.) generated a boost in consumption widespread to multiple sectors which included medium-high and high technological industries and modern services. Before 2008, there were some spillovers from the increased consumption to investment, production, and employment in several economic activities that raised income reinitiating the cycle. However, the sharp and persistent cycle of currency appreciation initiated a process of demand leakages – particularly in high technological industries and mostly to China -, especially after 2008, that broke the link between demand and production

which was crucial for the cumulative causation process of growth with redistribution and contributed to the process of regressive structural change in the country.

To corroborate the argument the chapter created an original indicator that captures Brazil's demand leakages at the industry level from 2000 to 2018. Demand leakages are the share of foreign value-added embodied in domestic demand – both final and intermediary demand. It uses trade-in-value-added techniques by manipulating interregional input-output matrixes from ICIO OECD to estimate Brazilian demand leakages to 67 countries and 17 industries. Descriptive statistics is used to show the sharp increase in demand leakages from around 2008, its sectoral heterogeneity, the role of China in accessing the Brazilian market, and to build an original indicator of domestic and foreign contributions to regressive structural change. Later, dynamic GMM econometric methodology is used to investigate the role played by the exchange rate and investment dynamics in determining demand leakages in Brazil. Exchange rate appreciation and low investments (compared with trade partners) had a substantial positive and significant effect on demand leakages.

This evidence brings new insights to the debate and discussions on development strategies that link growth with income distribution. There is an important and quite new debate on whether the PT government indeed has reduced income inequality in Brazil or whether it would be better classified as a government that promoted social inclusion (Medeiros, Souza, and Castro, 2015; Souza, 2018; Loureiro, 2020). The first studies of inequality during Lula's government, normally using PNAD and the Gini Index, showed that there was an important reduction of inequality in Brazil, driven by the expansion of public transfers, such as the *BP Program* and the Continuous Cash Benefit, but more importantly, by the dynamics observed in the labor market (Hoffmann, 2006; de Barros, Franco and Mendonça, 2007; Carvalhaes *et al.*, 2014). Nevertheless, more recent literature that combines PNAD with tax data has shown that there was some redistribution between the bottom 90% but that the top 10% remained stable, particularly in the 99% percentile (Medeiros, de Castro Galvão and de Azevedo Nazareno, 2018). Loureiro (2020) shows that between workers, the main drivers of equality were labor formalization and narrower income gaps between professional and informal workers, as well as greater pension coverage. Nonetheless, the increase in wages has been accompanied by rising workers' indebtedness (part of the credit rise was also stimulated by the government) which created the situation in which workers committed larger shares of wage income to interest payments (Marques and Rugitsky, 2023).

On the one hand, policies such as the substantial increases in MW and BF had important effects in terms of income distribution and social inclusion. On the other hand, the exchange rate appreciation to curb inflation and the very high interest rate associated with it generated income gains for the top percentile of the income brackets, appropriated part of the income gains by raising the share of income committed to pay interests and generated a dynamic between demand and production which contributed to a sharp fall in competitiveness that led to a regressive structural change and negligible productivity gains. During the period in

which there was a commodity boom and the international financial bonanza, this didn't generate a great macroeconomic crisis, but as long as a structural change towards sophisticated industries and services and productivity gains allows increasing wages without losing competitiveness, the model seemed to have internal inconsistencies, particularly, a mistaken macroeconomic policy.

This interpretation doesn't facilitate the task of designing economic policies to promote growth with distribution but rather shows how complex it is, both in terms of political viability as well as in the context of eager international competition. The use of exchange rate appreciation and high interest rates seemed to have important negative implications for the competitiveness of local producers and the productive structure, but they helped to curb inflation which was consistently above the central target. This suggests that alternative measures to promote income distribution such as income tax reforms and the provision of public goods (such as public infrastructure) should have been used simultaneously and interchangeably with the traditional income distribution policies. Tax reforms that improve the relative prices of tradable non-commodity sectors should also be considered. Moreover, this suggests that in open economies structural change (and the productivity gains associated with it) should be a priority to be tackled simultaneously with income distribution mitigating the constraints for wage increases in the medium and long run. The effect of the Dutch disease and the huge financial inflow on the exchange rate could have been curtained by the use of import and export tariffs (Bresser-Pereira, 2020a) and capital controls (Botta *et al.*, 2023). Results also corroborate the argument that macroeconomic and industrial policies should be coordinated (Bresser-Pereira and Rugitsky, 2018; Guzman, Ocampo, and Stiglitz, 2018; Ocampo, 2020).

Nonetheless, it is always easier to prescribe and analyze economic and public policies with benefit hindsight. The domestic and international scenarios are different today from what they were at the beginning of the 21st century. It seems appropriate to highlight two outcomes that derive from the model implemented by the PT governments that can make a new development strategy even harder to implement. The first is the role of hysteresis. As Baldwin and Krugman (1989) and Baldwin and Lyons (1994) have shown in the case of the USA, large and persistent currency appreciations can have a permanent effect on the productive structure and the economic dynamics. In our case, there has been a large substitution between manufacturing imported and domestic inputs, which increases the exchange rate to inflation pass-though (Iasco Pereira and Missio, 2024) and may generate a scenario in which exchange rate appreciation may increase profit margins in the short term – even thoe still reduces their access to demand, and profit rates, in the medium and long term, particularly in high technological content sectors (Marconi, G. R. Magacho, *et al.*, 2020). This highlights the need for design strategies with short and long-term components, not always trivial and certainly politically challenging.

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Appendix 1: Authors classification of CNAE activities

Classification	Economic Activity	Classification	Economic Activity
Agriculture	Agriculture, Forestry, and Logging	Manufacturing - medium-high tech	Paints, Varnishes, Enamels and Lacquers
	Livestock and Fishing		Miscellaneous Chemical Products and Preparations
the extractive industry	Iron Ore	High-tech manufacturing	Machinery and Equipment, Including Maintenance and Repair
	Other Extractive Industries		Household Appliances and Electronic Equipment
extraction and refining of oil	Oil and Natural Gas		Cars, Vans, Trucks and Buses
	Oil Refining and Coke		Parts and Accessories for Motor Vehicles
Manufacturing - medium-low technology	Food and Beverages		Other Transportation Equipment
	Tobacco Products		Pharmaceutical Products
	Textiles		Office Machines, Appliances, and Electronic Equipment
	Clothing and Accessories	Electricity	Electricity, Gas, Water, Sewage and Urban Cleaning Production and Distribution
	Leather Goods and Footwear	Construction	Construction
	Wood Products - excluding Furniture		Residential Construction
	Pulp and Paper Products	Commerce	Commerce
	Newspapers, Magazines and Records	Modern services	Information Services
	Alcohol		Financial Intermediation, Insurance, and Pension Funds, and Related Services
	Metal Products - Excluding Machinery and Equipment	Services with Mixed Characteristics	Transportation, Storage, and Mail
Manufacturing - medium technology	Rubber and Plastic Articles		Business Services
	Cement and Other Non-Metallic Mineral Products	Slightly dynamic services	Accommodation and Food Services
	Manufacture of Steel and Steel Products		Maintenance and Repair Services
	Metallurgy of Non-Ferrous Metals		Family and Association Services
	Furniture and Miscellaneous Industrial Products		Domestic Services
Manufacturing - medium-high tech	Chemical Products	Health and Education	Commercial Education
	Resin and Elastomer Manufacturing		Commercial Health
	Agricultural Defensives	Public Administration	Public Administration
	Perfumery Hygiene and Cleaning	Real Estate and Rental Activities	Real Estate and Rental Activities

Note: *Authors adaptation of OCDE* (Galindo-Rueda and Verger, 2016) *for industrial activities.*

Appendix 2: Sector classification of ICIO OECD according to R&D intensity, based on OCDE taxonomy.

medium-low and medium technological sectors
Food products beverages and tobacco
Textiles textile products leather and footwear
Wood and products of wood and cork
Paper products and printing
Rubber and plastic products
Other non-metallic mineral products
Basic metals
Fabricated metal products
Manufacturing repair and installation of machinery and equipment
High and medium-high technological sectors
Chemical and chemical products
Pharmaceuticals medicinal chemicals and botanical products
Computer electronic and optical equipment
Electrical equipment
Machinery and equipment
Motor vehicles trailers and semi-trailers
Other transport equipment
Modern Services
IT and information services

Source: *Authors adaptation of OCDE* (Galindo-Rueda and Verger, 2016). *OCDE classification has subgroups for manufacturing activities: High R&D intensity industries, Medium-high R&D intensity industries, Medium R&D intensity industries, and Medium-low R&D intensity industries. We have combined the first two subgroups and called* High and medium high technological sectors and combined the latter two subgroups and called Low and medium low technological sectors. *We also included in the analysis tradable services - modern services - which included IT and information services based on the IMF World Trade in Services database and classification (Loungani et al., 2017).*

Appendix 3: List of countries and regional classification

Northern, Southern and Western Europe			
	Austria		Lithuania
	Belgium		Luxembourg
	Denmark		Netherlands
	Estonia		Norway
	Finland		Portugal
	France		Slovenia
	Germany		Spain
	Greece		Sweden
	Iceland		Switzerland
	Ireland		United Kingdom
	Italy		Croatia
	Latvia		Malta
Eastern Europe		**Africa**	
	Czech Republic - Czechia		Morocco
	Hungary		South Africa
	Poland		Tunisia
	Slovak Republic		
	Bulgaria		
	Romania		
	Russian Federation		
Latin America (LA)		**Central Western Asia**	
	Chile		Israel
	Colombia		Turkey
	Costa Rica		Cyprus
	Mexico		India
	Argentina		Kazakhstan
	Brazil		Saudi Arabia
	Peru		
	Mexico		
Eastern Asia			**Southern East Asia**
	Japan		Malaysia
	Korea		Myanmar
	Chinese Taipei		Philippines
	China (People's Republic of)		Singapore
	Hong Kong, China		Indonesia
			Thailand
			Viet Nam
			Brunei Darussalam
			Cambodia
			Lao People's Democratic Republic
North America and Oceania			
	Australia		
	Canada		
	New Zealand		
	United States		

Source: Authors elaboration based on United National Regional Classification (https://unstats.un.org/unsd/methodology/m49/).

Appendix 4: 3 Country model for calculating Demand Leakages.

If we consider (a) country a, b and c; (b) v̇= value added to output ratio; (c) B= the Leontief inverse ($B=(I-A)^{-1}$) and F the final demand, we can calculate the domestic value added embodied in final demand (VAF) by multiplying the valued added coefficient matrix by the inter-country Leontief inverse and then post-multiply it by a matrix of final demand, as we can see in the VAF matrix below:

$$VAF = \begin{bmatrix} \dot{v}_a & 0 & 0 \\ 0 & \dot{v}_b & 0 \\ 0 & 0 & \dot{v}_c \end{bmatrix} \begin{bmatrix} B_{aa} & B_{ab} & B_{ac} \\ B_{ba} & B_{bb} & B_{bc} \\ B_{ca} & B_{cb} & B_{cc} \end{bmatrix} \begin{bmatrix} F_{aa} & F_{ab} & F_{ac} \\ F_{ba} & F_{bb} & F_{bc} \\ F_{ca} & F_{cb} & F_{cc} \end{bmatrix} (1)$$

Which is equal to:

$$VAF = \begin{bmatrix} v_a(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) & v_a(B_{aa}F_{ab} + B_{ab}F_{bb} + B_{ac}F_{cb}) & v_a(B_{aa}F_{ac} + B_{ab}F_{bc} + B_{ac}F_{cc}) \\ v_b(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) & v_b(B_{aa}F_{ab} + B_{ab}F_{bb} + B_{ac}F_{cb}) & v_b(B_{aa}F_{ac} + B_{ab}F_{bc} + B_{ac}F_{cc}) \\ v_c(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) & v_c(B_{aa}F_{ab} + B_{ab}F_{bb} + B_{ac}F_{cb}) & v_c(B_{aa}F_{ac} + B_{ab}F_{bc} + B_{ac}F_{cc}) \end{bmatrix}$$

(2)

By algebraically manipulating the VAF matrix, one can calculate the proposed indicators. For example, demand leakages in Brazil can be calculated as:

$$\text{Demand Leakages} = \left(\frac{v_b(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) + v_c(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca})}{v_a(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) + v_b(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) + v_c(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca})}\right) (3)$$

Where a represents Brazil, and b and c are the representative countries of the rest of the world.

If we want to analyze demand leakages to a specific country, let's say b=China, we can do it by:

$$\text{Demand Leakages of Brazil to China} = \left(\frac{v_b(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca})}{v_a(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) + v_b(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca}) + v_c(B_{aa}F_{aa} + B_{ab}F_{ba} + B_{ac}F_{ca})}\right) (3)$$

If we want to analyze how much Brazil has captured from demand abroad, we can calculate as:

$$Brazil\_AfD_a = \frac{v_a(B_{aa}F_{ab} + B_{ab}F_{bb} + B_{ac}F_{cb}) + v_a(B_{aa}F_{ac} + B_{ab}F_{bc} + B_{ac}F_{cc})}{v_b(B_{aa}F_{ab} + B_{ab}F_{bb} + B_{ac}F_{cb}) + v_b(B_{aa}F_{ac} + B_{ab}F_{bc} + B_{ac}F_{cc}) + v_c(B_{aa}F_{ab} + B_{ab}F_{bb} + B_{ac}F_{cb}) + v_c(B_{aa}F_{ac} + B_{ab}F_{bc} + B_{ac}F_{cc})}$$

(4)

Appendix 5: Models 1 with Difference GMM Methodology

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	demand_leakages	demand_leakages	demand_leakages	demand_leakages	demand_leakages	demand_leakages
L.lnAD_brazil	0.734***	0.665***	0.808***	0.543***	0.878***	0.543**
	(0.081)	(0.108)	(0.089)	(0.187)	(0.049)	(0.277)
lnRER_r	0.933***	1.428***	1.169*	3.016**	0.724***	2.352*
	(0.359)	(0.463)	(0.668)	(1.472)	(0.281)	(1.287)
lnTaxa_investimento_r	0.373**	0.341	0.388***	1.161***	0.195**	0.651
	(0.182)	(0.237)	(0.134)	(0.445)	(0.085)	(0.527)
lnGDP_pc_constUSD	0.417**	0.665***	0.379	1.109	0.240**	0.814
	(0.171)	(0.243)	(0.243)	(0.690)	(0.112)	(0.561)
lngov_educ_gdp	0.170	0.258	0.218	-0.130	0.086	0.563
	(0.244)	(0.297)	(0.413)	(0.891)	(0.115)	(0.509)
lnTrade_openess		-0.292				-0.734
		(0.211)				(0.454)
lnrer_stab			0.207			-0.091
			(0.192)			(0.266)
lni_ifs				0.073		-0.135
				(0.134)		(0.157)
L2.lnpatpop					0.030	-0.124
					(0.037)	(0.135)
Constant	-5.744***	-8.859***	-4.731	-11.163	0.000	-11.579*
	(2.018)	(2.825)	(3.575)	(6.917)	(0.000)	(6.819)
Observations	1,010	1,010	759	527	892	391
Number of Country	64	64	47	41	63	35
AR(1)	0.000608	0.000630	0.00409	0.0253	0.00154	0.118
AR(2)	0.265	0.340	0.440	0.279	0.538	0.0987
Hansen	0.0929	0.179	0.103	0.574	0.152	0.306

Appendix 6: Models 2 with Difference GMM Methodology

VARIABLES	(1) demand_leakages	(2) demand_leakages	(3) demand_leakages	(4) demand_leakages	(5) demand_leakages	(6) demand_leakages
L.demand_leakages	0.837***	0.713***	0.923***	0.831***	0.812***	0.560**
	(0.044)	(0.106)	(0.045)	(0.089)	(0.078)	(0.275)
ln_underval	0.469***	0.725**	0.402	1.079***	0.865***	2.064*
	(0.180)	(0.314)	(0.321)	(0.413)	(0.331)	(1.136)
lnInvRate_r	0.225**	0.283	0.195*	0.444*	0.307**	0.639
	(0.108)	(0.178)	(0.115)	(0.239)	(0.142)	(0.523)
lnGDP_pc_constUSD	0.122*	0.210*	-0.003	0.195	0.120	0.385
	(0.064)	(0.122)	(0.092)	(0.143)	(0.097)	(0.359)
lngov_educ_gdp	0.088	0.224	0.185	-0.002	0.089	0.559
	(0.157)	(0.199)	(0.218)	(0.377)	(0.175)	(0.474)
lnTrade_openess		-0.236				-0.719
		(0.157)				(0.470)
lnrer_stab			0.287*			-0.167
			(0.152)			(0.269)
lni_ifs				0.022		-0.149
				(0.052)		(0.156)
L2.lnpatpop					0.064	-0.123
					(0.061)	(0.127)
Constant	0.000	0.000	0.399	0.000	0.000	0.000
	(0.000)	(0.000)	(0.933)	(0.000)	(0.000)	(0.000)
Observations	1,024	1,024	759	530	906	391
Number of Country	65	65	47	42	64	35
AR(1)	0.000571	0.00229	0.00207	0.00134	0.00103	0.0811
AR(2)	0.250	0.269	0.375	0.688	0.529	0.0948
Hansen	0.0992	0.111	0.141	0.184	0.337	0.295