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# HETEROGENEOUS EFFECTS OF THE EXCHANGE RATE PASS-THROUGH: a sectoral and gendered analysis

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Orientador: Frederico Gonzaga Jayme Junior

Coorientadora: Clara Zanon Brenck

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# FOLHA DE APROVAÇÃO

## HETEROGENEOUS EFFECTS OF THE EXCHANGE RATE PASS-THROUGH: A SECTORAL AND GENDERED ANALYSIS

**MARIA LUÍZA ASSIS CUNHA**

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“For I know the plans I have for you, says the Lord, plans for welfare and not for evil, to give you a future and a hope”
(Jeremiah, 29:11)

RESUMO

O objetivo desta dissertação é avaliar como o repasse cambial afeta diferentes tipos de domicílios, a partir do impacto estimado sobre diversos subgrupos de bens na economia brasileira e da participação dos gastos entre diferentes bens no orçamento familiar. Para isso, estima-se a função impulso-resposta de um choque de desvalorização cambial sobre os subgrupos de inflação e calculam-se os respectivos coeficientes de repasse. Os resultados indicam que o efeito é heterogêneo entre os setores, variando de acordo com as estruturas de concorrência de mercado, a estrutura produtiva de cada indústria e o grau de dependência de insumos importados. Argumenta-se, ainda, que esse efeito heterogêneo pode gerar consequências distributivas, dependendo da presença de produtos sensíveis ao câmbio nas cestas de consumo dos domicílios. Essa discussão fundamenta-se em uma análise dos padrões de consumo domiciliar segundo o sexo da pessoa de referência, utilizando microdados da Pesquisa de Orçamentos Familiares (POF 2017–2018). Os resultados destacam que os domicílios que possuem mulheres como referência são mais afetados pelas variações cambiais devido aos seus padrões de gasto associados ao trabalho do cuidado e à menor renda média em relação aos domicílios que possuem homens como referência.

Palavras-chave: inflação cambial; desigualdade de gênero; padrões de consumo.

ABSTRACT

The objective of this thesis is to evaluate how exchange rate pass-through affects different households, based on the estimated impact on various subgroups of goods in the Brazilian economy and households' spending share on different product categories. To this end, it estimates the impulse response of an exchange rate shock on inflation subgroups and calculates the corresponding pass-through coefficients. The results indicate that the effect is heterogeneous across sectors, varying according to market competition structures, the production structure of each industry, and the degree of reliance on imported inputs. It also argues that this heterogeneous effect may lead to distributive consequences, depending on the extent to which exchange rate-sensitive products are present in households' consumption baskets. This discussion is grounded in an analysis of households' consumption patterns by the gender of the household reference person, using microdata from the Brazilian Consumer Expenditure Survey (POF 2017–2018). The findings highlight that households with female reference are more affected by exchange rate movements due to their spending patterns associated with care responsibilities and lower average income relative to households with male reference.

Keywords: exchange rate pass-through; gender inequality; consumption patterns.

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LIST OF ABBREVIATIONS

CPI – Consumer Price Index

EXPT – Exchange rate pass-through

FXR – Foreign exchange rate

IBGE – Brazilian Institute of Geography and Statistics

IGP – General Price Index

IPA – Broad Producer Price Index

IPCA – General Consumer Price Index

LOP – Law of One Price

NEXR – Nominal Exchange Rate

POF – Brazilian Consumer Expenditure Survey

PPI – Producer Price Index

SNIPC - National System of Consumer Price Indices

SUT – Supply and Use Table

VAR – Vector Autoregressive

# Contents

# INTRODUCTION

The macroeconomic framework experienced significant changes after the pandemic, as disruptions to global supply and demand chains required a reorientation of the monetary policy that had prevailed in previous years. Even after the lockdown ended, inflation continued to rise, inducing central banks to increase interest rates. In the United States (US), inflation rose from 1.5% in March 2020 to 3.1% in January 2024, while in the European Union (EU) it increased from 1.3% to 3.7% over the same period. During this time, interest rates climbed from 0.25% to 5.5% in the US and from 0% to 4.5% in the EU. Inflation peaked at 9.1% in the US in June 2022, and at 6.6% in the EU in March 2023[1]. This global trend brought back debates about price shocks sources and the effectiveness of policy responses (Clarida, 2025; Hajdini et al., 2025).

Brazil underwent a similar process. Between March 2020 and January 2024, inflation increased from 3.3% to 4.51%, and the interest rate rose from 3.75% to 11.25%. However, the Brazilian economy is particularly vulnerable to global fluctuations due to its peripheral position in the international monetary system. Because the Real does not fully perform the three basic functions (store of value, means of payment, and unit of account) at the international level, it occupies the lower end of the global currency hierarchy (Conti et al., 2014). As a result, capital flows into the country are more volatile, with greater inflows during periods of global stability and sharper inflows during instability. This dynamic implicates in higher domestic interest rates to compensate for the currency's lower liquidity and contributes to greater exchange rate volatility (Andrade & Prates, 2013).

The foreign exchange rate plays a central role in this context, influencing capital flows, investments, and production costs. In periods of global stability, currency devaluation is often used by emerging economies as a strategy to stimulate economic growth (Eichengreen, 2008), as it promotes exports and enhances external competitiveness. However, given the high dependence of many industries on imported inputs, devaluation also leads to higher production costs, thereby offsetting some of its potential benefits. As a cost channel, the exchange rate directly affects domestic prices. Considering the oligopolistic markets framework (Eichner, 1973; Lavoie, 2014), firms set their prices based on their costs and markup (Lee, 1998). Given a change in the exchange rate, price adjustments depend on the degree of market integration,

[1]Inflation and interest rates data were gathered from Trading Economics.

the substitutability between domestic and foreign products, and market organization (Dornbush, 1987). Firms tend to absorb temporary fluctuations by adjusting markups (Froot & Klemperer, 1989; Pereira & Missio, 2024), but pass cost changes into prices when exchange rate shifts are perceived as permanent. The local price variation induced by a change in the exchange rate is known as exchange rate pass-through (EXPT) (Campa & Goldberg, 2002). Goods that depend on imported components or have part of their production abroad may have their prices associated with a higher EXPT coefficient.

Because firms set their prices according to their specific productive and competitive structure, EXPT varies across sectors (Correa, 2017; Pereira & Missio, 2024; Pimentel et al., 2020). From the consumption perspective, households whose baskets rely more heavily on goods with high EXPT coefficients are more vulnerable to exchange rate fluctuations.

Household consumption patterns, however, are not homogeneous. A vast literature shows that they differ depending on the gender of the household reference person (Phipps & Burton, 1998; Doss, 1996; Pinheiro & Fontoura, 2007; Carvalho & Alves, 2010; Passos et al., 2024). Women, historically associated with care responsibilities (Kergoat, 2003; Fraser, 2016), tend to allocate a larger share of income to food, health, and clothing, while households with male reference spend relatively more on transportation, recreation, and tobacco. In addition, women's lower average income and heavier burden of unpaid care restrict their budgets, leaving them more exposed to inflationary pressures.

Gender disparities in inflation perception and care responsibilities not only reduce household welfare but also generate inefficiencies that undermine economic growth (Davis, 1981; Folbre, 2009). Braunstein (2015) argues that economies with higher wage participation on income and a more egalitarian division of care improve economic growth and the production of human capabilities. The reduction of gender inequality, therefore, promotes not only a better living standard for women but also better economic outcomes.

Given these characteristics, this research investigates whether EXPT affects households differently according to the gender of the household reference person. As far as is known, no previous research has discussed the pass-through effect on household budget composition. Thus, this study contributes to the literature by discussing the impact of EXPT on budget composition by different households and by expanding the sectoral analysis of the EXPT in Brazil to include all categories of final consumption goods.

This thesis is organized into two connected chapters. The first is dedicated to the discussion of the EXPT in light of the markup theory. It reviews the debate regarding price formation in an oligopolistic framework, the impact of the exchange rate on domestic prices,

the empirical literature on EXPT, and the Brazilian industrial structure. Using an econometric model, it estimates the EXPT for the aggregated price index and its 19 subgroups. The findings highlight the Brazilian sensitivity to exchange rate movements, as most of the sector's prices respond significantly to the devaluation shock. Besides that, the difference between the responses confirms that production and competitive structures influence the degree of the EXPT on prices.

The second chapter introduces feminist theory on the sexual division of labor and explores how gender relations shape agents' decision-making process. It also addresses the empirical literature on household consumption patterns and their effect on inflation perception. Using microdata from the 2017-2018 Brazilian Consumer Expenditure Survey (POF), it calculates the expenditure shares of male and female reference-person households and evaluates how exchange rate shocks affect them differently, considering the findings from Chapter One. The evidence shows that households with a female reference person are more affected by exchange rate movements due to their spending patterns and lower average income.

The final chapter presents the main conclusions and outlines policy recommendations aimed at reducing gendered vulnerabilities to exchange rate shocks and promoting a more inclusive macroeconomic framework.

# 1. CHAPTER ONE - Sectoral Exchange Rate Pass-through: an empirical analysis for the Brazilian economy

## 1.1 Introduction

The exchange rate is an important macroeconomic variable that connects the domestic economy to foreign markets. It affects investment, capital flows, and production costs. A competitive, i.e., undervalued, exchange rate is positively associated with higher economic growth, especially for emerging economies (Rapetti et al, 2012). This effect could be attributed to the increase in exports, which stimulates the increase in capacity utilization, profit margins, and investment, making higher profitability of tradable over non-tradable investment (Gala, 2007; Rodrick, 2008).

Eichgreen (2008) argues that it is common for emerging economies that experienced sustained growth acceleration to have an undervalued exchange rate during that period. The competitive exchange rate encourages the redeployment of resources into the manufacturing sector, boosting domestic income growth. This happens because exports become more attractive and imports more costly. As domestic manufacturing and production develop, dependence on imported goods decreases. In discussing the development of Latin American economies, Tavares (2000) argues that the increase in the relative price of imports provided a significant stimulus to substitute them for domestic production, mainly durable goods. However, these economies had to shift their import composition into capital goods to develop domestic industry, as exports continued relying mainly on low-price elasticity goods. This process resulted in a balance of payments pressure, leading to the import substitution breakdown.

Thus, it is essential to understand the effects of exchange rate changes in emerging economies. The exchange rate pass-through (EXPT) is the local price change in response to a change in the exchange rate (Campa & Goldberg, 2002). Goods that depend on imported components or have part of their production abroad will find their prices more sensitive to changes in the exchange rate. The EXPT is especially relevant for emerging economies, as they tend to be highly dependent on the import of capital goods and technological inputs for economic growth.

The price formation process is different given the market competitive structure. In competitive markets, where product substitutability is high, firms have limited control over

pricing decisions, leading to greater price volatility in the short run (Lavoie, 2014). In contrast, the post-Keynesian framework introduces the markup theory in oligopolistic markets, where firms act as price makers. In these markets, firms are less responsive to demand fluctuations compared to competitive markets, setting prices based on production costs and their desired profit margins (Lee, 1998). The exchange rate is an important cost factor in oligopolistic structure, influencing prices by the degree of market concentration, production structure, and goods substitutability (Dornbusch, 1987).

Empirical studies have shown that emerging economies exhibit a higher pass-through rate, in contrast to developed ones (Alpaslan & Demirel, 2014; Borenztein & Heideken, 2016). Given that the EXPT is a country-specific phenomenon, this analysis is conducted solely on the Brazilian economy. The country choice is given for two main motives. First, Brazil has a diversified industry, but with a relevant degree of import dependence, making the country's pricing sensitive to exchange rate shocks. Second, because it is a relevant emerging economy, it could give insights into other countries' analysis.

The exchange rate has multiples effects on the economy, depending on whether the change reflects an appreciation or depreciation and how different sectors respond. Using evidence from Brazil, Modenesi et al. (2017) show that an appreciation may not be sufficient to offset a previous inflationary effect followed by a depreciation of the same magnitude. Instead, a depreciation followed by an appreciation may reinforce the inflationary process even with a smaller inflationary effect. Others have also highlighted these exchange rate asymmetries (Couto & Fraga, 2014; Modenesi et al., 2017; Pimentel et al., 2020) and their heterogeneous effects on different sectors (Correa, 2017; Kannebley, Prince & Costa, 2023; Pereira & Missio, 2024; Pimentel et al., 2020).

The works that analyze the sectoral effect of the EXPT for the Brazilian economy tend to use different types of industrial price indexes (Correa, 2017; Kannebley, Prince & Costa, 2023; Pereira & Missio, 2024; Pimentel et al., 2020). However, the main inflation index for the economy is the General Consumer Price (IPCA), and to the best of current knowledge, no study has addressed the effects of exchange rate pass-through across IPCA subgroups. Therefore, the aim of this discussion is to contribute to the literature by expanding the analysis to include all nineteen inflation subgroups and examine a more recent and extended period.

In addition to this introduction, this chapter comprises four more sections. The next section presents a literature review of the pass-through effect. The third section presents the local projections methodology used to obtain the impulse response functions and briefly

contextualizes the Brazilian inflation index employed. Section four discusses the results, followed by concluding remarks in the last section.

## 1.2 Price formation and the pass-through effect

The exchange rate pass-through (EXPT) is the "percent change in local currency import prices resulting from a one percent change in the exchange rate between the exporting and importing country" (Campa & Goldberg, 2002, p.5), commonly given by a number between 0 and 1. The pass-through is considered complete when it equals one, whereas zero means no pass-through, and any number between means an incomplete pass-through. The study of this effect gained relevance when countries began transitioning from fixed exchange rates to a floating exchange-rate regime. It was expected that once prices were converted to a common currency, the same goods would be sold for the same price in different countries (Miljkovic, 1999). This dynamic is known as the law of one price (LOP). However, because the exchange rate transmits the price variation in each country, the transition from fixed to floating regimes did not bring the expected effect of equalizing prices internationally. The LOP is only valid for quality-alike tradable items, such as commodities. Factors such as pricing to market, the presence of non-tradable inputs, exchange rate risk, and geographical separation of markets (transportation costs and institutional factors that influence price settings in different markets) help justify the failure of the law (Miljkovic, 1999).

Before examining the EXPT determinants and their implications, it is essential to revisit the micro and macroeconomics of post-Keynesian price theory. The discussion begins with the theory of price decisions by firms on oligopolistic markets and how the exchange rate pass-through impacts this decision.

### 1.2.1 Price decision by firms

Competitive markets are composed of relatively large firms with similar products. Since they are perfect substitutes, price and production adjustments are more volatile in the short term as demand changes. This means that firms have low decision-making power over price and

production. However, competition is a dynamic process through non-price means. Price competition is likely to squeeze firm profits and induce lower product quality. Thus, too much price competition is not optimal, and perfect competition is neither possible nor superior (Aidar & Terra, 2019; Lavoie, 2014).

In contrast, oligopolies have more power over price decisions. Therefore, prices are more stable over time, and competition is for market share (Lavoie, 2014). In this way, these firms prioritize their growth rate and market share over short-term profits, a phenomenon known as the "managerial" theory (Eichner, 1973).

According to Eichner (1973), most monopolist firms can manage prices with some market power, which goes against the traditional microeconomic rational choice model assumptions. Evidence suggests that the supply side, rather than demand, determines prices in certain industries (Lee, 1998). Firms' costs are an important mechanism for supply-led prices, consisting of labor costs, material costs, and depreciation components for both shop and enterprise expenses (Lee, 1998).

Once costs are known, the firm sets its markup to be sufficient to cover inputs and enterprise expenses, thereby producing a profit, and thus the final consumer price is determined. Eichner (1973) says that "the margin size of the markup depends on the demand and supply of additional investment funds by the firm or the firm group that have, inside the industry, the power to establish the price" (p.10).

In this way, depending on the firm's production structure, the exchange rate can affect its costs. If the firm has part of its production abroad or imports part of its inputs (services or goods), then the relation between the domestic and foreign currency will impact production costs. If costs change, final consumer prices may also be affected. This link is explored in the following subsection.

### 1.2.2 The exchange rate pass-through and its determinants

Campa and Goldberg (2002) discuss both macroeconomic and microeconomic determinants of pass-through and its magnitude, executing an empirical exercise for a 25-OECD country sample. According to the authors, the macroeconomic determinants of pass-through are the relationship between inflation rates, money growth rates, and exchange rate variability. Lower inflation leads to a decrease in costs, and if firms were to pass this decrease on to their final goods in the form of lower prices, then we would have a lower import price

pass-through. From the perspective of exchange rate variability, countries with a more volatile exchange rate tend to have higher exchange rate pass-through, as firms prefer to set their prices in a more stable currency to avoid price instability. These variables are significant but have a limited role in explaining long-run cross-country differences in pass-through. On the other hand, the authors argue that microeconomic factors, such as changes in the composition of industries in a country's import basket, are far more important for overall pass-through rates (p. 4).

From the perspective of exchange rate dynamics, Modenesi et al. (2017) and Pimentel et al. (2020) emphasize exchange rate asymmetries, differentiating between appreciation and depreciation movements. Modenesi et al. (2017) state that, for the Brazilian economy, appreciation is not sufficient to offset a depreciation effect of the same magnitude. Instead, even with a lower inflationary impact, depreciation after an appreciation amplifies the inflationary process. Pimentel et al. (2020) analyze 21 Brazilian industrial activities, finding "the existence of asymmetry in the majority of activities, with the pass-through of the positive variations being higher than for the negative variations in all cases" (p. 389).

From a market share perspective, Froot and Klemperer (1989) provide evidence that firms behave differently when expecting a temporary or permanent currency depreciation. The temporary change does not induce firms to adjust their prices to compete for market share. In other words, they will not pass on the lower costs to consumer prices, letting their profits grow as an intertemporal profit gain. In contrast, the permanent change in the exchange rate implies a permanent change in costs, making firms compete more vigorously for market share. In this case, firms would reduce the exchange rate pass-through to final consumer prices to maintain their local market share.

Sectoral price dynamics determine the microeconomic effects of the pass-through. If money is neutral and by assuming the LOP, exchange rate movements would reflect divergent national price trends:

$$P = e * P^{*} \qquad (1.1)$$

Where $P$ indicates the domestic price, $e$ is the nominal exchange rate, and $P^{*}$ is the foreign price. The LOP would apply to a competitive market with flexible prices (as in the case of raw materials). An appreciation should lead to a decline in the price of imports and, if the goods are homogeneous, the decline fully matches the appreciation. However, in a market with short-term price rigidity, differentiated goods, and imperfect competition, the LOP is not valid.

What happens in this case (with manufacturers) is an oligopolistic structure, making the relative price of domestic and foreign goods equal to the real exchange rate ($\lambda$) (Dornbush, 1987):

$$\lambda = \frac{P}{(e * P^*)} \qquad (1.2)$$

When discussing EXPT in an oligopolistic market, Dornbush (1987) argues that the adjustment after an exchange rate change depends on market integration or separation, the substitution between domestic and foreign product variants, and market organization.

### 1.2.3 Sectoral pass-through evidence

As a country and industry-specific condition, the EXPT empirical analysis is a rich field and can be explored from various perspectives. National analyses between different economies are conducted by Borenztein and Heideken (2016) and Alpaslan and Demirel (2014). Both works have similar findings, indicating that, although incomplete, emerging economies exhibit a higher pass-through compared to developed economies. Examining the Brazilian economy, Belaisch (2003) and Nogueira, Mori, and Marçal (2013) observe that the EXPT has decreased over time, whereas Couto and Fraga (2014) provide empirical evidence of a long-term relationship between the exchange rate and domestic prices.

The analysis employed in the current work focuses on Brazil due to its diversified industrial structure and significant economic role among emerging economies. Sectoral analysis of the EXPT in Brazil was conducted by Correa (2017) and Pereira and Missio (2024). Correa (2017) analyzes 13 manufacturing sectors, finding that they do not entirely pass the exchange rate devaluations into prices. Examining 23 different sectors, Pereira and Missio (2024) draw similar conclusions. Additionally, the authors provide empirical evidence of a positive association between markup rate and pass-through. Firms with a high share of imported inputs in their costs and competing with foreign firms absorb the exchange rate devaluations and reduce their markup instead of passing on cost pressures to the final price.

The main recent work for the Brazilian economy is summarized in Table 1.1:

Table 1.1 - Recent work that analyzes the pass-through for the Brazilian economy

| Author | Methodology | Dependent Variable* | Period of Analysis | Type of Analysis |
|---|---|---|---|---|
| Nogueira, Mori and Marçal (2013) | SVAR and VEC | IGP, IPA, IPCA | 1999 – 2011 | National |
| Correa (2017) | VAR | IPP - 13 sectors | 2009 – 2015 | Sectoral |
| Modenesi et al. (2017) | SVAR | IPCA | 1999 – 2016 | National |
| Couto e Fraga (2018) | VEC | IPCA, IGP-DI | 1999 - 2012 | National |
| Pimentel et al. (2020) | SVAR | IPP - 21 sectors | 1996 - 2014 | Sectoral |
| Pereira and Missio (2024) | GMM | IPP - 23 sectors | 2010 - 2019 | Sectoral |

Source: Author's elaboration.
*IGP = General Price Index (Índice Geral de Preços); IPA = Broad Producer Price Index (Índice de Preços ao Produtor Amplo); IPCA = Broad Consumer Price Index (Índice de Preços ao Consumidor Amplo); IPP = Producer Price Index (Índice de Preços ao Produtor).

The literature shows that each industry experiences a specific price adjustment in response to an exchange rate variation. The works that analyze the EXPT for the Brazilian sectors utilize the Producer Price Index (PPI), thereby bringing the discussion into the scope of production. In this regard, this study aims to contribute to the literature by examining how the Brazilian General Consumer Price components respond to an exchange rate shock, utilizing a more extended and recent period than previous analyses and looking at final goods prices.

Ribeiro et al. (2024) discuss the Brazilian inflationary dynamics using IPCA groups and subgroups. They analyze the response of inflation to a restrictive monetary policy, the primary Central Bank instrument for controlling inflation. The results show different responses among groups and subgroups, implying that, given the primary source of inflation, the restrictive monetary policy may not be enough for its control. Inspired by their discussion, the hypothesis here is that the impact of exchange rate shocks may also differ among IPCA subgroups, given the heterogeneity among subgroups and the specific characteristics of each industry.

As far as is known, no work has been conducted to analyze the EXPT for IPCA subgroups. Nevertheless, it could bring a new perspective on how the exchange rate affects household budgets, as this index considers the consumption sphere. Hence, the first step of this analysis is to understand how Brazilian industries are connected to foreign markets.

### 1.2.4 Brazilian industry structure

From the 1960s onwards, Brazilian industrial policy aimed primarily at reducing dependence on imports of goods with strong domestic demand (Tavares, 2000). Only a few sectors accumulated enough strength and capital to compete internationally. Silva and Laplane (2016), drawing on the Brazilian Industry Competitiveness Research, classify industries according to systemic, corporate, and structural factors. Competitive sectors tend to be natural-resource intensive, operate with updated production technologies, achieve adequate scale, and possess qualified managerial capacity. By contrast, sectors with weak competitiveness rely heavily on domestic demand and concentrate on durable and non-durable consumer goods. Despite these general patterns, both intra- and inter-sectoral heterogeneity persist, meaning not all firms within the same industry complex exhibit the same competitive capacity (see Table 1.2).

As shown by Silva and Laplane (2016), the abundance and low cost of natural resources benefited the agro, metallurgical, chemical, and pulp and paper industries. These sectors were able to expand productive capacity, develop learning process, and participate more actively in international markets. Nevertheless, they remain highly vulnerable to global fluctuations and trade barriers, which pose challenges to sustained expansion.

Table 1.2 – Brazilian industrial sectors and their external competitive capacity

| Sector Type | Sector | Sub-Sectors |
|---|---|---|
| **Sectors with Competitive Capacity** | Agro-industrial Complex | Soybean oil; Coffee; Orange juice |
| | Chemical Complex | Petroleum; Petrochemicals |
| | Metallurgical Complex | Iron ore; Steel industry; Aluminum |
| | Pulp and Paper Complex | Pulp; Paper |
| **Sectors with Competitive Deficiencies** | Agro-industrial Complex | Slaughtering; Dairy |
| | Chemical Complex | Fertilizers |
| | Metallurgical Complex | Automotive; Auto parts |
| | Electronic Complex | Consumer electronics |
| | Textile Complex | Textiles; Clothing; Leather footwear |
| | Construction Materials Complex | Cement; Ceramic tiles; Plastics for civil construction |
| | Pulp and Paper Complex | Printing |
| | Extracomplex | Wooden furniture |

| Sector Type | Sector | Sub-Sectors |
|---|---|---|
| **Sectors Driving Technical Progress and Competitive Deficiencies** | Electronic Complex | Information technology; Telecommunications; Industrial automation; Software |
| | Metallurgical Complex | Machine tools; Electrical equipment; Agricultural machinery |
| | Chemical Complex | Pharmaceuticals; Agrochemicals |
| | Extracomplex | Biotechnology |

Source: Silva and Laplane (2016) *apud* Coutinho and Ferraz (1994:257).

In contrast, less competitive sectors face constraints primarily arising from their dependence on domestic demand, which often remains stagnant for extended periods. This discourages investment in productive capacity and innovation. Overcoming these challenges would require both a recovery in domestic demand, accompanied by more sophisticated consumer preferences, and continuous product upgrades. The authors also argue that strengthening cooperation networks among firms could enhance investment and technological capabilities.

Finally, Silva and Laplane (2016, p. 93) highlight producers of capital goods and knowledge-intensive sectors as the weakest links in Brazilian industry. Branches of the electronics, metallurgical, chemical, and biotechnology industries not only face the same dependency on domestic demand but also suffer from frequent regulatory changes, which hinder their ability to reduce long-standing competitive deficiencies.

Going further into the industry's structural factors, the Supply and Use Table (SUT), published by the Brazilian Institute of Geography and Statistics (IBGE), helps to understand demand and supply flows for goods and services, as inputs or final demand. From the SUT 2019, Passoni (2019) calculated the import shares of final goods and services, considering the demand for imports at all stages of production. Given that the empirical assessment is between IPCA subgroups, Table 1.3 presents the import coefficients of the products that most closely match the National Consumer Price Index System (SNIPC) classification. The complete table calculated by Passoni (2019) can be found in the Annex A.1.

Table 1.3 – Selection of IPCA items from SUT

| Supply and Use Table Code | Product | Total share of imported products |
|---|---|---|
| | **Food and Beverages** | |
| 01911 | Rice, wheat, and other cereals | 56.24% |
| 01912 | Corn (grain) | 1.91% |

| | | |
|---|---|---|
| 01913 | Upland cotton, other temporary crop fibers | 0.09% |
| 01914 | Sugarcane | 0.00% |
| 01915 | Soybeans (grain) | 0.20% |
| 01916 | Other products and services from temporary crops | 3.95% |
| 01917 | Oranges | 0.95% |
| 01918 | Coffee (beans) | 0.00% |
| 01919 | Other permanent crop products | 7.83% |
| 01921 | Cattle and other live animals, animal products, hunting, and related services | 0.22% |
| 01922 | Cow's milk and milk from other animals | 0.00% |
| 01923 | Swine (pigs) | 0.14% |
| 01924 | Poultry and eggs | 0.57% |
| 02802 | Fishing and aquaculture (fish, crustaceans, and mollusks) | 12.55% |
| 10911 | Beef and other meat products | 1.46% |
| 10912 | Pork | 0.00% |
| 10913 | Poultry meat | 0.07% |
| 10914 | Processed fish | 35.84% |
| 10915 | Chilled, sterilized, and pasteurized milk | 0.00% |
| 10916 | Other dairy products | 3.10% |
| 10921 | Sugar | 0.12% |
| 10931 | Canned fruits, vegetables, other produce, and fruit juices | 10.83% |
| 10932 | Vegetable and animal oils and fats | 4.32% |
| 10933 | Processed coffee | 2.50% |
| 10934 | Processed rice and rice products | 4.39% |
| 10935 | Wheat, cassava, or corn-based products | 2.19% |

*Table 1.3 continued…*

| Supply and Use Table Code | Product | Total share of imported products |
|---|---|---|
| 10936 | Balanced animal feed | 2.64% |
| 10937 | Other food products | 2.75% |
| 11001 | Beverages | 10.31% |
| | **Total Food and Beverages*** | **3.51%** |
| 56001 | Food Services | 5.11% |
| | **Clothing** | |
| 13001 | Processed textile yarns and fibers | 13.05% |
| 13002 | Fabrics | 20.55% |
| 13003 | Household and other textile items | 17.19% |
| 14001 | Clothing and accessories | 13.67% |
| 15001 | Footwear and leather goods | 8.18% |
| | **Fuel and Transport** | |
| 06801 | Petroleum, natural gas, and support services | 10.77% |
| 19912 | Gasohol | 0.00% |
| 19915 | Diesel – biodiesel | 0.00% |
| 19921 | Ethanol and other biofuels | 3.06% |
| 49002 | Land passenger transportation | 3.01% |
| 29911 | Cars, pickup trucks, and utility vehicles | 16.64% |
| 29921 | Parts and accessories for motor vehicles | 24.63% |

| | | |
|---|---|---|
| | **Housing and Household Items** | |
| 68001 | Actual rent and real estate services | 2.21% |
| 68002 | Imputed rent | 0.00% |
| 23001 | Cement | 1.74% |
| 23002 | Cement, plaster, and similar products | 1.23% |
| 23003 | Glass, ceramics, and other non-metallic mineral products | 11.93% |
| 27001 | Machinery, electrical devices, and materials | 29.88% |
| 27002 | Home appliances | 14.06% |
| 31801 | Furniture | 5.34% |
| 35001 | Electricity, gas, and other utilities | 1.74% |
| 36801 | Water, sewage, recycling, and waste management | 0.00% |
| 26001 | Electronic components | 80.94% |
| 22001 | Rubber products | 23.90% |
| 22002 | Plastic products | 12.34% |
| 94802 | Maintenance of computers, phones, and household items | 0.00% |
| | **Recreation** | |
| 50001 | Air transport | 15.46% |
| 55001 | Hotel and similar accommodation services | 40.87% |
| 90801 | Arts, culture, sports, and recreation services | 9.86% |
| | **Communication** | |
| 59801 | Film, music, radio, and television services | 1.54% |
| 61001 | Telecommunications, pay TV, and related services | 1.63% |
| 52802 | Postal and other delivery services | 0.03% |

*Table 1.3 continued…*

| **Supply and Use Table Code** | **Product** | **Total share of imported products** |
|---|---|---|
| | **Education** | |
| 85911 | Public education | 0.00% |
| 85921 | Private education | 0.79% |
| 58001 | Books, newspapers, and magazines | 13.11% |
| | **Health** | |
| 86911 | Public health | 0.00% |
| 86921 | Private health | 0.18% |
| 21001 | Pharmaceutical products | 32.29% |
| | **Personal Care Services and Expenses** | |
| 12001 | Tobacco products | 36.04% |
| 20931 | Perfumes, soaps, and cleaning products | 15.52% |
| 94803 | Personal services | 0.00% |
| 97001 | Domestic services | 0.00% |
| 45801 | Wholesale and retail trade | 0.19% |
| | **TOTAL** | 5.16% |

Source: Passoni (2019).
*The coefficient “Total Food and Beverages” was created by the authors from the aggregation of products related to food and beverages.

There is a high heterogeneity among products within the same industry. In the case of Food and Beverages, most products show low import dependency, with an average of 3.51%. Notable exceptions include rice, wheat, and other cereals (56.24%) and processed fish (35.84%). Overall, the agro-industrial complex stands out as one of Brazil's most competitive sectors: the abundance of natural resources enables it to supply nearly all domestic demand.

Clothing-related products, however, are relatively more dependent on external markets, with import shares ranging from 8% to 20%. This sector is classified among those with competitive deficiencies, characterized by low technological development and limited investment incentives, which increases reliance on imports to meet domestic consumption.

Fuel products, despite having strong competitive capacity, display moderate import dependence. Petroleum, natural gas, and related services present the highest share within this group (10.77%). While Brazil is a global leader in oil extraction, not all refined products are domestically produced, making imports necessary. By contrast, vehicle-related goods fall into the category of weak competitiveness, with import coefficients of 16.64% for cars, pickup trucks, and utility vehicles, and 24.63% for motor vehicle parts and accessories.

Housing and household items reveal a dual pattern. Service-related products – such as rent, utilities, waste management, and household maintenance – have import coefficients close to zero. Furniture, cement, and similar goods, which are resource-intensive and low-tech, also rely minimally on imports. The other products from these groups share similar characteristics with clothing, including sectors with low competitive capacity and low investment incentives, where imports range from 11% to 24%. On the other hand, electronic components and machinery, electrical devices, and materials are products that demand high technology and capital goods, are the weakest links of Brazilian industry, as discussed by Silva and Laplane (2016). Therefore, they present higher import coefficients: 80.94% and 29.88%, respectively.

Recreation-related products exhibit greater import dependence, with 15.46% attributed to air transport, 40.87% to hotel and similar accommodation services, and 9.86% to arts, culture, sports, and recreation services. Air transport depends on technological innovation and capital goods.

Communication, education, and health are largely domestically provided services, the majority of which have coefficients close to zero. Exceptions include books, newspapers, and magazines (13.11%), which may reflect the strong influence of international editors, and pharmaceutical products (32.29%), a high-technology sector with a persistent competitive deficiency.

Finally, products related to personal care services and expenses also exhibit low import shares for most items, as they are service-oriented. Yet, tobacco products (36.04%) and perfumes, soaps, and cleaning products (15.52%) present higher import dependence. These industries are marked by low technological development, unstable domestic demand, and weak incentives for investment.

This overview of the competitive characteristics and external dependence of Brazilian industries provides the basis for assessing how their prices respond to exchange rate shocks. The next section presents the empirical strategy, followed by the estimation results.

## 1.3 Empirical strategy

To examine the EXPT, an empirical analysis of the Brazilian economy was conducted with the aim to assess how the aggregate inflation index and its subgroups respond to a 1% exchange rate depreciation shock. The impulse response functions allow us to trace these dynamics over a 24-month horizon. To obtain as many data as possible and guarantee the model robustness, it was selected the period from January 2003, when the Brazilian Economic Activity Index series begins, to March 2025, with monthly frequency. Details on the model specification and variable definitions are provided in the following section.

### 1.3.2 Model Specification

The local projections (LP) methodology (Jordà, 2005) was employed to analyze the impulse response functions for the pass-through estimation. This econometric method is based on sequential regressions of the transformed endogenous variable for several periods ahead, resembling a direct multi-period-ahead forecast but reducing forecast errors. For each forecast horizon, there is the following Ordinary Least Squares regression:

$$y_{t+h} = \alpha^h + B_1^h y_{t-1} + \cdots + B_p^h y_{t-p} + u_{t+h}^h , \qquad h = 0, 1, 2, \ldots, H-1 \tag{1.3}$$

Where $\alpha^h$ is a vector of constants; $B_p^h$ is the coefficient vector associated with the parameter matrices *y*, for lag *p* and forecast horizon *h*; and $u_{t+h}^h$ is the error term for the horizon

$t+h$. In a VAR model, the residuals are contemporaneously correlated, leading to biased economic interpretation. Because the VAR is a simultaneous equations method, to identify exogenous disturbances it is necessary to impose restrictions in the reduced form. A way to conduct this analysis is by using the Cholesky decomposition of the covariance matrix of the residuals. The result is going to be a triangular shock matrix that depends on the variables ordering, since the first variable responds to its own exogenous shock, the second variable to the first variable plus an exogenous shock to the second variable, and so on (Addamer, 2019; Greene, 2011).

Because it is a single-equation estimation, LP's advantage over the VAR lies in the fact that it does not face the identification problem. In other words, imposing restrictions (making assumptions about the model dynamics) to reach the structural form to make economic assumptions is unnecessary. Besides that, the impulse response coefficients are directly estimated by LPs, implicating in reduced bias in long horizons and not compounded small misspecification errors related to VARs estimations (Jordà & Taylor, 2024).

According to Modenesi et al. (2017), inflation dynamics depend on aggregate demand, supply (or cost) conditions, and the exchange rate. Following the literature that has estimated the EXPT in Brazil (Belaisch, 2003; Modenesi et al., 2017; Pereira & Missio, 2024), and Ribeiro et al. (2024), the equation to be estimated is:

$$Inflation\ Rate_{t+h}^{h} = a_1^h + a_2^h Exchange\ Rate_t + B_t^h Y_{t-p} + u_{t+h}^h \quad (1.4)$$

The inflation rate is the cumulative monthly rate of the Brazilian Consumer Price (IPCA) - aggregate and disaggregated for nineteen sectors; the exchange rate is the Nominal Exchange Rate Index (NEXR), weighted by the share of each trade partner; and Y is a matrix of control variables for the regressor, which include the output gap, labor unit cost, commodity prices, and administered prices index.

The output gap is used to isolate demand-driven component of inflation. When the gap is positive, it indicates a heated economy, which tends to induce a price level increase; conversely, a negative gap represents economic activity below potential, suggesting weak demand and limited inflationary pressure (Calvo, 1983). Because no official monthly output gap series exists for Brazil, the series were constructed by applying the Hodrick-Prescott (HP) filter to the cumulative Brazilian Economic Activity Index, using a smoothing parameter of λ = 14,400 (Hodrick & Prescott, 1997; Ravn & Uhlig, 2002).

When analyzing inflation dynamics, it is essential to account for both domestic and external cost pressures. The commodity prices capture external costs (Modenesi *et al.,* 2017). When it goes up, it indicates a supply shock that raises inflation. Domestic cost pressure is represented by the labor unit cost. Higher labor costs can be passed through to final prices, functioning as a domestic supply shock. In addition, if rising labor costs stem from increases in workers' income, they may also stimulate consumption, and thus generate a demand-side inflationary pressure.

Additionally, the administered prices index was used as an exogenous control for the aggregated index model. Because they are prices adjusted by policy decisions and constitute a large share of the aggregated index, including them helps isolate the influence of discretionary policies over the aggregated prices dynamics.

The shock matrix from the LP approach must be identified from a linear VAR, meaning that the endogenous variables ordering is relevant. In this model, the ordering choice was given from the most to the least exogenous variable in the system, being the exchange rate first, followed by the inflation rate, unit labor cost, and output gap. The commodity price index and the administered prices index were used as strictly exogenous variables.

The number of lags *p* was chosen after several adjustment tests. For the endogenous variables, one lag was selected as the most parsimonious (to avoid over-identification) and the best fit for all indexes. The lag for the exogenous variable was chosen according to each index's specific dynamics, described in the results discussions. To prevent seasonal effects and deterministic seasonal patterns from biasing the results, all variables were seasonally adjusted by the X-13 ARIMA method (Harrison & Stevens, 2018). In addition, Newey-West standard errors were employed to account for potential autocorrelation and heteroscedasticity (Newey & West, 1987). The sources and descriptions of all variables are shown in Table 1.4.

Table 1.4 - Variables Description

| Variable | Description | Source |
|---|---|---|
| Inflation Rate | Cumulative monthly variation (%) | IBGE |
| Nominal Effective Exchange Rate Index | Index (level) | Brazilian Central Bank |
| Output gap | Trend component by the HP filter of the Brazilian Economic Activity Index (level) | Brazilian Central Bank |
| Commodity Prices | US$ (level) | Brazilian Central Bank |
| Labor Unit Cost | US$ (level) | Brazilian Central Bank |
| Administered Prices Index | Cumulative monthly variation (%) | Brazilian Central Bank |

Source: Author's elaboration.

### 1.3.2. Brazilian Consumer Price Index

The Brazilian Consumer Price Index is released monthly by the IBGE. The IPCA is calculated considering the consumption of families whose monthly income ranges from 1 to 40 times the minimum income and resides in one of the 16 regions – metropolitan region of Belém (PA), Fortaleza (CE), Recife (PE), Salvador (BA), Belo Horizonte (MG), Rio de Janeiro (RJ), São Paulo (SP), Curitiba (PR), Vitória (ES), and Porto Alegre (RS), besides the capitals Goiânia (GO), Campo Grande (MS), Rio Branco (AC), São Luís (MA), Aracaju (SE) e Brasília (DF). The consumption basket and the relative weights of the goods are calculated based on the Consumer Expenditure Survey (POF)[2].

The IPCA is structured into groups, subgroups, items, and subitems, each of which is assigned a weight[3] to calculate the overall index. A more sectorally disaggregated pass-through analysis is carried out using the General Consumer Price Index and its nineteen subgroups[4]. Each subgroup has a distinct composition and is subject to specific factors that influence price dynamics, as outlined in Table 1.5.

Figure 1 illustrates the trend of each inflation subgroup in relation to the General Consumer Price (red dashed line). This comparison highlights the heterogeneity among the subgroups, as their individual trends do not necessarily align with the overall index in terms of both direction and magnitude. The differences in the means and standard deviations of each index, presented in Table 1.6, further emphasize that distinct factors drive the dynamics of each subgroup.

[2] The weight of each product consumed by a family is updated every time a new POF is released. The last research was conducted during 2017/2018 and was published by the end of 2019. Hence, the latest IPCA's structure update is from January 2020, and from this date only the weight of each product on the general index is monthly updated, considering constant the families' consumption basket.

[3] The weight of each subgroup on the general index is described in Annex 1.2.

[4] The subgroup 7.2 received a specific treatment. The composition of this subgroup changed along the analyzed period, as items related to film and photograph were modified due to technological advancements in the sector. For this reason, the items 7.2.1 and 7.2.2 were used, related to recreation and tobacco, respectively, as these remained constant throughout the period.

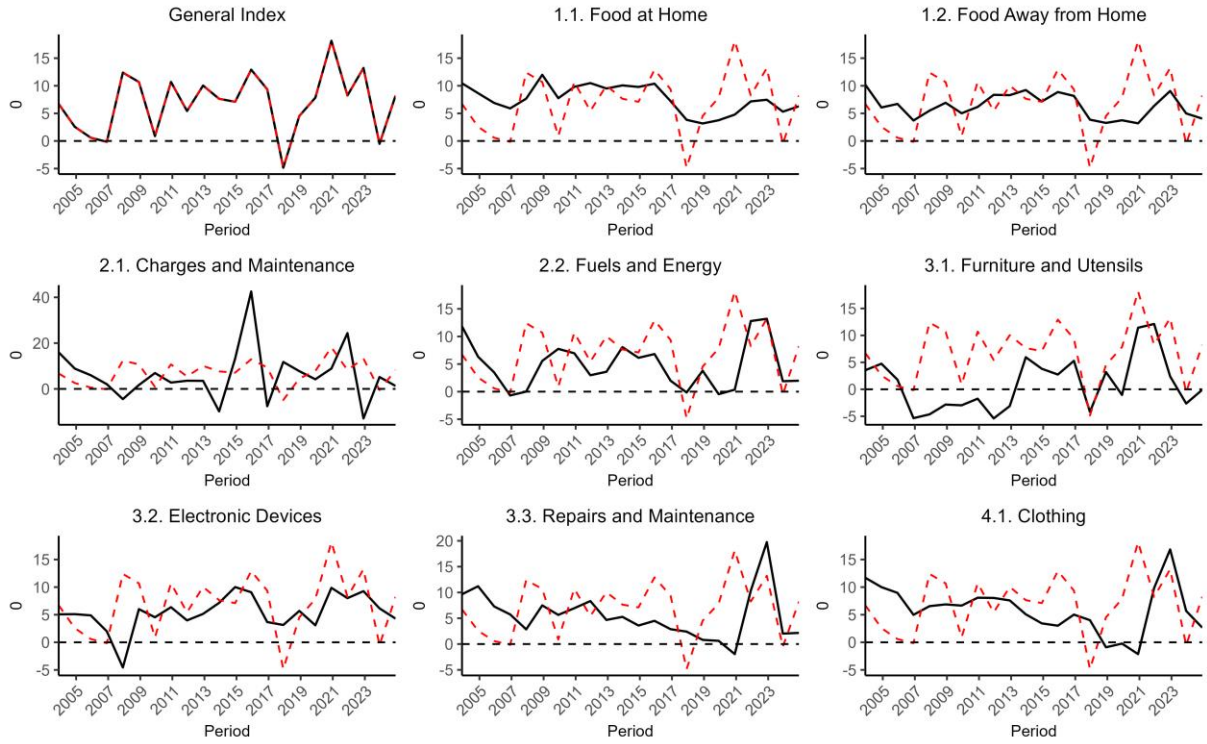
Table 1.5 - Description of General Consumer Price Index groups and subgroups

| Groups and Subgroups of the General Consumer Price Index | Type of Goods* | Factors that affect prices |
|---|---|---|
| 1. Food and beverages | | |
| 1.1 Food at Home | T | Prices can be influenced by factors like seasonality, climate conditions, agriculture, logistics, and service costs. |
| 1.2 Food Away from Home | T - NT | |
| 2. Housing | | |
| 2.1 Charges and Maintenance | T - NT | Prices can be influenced by public tariffs, construction costs, and energy costs. |
| 2.2 Fuels and Energy | T | |
| 3. Household items | | |
| 3.1 Furniture and Utensils | T | Prices can be influenced by raw material costs, durable goods demand, and import conditions (prices, tariffs, and exchange rate). |
| 3.2 Electronic Devices | T | |
| 3.3 Repairs and Maintenance | T - NT | |
| 4. Clothing | | |
| 4.1 Clothing | T | This group's prices can be influenced by the season of the year (summer, spring, winter, and fall), fashion tendencies, and import conditions (prices, tariffs, and exchange rate). |
| 4.2 Shoes and Accessories | T | |
| 4.3 Jewelry and Costume Jewelry | T | |
| 4.4 Fabrics and Notions | T | |
| 5. Transportation | | |
| 5.1 Transportation | T - NT | This group includes public transportation tariffs, sale prices of private transportation, fuels, and transport maintenance. Given this, inflation can be influenced by public tariffs, fuel prices, and import conditions (prices, tariffs, and exchange rate). |
| 6. Health and personal care | | |
| 6.1 Pharmaceuticals and Optics | T | This group's prices can be influenced by health insurance readjustments, drug price changes, and import conditions (prices, tariffs, and exchange rate). |
| 6.2 Health Services | NT | |
| 6.3 Personal Care | T | |
| 7. Personal expenses | | |

| | | |
|---|---|---|
| 7.1 Personal Services | NT | Comprises general services, in which prices are more deregulated and respond faster to demand and operational cost changes. |
| 7.2.1 Recreation | T - NT | Prices are more influenced by import costs and demand. |
| 7.2.2. Tobacco | T | |
| | 8. Education | |
| 8.1 Courses, Reading and Stationery | T - NT | Prices can be influenced by changes in schools and courses tuition, and school material prices. |
| | 9. Communication | |
| 9.1 Communication | NT | Prices can be influenced by changes in telecommunication services tariffs, technological costs, and sector regulatory policies. |

Source: Own elaboration, based on IBGE data.
*T indicates tradable and NT is non-tradable.

Figure 1.1 - Inflation subgroups dynamics relative to the General Price Index. Annual percentage change (2003-2024)



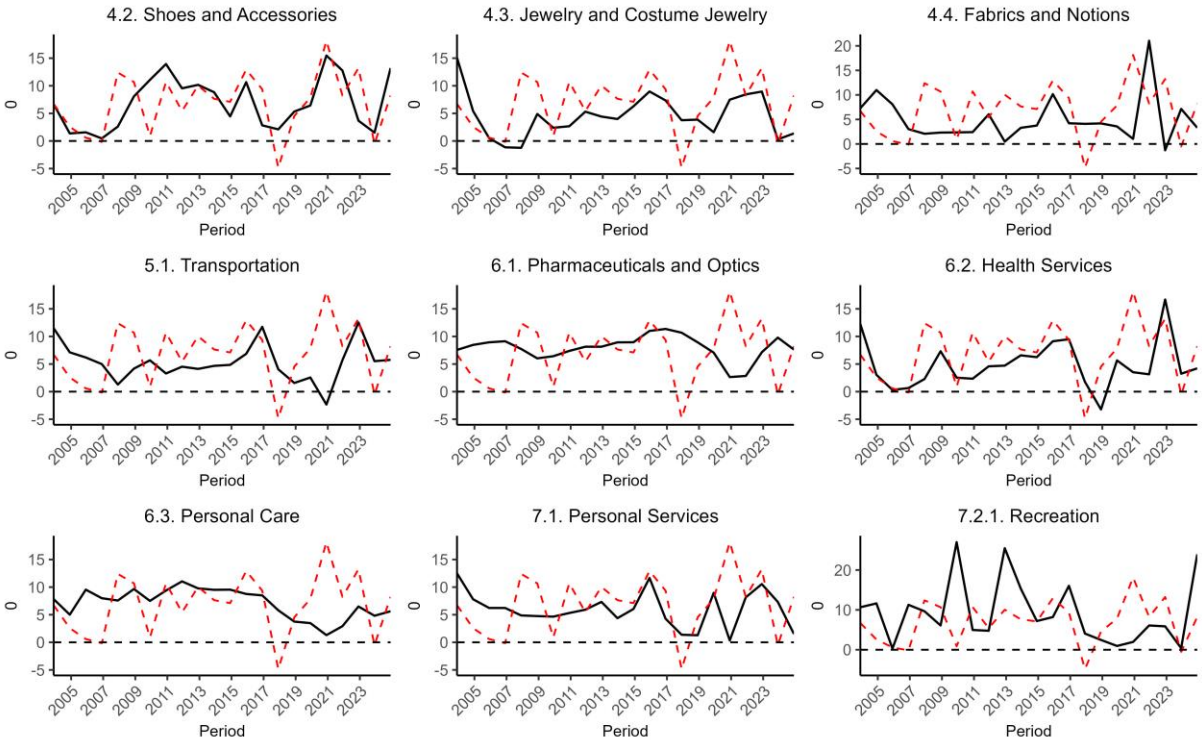
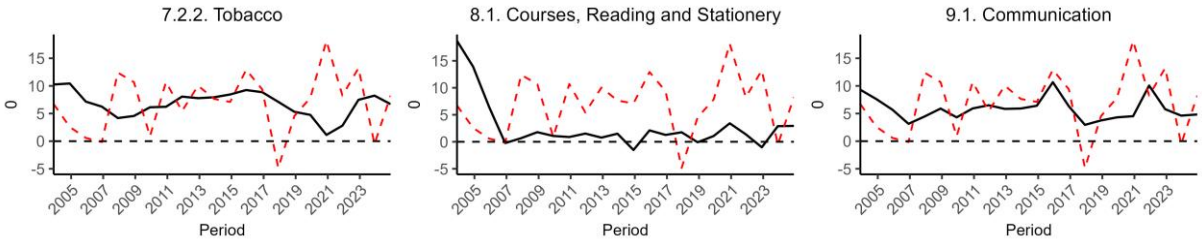



*Figure 1.1 continued…*




Source: Own elaboration, based on IBGE data. The red line indicates the General Consumer Price Inflation, and the black line indicates the subgroup index

Table 1.6 - Inflation subgroups descriptive analysis

| Variable | Mean | Standard Deviation | Min | Pctl. 25 | Pctl. 75 | Max |
|---|---|---|---|---|---|---|
| Nominal Exchange Rate Index | 209.9537 | 45.5455 | 315.26 | 137.21 | 172.17 | 239.865 |
| General Consumer Price | 5.63 | 1.84 | 2.93 | 4.38 | 6.23 | 10.2 |
| Food at Home | 6.46 | 5.31 | -4.95 | 2.46 | 10.06 | 16.84 |
| Food away from Home | 7.38 | 2.33 | 3.14 | 5.76 | 9.39 | 11.4 |
| Maintenance Costs | 6.18 | 1.97 | 3.15 | 4.89 | 7.99 | 8.87 |
| Fuels and Energy | 5.75 | 10.82 | -13.39 | 2.03 | 8.83 | 37.01 |
| Furniture and Utensils | 4.58 | 3.89 | -0.7 | 1.88 | 6.75 | 12.49 |
| Electronic Devices | 0.94 | 5.00 | -5.49 | -3 | 3.77 | 11.5 |
| Repairs and Maintenance | 5.21 | 3.16 | -4.65 | 3.77 | 6.93 | 9.62 |
| Clothing | 5.50 | 4.33 | -1.92 | 2.81 | 7.31 | 18.18 |
| Shoes and Accessories | 5.86 | 4.03 | -2.15 | 3.96 | 7.79 | 15.65 |
| Jewelry and Costume Jewelry | 6.30 | 4.31 | 0.47 | 2.6 | 9.78 | 14.5 |
| Fabrics and Notions | 4.45 | 3.40 | -1.24 | 2.4 | 7.1 | 11.53 |
| Transportation | 4.71 | 4.40 | -1.04 | 2.34 | 5.91 | 19.33 |
| Pharmaceuticals and Optics | 5.04 | 3.19 | -2.34 | 4 | 6.08 | 12.01 |
| Health Services | 7.65 | 2.11 | 2.63 | 6.86 | 8.6 | 10.83 |
| Personal Care | 4.63 | 4.02 | -3.16 | 2.31 | 6.4 | 15.62 |
| Personal Services | 6.81 | 2.56 | 1.3 | 4.89 | 9.12 | 10.52 |
| Recreation | 5.92 | 2.89 | 0.37 | 4.51 | 7.52 | 11.17 |
| Tobacco | 8.14 | 6.93 | 0.28 | 4.01 | 10.84 | 25.3 |
| Courses, Reading and Stationery | 6.60 | 2.20 | 1.26 | 5.25 | 8.12 | 10.14 |
| Communication | 2.67 | 4.52 | -1.51 | 0.77 | 2.1 | 17.24 |

Source: Author's elaboration. The base date for the Nominal Effective Exchange Rate is June 1994.

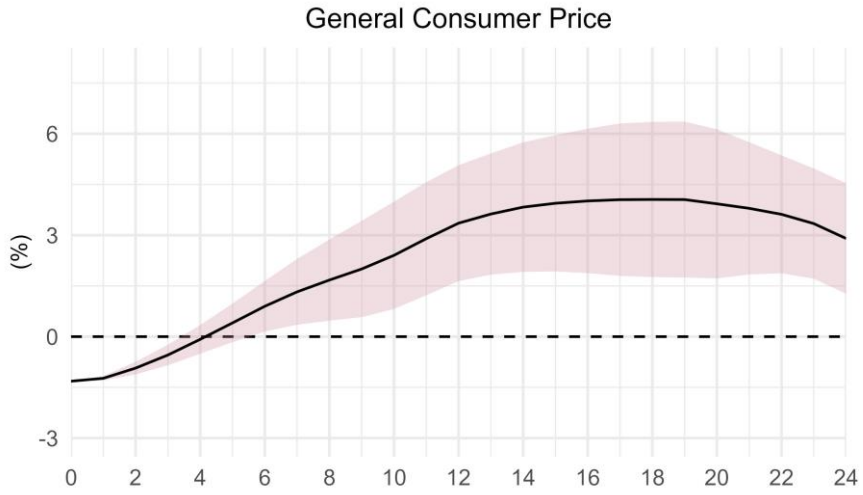
It was simulated each price index's response to a 1% depreciation shock in the NEER. The pass-through coefficients are obtained from the cumulative response, normalized by the cumulative shock. The results are presented in the following section.

## 1.4 Empirical Results

### General Consumer Price

The General Consumer Price is sensitive to the exchange rate, presenting a persistent price increase from the sixth month and achieving the highest PT on the eighteenth month, of 4.05% (see Figure 1.2). This confirms previous estimations of EXPT for Brazil found by Modenesi et al. (2017), in which the effect of a currency devaluation is transmitted to the general consumer price. Nonetheless, as mentioned previously, it may not be necessarily true that every subgroup responds similarly to changes in the exchange rate. Hence, the following subsections present the results segregated by subgroup of the price index.

Figure 1.2 - Projected inflation for the General Consumer Price 24 months after a NEER depreciation shock



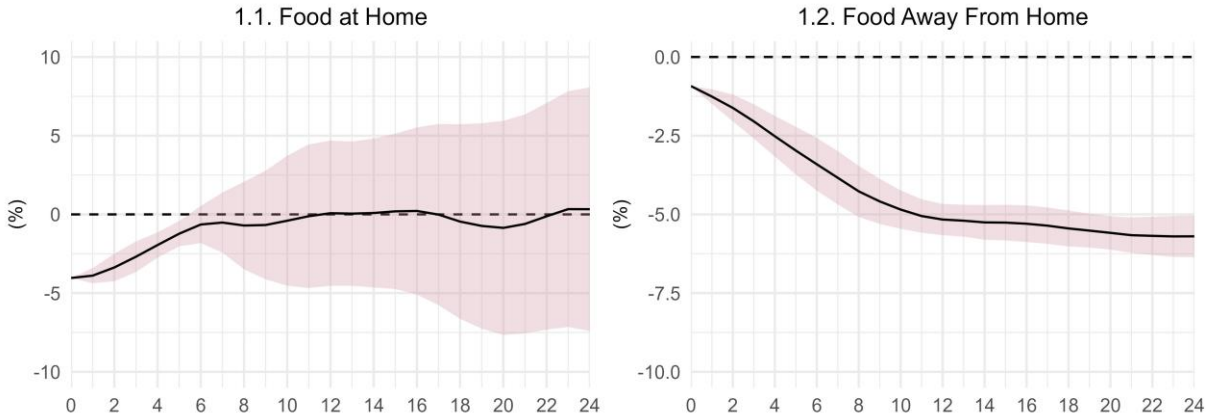

Source: Author's elaboration. Confidence Interval of 95%.
*It was used 1 lag for endogenous variables.

Food and Beverages

Both subgroups, "Food at Home" and "Food Away From Home", have similar factors that influence prices. As presented in Table 1.5, food prices depend on climate conditions, climate seasonality, agriculture, production, and logistics costs. Nonetheless, prices in the "Food Away From Home" subgroup are also impacted by costs associated with the services sector. In other words, the main difference is that for the second subgroup, variables such as establishments' costs, employees' costs, and taxes can also impact prices.

As can be seen in Figure 1.3, the "Food at Home" subgroup responds to the NEER shock with a decrease in prices that loses its effect after the sixth month. In turn, the subgroup "Food Away From Home" exhibits a steeper and more persistent price decrease. These sectors have highly competitive capacity and low import coefficients, as discussed in Section 1.2.4. This behavior can be explained by the drop in domestic demand due to the price increase in other sectors, following the devaluation. Consequently, eating out, which is a typical non-tradable good, as long as has a higher price elasticity, experiences a drop in prices.

Figure 1.3 - Projected inflation for the Food and Beverages group 24 months after a NEER depreciation shock



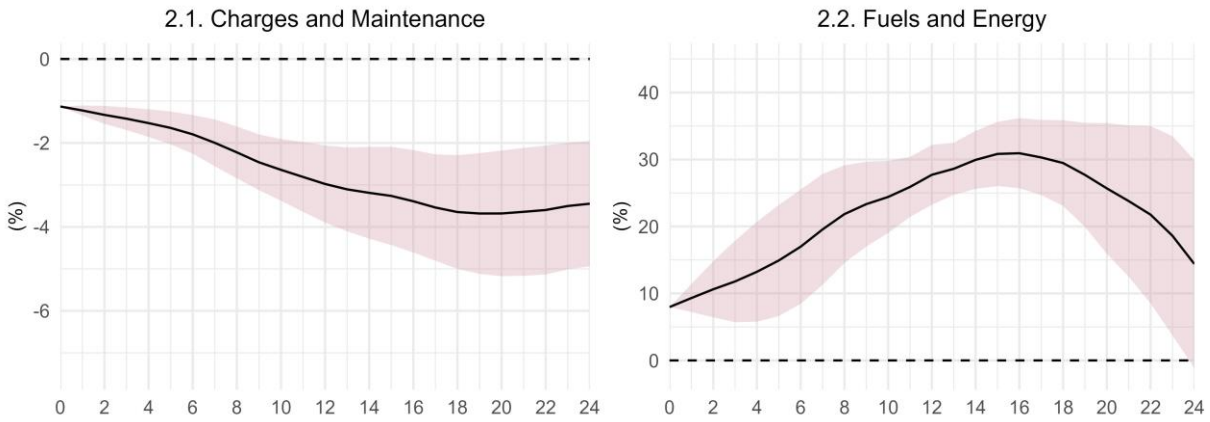

Source: Author's elaboration. Confidence Interval of 95%.
* Subgroups 1.1 and 1.2 were controlled using 1 lag for the endogenous variables

Housing

Figure 1.4 shows the impulse response for "Charges and Maintenance" and "Furniture and Utensils". The subgroup "Charges and Maintenance" includes housing tariffs and charges, repair material, and cleaning supplies. Hence, it comprises both tradable and non-tradable items, with most of its production being local. Domestic producers may use an external cost increase as an advantage to improve their competitiveness and gain market share. The pass-through coefficient reaches -2.96% in the twenty-first month.

"Fuels and Energy", on the contrary, comprises items priced according to international standards, such as gas and coal. With an exchange rate depreciation, the price of these goods in the domestic currency increases significantly, reaching an exchange rate pass-through coefficient of 28.06% in the nineteenth month, beginning a reduction trend in the following months.

Figure 1.4 - Projected inflation for the Housing group 24 months after a NEER depreciation shock




Source: Author's elaboration. Confidence Interval of 95%.
* Subgroups 2.1 and 2.2 were controlled using one lag of the exogenous variable.

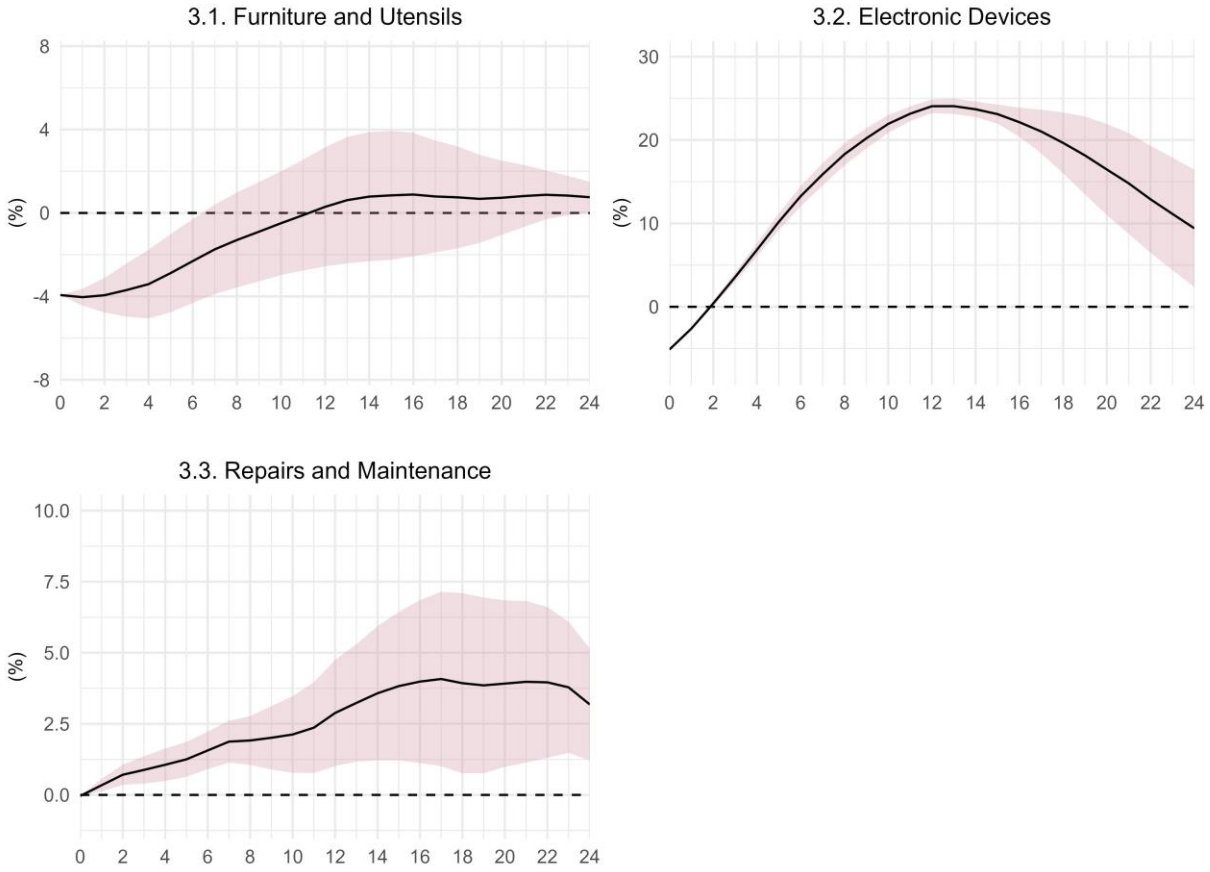
Household Items

The subgroup "Furniture and Utensils" comprises tradable items, such as furniture, household decorations, and utensils. The price decrease from the first to the sixth month could indicate a rapid response by domestic firms, likely enhanced by competition, as an attempt to maintain market share. This response, however, stops being statistically significant for the following months, as indicated by Figure 1.5.

The subgroups "Electronic Devices" and "Repairs and Maintenance" exhibit a price increase in the whole simulation period. The "Electronic Devices" have a persistent response that does not recover by the end of the simulation forecast, achieving a PT coefficient of 25.92% in the fifteenth month. The shock for the "Repairs and Maintenance" subgroup, however, presents a more constant trend, with a maximum effect of 3.19% in the sixteenth month.

The subgroup "Electronic Devices" includes household appliances and equipment, sound and computing devices, all of which are tradable items with a high technological component that Brazil does not produce, with a high import coefficient and the exchange rate as an important cost factor. For "Repairs and Maintenance", items such as refrigerator, television, cell phone, and bike repairs are included. This subgroup can be seen as a service provision, but it depends on imported items to operate, which explains the rise in prices following the exchange rate devaluation. The response from these two subgroups reinforces the typical tradable dynamics: items with strong imported components are expected to exhibit a rapid and persistent price increase following a currency devaluation.

Figure 1.5 - Projected inflation for the Household Items group 24 months after a NEER depreciation shock




Source: Author's elaboration. Confidence Interval of 95%.
* Subgroup 3.1 was controlled using two lags of the exogenous variable.
** Subgroups 3.2 and 3.3 were controlled using one lag of the exogenous variable.

Clothing

This group results are presented in Figure 1.6. The clothing sector is characterized as being competitive deficient, with import coefficients ranging between 8% and 20.55% (see Table 1.3). Besides, markets are non-oligopolistic and more demand sensitive. In the case of currency depreciation, domestic companies can use the favorable scenario to reduce their prices and increase competition, this could be the case for the subgroups "Clothing" and "Shoes and Accessories", which decrease in prices achieve 2.26% and 2.34%, respectively.

The "Jewelry and Costume Jewelry" subgroup comprises jewelry, costume jewelry, and wristwatches, encompassing both domestic and non-domestic production. The increase in prices from the first to the sixth month could indicate that the import share of the subgroup reacts faster to the cost increase, reaching an EXPT coefficient of 5.95% in the second month. However, it is important to consider the weight that each item has on the family consumption basket. These price indexes are constructed with a sample of families that have family income

between 1 and 40 times the minimum income. These families are not the typical customers for these goods, which helps explain the unexpected price decrease in the estimation. This may be reflected in the market demand adjustment from the eleventh month, resulting in a 14.62% price reduction by the twenty fourth month of the estimation.

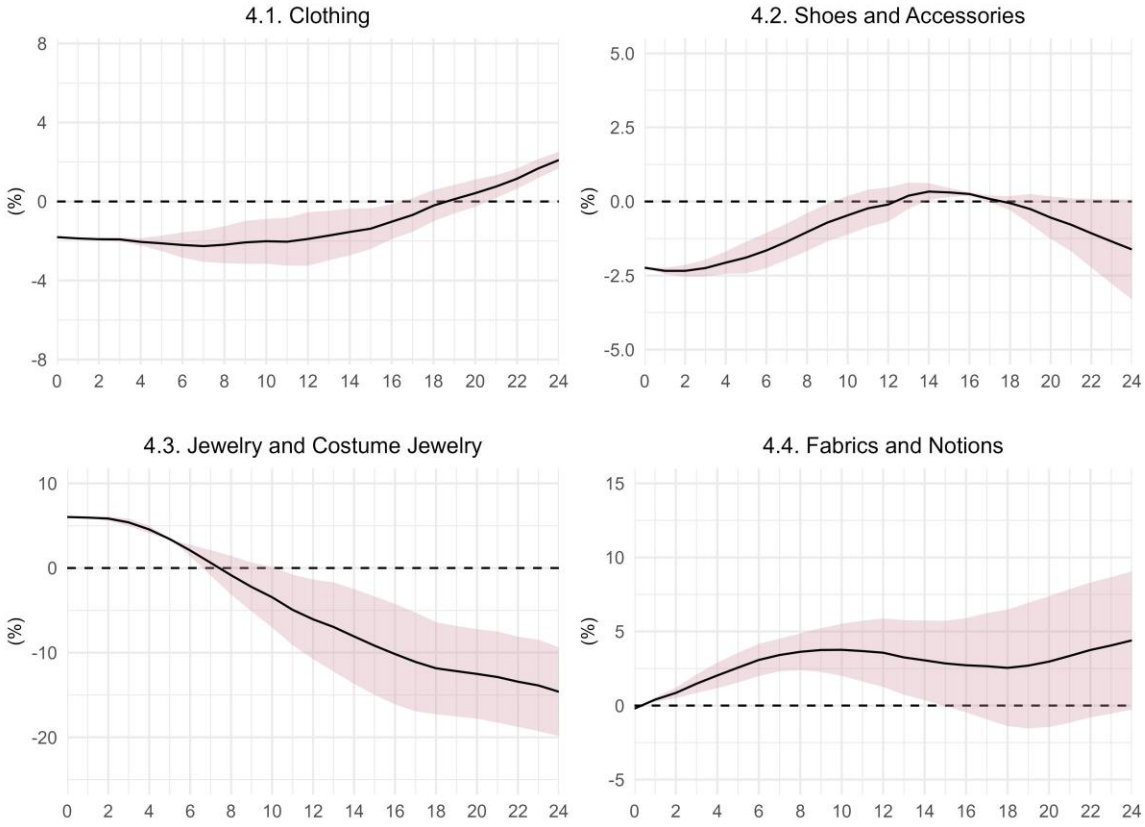
The subgroup “Fabrics and Notions” presents a persistent price increase throughout the entire simulation period, reaching an EXPT coefficient of 3.76% in the twelfth month, which stops being statistically significant by the fifteenth month. This effect can be attributed to a stronger presence of imported goods and inputs in the sector, as this subgroup presents the highest import coefficient of the group (see Table 1.3). The higher competition in this sector allows the cost increase to be passed on to the final consumer price.

Transportation

This subgroup comprises various types of items, including public transportation (which encompasses tariffs), private transportation (along with its associated costs, such as rent, purchase, insurance, and accessories), and fuel. The subgroup response to the exchange rate shock is shown in Figure 1.7, which highlights a consistent price increase throughout the entire period.

Although some items may be non-tradable, private transport accounts for the largest share within this subgroup, featuring high import coefficients and prices that are internationally determined. These characteristics explain the significant pass-through of 20.2% in the fifteenth month for this subgroup's prices.

Figure 1.6 - Projected inflation for the Clothing group 24 months after a NEER depreciation shock




Source: Author's elaboration. Confidence Interval of 95%.
*Subgroups 4.1, 4.3, and 4.4 were controlled using 1 lag of the exogenous variable and its contemporaneous effect.
**Subgroup 4.2 was controlled using one lag of the exogenous variable.

Figure 1.7 - Projected inflation for the Transportation group 24 months after a NEER depreciation shock


Source: Author's elaboration. Confidence Interval of 95%.
*Subgroup 5.1 was controlled using one lag of the exogenous variable.

Health and Personal Care

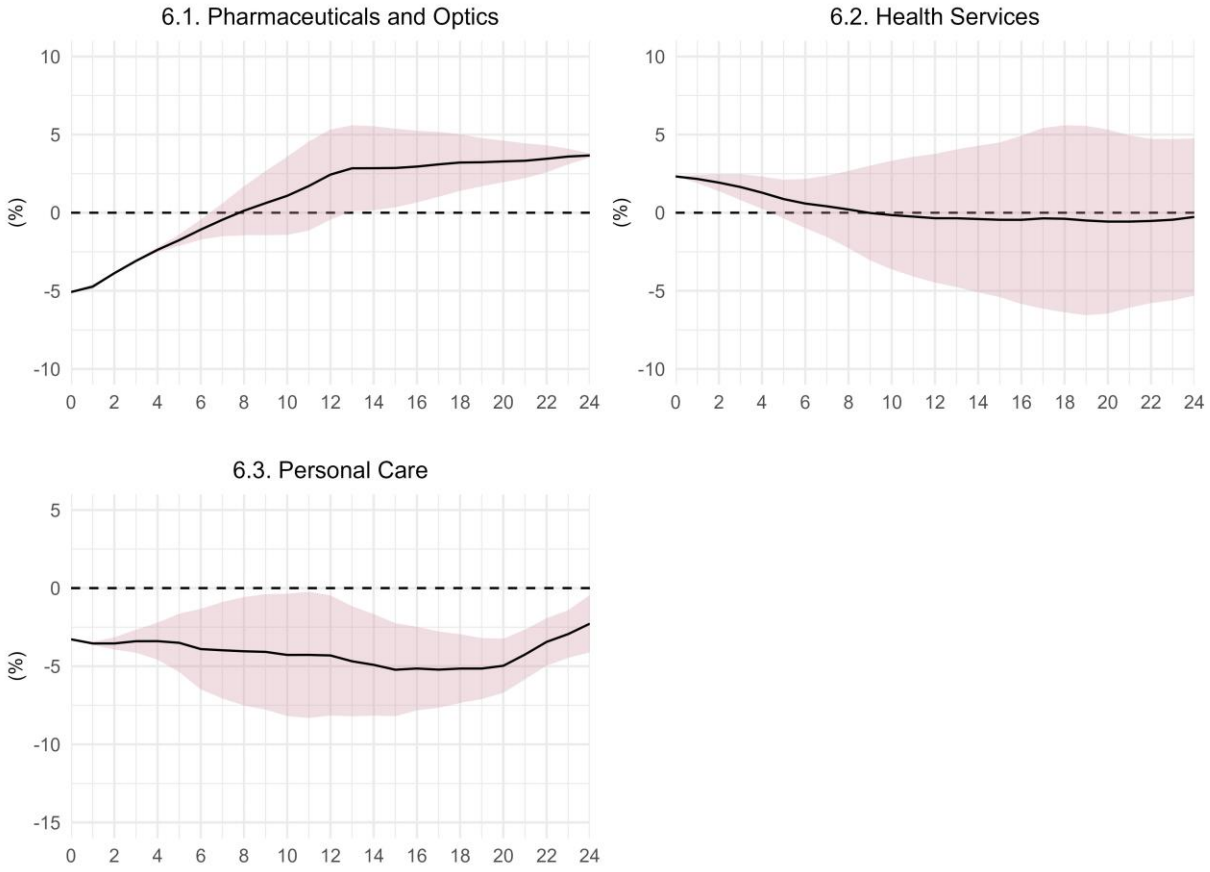
The "Pharmaceuticals and Optics" subgroup comprises tradable items and is primarily driven by the dynamics of pharmaceutical products. This sector has a high import share and is

characterized by competitive deficiency and oligopolistic markets. These characteristics imply a dual response to the exchange rate devaluation shock. At first, there is a decrease in prices of 4.73%, which may be associated with an attempt to absorb the cost increase and gain market share. However, this effect is not persistent, with a price increase from the fifteenth month through to the last month, when it reaches an EXPT coefficient of 3.66%. This increase in prices may reflect a delayed transmission of costs to final prices, given that the import share is 32.29%.

The “Health Services” subgroup is mainly composed of non-tradable items, which include medical appointments’ tariffs, medical exams, and health insurance tariffs. Even though they are coming mostly from the service sector, some of them are sensitive to external prices, given the technological complexity of the health sector. The results presented in Figure 1.8 indicate a slight price adjustment of 2.16% in the initial months, followed by a stabilization for the rest of the period.

Lastly, the “Personal Care” subgroup contains tradable items, such as personal hygiene products, with market characteristics very similar to “Clothing”: it is competitive deficient, has a relatively high import coefficient (15.52%, as presented in Table 1.3), characterized with non-oligopolistic markets, and is more demand sensitive. In this respect, the exchange rate devaluation may be used by domestic firms to improve their competitiveness and gain market share, by reducing prices. The EXPT coefficient indicates a price decrease of 5.22% in the seventeenth month.

Figure 1.8 - Projected inflation for the Health and Personal Care group 24 months after a NEER depreciation shock




Source: Author's elaboration. Confidence Interval of 95%.
*Subgroup 6.1 was controlled using one lag of the exogenous variable.
**Subgroup 6.2 was controlled using two lags of the exogenous variable and its contemporaneous effect.
***Subgroup 6.3 was controlled using four lags of the exogenous variable and its contemporaneous effect.

Personal Expenses

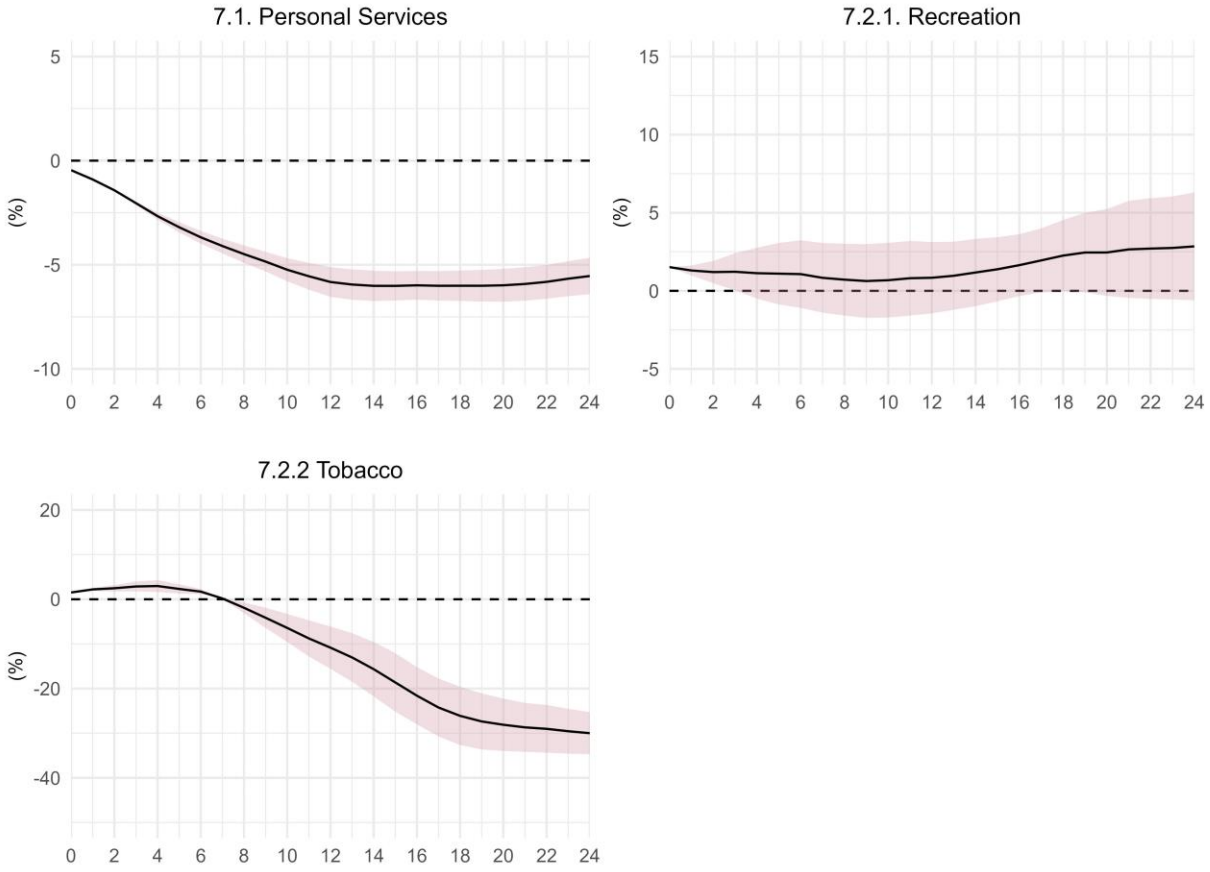
The "Personal Services" subgroup consists of non-tradable items, presenting a price decrease as a response to the exchange rate depreciation shock. Given the sector's substitutability and non-oligopolistic structure, sellers may react to the shock by lowering prices to strengthen competition. As a result, prices fall by 6% in the nineteenth month, as shown in Figure 1.9.

The "Recreation" subgroup comprises both tradable and non-tradable subitems, including toys, cultural activities, travel, pet care, musical instruments, and gambling. Prices increase by 1.3% in the first month, but the effect loses statistical significance from the third month onward. Since non-tradable products account for a larger share of this item, its overall sensitivity to the exchange rate shock is relatively limited.

"Tobacco" and related products, in turn, present a relatively high import share of 36.04% (see Table 1.3). Accordingly, prices initially rise, reaching an EXPT coefficient of 2.97% in the fourth month. However, this market is subject to specific competitive and

regulatory conditions, shaped by strong anti-smoking policies and public health initiatives. These factors, combined with the initial price increase, may trigger demand adjustments, which help explain the subsequent decline in prices from the eighth month to the twenty-fourth month, when it reaches 30%.

Figure 1.9 - Projected inflation for the Personal Expenses group 24 months after a NEER depreciation shock




Source: Author's elaboration. Confidence Interval of 95%.
*Subgroup 7.1, 7.2.1 were controlled using one lag of the exogenous variable.
**Subgroup 7.2.2 was controlled using two lags of the exogenous variable and its contemporaneous effect.

Education

All items in this subgroup are non-tradable, including education fees, reading materials, school supplies, and courses. Figure 1.10 reports the estimation results, showing a continuous decline in prices over the entire period, reaching a 2.81% reduction by the eleventh month. As these are exclusively domestic goods and services, the exchange rate affects the sector primarily through the demand channel. Exchange rate depreciation raises overall prices and,

consequently, reduces households' purchasing power. Given the high income elasticity of these products, demand falls as real income declines. This contraction in demand triggers a supply-side adjustment, which materializes in lower prices.

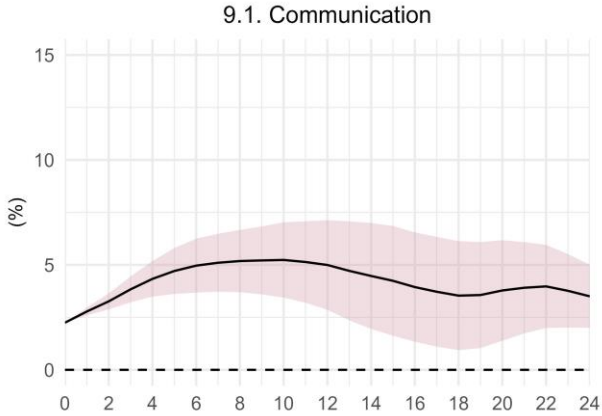
Communication

This subgroup comprises non-tradable items, including post, telephone, and internet tariffs. Figure 1.11 reveals that this sector reacts to the exchange rate shock with a price increase in the entire period, reaching an EXPT coefficient of 5.23% by the tenth month. This increase may be related to technological factors within the sector, where prices are externally determined.

Figure 1.10 - Projected inflation for the Education group 24 months after a NEER depreciation shock


Source: Author's elaboration. Confidence Interval of 95%.
*Subgroup 8.1 was controlled using one lag of the exogenous variable.

Figure 1.11 - Projected inflation for the Communication group 24 months after a NEER depreciation shock




Source: Author's elaboration. Confidence Interval of 95%.
*Subgroup 9.1 was controlled using one lag of the exogenous variable.

Table 1.7 presents the EXPT coefficient for each estimation and the statistical significance for the last month of the simulation.

Table 1.7 – EXPT coefficients and their significance for the 24th month

| Price Index | EXPT Coefficient (%) | Significance |
|---|---|---|
| General Index | 2.90 | Yes |
| 1.1. Food at Home | 0.33 | No |
| 1.2. Food Away from Home | -5.70 | Yes |
| 2.1. Charges and Maintenance | -3.45 | Yes |
| 2.2. Fuels and Energy | 18.92 | Yes |
| 3.1. Furniture and Utensils | 0.75 | No |
| 3.2. Electronic Devices | 9.41 | Yes |
| 3.3. Repairs and Maintenance | 3.18 | Yes |
| 4.1. Clothing | 7.11 | Yes |
| 4.2. Shoes and Accessories | 5.33 | Yes |
| 4.3. Jewelry and Costume Jewelry | -13.17 | Yes |
| 4.4. Fabrics and Notions | 3.99 | No |
| 5.1. Transportation | 11.51 | Yes |
| 6.1. Pharmaceuticals and Optics | 3.67 | Yes |
| 6.2. Health Services | -0.27 | No |
| 6.3. Personal Care | -2.28 | Yes |
| 7.1. Personal Services | -5.54 | Yes |
| 7.2.1. Recreation | 2.85 | No |
| 7.2.2. Tobacco | -30.00 | Yes |
| 8.1. Courses, Reading and Stationery | -2.30 | Yes |
| 9.1. Communication | 3.50 | Yes |

Source: Author's elaboration.

## 1.5 Concluding Remarks

In this study, the effect of an exchange rate shock on the Brazilian General Consumer Price and its components was estimated. The results are consistent with the literature (Pereira & Missio, 2024; Modenesi et al., 2017; Correa, 2017; Couto & Fraga, 2014; Nogueira, Mori & Marçal, 2013), indicating that the Brazilian economy is sensitive to the exchange rate, as the majority of the indexes were statistically significant to the shocks and presented an incomplete pass-through.

The results suggest that a domestic currency devaluation is not homogeneous among subgroups, with the highest price increases observed in categories such as “Electronic Devices”, “Fuels and Energy”, and “Transportation”, which have a higher share of imports in their production and final demand, and have prices internationally set (in the case of “Fuels and Energy”). On the other hand, the subgroups that presented the largest price decreases were “Tobacco”, “Jewelry and Costume Jewelry”, and “Personal Services”, due to specific demand and competition dynamics. This heterogeneity can be explained by the degree of sector competitiveness and the varying dependence on imported inputs (Krugman, 1986; Arestis & Milberg, 1993). Differences in productive and competitive structures influence the price formation process and, consequently, the behavior of prices in each subgroup when faced with a currency devaluation. Additionally, the Brazilian economy underwent significant indexation during the privatization process, causing exogenous shocks to affect service prices (Farhi, 2007). In this regard, it is not only tradable goods that are sensitive to exchange rate fluctuations, but also non-tradable and administered prices.

An extension of this work could involve a more detailed analysis of the different channels through which the exchange rate affects prices – namely, import degree, external competitiveness, markup, and market share. Each of these channels are linked to complex and often hidden process that require careful examination. Additionally, the effects of exchange rate devaluations on consumption in economies with different productive structures could be explored, allowing for a comparison across countries. To carry out such an analysis, the availability of inflation data from the consumption perspective, disaggregated by sector, would be essential.

The next step in this research is to evaluate the exchange rate effect on personal income distribution, based on the consumption baskets of different family arrangements. By observing the relative weight of exchange rate-sensitive products in each household budget, it is possible to discuss the exchange rate effects on different household compositions. This discussion will be addressed in the next chapter.

# 2. CHAPTER 2 – Exchange Rate Pass-through and Family Budget

## 2.1 Introduction

When discussing gender inequality, there is evidence that “gender gaps in education, health, unpaid labor, employment, and wages have economy-wide consequences and influence the rate of growth” (Seguino, 2020, p.1). These gender gaps stem from the sexual division of labor, where unpaid reproductive labor is historically associated with women, as the paid productive labor is associated with men. There is an inherent contradiction between the two, with productive labor dominating over reproductive labor (Kergoat, 2003).

This sexual division is rooted in society, in a way that women are given the responsibility for care even before they are born. Thus, this role grows with them, to the extent that every decision-making has this factor as a weight, even if unintended. There is no such thing as an arbitrary choice. Every individual carries with them their personal background, experiences, and knowledge, all of which influence their choices.

In this way, it cannot be expected that men and women make the same decisions regarding consumption. Even within the household, expense priorities will differ depending on the family's reference person's gender. Several empirical studies confirm that households with a female reference tend to spend a higher income share with basic necessities and care-related expenses – such as housing, food, healthcare, education, clothing – whereas families with male reference allocate higher spending share with expenses such as transport, recreation, gambling, and assets increase (Phipps & Burton, 1998; Doss, 1996; Pinheiro & Fontoura, 2007; Carvalho & Alves, 2010; Passos et al., 2024).

Given that consumption patterns differ significantly between families with a male or female reference person, it is reasonable to expect that inflation is not perceived uniformly across these two groups. The general inflation index is built based on household consumption, weighted by the share of each expense in relation to total household income. This method, known as plutocratic weighting, calculates the weight of each item by the proportion of total expenditure on that good relative to the overall spending across all households. As a result, families with higher total consumption exert more influence on both the composition and weighting of the consumption basket (Ley, 2001; IBGE, 2020). For example, in the event of a fuel price shock caused by rising oil prices, the overall inflation index may rise, since wealthier families tend to allocate more of their spending to private transportation. In contrast, public

transportation fares - more relevant to low-income households - are regulated by the government and typically adjust more slowly. Thus, a low-income family without access to private transport may not perceive the same level of inflationary pressure. When discussing the US consumer price index (CPI), Ley (2001) highlights that plutocratic weighting introduces a bias toward upper-income households as the "representative" consumer (p. 4). Hence, it is important to look not only at the aggregate inflation level, but also at its subgroups when dealing with inequality.

Similarly, foreign exchange rate (FXR) shocks may be felt differently, given the household's consumption basket. As discussed in the previous chapter, the FXR is an important cost variable that influences the consumer's final price. If a family has a higher share of tradable goods in their consumption basket, whose prices are more sensitive to the FXR, then they may find their real income more or less affected as the economy faces FXR shocks.

This chapter introduces a discussion connecting the gender of the household reference person with the exchange rate pass-through estimated in the previous chapter. For that matter, data found in the literature that uses the Brazilian Consumer Expenditure Survey from 2018 (POF 2017-2018) is compiled to analyze the consumption basket of families with a male and female reference, and discuss how the exchange rate pass-through effect would impact their budget, in light of the empirical findings from the first chapter.

This chapter is organized as follow: Section 2.2 discusses gender inequality, from the concept of productive and reproductive labor, and how this division shapes the individual decision-making process; Section 2.3 reviews the literature regarding different consumption patterns between men and women; Section 2.4 investigates how different consumption may be translated into different inflation perception for, in Section 2.5, connect this discussion to the exchange rate pass-through. Finally, Section 2.6 presents the concluding remarks.

## 2.2 Decision-making process in light of the sexual division of labor

The division of labor between men and women is not natural and complementary, but rather a reflection of the power relations between men and women. We find a sexual division of labor, where the social division of labor is shaped by social relations between men and women (Kergoat, 2003), influenced by historical and local contexts. In this division, men are given the role of production and higher socially valued activities, while women are given the reproductive and least socially renowned activities.

Social reproduction is an undervalued work, though indispensable for society. The provisioning, caregiving, and interaction activities produce and maintain social bonds, forming human subjects and constituting them as social beings (Fraser, 2016). Productive and reproductive labor, although indispensable to each other, were separated into two different spheres and seen as an inherent contradiction. By not being remunerated, reproductive labor is often taken for granted and not treated as labor, reinforcing gender inequalities -even though the feminist economics literature theoretically and empirically discusses the importance of reproductive work to economic growth (Braunstein, van Staveren & Tavani, 2011; Braunstein, 2015; Braunstein, Bouhia & Seguino, 2019; Onaran, Oyvat, & Fotopolou, 2022).

Safiotti (1979) contrasts gender roles in pre-capitalist communities - specifically feudal societies - with those in modern capitalist systems, emphasizing that although gender inequalities have always existed, their manifestations have evolved alongside societal development. In the feudal context, married women enjoyed a degree of autonomy to engage in commercial activities. Still, they were subject to male supervision for other matters, while single women were largely excluded from such economic participation. Women's validation for non-domestic activities was given only through marriage. Furthermore, as argued by the author, in these economies, female labor in productive work was tolerated, as it served the function of sustaining the leisure class represented by the elites.

As the capital gained its strength and the idleness lost its value, the relationship of women and paid work changed. Even though marriage was no longer a condition for women to be validated in market work, the positions they had access to, and their quality, were very limited relative to the ones that men accessed. Women were found in manual and less skilled activities, while men were in more qualified positions and at decision-making places. Even today, with higher women's participation in the paid labor force and skilled work, the quality and pay of those jobs are not equal, with women representing a significant portion of informal and part-time jobs, making them more susceptible to economic fluctuations (Safiotti, 1979; Vasudevan & Raghavendra, 2022).

These gender differences in the labor market can be attributed to factors such as the greater responsibility that women bear for care work. These stereotypes put men and women into different occupations and sectors of the economy. Undervaluing care work is also responsible for the gender wage gap in the market (Seguino, 2020). Reproductive and productive labor did

not start to be more equally divided after women started integrating the labor force[5]. Instead, new family arrangements were implemented to outsource reproductive labor to families with the financial conditions (Fraser, 2016), while a female double journey was established for families who did not (Silva, 2019).

Despite being able to participate more easily in productive work, the path women need to follow to make this decision, and the necessary conditions to remain in that position, are very different from those men face. Material and symbolic factors shaped by the social structure generate distinct norms and roles for men and women. For instance, since an early age, girls are taught and assigned to care responsibilities. Research conducted for Brazil showed that the presence of teenage children reduces the load of parents' domestic work, but only adolescent girls reduce women's domestic burden (Pinheiro et al., 2023). The burden of domestic work for girls also impacts their schooling. When considering both domestic and market work in Bolivia, Zapata et al. (2011) find that girls are more likely to combine work and school than boys.

It is evident that men and women are assigned to different roles from the moment they are born. Thus, it is not expected that they will make the same decisions since an individual's decision-making is influenced by their subjective perspective, constructed by particular lived experiences and accumulated knowledge (Biroli, 2015). In other words, choices are always restricted by one's personal background and social position, which are unique to them. As stated by Biroli:

> "It is within this context of constrained choices, shaped by the prevailing patterns of the sexual division of labor, that what is defined is not exclusion, but rather unequal forms of inclusion. What is produced is unequal access to occupations, income, and time. The assignment of differentiated responsibilities to women and men implies that the set of issues considered when 'choosing' an occupation or 'lifestyle' has specificities for women." (Biroli, 2015, p.91. Own translation)

For women, life is shaped by decisions like marrying, having children, and dedicating themselves to professional or domestic life. They are judged by each of these decisions, and it is hardly difficult to change the path after one is made (Biroli, 2015). All choices are, to some extent, shaped by involuntary factors.

In conclusion, the social structure imposes different life paths on men and women, with reproductive work being assigned to women as if it were something "natural". The next section

[5]For a more extensive review regarding gender job segregation and wage inequality, see Braunstein (2000), Seguino (2000), and Seguino (2020).

moves from this conceptual basis and explores how such gender roles in society also reflect different consumption behavior.

## 2.3. Literature review on different consumption patterns across gender and family composition

The understanding of family behavior in terms of consumption and spending, in general, is a well-stated problem in the economics literature. The neoclassical school usually includes the gender aspect by considering that men and women have different preferences, with empirical work corroborating this statement. Nonetheless, as discussed in the previous section, these differences are neither due to natural or biological factors, nor the result of individual behavior. Instead, they are shaped by structural and social conditions. Hence, within this context, it is reasonable to expect that the gender of the household reference person influences the family's consumption patterns.

Nowadays, with demographic and social transformations, family arrangements are getting increasingly heterogeneous. Families that used to follow the traditional pattern of two parents, with the man having paid work and the woman having unpaid work, and multiple children, now present different compositions, such as with fewer children, more elderly individuals, both parents with paid work, single parents, or non-heteronormative couples.

Table 2.1 summarizes the compositional characteristics of Brazilian households in 2017-2018. Women who are considered the household reference are older and more educated than men in the same position. Households without kids and families with kids and no elders usually have men as reference, as households with elders tend to have a woman as the family reference person. Women are more likely to be single, as 10.36% of these families have partners, compared to 22.44% of men and 14.42% of the Brazilian average. Households with a male reference tend to be more numerous, with an average of 3.12 people, compared to 3 for households with a female reference. This result could reflect the previous statistic, that families composed of two adults are more likely to have a man as the reference.

Table 2.1 – Descriptive Analysis of Households by Gender of the Reference Person. 2017-2018. Brazil

| Variables | Brazil | Men | Women |
|---|---|---|---|
| Reference person characteristics | | | |
| Age | 49.85 | 49.05 | 51 |

| | | | |
|---|---|---|---|
| Completed school years | 8.19 | 8.02 | 8.9 |
| Household characteristics | | | |
| Without kids (%) | 58.49 | 57.98 | 42.02 |
| With kids and no elders (%) | 37.23 | 38.53 | 35.39 |
| With elders (%) | 24.2 | 21.13 | 28.52 |
| Have partner (%) | 17.42 | 22.44 | 10.36 |
| Number of people | 3.07 | 3.12 | 3 |
| Receive Transfers (%) | 20.45 | 18.64 | 22.99 |
| Total Income per capita (R$) | 1,848.59 | 1,926.05 | 1,739.54 |

Source: Passos et al., 2024, p. 12

When examining income statistics, it is clear that total per capita income is smaller for households with female reference (R$1,739.54) compared to those with male reference (R$1,926.05). This disparity reflects gender inequalities in the labor market, where women often face limited access to the same opportunities as men and earn lower wages for equivalent positions. The smaller per capita income in female-reference households could explain the higher proportion of transfers these families receive. These transfers include retirement and pension benefits, child support, allowance and donation, federal social programs, and other transfers, which are present in 23% of the households with female reference, compared to 18.64% of households with male reference.

Table 2.2 and Figure 2.1 illustrate the distribution of the mean per capita disposable income among these households by income decile. The data shows that female-reference households have higher incomes than male-reference households, as well as above the Brazilian average, in the first and second deciles. In the third decile, women's income matches the Brazilian average. However, from the third to the tenth decile, families with male reference earn more on average. This highlights the gender income inequality, with the income gap widening as households move up the income distribution.

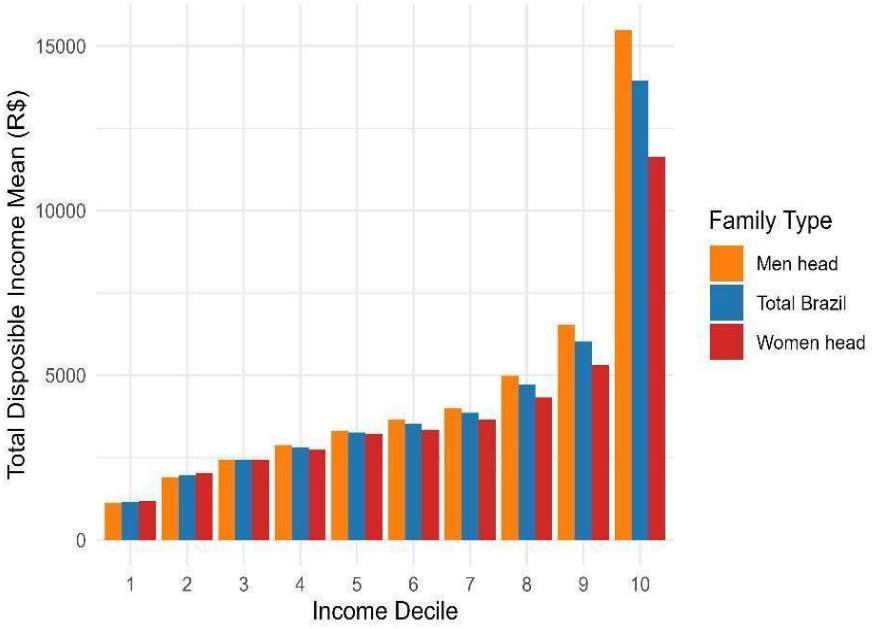
Table 2.2 – Per Capita Income Distribution by Gender of the Household Reference. Mean by Decile. 2017-2018. Brazil. (R$).

| **Decile** | **Brazil** | **Men** | **Women** |
|---|---|---|---|
| 1st | 1,161.44 | 1,132.49 | 1,196.66 |
| 2nd | 1,955 | 1,908 | 2,014.06 |
| 3rd | 2,423.3 | 2,422.8 | 2,423.96 |
| 4th | 2,818.74 | 2,886.51 | 2,735.27 |
| 5th | 3,264.44 | 3,303.26 | 3,210.48 |
| 6th | 3,528.27 | 3,652.16 | 3,333.93 |

| | | | |
|---|---|---|---|
| 7th | 3,863.56 | 4,005.67 | 3,659.83 |
| 8th | 4,718.2 | 4,981.39 | 4,332.03 |
| 9th | 6,015.87 | 6,523.24 | 5,323.53 |
| 10th | 13,950.42 | 15,486.23 | 11,641.52 |

Source: POF 2017-2018. Author's elaboration

Figure 2.1 – Mean Total Disposable Income by Decile and Gender of the Household Reference. Per Capita. 2017-2018. Brazil. (R$).




Source: POF 2017-2018. Author's elaboration.

Given such demographic and income characteristics, it can be expected that the average consumption basket of different types of families will differ. If the family has more elderly members, they may spend more on health. Conversely, if they have more children, education and clothing may take a higher share of the income. For instance, if a person is living alone, they may spend more on culture and recreation. Additionally, factors such as the household reference person income level and gender interact with family composition to shape their consumption pattern.

Ernst Engel was the first to investigate the relationship between consumption and income, finding that the poorer the family is, the larger is their share spent on nourishment (Engel, 1857). This statement was valid for any population in any economy, and for this reason was named as Engel's Law (Chai & Moneta, 2010). There was a debate regarding Malthus's (1798) proposition that population growth would outpace the means of subsistence. Engel, however, observed that, as household income rises, the share of expenditure on food declines.

This pattern was part of an important economic debate, suggesting that "as the economy grows and per capita income increases, new resources can be dedicated to the production of other goods unrelated to food" (Chai & Moneta, 2010, p. 227).

Using consumption and income data, it is possible to measure the sensitivity of an individual or family's consumption given an income change, known as Engel's curve (Deaton & Muellbauer, 1980; Banks, Blundell & Lewbel, 1997). Overall, the income elasticities of luxury goods are high, indicating that consumption increases as income rises. In contrast, the income elasticity of basic goods tends to be low, with minor changes in consumption given an income increase. Due to this matter, consumption inequality is often associated with income inequality.

Aguiar and Bils (2015) estimated the Engel's curve for the United States (US). They find that domestic services, education, and entertainment are luxury goods, with high elasticity. Food outside the home also has high elasticity, as food at home and housing services have low elasticity, and tobacco has a negative elasticity. Bertasso et al. (2006) use the 1995-1996 Brazilian Consumer Expenditure Survey (POF) to investigate consumption patterns across different family groups. Similar to Engel's curve results for the US, they find that the poorest family groups dedicate a higher share of their income to basic food, urban transport, medicine, and tobacco. Groups with higher income have a higher spending share on housing, public services, healthcare, and education. Carvalho and Alves (2010) also investigate consumption patterns across different income groups, but using the POF 2002-2003, finding that higher-income families spend a higher share of their income on transportation, healthcare, education, and recreation, while low-income families spend a higher proportion on food, housing, and clothing. All these works present similar results and reinforce the validity of Engel's Law, confirming that families with different income levels present different consumption patterns.

In addition to consumption differences by income level, the share of the household's resources controlled by women or men determines consumption patterns. "Women in control of their household's resources spend more on basic necessities for the household and on the development of their children's potential than men do in similar circumstances." (Stotsky, 2006, p. 3). These gender differences in consumption occur due to the reproductive labor responsibility that lies on women.

From this perspective, Phipps and Burton (1998) explore whether men's and women's incomes are shared within the household. In other words, whether income is pooled for household consumption. Using Canada's expenditure microdata from 1992 and selecting only families where both man and woman are full-time employed in the paid labor market, they find

that income pooling is not statistically significant for personal consumption like restaurant food, household food, clothing (men, women, and children), childcare, and transportation. For these categories, the income is more likely to be used according to gender roles. An increase in women's income is more likely to be used for care-related expenses, such as food, child clothing, and childcare. In contrast, men's income increase is associated with an increase in men's clothing and transportation expenses. There is, however, an income pooling for expenses associated with housing, recreation, donation, tobacco, and alcohol. For these categories, men's and women's income exerts an identical influence on household spending. These are important findings, highlighting that even in households where both partners participate in the labor market and contribute financially, spending decisions often remain aligned with traditional gender roles.

Extending this discussion beyond income flows, the bargaining power related with the assets held by men and women also shapes household spending patterns. In this respect, Doss (1996) conducted an investigation for the Ghana economy, finding a positive relation between the proportion of assets (land, savings, and business assets) held by women and the spending on education, utilities, and food. Adding a child or an elder increases the relative amount spent on food, while an additional adult decreases it. Conversely, other expenses such as alcohol, tobacco, housing, miscellaneous items (personal care, jewelry, taxes, ceremonies, and gifts), recreation and remittances are negatively associated with women's asset ownership, suggesting that as women hold a greater share of assets, total expenditure on these categories tends to decrease.

Taken together, the results from Phips and Burton (1998) and Doss (1996) reinforce that household consumption patterns are shaped not only by the level of income pooling but also by intra-household bargaining power. In both cases, financial contribution - whether through income or asset ownership - translates into greater influence over how resources are allocated within the household. The studies conducted for the Brazilian economy, on the other hand, focus their analysis on a comparison between households with a male reference and households with a female reference, regardless of the financial contribution of the partners.

Pinheiro and Fontoura (2007) rely on the POF 2002-2003, and among their findings regarding income, families with male reference have a higher income level than those with female reference, with 65.4% of their income coming from paid work, compared to 53.5% for female-reference families. Additionally, families with male reference receive less in transfers (mostly from pensions and child support), with 12% of their income coming from these sources, versus 23.5% for female-reference families. Comparing these results with the ones in Table 2.1,

it is evident that men's higher earnings and women's higher transfers are in a constant relation in subsequent POF releases. As for consumption choices, the authors find that families with male reference spend a higher proportion of their income on food and transport, while families with female reference allocate a higher share of their income to housing, clothing, hygiene and personal care, health assistance, education, recreation, and culture. However, in the expenses ranking, both types of families give the same priority to housing and food, and, as suggested by the authors, the differences in budget share are due to differences in income levels between these families.

More recent research regarding Brazilian families' consumption basket was conducted by Passos et al. (2024). Similar to Pinheiro and Fontoura (2007) and Carvalho and Alves (2010), they analyze different family arrangements, with an intersectional perspective and by using the POF 2017-2018. They divide consumption between six categories: habitation, transportation, food, education, health, and other aggregate expenses (which includes hygiene and personal care, personal services, clothing, recreation and culture, tobacco, and others), looking at the weight that each of these expenses has in the household's total consumption expenses.

They show that women present a larger spending share with housing, health, and education, while men tend to have a larger share of their expenses with food and transport. When analyzing expenses by income percentile, they find that expenses with housing, food, and other aggregate expenses reduce as income increases, whereas spending on transport and education increases, validating Engel's Law.

It has been acknowledged that gender impacts consumption choices for individuals and households, confirming Stotsky's statement that women in control of the household budget prioritize expenditures on basic necessities. In the next section, this discussion is connected with inflation measurements.

## 2.4. The aggregated price index inequality bias

The main price index used to measure inflation in Brazil is the General Consumer Price Index. It is constructed based on the consumption of families that live within sixteen metropolitan regions and have a total family income between 1 and 40 minimum wages. The methodology employs Laspeyre's index with plutocratic weight, in which families with higher aggregate spending have a higher weight. Hence, the price index is constructed based on the following equations:

$$R_{0,t}^{i} = \left(\frac{p_t^i}{p_0^i}\right) \tag{2.1}$$

$$W_0^i = \left(\frac{p_0^i q_0^i}{\sum_{j=1}^{n} p_0^i q_0^i}\right) \tag{2.2}$$

$$L_{0,t} = \sum_{i=1}^{n} W_0^i R_{0,t}^i \tag{2.3}$$

The price variation from time 0 to time t of the good *i* is given by equation (2.1), while the weight of the expense of the good *I* on total consumption expenses is expressed by equation (2.2). Laspeyre's index $L_{0,t}$ (equation (2.3)) expresses the ratio between the total expenditure needed at time t, necessary to buy the same basket of goods from time 0, and the expenditure made at time 0 with that basket. Families are indexed by j=1,...,n.

This method, however, does not consider the effects of different socio-demographic groups (Chelli, Gigliarano & Mattioli, 2009), since families with a higher aggregate spending are the richest. If there is a price change on a good with low income elasticity, it may have a lower effect on the overall index than a price change in a good with high-income elasticity. As stated by Ley (2001), a single plutocratic CPI would be less appealing when there is a significant income inequality, since it implies different consumption patterns by income groups, thus, a larger variance in individual price behavior (p. 15).

An alternative for a more representative index would be a democratic weighting, which assigns equal weights to each household, considering their expenditure relative to the total of all households. Studies comparing plutocratic and democratic weights find significant differences in the results, which vary depending on the period analyzed (Kokoski, 2000; Ley, 2001; Chelli, Gigliarano & Mattioli, 2009). However, even democratic indices may fail to capture important differences when the specific characteristics of the consumption basket across household groups are not considered. Chelli, Gigliarano, and Mattioli (2009) study the different effects of the price dynamics on subgroups of Italian households, proposing specific price indices for each group (family with male or female reference, with or without individuals under 18 years old). Using 2005 data, they compare a plutocratic index with a democratic index, with findings suggesting that male-reference households and those without children under 18 tend to experience higher perceived inflation than those with female reference. Furthermore, the democratic indices are consistently higher than the plutocratic ones, suggesting that price

increases were more pronounced for goods consumed by most households—typically essential items.

On the other hand, data from interviews conducted for Italy, from 1994 to 2018, indicate that women tend to perceive a higher level of inflation than men (Corduas, 2022). As stated by Corduas (2022), “when the perceived inflation closely tracked the true rate, the gender difference was more pronounced because of the smaller heterogeneity and the higher asymmetry in the distribution of women’s judgments” (p. 1). The higher inflation perception by women may be associated with their lower income compared to men, making their budget more constrained due to price changes.

Given that families' consumption baskets can differ depending on their income and demographic composition, they will also face different inflation. The following section discusses how this inflation heterogeneity may be translated into a different exchange rate pass-through effect between families.

## 2.5. Engendering the exchange rate pass-through

The FXR is a relevant production cost variable that may impact a good’s final price. If a family’s consumption basket contains more products sensitive to the FXR, their budget may be affected by a shock in that variable.

The previous section demonstrated that women tend to spend more on hygiene and personal care. Triches, Godoy, and Silva (2018) analyze the exchange rate pass-through in this sector for Brazil, from 2009 to 2015. They find a pass-through coefficient of 79.11% for deodorant, 52.28% for toilet paper, 29.55% for skin products, and 18.11% for sanitary pads. Overall, more than half of this sector’s products presented a smaller price variation than inflation and the exchange rate. However, the conducted analysis in this work is not for specific products, as made by Triches, Godoy, and Silva (2018), but for the aggregated sector.

Based on Passos et al. (2024) methodology, household’s consumption were summarized by dividing them between two groups: those with a male reference and those with a female reference. However, to have a closer assessment of the IPCA’s subgroups, a higher product disaggregation was used compared to the one conducted by the authors. Thus, it was calculated the share within the family’s total income for the following expenditures: food, health assistance, housing, hygiene and personal care, miscellaneous expenses (which include gambling, communication, ceremonies and parties, professional services, casual use property,

and others), personal services, education, recreation and culture, transportation, clothing, tobacco, and other current expenses (taxes, labor contributions, bank services, child support, allowance, and donations, private pension, others). The findings are highlighted in Table 2.3.

Table 2.3 – Spending share given the household reference gender. 2017-2018. Brazil

| Expenditure Category | Brazil (%) | Men (%) | Women (%) | Difference Between Women and Men (p.p.) |
|---|---|---|---|---|
| Food | 18.95 | 18.73 | 19.25 | 0.52 |
| Health care | 6.54 | 6.18 | 7.03 | 0.85 |
| Miscellaneous expenses | 1.95 | 2.02 | 1.85 | -0.17 |
| Education | 2.88 | 2.87 | 2.9 | 0.03 |
| Tobacco | 0.58 | 0.58 | 0.57 | -0.01 |
| Housing | 35.66 | 33.31 | 38.93 | 5.62 |
| Personal hygiene and care | 4.2 | 4 | 4.47 | 0.47 |
| Recreation and culture | 2.05 | 1.92 | 2.25 | 0.33 |
| Personal services | 1.09 | 1.06 | 1.14 | 0.08 |
| Transportation | 12.9 | 14.82 | 10.23 | -4.59 |
| Clothing | 4.07 | 3.95 | 4.24 | 0.29 |
| Other Current Expenses | 9.13 | 10.56 | 7.14 | -3.42 |

Source: POF 2017-2018. Author's elaboration

Families with male reference tend to allocate a larger share of their income to miscellaneous expenses, transportation, and other current expenses, compared to female-reference families. In contrast, women use more of their income on the majority of categories: food, health care, education, housing, personal hygiene and care, recreation and culture, personal services, and clothing. The most significant gap between men and women is found in (i) housing, where women spend 5.47 p.p. more; (ii) transportation, with a difference of 4.59 p.p. more for men; and (iii) other current expenses, where men spend 3.42 p.p. more than women.

These results reflect several factors. First, since spending shares are estimated relative to total income, Engel's Law helps explain why lower-income households allocate more to basic necessities, such as food and housing. Families with female reference are particularly

disadvantaged in this regard, as they face lower earnings than male-reference families, as highlighted in Tables 2.1 and 2.2. Moreover, 89.64% of these families do not have partners to share financial and domestic responsibilities. Second, consumption patterns also reflect gender roles. Categories related to care - such as healthcare, education, personal hygiene and care, and clothing - account for a larger share of women's budget. Income disparities and gender roles may also explain the higher share of "other current expenses" among male-reference households, as this category includes disbursements related to paid work and child support (typically paid by men with custody obligations).

The results are now discussed in light of the initial findings. Table 2.4 brings the EXPT coefficients found in the previous chapter, related to the spending shares calculated in this section.

Table 2.4 – Association between gender differences in consumption and EXPT

| **POF Expenditure category** | **Related IPCA subgroup** | **EXPT coefficient in H 24˚** (%) | **Spending share on Brazilian average income (%)** | **Difference in spending shares between Women and Men (p.p.)** |
|---|---|---|---|---|
| Food | 1.1 Food at Home | 0.33˚ | 18.95 | 0.52 |
| | 1.2 Food Away from Home | -5.7 | | |
| Health care | 6.1. Pharmaceuticals and Optics | 3.67 | 6.54 | 0.85 |
| | 6.2. Health Services | -0.27˚ | | |
| Miscellaneous expenses* | - | - | 1.95 | -0.17 |
| Education | 8.1. Courses, Reading, and Stationery | -2.3 | 2.88 | 0.03 |
| Tobacco | 7.2.2. Tobacco | -30 | 0.58 | -0.01 |
| Housing | 2.1. Charges and Maintenance | -3.45 | 35.66 | 5.62 |
| | 2.2. Fuels and Energy | 18.92 | | |
| | 3.1. Furniture and Utensils | 0.75 | | |
| | 3.2. Electronic Devices | 9.41 | | |
| | 3.3. Repairs and Maintenance | 3.18 | | |
| | 9.1. Communication | 3.5 | | |
| Personal hygiene and care | 6.3. Personal Care | -2.28 | 4.2 | 0.47 |
| Recreation and culture | 7.2.1. Recreation | 2.85˚ | 2.05 | 0.33 |
| Personal services | 7.1. Personal Services | -5.54 | 1.09 | 0.08 |
| Transportation | 5.1. Transportation | 11.51 | 12.9 | -4.59 |
| Clothing | 4.1. Clothing | 7.11 | 4.07 | 0.29 |

| | | | | |
|---|---|---|---|---|
| | 4.2. Shoes and Accessories | 5.33 | | |
| | 4.3. Jewelry and Costume Jewelry | -13.17 | | |
| | 4.4. Fabrics and Notions | 3.99° | | |
| Other Current Expenses* | - | - | 9.13 | -3.42 |

Source: Author's elaboration.
*The POF categories Miscellaneous Expenses and Other Current Expenses do not have any subgroup with the same characteristics.
°The EXPT coefficient for subgroups 1.1, 6.2, 7.2.1, and 4.4 was not statistically significant in horizon 24, and for this reason, is not considered in this section analysis.

The EXR accumulated shock within 24 months lead to price increases in the subgroups "Fuels and Energy", "Furniture and Utensils", "Electronic Devices", "Repairs and Maintenance", "Clothing", "Shoes and Accessories", "Fabrics and Notions", "Transportation", "Pharmaceuticals and Optics", "Recreation", and "Communication". On the other hand, the subgroups "Food Away from Home", "Charges and Maintenance", "Jewelry and Costume Jewelry", "Personal Care", "Personal Services", "Tobacco", and "Courses, Reading and Stationery" responded to the shock with a decrease in their prices. These results, as discussed in the previous chapter, are related to specific competitiveness and productive structure within each sector (Krugman, 1986; Arestis & Milberg, 1993).

The POF categories with a higher spending share on the Brazilian average income (housing, food, and transportation) are associated with relatively high EXPT coefficients. From these, only the subgroup "Food Away from Home" presents a negative EXPT coefficient. Households with male reference are more affected by the positive EXPT from the subgroup related to transportation, and the negative EXPT from the subgroup related to tobacco. The other two POF categories with higher weight in households with male reference - miscellaneous expenses and other current expenses - are not directly comparable with the IPCA classification. The miscellaneous expenses are distributed across different subgroups, while other current expenses, not directly related to the acquisition of goods and services, fall outside the scope of the IPCA. For these reasons, no EXPT coefficient is associated with these two categories.

Among the categories with greater weight in female-reference households, the subgroups related to health care, housing, and clothing exhibit a positive EXPT coefficient. By contrast, the subgroups related to food, education, personal care, and personal services present a negative EXPT coefficient. These results indicate that households with a female reference dedicate a higher share of their budgets to goods and services more sensitive to exchange rate fluctuations, in contrast to households with a male reference.

The literature discussing this topic is very limited. Triches, Godoy, and Silva (2018) analyze the EXPT from the consumption perspective, but for specific personal care and hygiene products. This work goes further in the discussion, evaluating not only the aggregate personal care and hygiene sector, but also nine more sectors within the POF classification.

## 2.6. Concluding Remarks

In this chapter, it was discussed how reproductive labor, being unpaid work, is often taken for granted and not considered as important for the economy as productive labor. Besides, reproductive labor has always been associated with women, implicating gender roles that are perpetuated over time and within society (Kergoat, 2003). These gender roles affect the individual's decision-making process by setting different priorities (Biroli, 2015).

Given the existence of gender roles and the increasing heterogeneity in household compositions, it was investigated whether the gender of the household reference would impact different consumption choices. The analysis from twelve consumption categories in the POF 2017-2018 confirms the literature discussion (Pinheiro & Fontoura, 2007; Carvalho & Alves, 2010; Passos et al., 2024) that household consumption follows gender roles, with women allocating higher income share with food, health care, education, housing, personal hygiene and care, recreation and culture, personal services, and clothing. In contrast, families with male reference spend more than women on miscellaneous expenses, tobacco, transportation, and other current expenses.

These consumption differences would imply different inflation perceptions by each household, as suggested by Chelli, Gigliarano, and Mattioli (2009) and Corduas (2022). Considering this discussion, one of the objectives was to investigate whether these consumption differences would result in different budget impact after an EXR shock. In light of the EXPT coefficients calculated in Chapter One for the IPCA subgroups, it was found that households with a female reference have their budgets more sensitive to an EXR devaluation shock.

# 3. CONCLUSION

This thesis sought to evaluate the extent to which the exchange rate may impact household consumption. To answer this question, Chapter One discussed the EXPT effect in the Brazilian economy for the 2000s period. The markup theory and industry structures contribute to understanding how the exchange rate influences domestic prices (Eichner, 1973; Lee, 1998; Dornbush, 1987). Accordingly, an empirical test was conducted to estimate the EXPT coefficients and their dynamics for the aggregated IPCA and its subgroups. Most subgroups, as well as the aggregated index, were found to be statistically significant to the exchange rate shock, reinforcing the evidence in the literature that the Brazilian economy is sensitive to exchange rate fluctuations (Pereira & Missio, 2024; Modenesi et al., 2017; Correa, 2017; Couto & Fraga, 2014; Nogueira, Mori & Marçal, 2013). The direction and magnitude of the responses, however, differ across sectors, indicating that productive and competitive structures are relevant for the sector outcome (Krugman, 1986; Arestis & Milberg, 1993).

The Second Chapter was dedicated to discussing the consumption patterns of different household compositions – more specifically, households with male reference in contrast to those with female reference – and the heterogeneous effects of the EXPT across them. Feminist theory explains how the sexual division of labor associates care activities with women and productive activities with men (Kergoat, 2003; Fraser, 2016), resulting in gender inequalities rooted in unequal, socially determined power relations. Because women are socialized into performing reproductive labor since they are born, these responsibilities become involuntarily present in every decision they make (Biroli, 2015), including their consumption choices. The analysis of POF 2017-2018 data aligns with previous studies (Pinheiro & Fontoura, 2007; Carvalho & Alves, 2010; Passos et al., 2024), showing that female-reference households allocate a larger share of their income to care-related products and services (food, health care, education, housing, personal hygiene and care, recreation and culture, personal services, and clothing). In contrast, male-reference households spend proportionally more on miscellaneous expenses, tobacco, transportation, and other current expenses. Associating these results with those from Chapter One, it was found that households with female reference spend relatively more on products that are more sensitive to exchange rate shocks, making their budgets more vulnerable to exchange rate fluctuations.

Although a currency devaluation may be favorable to economic growth in the short term, its long-term effects on the economy are undesirable. Since this analysis is made from the consumption perspective, it is important to consider the distributive effects that the EXPT may

cause, as each component of the General Consumer Price reacts differently depending on its industry's structure. Households whose consumption baskets have a relatively larger share of products experiencing price increases due to currency devaluation will face greater budgetary pressure. On the other hand, households consuming fewer of these products will see their budgets less affected by the devaluation.

The discussion on how to mitigate the undesirable distributive effects is complex. Exchange rate policies typically involve active reserve management (buying and selling of dollar reserves), capital flow controls, and regulatory measures that strengthen the financial system (Rossi, 2016). These policies aim to control the exchange rate, alleviating the effects of its fluctuations. While they may be effective in mitigating the impact of currency devaluation on the general price index, they might not be sufficient to prevent the heterogeneous effects on sectors affecting the income distribution.

Therefore, for greater effectiveness of public policies aimed at reducing the impact of exchange rate fluctuations on inflation, it is not enough to focus solely on the general index. It is also necessary to consider each of its components. This would enable targeting policies in sectors most sensitive to the exchange rate. Strengthening financial markets and the domestic industry, reducing dependence on imports, improving external competitiveness, and fostering domestic markets would serve as alternatives to more generalized policies.

Another important matter to be addressed is gender inequality. As Engel (1857) observed, lower-income households allocate a larger share of their income to nourishment. Historical and social structures have also pushed women into occupations with low added value and lower earnings compared to men (Kergoat, 2003; Seguino, 2020). Consequently, female-reference households – where women are often solely responsible for household management – tend to be more vulnerable to economic fluctuations (Safiotti, 1979). Furthermore, as shown in Chapter Two, women spend proportionally more than men in 8 out of 12 expenditure categories essentially because they are responsible for care-related activities. By contrast, men allocate relatively more to individual consumption or financial expenses. This pattern further constrains women's budgets, as a greater share of their income is directed toward essential and collective needs rather than discretionary spending.

It is therefore important to discuss policies that promote a more gender egalitarian society. Measures such as expanding women's access to higher-value-added occupations and implementing income equality policies could reduce the sensitivity of women's budgets to economic fluctuations. In addition, increasing the public provision of care services and fostering a more balanced division of care responsibilities between women and men would improve the

development of human capabilities and ease women's time to engage in activities beyond care work. As well addressed in the literature (Braunstein, van Staveren, & Tavani, 2011; Braunstein, 2015; Seguino, 2020), economies that promote gender equality and place social reproduction at the center of public priorities tend to achieve stronger economic and social development outcomes.

An extension to this study could include the analysis of different household arrangements - for instance, variations in household size, the presence of children or elderly members, and racial composition. In addition, the discussion on alternative weighting schemes for the price index could be further developed.

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# 5. ANNEX

## A.1 - Complete Supply and Use Table 2019

| Supply and Use Table Code | Product | Total share of imports |
|---|---|---|
| 01911 | Rice, wheat, and other cereals | 56.24% |
| 01912 | Corn (maize) grain | 1.91% |
| 01913 | Upland cotton, other temporary crop fibers | 0.09% |
| 01914 | Sugarcane | 0.00% |
| 01915 | Soybeans | 0.20% |
| 01916 | Other products and services from temporary crops | 3.95% |
| 01917 | Oranges | 0.95% |
| 01918 | Coffee beans | 0.00% |
| 01919 | Other products from permanent crops | 7.83% |
| 01921 | Cattle and other live animals, animal products, hunting, and related services | 0.22% |
| 01922 | Cow’s milk and milk from other animals | 0.00% |
| 01923 | Swine (pigs) | 0.14% |
| 01924 | Poultry and eggs | 0.57% |
| 02801 | Products from forestry and silviculture | 5.66% |
| 02802 | Fishing and aquaculture (fish, crustaceans, and mollusks) | 12.55% |
| 05801 | Coal | 91.53% |
| 05802 | Non-metallic minerals | 9.24% |
| 06801 | Oil, natural gas, and support services | 10.77% |
| 07911 | Iron ore | 0.14% |
| 07921 | Non-ferrous metallic minerals | 19.88% |
| 10911 | Beef and other meat products | 1.46% |
| 10912 | Pork | 0.00% |
| 10913 | Poultry meat | 0.07% |
| 10914 | Processed fish and seafood | 35.84% |
| 10915 | Chilled, sterilized, and pasteurized milk | 0.00% |
| 10916 | Other dairy products | 3.10% |
| 10921 | Sugar | 0.12% |
| 10931 | Canned fruits, vegetables, and fruit juices | 10.83% |
| 10932 | Vegetable and animal oils and fats | 4.32% |
| 10933 | Processed coffee | 2.50% |
| 10934 | Processed rice and rice-derived products | 4.39% |
| 10935 | Products derived from wheat, cassava, or corn | 2.19% |
| 10936 | Balanced animal feed | 2.64% |
| 10937 | Other food products | 2.75% |
| 11001 | Beverages | 10.31% |
| 12001 | Tobacco products | 36.04% |
| 13001 | Processed textile yarns and fibers | 13.05% |

*Table A.1 continued...*

| Supply and Use Table Code | Product | Total share of imports |
|---|---|---|
| 13002 | Fabrics | 20.55% |
| 13003 | Household and other textile articles | 17.19% |
| 14001 | Clothing and accessories | 13.67% |
| 15001 | Footwear and leather goods | 8.18% |
| 16001 | Wood products (excluding furniture) | 1.44% |
| 17001 | Pulp | 2.75% |
| 17002 | Paper, cardboard, packaging, and paper products | 4.93% |
| 18001 | Printing and reproduction services | 1.78% |
| 19911 | Aviation fuels | 29.62% |
| 19912 | Gasohol | 0.00% |
| 19913 | Naphtha for petrochemical use | 53.10% |
| 19914 | Fuel oil | 0.58% |
| 19915 | Diesel - biodiesel | 0.00% |
| 19916 | Other petroleum refining products | 20.06% |
| 19921 | Ethanol and other biofuels | 3.06% |
| 20911 | Inorganic chemicals | 51.61% |
| 20912 | Fertilizers and manure | 9.76% |
| 20913 | Organic chemicals | 44.37% |
| 20914 | Resins, elastomers, and artificial and synthetic fibers | 33.90% |
| 20921 | Agricultural pesticides and household disinfectants | 32.94% |
| 20922 | Various chemical products | 24.37% |
| 20923 | Paints, varnishes, enamels, and lacquers | 8.97% |
| 20931 | Perfumes, soaps, and cleaning products | 15.52% |
| 21001 | Pharmaceutical products | 32.29% |
| 22001 | Rubber products | 23.90% |
| 22002 | Plastic products | 12.34% |
| 23001 | Cement | 1.74% |
| 23002 | Cement, plaster, and similar products | 1.23% |
| 23003 | Glass, ceramics, and other non-metallic mineral products | 11.93% |
| 24911 | Pig iron and ferroalloys | 3.38% |
| 24912 | Semi-finished products, flat-rolled, long-rolled, and steel pipes | 17.50% |
| 24921 | Non-ferrous metallurgy products | 21.40% |
| 24922 | Cast steel and non-ferrous metal parts | 6.56% |
| 25001 | Metal products, excluding machinery and equipment | 12.62% |
| 26001 | Electronic components | 80.94% |
| 26002 | Office machines and IT equipment | 32.82% |
| 26003 | Electronic material and communication equipment | 35.23% |
| 26004 | Measuring, testing, control, optical and electromedical equipment | 59.51% |
| 27001 | Electrical machinery, appliances, and materials | 29.88% |
| 27002 | Home appliances | 14.06% |
| 28001 | Tractors and other agricultural machinery | 9.25% |
| 28002 | Mining and construction machinery | 25.63% |

*Table A.1 continued...*

| Supply and Use Table Code | Product | Total share of imports |
|---|---|---|

| | | |
|---|---|---|
| 29911 | Passenger cars, pickups, and utility vehicles | 16.64% |
| 29912 | Trucks and buses, including cabins, bodies, and trailers | 5.77% |
| 29921 | Parts and accessories for motor vehicles | 24.63% |
| 30001 | Aircraft, vessels, and other transport equipment | 57.06% |
| 31801 | Furniture | 5.34% |
| 31802 | Products from various industries | 26.44% |
| 33001 | Maintenance, repair, and installation of machinery and equipment | 13.53% |
| 35001 | Electricity, gas, and other utilities | 1.74% |
| 36801 | Water, sewage, recycling, and waste management | 0.00% |
| 41801 | Buildings | 0.22% |
| 41802 | Infrastructure works | 0.00% |
| 41803 | Specialized construction services | 1.23% |
| 45801 | Wholesale and retail trade | 0.19% |
| 49001+51001 | Freight transport (land and water) | 2.03% |
| 49002 | Land passenger transport | 3.01% |
| 50001 | Air transport | 15.46% |
| 52801 | Storage and auxiliary transport services | 2.25% |
| 52802 | Mail and other delivery services | 0.03% |
| 55001 | Hotel and similar accommodation services | 40.87% |
| 56001 | Food services | 5.11% |
| 58001 | Books, newspapers, and magazines | 13.11% |
| 59801 | Film, music, radio, and television services | 1.54% |
| 61001 | Telecommunications, subscription TV, and related services | 1.63% |
| 62801 | Software development and other information services | 9.71% |
| 64801 | Financial intermediation, insurance, and private pension plans | 5.00% |
| 68001 | Actual rentals and real estate services | 2.21% |
| 68002 | Imputed rent | 0.00% |
| 69801 | Legal, accounting, and consultancy services | 3.31% |
| 71801 | Research and development | 0.00% |
| 71802 | Architecture and engineering services | 17.59% |
| 73801 | Advertising and other technical services | 4.40% |
| 77001 | Non-real estate rentals and intellectual property asset management | 57.14% |
| 78801 | Condominium and building services | 1.56% |
| 78802 | Other administrative services | 3.46% |
| 80001 | Security, surveillance, and investigation services | 0.00% |
| 84001 | Public administration services | 0.00% |
| 84002 | Social security and welfare services | 0.00% |
| 85911 | Public education | 0.00% |
| 85921 | Private education | 0.79% |
| 86911 | Public health | 0.00% |
| 86921 | Private health | 0.18% |
| 90801 | Arts, culture, sports, and recreation services | 9.86% |

*Table A.1 continued...*

| **Supply and Use Table Code** | **Product** | **Total share of imports** |
|---|---|---|
| 94802 | Computer, phone, and household item repair services | 0.00% |
| 94803 | Personal services | 0.00% |

| | | |
|---|---|---|
| 97001 | Domestic services | 0.00% |
| | **Total** | 7.85% |

Source: Lissoni (2019).

A.2- Subgoups' weigh on General Consumer Price

| Subgrup | Weigh on General Index (%) |
|---|---|
| General Index | 100 |
| 1.1 Food at Home | 13.4813 |
| 1.2 Food away from Home | 5.867 |
| 2.1 Charges and Maintenance | 9.9808 |
| 2.2 Fuels and Energy | 5.6138 |
| 3.1 Furniture and Utensils | 1.7949 |
| 3.2 Electronic Devices | 1.6432 |
| 3.3 Repairs and Maintenance | 0.3147 |
| 4.1 Clothing | 3.1247 |
| 4.2 Shoes and Accessories | 1.1975 |
| 4.3 Jewelry and Costume Jewelry | 0.1996 |
| 4.4 Fabrics and Notions | 0.0551 |
| 5.1 Transportation | 20.5979 |
| 6.1 Pharmaceuticals and Optics | 3.7898 |
| 6.2 Health Services | 5.8041 |
| 6.3 Personal Care | 3.9395 |
| 7.1 Personal Services | 6.7873 |
| 7.2.1 Recreation | 3.3997 |
| 7.2.2. Tobacco | 0.546 |
| 8.1 Courses, Reading and Stationery | 6.1485 |
| 9.1. Communication | 5.7146 |

Source: Sidra – IBGE. Values from January 2020, the first month of the latest series.