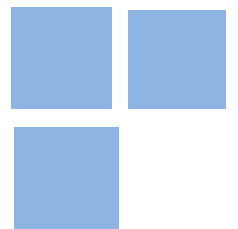Department of Economics- FEA/USP

Can Tax Reforms Shape Food Consumption? An Investigation of the Impact of the Brazilian VAT

PAULA CARVALHO PEREDA
TAINÁ PORTELA
PATRÍCIA RAVAIOLI

Can Tax Reforms Shape Food Consumption? An Investigation of the Impact of the Brazilian VAT

Paula C. Pereda (pereda@usp.br)
Tainá Portela (taina.portela.silva@usp.br)
Patrícia Ravaioli (pf.ravaioli@usp.br)

Abstract:

The need for a tax reform in Brazil stems from the country's complex tax system, which has contributed to decreased productivity and hindered investments. The Brazilian Tax Reform, approved in December 2023, introduces a Value-Added Tax (VAT) system comprising a federal VAT (CBS), a local VAT (IBS), and a selective tax (IS) on products with negative health and environmental externalities. This study explores the potential impacts of various scenarios of the reform on consumption, using data from the latest Household Budget Survey (POF 2017-2018). Our findings indicate that a broader tax reform (in terms of food basket exemptions and selective taxes on ultraprocessed products) could result in a decrease in 8.80% of government tax collection on consumption. However, consumption patterns would shift significantly, with a sharp increase in healthy food consumption and decrease in ultra-processed food. The scenario considering the newest tax rate proposal, which is more conservative in terms of exemptions and includes a selective tax only on one type of ultra-processed product (sweetened drinks), suggests an increase in government revenue but highlights reductions in the consumption of both in natura and ultra-processed products. These results underscore the reform's potential to influence consumption patterns and highlight the balance between generating tax revenue and ensuring the affordability of essential goods. In this sense, there is room for improvement in the newest tax proposal to achieve a more nutritional balance within Brazilian households.

Can Tax Reforms Shape Food Consumption? An Investigation of the Impact of the Brazilian VAT

Paula Pereda, Tainá Portela, Patrícia Ravaioli

Abstract

The need for tax reform in Brazil stems from the country's complex tax system, which has contributed to decreased productivity and hindered investments. The Brazilian Tax Reform, approved in December 2023, introduces a value-added tax (VAT) system comprising a federal VAT (CBS), a local VAT (IBS), and a selective tax (IS) on products with negative health and environmental externalities. This study explores the potential impacts of reform scenarios on food consumption, using data from the latest Household Budget Survey (POF 2017-2018). Our findings indicate that broader tax reform (in terms of food basket exemptions and selective taxes on ultraprocessed products) could result in a decrease of 8.80% in government tax collection on consumption. However, consumption patterns would shift significantly, with a sharp increase in healthy food consumption and decrease in ultra-processed food consumption. A scenario based on the newest tax rate proposal, which would be more conservative in terms of exemptions and takes into consideration the selective tax only on one type of ultra-processed product (i.e., sweetened drinks), suggests there would be an increase in overall government revenue but highlights reductions in the consumption of both *in natura* and ultra-processed product. These results underscore the potential of the reform to influence consumption patterns and highlight the balance between generating tax revenue and ensuring the affordability of essential goods. In this sense, there is room for improvement in the newest tax proposal to achieve a more nutritional balance within Brazilian households.

Can Tax Reforms Shape Food Consumption? An Investigation of the Impact of the Brazilian VAT

1. Introduction

Brazil has experienced a decrease in the total factor productivity of its economy over the past three decades. The loss of productivity can be attributed, among other factors, to a complex tax system that imposes high barriers on new firms and discourages investments in the country. Brazil stands out among countries for the high number of hours (approximately 1,500 per year) required to prepare taxes, according to the data from World Bank (OECD, 2023). The second country in this 'bureaucracy ranking' is Panamá, where 400 hours are required to prepare for taxes. To simplify the collection of some taxes, the Brazilian Tax Reform, approved by the National Congress in December 2023, adopts a value-added tax (VAT).

VAT is one of the most common tax systems in the world and is present in more than 175 countries[1]. The literature on the efficiency of VAT-based tax systems suggests that it can be more effective (Adhikari, 2020). However, the efficiency gains from introducing a VAT and the subsequent effects on overall consumption by the population can vary from country to country, and the literature is more focused on VAT systems in developed countries. Moreover, significant tax reforms present unique opportunities to shape consumer behaviors in society. By strategically changing fiscal policies, targeted tax reforms can influence dietary choices, promote healthier eating habits, and even address environmental concerns associated with food production and consumption. These reforms can range from implementing taxes on unhealthy food products to providing tax incentives for purchasing locally and sustainably produced foods. Therefore, tax reforms serve as powerful tools to direct behaviors and shape a more desirable future for communities and the planet.

---

[1]https://www.vatcalc.com/global/how-many-countries-have-vat-or-gst-174/#:~:text=Since%20the%20first%20introduction%20of,175%20countries%20around%20the%20world.

The text of the tax reform (Constitutional Amendment 132/2023) introduces a VAT framework consisting of (i) CBS, a federal VAT replacing former federal taxes (PIS, Confins, and IPI), (ii) IBS, a local VAT replacing state and municipal taxes (ICMS and ISS), and (iii) IS, a selective tax to discourage consumption of products that generate negative externalities for health and the environment. Tax reform also considers the possibility of implementing a cashback system to mitigate potential income inequalities. Originally, the proposal suggested a partial refund of taxes collected from low-income taxpayers through income transfer mechanisms. However, ongoing discussions have focused on exemptions for certain essential goods and services consumed by low-income households, including electricity, cooking gas (LPG), and items in the basic food basket. To this end, the Ministry of Social Development (MDS) in Brazil has issued a decree outlining the specific food products that must be included in the food basket.

To understand the impacts of the reform on consumption in Brazil, this study presents simulations related to tax exemptions for the food basket designed by the MDS, as well as scenarios involving additional tax rates (selective tax) for ultra-processed foods, which are considered harmful to human health (Mendonca et al. 2017, Fiolet et al. 2018, Hall et al. 2019, Rico-Campà et al. 2019, Srour et al. 2019). Ultra-processed products are industrial formulations made from substances derived from food, often containing flavorings, colorings, and other cosmetic additives added, as defined by the NOVA classification system. Over the years, ultra-processed products (foods and beverages) have become increasingly prevalent in the food supply of high-income countries as well as middle and low-income countries (Vandevijvere et al. 2019). These foods have been associated with weight gain (Hall et al. 2019), diabetes (Srour et al. 2019), hypertension (Mendonca et al. 2017), cancer (Fiolet et al. 2018), and all-cause mortality (Rico-Campà et al. 2019). In contrast, the protective effects of unprocessed or minimally processed foods, especially fruits and vegetables (FV), have been widely studied. The consumption of in natura products, such as fruits and vegetables, is associated with a lower risk of developing various types of cancer and cardiovascular diseases, as well as reduced mortality rates (Wang et al. 2014).

Several factors explain the increase in the consumption of ultra-processed products worldwide, including convenience, low-cost ingredients, hyperpalatability, long shelf life, and advertising (Monteiro et al. 2018). Another reason for the increase in the consumption of ultra-processed products is the relative reduction in the prices of these products compared to unprocessed or minimally processed foods (Yuba et al. 2013, Pereda et al. 2023). Therefore, fiscal policies may

be a potential solution to reduce the consumption of this type of product, and the question remains open as to how tax reform would affect the nutritional quality and well-being of consumers in Brazil.

To understand the initial tax collection (our base scenario), we use the tax rates of the current system as presented by Silveira et al (2022). Then, we conduct a detailed simulation of the implementation of the reform. We considered a VAT rate of 27% for general goods and services in the economy but explored scenarios with a 0% tax rate (or a 60% discount on selected items) for the food basket of the Ministry of Social Development (MDS) and a 20% IS rate for ultra-processed products selected by the Epidemiological Research Center in Nutrition and Health (NUPENS-USP). Additionally, we explore the scenario in which the rates and taxes determined in the Complementary Law Project presented to Congress by the Ministry of Economy (ME) on April 25, 2024.

Using data from the most recent Brazilian Household Budget Survey (POF 2017-2018), we estimate the own and cross elasticities of 29 groups of foods and beverages and 14 major groups of the general budget. These estimates were made considering the total number of households reported in the POF. Based on the estimated elasticities and current effective tax rate data, it was possible to simulate the effects of the ongoing tax reform on the consumption of healthy (food basket and *in natura* products) and unhealthy (ultraprocessed) foods and beverages. It is also possible to assess impacts on tax revenue from domestic consumption in Brazil in general.

The study findings projects a 0.8% increase in tax revenue from consumption with a new VAT at a 27% flat rate (i.e., excluding scenarios with differential taxes on specific goods or services). However, when we incorporate the reduced rate for the food basket (0% tax rate or a discount), alongside selective taxes on tobacco, alcoholic beverages, and ultra-processed foods, it results in a slight reduction in tax collection on domestic consumption of 8.8%. The revenue reduction from the 0% or reduced rates of the MDS Food basket is partially offset by a selective tax on ultra-processed foods, with a 10.2% reversal, and more significantly when adding selective taxes on alcoholic beverages and tobacco, resulting in a 24% reversal.

In terms of consumption, the reduced rates for the MDS food basket increase the consumption of healthier products by 5.3%, but this effect diminishes to a 2.7% increase when selective taxes on selected ultra-processed products and alcoholic beverages are applied. Consumption of ultra-

4

processed foods and beverages drops significantly, by 20.9%, with a selective tax on UPPs and alcoholic beverages. With the new reform proposal, the forecasts show a significant increase in tax revenue but an important impact on consumption, with a 5.2% drop in consumption of healthier products (*in natura* and minimally processed food) and a 13.7% reduction in ultra-processed food consumption.

Our paper relates to a broad literature on the impacts of fiscal policies. Caro (2020) and Pereda et al (2024) demonstrated that a combined fiscal policy, including taxes on unhealthy foods and sweetened beverages and subsidies for healthy foods, can lead to a net welfare gain and subsidy transfer for the average household, with low-income households benefiting the most. These findings suggest that the design and implementation of fiscal policies play a crucial role in influencing the consumption of healthy food, as documented by this paper.

The paper is structured as follows: Section 2 describes the tax reform in detail and the decisions and materials that underpinned the choices of products for the scenarios. Section 3 describes the data and methodology used. Section 4 presents the estimated results. Section 5 presents the conclusion of the study.

2. Background

2.1 The Basics of the Tax Reform

The Constitutional Amendment (EC) 132/2023 marks a significant milestone in the Brazilian Tax Reform effort, as approved by the Brazilian Congress, aiming to simplify the tax system, approved it. The primary objective is to introduce a more straightforward approach to taxation on consumption. This is achieved through the creation of a value-added tax (VAT) framework, which encompasses various components. First, a Federal VAT tax rate (called Contribution on Goods and Services, or CBS), which replaces the previous PIS and Cofins taxes at the federal level. Second, a Local VAT tax rate (called Goods and Services Tax or IBS), implemented at the subnational level, overlapping with existing state ICMS and municipal ISS taxes. Finally, a Selective Tax (IS), an additional VAT tax rate proposed to discourage the consumption of products that generate negative externalities on health and the environment. Figure 1 illustrates how taxes from the old system will be replaced by the VAT in its three dimensions.

Figure 1: Brazilian Tax Reform: Old Taxes and New VAT.
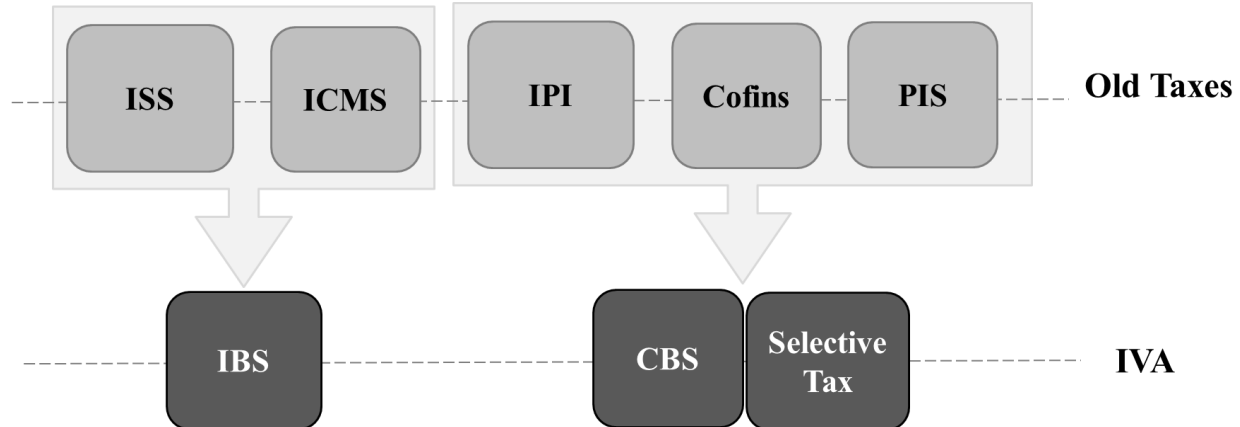
The IBS/CBS will have a national scope, and its rate will be composed of the sum of federal, state, and municipal rates (by law, states and municipalities are responsible for determining their own rates). The tax will be noncumulative, and in the case of interstate and intermunicipal transactions, the destination state and municipality will collect it.

2.2   The Basic Food Basket from MDS

The IBS/CBS will have exemptions, zero or a reduced rate, on basic food basket items. Decree No. 11,936/2024, signed on March 6, 2024, addresses a set of foods with the aim of guaranteeing the human right to adequate food (this set is called the basic food basket). The list of foods is included in Article 4 of the Decree, which we reproduce here for convenience:

"Art. 4 The basic food basket will consist of fresh or minimally processed foods and culinary ingredients, and will include the following groups:

I - beans (legumes);

II - cereals;

III - roots and tubers;

IV - vegetables;

V - fruits;

VI - nuts and seeds (oleaginous);

VII - meats and eggs;

VIII - milk and dairy products;

IX - sugars, salt, oils, and fats; and

X - coffee, tea, yerba mate, and spices."

The proposal for items in the food basket was made by the Ministry of Social Development and Fight against Hunger (MDS), in partnership with federal agencies and entities working in the area of food security and nutrition. In Appendix Table A1, we give examples of products we consider in each group from Article 4, splitting the list into exempted products (those for which the tax rate equals 0%) and discounted products (those for which the tax rate is 60%).

2.3   The List of UPPs from NUPENS-USP

In addition to potential rate reductions, there is also a tax planned to discourage the consumption of certain goods and services harmful to health and the environment, such as tobacco, alcoholic beverages, and ultra-processed products, called the selective tax (ST). In this study, we evaluate the ST applied to all ultra-processed products and a scenario based on a list provided by the research group NUPENS in cooperation with the Ministry of Health (MS). The NUPENS research lab has provided a detailed list of UPPs based on the POF 2018 and the identification of items from the NCM table (used by the Brazilian IFRS to define taxation), following these steps:

- The selection of items was made from the Common Nomenclature of the Mercosur (NCM) Table via a three-step procedure. The first step was the identification of Table Chapters that could include ultra-processed foods. For this purpose, the definition of ultra-processed foods from the Food Guide for the Brazilian Population (2014) was taken into account.

- The second step was the selection, within the chapters, of items that exclusively included ultra-processed foods, while items that include a combination of ultra-processed foods and other foods were not considered. To verify the types of foods included in the items labeled "Other," the website of Portal Único Siscomex was consulted.

- Finally, in the third step, the selected items were grouped into nine categories, namely, industrial formulations based on meats; margarines; sweetened dairy beverages and other industrial formulations based on milk (except yogurt and other fermented products); mayonnaise; chocolate, caramel, ice cream, etc.; industrial formulations based on cereal

derivatives; biscuits, cookies, and sweet breads; industrial formulations for broths and soups; and sweetened carbonated and noncarbonated beverages.

2.4 The New Proposal: Food Basket and Products under Selective Taxes

Complementary Bill 68/24 regulates the tax reform and lists products that should be (i) exempt from the new taxes in the new basic food basket, (ii) have a discount of 60% in the tax rate; and (iii) receive an additional tax rate due to health and environmental externalities.

The list of exempted food and beverages (tax rate of 0%) considered is as follows (Annex I and XVI): rice; pasteurized or industrialized fluid milk, in the form of ultra-pasteurized, milk powdered, whole, semi-skimmed or skimmed; and infant formulas; butter; margarine; beans; roots and tubers; coconuts; coffee; soy oil; cassava flour; corn flour and groats; wheat flour; sugar; pastas; bread; eggs; fresh or refrigerated fruits; vegetables.

A different list of products would also have a discount of 60% of the tax rate. The food and beverages listed are (Annex VIII): beef, pork, lamb, goat and poultry meat and products of animal origin (except foie gras); goat meat and edible offal from sheep and goats; fish and fish meat (except salmonids, tuna, cod, haddock, saithe and roe and other byproducts); crustaceans (except lobsters and crayfish) and mollusks; fermented milk, beverages and dairy compounds; cheeses such as mozzarella, minas, dish, coalho, ricotta, cottage cheese, provolone, parmesan, unmatured fresh cheese and black cheese; natural honey; yerba mate; flour, cereal meal; crushed or flaked cereal grains and corn starch; tapioca and its prepared products; vegetable oils and canola oil; pasta; iodized table salt; natural fruit or preservative-free vegetable juices without added sugar or other sweeteners; and preservative-free fruit pulp without added sugar or other sweeteners.

Finally, Annex XVIII describes the goods subject to selective taxes, namely, tabacco products, alcoholic drinks, and sugary drinks.

3 Data and Method

This work aims to simulate scenarios of selective taxes and basic food basket to understand how the consumption of Brazilian households will change in the face of expected changes. The aim of these measures is to avoid the consumption of ultra-processed foods and promote the consumption of fresh products, since the consumption of ultra-processed foods increases the prevalence of cardiovascular diseases, diabetes, obesity, hypertension, and various types of cancer, as discussed in this section.

To achieve this, we conducted the following activities:

a) Estimation of demand elasticities: We estimated a demand system using data from the latest Household Budget Survey (POF 2017-18) to calculate the elasticities of consumers' total budget and, especially, the budget spent on food within the household. The latter was performed to investigate in more detail the effect of tax reform on the acquisition of food and beverages, focusing on ultra-processed and natural products. Using price, income, and consumer preference variables, we were able to understand how changes in tax rates can affect demand for these products.

b) Comparative analysis of current tax rates: We conducted an analysis of the tax rates currently applied to categories of products in the Brazilian budget basket. We evaluated the effects of these rates on the economy, identifying areas of tax relief and possible fiscal distortions. For this purpose, we used tax rates from the tax system according to Silveira et al (2022).

c) Simulation of the VAT (IBS/CBS): We conducted a detailed simulation of the implementation of the IBS/CBS in Brazil at 27%, applying it to products in the Brazilian consumption basket and possible scenarios of selective tax implementation. We analyzed the results in terms of changes in demand and tax revenue.

3.1 Data

Household Budget Survey

We used data from the Household Budget Survey (POF) of 2017-2018 collected by the Brazilian Institute of Geography and Statistics (IBGE). The POF uses a two-stage cluster sampling method with geographic and statistical stratification of primary sampling units (PSUs) corresponding to the census tracts of the 2010 Demographic Census. The subsample of sectors was selected by simple random sampling within each stratum; households in each sector were selected by random sampling without replacement, totaling 575 geographic strata, 5494 PSUs, and 57,920 sampled households. Due to the survey design, and to mitigate the problem of censoring, we used the PSU as the unit of analysis. Consequently, each PSU observation refers to an average household, or representative household, with homogeneous regional stratification. After excluding three PSUs with outlier values in some consumption groups, our analysis was conducted with 5491 PSUs.

For the accounting of the budget spent on food and beverages, in particular, the survey collects a 7-day record of all acquisitions related to food products (monetary and nonmonetary, excluding purchases outside the home). The food acquisition measures collected by the POF include total quantity (in kg), monetary value (in Brazilian *reais*), unit of measure (packages, weight, etc.), and place of acquisition. For other consumer items in the survey, generally, a unit of measure is not provided. We constructed individual measures, focusing on the demographic characteristics of the household head, which will be used in demand estimations.

The POF also provides the frequency of acquisition of all items captured during the period the household was followed in the survey. For standardization purposes, we chose to report annual expenses for each of them.

Categorization of goods

To simulate the effects of alternative tax policies, we need to specify which products would be subject to tax increases/reductions. To do this, we organized all items captured by the POF following the classifications suggested by the IBGE, aggregating these items into 18 categories of household expenses. Moreover, food and beverage items acquired for consumption at home were aggregated according to the NOVA Classification System (see Monteiro et al. 2019 for more details) - corresponding to 54 categories of food products.

10

For demand estimations, aiming to reduce the dimensionality of the analysis, we arrived at a simplified version of 14 categories of household expenses and 29 categories of food and beverages within the household. Tables 1 and 2 below provide more details on the classification, as well as the expenditure share of Brazilian households per group or subgroup, respectively.

Among the categories referring to all household expenses, we prioritized those that would be subject to some kind of rate reduction or increase, according to the tax reform bill, such as: food at home, education, tobacco, health care, transportation, and hygiene and personal care. Additionally, we also kept categories that could distort the analyses if aggregated, such as housing (which we separated into general and housing), services (banking and personal), clothing, and recreation and culture. The remaining categories proposed by IBGE were aggregated under the label "Others".

Table 1: General groups and their expenditure shares, all household budget, POF 2017/18

Groups	Description	Expenditure share (%)
Food at home	All food and beverages acquired by the household to consume at home	15.5%
Eating outside the home	Meals (food and beverage) consumed out of home	6.8%
Health assistance	Healthcare expenses in general (medical consultations, exams, medicines, among others).	9.6%
Education	Educational services and materials acquired by the household	0.8%
Tobacco	Tobacco products	0.5%
Housing: general	Cleaning products, dishes, utility bills (water, energy, gas), among others related to housing	18.8%
Housing: housing	Rental or house acquisition	3.8%
Hygiene and personal care	Beauty and personal hygiene products	4.6%
Clothing	All clothes, shoes, and personal items	5.5%
Recreation and culture	Products and services related to recreation and culture.	2.2%
Bank services	Banking taxes and fees.	1.2%
Personal Services	Beauty, repair and other services	1.5%
Transport	Transportation services, vehicle expenses in general	21.6%
Others	Lottery, post services, among others	7.4%
Total		**100%**

As described above, the "food at home" group was grouped into 29 categories, as shown in Table 2 below. We considered products that are part of the basic diet of Brazilians and, where possible, were aggregated into broader categories as proposed by the Nova Classification. For example, we combined all fruits that were isolated into a larger group, "Fruits." Additionally, we retained the categories "Other foods," "Other beverages," "Other meats," and "Other whole food foods" to aggregate food products that could not be allocated to existing categories.

Table 2: Food and beverage subgroups and their expenditure share, all household budgets, POF 2017/18

Subgroups	Expenditure share (%)
Rice (all types)	3.6%
Sugar	1.5%
All potatoes	0.7%
Sweetened drinks (juices, soft drinks, sweetened milk drinks)	3.6%
Alcoholic beverages (wine, beer, among others)	2.8%
Beef (all cuts)	10.0%
Pork (all cuts)	1.7%
Ultra-processed meats (sausages, ham, nuggets, hamburgers, among others)	3.3%
Other foods (pasta, cheese, other breads)	12.4%
Other beverages (water, natural juices)	0.8%
Sweets and cookies (cookies, jam, sweets, candies, deserts)	4.4%
Cassava flour	0.7%
Cornflour	0.2%
Bean (all types)	1.6%
Chicken (all cuts)	7.0%
Fruits (all)	5.6%
Vegetables, and salads (all)	5.1%
Cow milk	3.2%
Powdered milk	1.6%
Butter	0.5%
Margarine	0.6%
Other meats (fish, crustaceans)	3.6%
Others in natura (corn, nuts, coconut, among others)	8.1%
Chicken eggs	2.0%

Subgroups	Expenditure share (%)
Bread	4.7%
Ready and semi-ready meals	1.4%
Spices (all)	0.9%
Other ultra-processed product (deserts, mayo, ready spices, tomato sauce)	7.3%
Soy oil	1.1%
Total	**100.0%**

Calculation of income and price variables

We used total household expenditure as a proxy for income. Self-reported household income may be associated with negative reporting bias (Deaton and Muellbauer, 1980). In general, the prices used were calculated as average values of the PSU per category of household expenses and, in the specific case of food and beverages within the household, by category of food. The unit value of a good is its total expenditure divided by the total quantity consumed (or implicit price). Averages were calculated weighted by the weight of each household within the PSU. In the case of zero acquisitions within the PSU, we imputed the median price of PSUs within the same geographic stratum under the assumption that households within the same geographic region pay the same prices. This practice has also been adopted by other studies, such as Christoffoletti and Pereda (2021) and Pereda et al. (2024).

When we observed zero consumption for a category (missing unit value for that item), we estimated its observed price using the median of neighboring regions, prioritizing first the median within the PSU, followed by the median in the POF stratum, and if there was still no consumption for that category, the median in the state (UF), under the assumption that individuals observe the same local prices.

3.2 Empirical Strategy

a. Estimation of the Demand System

We estimated a two-stage demand system using data from the 2017-2018 Household Budget Survey (POF)[2], calculating the elasticities of the entire consumer budget, namely: income elasticity, compensated price elasticity, and uncompensated price elasticity[3]. In the first stage, households decide how much of their total income will be allocated to the consumption of food and beverages and to 13 other possible consumption groups considered in the analysis[4], the total system (designated "All"). In the second stage, households allocate the total expenditure on food and beverages at home among the 29 possible subgroups5, the detailed food system at home (designated "Food").

In both the first and second stages, the resource allocation decision was modeled using a system of equations in the functional form of the quadratic almost ideal demand system (QUAIDS), which is a second-order approximation of a demand system with price invariant generalized logarithmic (PIGLOG) preferences for a nonrepresentative agent. Thus, the system in question, both in the first and second stages, can be expressed as a system of expenditure share relations for goods as follows:

$$w_i = \alpha_i + \sum_j \gamma_{ij} log(p_j) + \beta_{1i} log\left(\frac{y}{P}\right) + \left(\frac{\lambda_i}{f(P)}\right) log\left(\frac{y}{P}\right)^2 + e_i, \qquad 1$$

---

[2] It is worth noting that, to estimate the proposed equation system, it was necessary to assume the hypothesis of weak separability.

[3] Total expenditure elasticity measures the proportional change in quantity demanded as a response to a change in total expenditure. Compensated price elasticity measures the sensitivity of quantity demanded in response to changes in price, keeping purchasing power constant (compensating the income effect). It allows a more accurate assessment of the direct impact of price changes, isolating the price effect from the influence of consumer purchasing power. Finally, uncompensated price elasticity measures the sensitivity of quantity demanded in response to changes in price, without compensating for the income effect. Thus, it considers the total effect, including changes in consumer purchasing power.

[4] As mentioned in the Data Description section, 14 possible consumption groups were considered for the general budget, as listed in Table 1.

[5] In the second step of estimation, we consider 29 subgroups, according to Table 2.

In which w_i is the expenditure share of good i, p_i is the price of good i, y is the measure of total expenditure, and $log(P)$ is the translog price index, such as:

$$log(P) = \alpha_0 + \sum_k \alpha_k log(p_k) + \frac{1}{2}\sum_k \sum_l \gamma_{kl} log(p_k) log(p_l) \qquad 2$$

And
$$f(P) = \prod_k p_k^{\beta_k} \qquad 3$$

In this model, it is possible to incorporate demographic variables as intercept shifters, following the method described by Pollak and Wales (1981) which takes into account household heterogeneities. For the estimations carried out, we select information on the average household size in the primary sampling unit (UPA), the proportion of household heads who are women in the UPA, the proportion of household heads with complete basic education in the UPA, and an indicator variable of the macro-region where the UPA is located.

This model estimates the response of goods characteristics to changes in expenditure (elasticities) and allows the imposition of restrictions consistent with economic theory, enabling analyses of price shock scenarios.

To determine the first-stage elasticities, we used the coefficients obtained from the estimations of Equations 1 and 2 and calculated the elasticities from the following formulas:

Income/
Expenditure:
$$e_i = 1 + \frac{1}{w_i}\left[\beta_i + \frac{2\lambda_i}{f(P)}\left(log(y/P)\right)\right] \qquad 4$$

Marshallian:

$$\varepsilon_{ij}^M = \frac{1}{w_i}\left[\gamma_{ij} - \mu_{iy}\left(\alpha_j + \sum_k \gamma_{jk}\log(p_k)\right) - \lambda_i \frac{\beta_i}{f(P)}\left(\log\left(\frac{y}{P}\right)\right)^2\right] \qquad 5$$
$$- \delta_{ij}$$

Hicksian:
$$\varepsilon_{ij}^H = \varepsilon_{ij}^M + e_i w_j \qquad\qquad 6$$

To calculate the second-stage elasticities, we used the same formulas described in Equations 5, 6, and 7. However, these elasticities are conditional on those calculated in the first stage, as described in Boysen (2012). To calculate the unconditional elasticities, we applied the following formulas:

Unconditional Expenditure Elasticity:
$$e_i^{\bar{c}} = e_{i|F}\, e_F \qquad\qquad 7$$

Unconditional Price Elasticity (uncompensated):
$$\varepsilon_{ij}^{M\bar{c}} = \varepsilon_{ij} + w_{j|F}\left(\frac{1}{e_{j|F}} + \varepsilon_F\right)e_{i|F}e_{j|F} \qquad\qquad 8$$
$$+ w_F w_{j|F} e_F e_{i|F}(e_{j|F} - 1)$$

Unconditional Price Elasticity (compensated):
$$\varepsilon_{ij}^{H\bar{c}} = \varepsilon_{ij}^H + w_{j|F}\varepsilon_F^H e_{i|F}e_{j|F} \qquad\qquad 9$$

b. Scenarios

On the basis of the estimates of price and expenditure elasticities, we calculated the effects of consumption taxes and subsidies for some hypothetical fiscal policy scenarios, taking into consideration potential changes to the current tariff structure. The scenarios are described in Table 3 below:

Table 3: The Analyzed Scenarios

Scenarios	Description
Base Scenario	Current effective rate based on Siqueira et al (2022)
Scenario 1	27% rate for all POF products and services, maintaining the current rate on housing and 60% discounts or 0% rate for education, health, and transport services
Scenario 2	(i) 27% rate for all POF products and services, maintaining the current rate on housing and 60% discounts or 0% rate for education, health, and transport services; (ii) 0% rate (or 60% discounts) on the MDS Food basket
Scenario 3	(i) 27% rate for all POF products and services, maintaining the current rate on housing and 60% discounts or 0% rate for education, health, and transport services; (ii) 0% rate (or 60% discounts) on the MDS Food basket; and (iii) Selective Tax on a list of UPP from NUPENS-USP (47%)
Scenario 4	(i) 27% rate for all POF products and services, maintaining the current rate on housing and 60% discounts or 0% rate for education, health, and transport services; (ii) 0% rate (or 60% discounts) on the MDS Food basket; (iii) Selective Tax on a list of UPP from NUPENS-USP (47%), tobacco (180%), and alcoholic beverages (86.92%)
Scenario 5	(i) 26.5% rate for all POF products and services, maintaining the current rate on housing, fuels, and intercity/interstate transport; 60% discounts or 0% rate for education, health, transport, personal hygiene, and cleaning services; (ii) 0% rate (or 60% discounts) on selected food products; and (iii) Selective Tax on sugary drinks (46.5%), vehicles (46.5%), tobacco (180%), and alcoholic beverages (86.92%) – ME proposal

The current tax system rates were taken from the publication by Silveira et al. (2022) and aligned according to the interest groups constructed in this study[6], both for the first stage (All) and the second stage of the demand system (Food). Appendix Tables A2 and A3 show the changes in prices considered after alignment for the baseline scenarios (rate in effect before the tax reform) and hypothetical scenarios considered (according to Table 3) for the first (All) and second stages (Food) of the demand system, respectively.[7] It should also be noted that we assume the effect of consumption taxes ($\Delta p > 0$) and subsidies ($\Delta p < 0$) are fully passed on to final consumer prices (i.e., 100% pass-through).

c. Impact Simulation

Consumption impacts: Based on the estimated elasticities, we can calculate the percent change in food and beverages acquisition (as well as other bidget groups), $\frac{\Delta q_i}{q_i}$ ($\forall i = 1, \ldots, n$), using the following equation:

$$\frac{\Delta q_i}{q_i} = \sum_{j=1} \varepsilon_{ij}^M \tau_j \qquad [9]$$

where τ_j is the change in tax (+ if there is an additional tax and—if there is a subsidy) on good j. On the basis of this information, we calculated the change in quantity (in kilograms, for food and beverages, and in units, for the other goods and services).

Government revenue: We also calculate the change in government tax revenue based on the change in relative prices using the following equation:

$$\Delta GR_{ii} = (p_i^1 - p_i^0) \times q_i(p_i^1, p_{-i}, y) = \left(\frac{\tau_i}{1+\tau_i}\right) p_i^1 \times q_i(p_i^1, p_{-i}, y) \qquad [11]$$

The change in revenue is calculated based on:

$$\Delta GR = \sum_{i=1}^{n} \sum_{j=1}^{n} \Delta GR_{ij} \qquad [12]$$

---

[6] More information on the compatibilization can be found in Siqueira et. al. (2022).
[7] It is worth highlighting that the variation in the rates listed below is computed taking the baseline scenario as the starting point.

4. Results

a. Estimated elasticities

We report the uncompensated elasticities for all budget groups and for the food and beverage subgroups consumed by households at home in the Appendix, Tables A4 and A5, respectively.

The most sensitive budget categories (elasticity with value Ep_ii (i/i)<-1) are food consumed away from home, housing (in general), clothing, banking services and transport. In other words, for these categories of expenses, an increase in their average price leads to a more than proportional decrease in the quantity demanded in this same group–see main diagonal. The results listed above are in line with expectations, as they are categories that allow greater flexibility in the allocation of resources to the household. For example, when eating outside the home, a household can choose to reduce this type of consumption and start eating more frequently at home. The same occurs with the categories of clothing, banking services and transport, since households can decide to consume less expensive items/brands or even postpone consumption, as in the case of clothing. Finally, for the housing group, as well as for the previous categories, there is also the possibility of reducing expenses more than proportionally, for example, as with the payment of cheaper rent.

On the other hand, the categories with less sensitivity to price are food at home, education, tobacco, recreation and culture. For these goods, an increase in the average price leads to a proportionally smaller reduction in the quantity demanded (elasticity with value -1< Ep_ij (i/j)<0).

In general, these results seem to be justified when analyzing the items that compose them. In the case of food at home, for example, the items consumed by the majority of the population are already essential, making it difficult, therefore, to change their consumption rate, given that a considerable proportion of Brazilian households have a low per capita income.

The food categories for which households are most price sensitive (price elasticities lower than -1) are potatoes, chicken, sweetened drinks, alcoholic drinks, margarine, spices, soybean oil, ready-to-eat meals, and other whole food products (Table A5). This suggests that a 1% increase in the price of these items leads to more than a 1% decrease in their quantity demanded.

The high price elasticity in these categories underscores the flexibility consumers have in substituting or foregoing these items when prices change. This reflects their nonessential nature, the availability of close substitutes, and discretionary purchase patterns.

b. Main results: the full sample of households

The study findings projects a 0.8% increase in tax revenue (from consumption) with the tax reform (without considering any 0% rate or discount, nor Selective Taxes – scenario 1 in Table 4), but a slight reduction in tax revenue from consumption (-8.80%) when the reduced rate for the food basket of the MDS is considered, even with the forecast of selective taxes on tobacco, alcoholic beverages, and ultra-processed foods – see Scenario 4 in Table 4.[8]

The revenue reduction with 0% or reduced rates for the MDS Food Basket is partially offset by a selective tax on ultra-processed foods (10.2% reversal – comparison between Scenarios 2 and 3 in Table 4) and more significantly offset when adding a selective tax on alcoholic beverages and tobacco (24% reversal – comparison between Scenarios 2 and 4 in Table 4).

Decomposing the tax revenue in Scenario 4, the exemption of the Food basket generates a revenue reduction of approximately R$72.8 billion, while the selective tax (IS) on UPP would generate an increase in revenue of R$7.7 billion and the selective tax on alcoholic beverages would increase revenue by R$2.7 billion.

---

[8] We have also conducted robustness test using long-term tax rates, and results are qualitatively the same for scenarios 2 to 5 (results are available upon request).

Table 4: Changes in government tax revenue from consumption, all budget groups, in R$ of January 2024.

	Base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Annual gov. revenue by household	R$ 9,417	R$ 9,492	R$ 8,325	R$ 8,437	R$ 8,588	R$ 10,524
Total Brazilian households	69,017,704	69,017,704	69,017,704	69,017,704	69,017,704	69,017,704
Annual gov. revenue (in billion R$)	R$ 649.94	R$ 655.13	R$ 574.61	R$ 582.32	R$ 592.72	R$ 726.33
Change in revenue (in billion R$)		R$ 5.19	-R$ 75.33	-R$ 67.62	-R$ 57.22	R$ 76.39
Change in revenue (%)		0.80%	-11.59%	-10.40%	-8.80%	11.75%
Average tax rate	19.60%	20.61%	18.05%	18.54%	19.79%	25.08%

Table 5: Changes in consumption and expenses with food at home, all subgroups, in percent change of Brazilian reais (for expenses) and kilograms (for quantity)

Change in relation to base scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Food and Beverage Expenses	-7.6%	1.6%	-1.7%	-4.8%	-7.4%
- In natura or minimally processed	-10.5%	6.9%	6.1%	4.5%	-4.5%
- Ultraprocessed	-4.2%	-10.1%	-20.5%	-21.6%	-10.6%
Food and Beverage Consumption (kg)	-8.0%	3.3%	0.6%	-2.1%	-6.8%
- In natura or minimally processed	-10.3%	5.3%	4.3%	2.7%	-5.2%
- Ultraprocessed	-1.8%	-8.3%	-20.1%	-20.9%	-13.7%

Analyzing the effects of the reform on food consumption (Table 5), the scenario with reduced rates for the MDS Food Basket increases the consumption of in natura or minimally processed products (in kg) of 0% rate products by 5.3% (Scenario 2). However, this consumption is lower when adding selective taxes on selected UPPs and alcoholic beverages (2.7% increase in consumption).

The consumption of ultra-processed foods and beverages significantly decreased after considering the 20% additional selective tax to the 27% base tax on these products and the 86.92% selective tax on alcoholic beverages (20.9% decrease compared to the current tax structure) – Scenario 4 in Table 5. Without establishing a selective tax on UPP and alcoholic beverages, i.e., only with a 0% or reduced rate on the MDS Food Basket, a 8.3% reduction in UPP consumption by Brazilian households is observed (Scenario 2 of Table 5).

Considering the new tax reform proposal (April 2024), the study findings projects a much greater effect on household consumption, with a 11.8% increase in revenue (see Scenario 5 in Table 4). The consumption of the in natura or minimally processed products decreases by 5.2% in the scenario with the new proposal, while the consumption of ultra-processed foods also falls by 13.7% in this scenario. Therefore, the results are more modest than those estimated in Scenario 4.

5. Final Remarks

Using a national sample of Brazilian households, we calculate own and cross price elasticities for food and beverages purchased by households and for the entire consumer budget to preliminarily simulate the effects of initial scenarios of ongoing tax reform on the consumption of food. The scenarios comparison highlights the revenue trade-off associated with providing tax relief on essential food items to ensure affordability for consumers. We find that the revenue reduction due to the 0% or reduced rates on the food basket is partially offset by selective taxes on ultra-processed foods, but this offset is even more pronounced when selective taxes on alcoholic beverages and tobacco are also included. Analyzing the effects of the reform on food consumption, we find promising results on the reduction of UPP consumption when a broad food basket is considered (MDS proposal), which is even more stimulated by the proposal of selective taxes on UPPs.

The consumption of ultra-processed foods and beverages drops significantly by 20.9% with the inclusion of a 20% additional selective tax to the 27% base tax on these products. Without these selective taxes, the reduction in UPP consumption by Brazilian households is only 8.3%. This indicates the potential effectiveness of selective taxes in curbing the consumption of unhealthy products.

We also assessed the impacts on the new proposal (released in April 2024) of food basket and selective taxes. This scenario also reduced the consumption of our list of UPP (by 13.7%), but also decrease the consumption of in natura products by 5.2%.

In general, it is estimated that the tax reform, as by the new proposal, will generate an increase of R$ 5 billion in the average Brazilian tax burden related to the total expenditure of Brazilian households. In other scenarios, that consider a more aggressive tax reform to stimulate the consumption of healthy products, the total loss in government revenues related to total consumption is expected to be 14.78%.

We highlight the delicate balance between generating tax revenue and ensuring the affordability of essential goods. The findings underscore the potential of selective taxes on nonessential and unhealthy products to offset revenue losses from tax exemptions on basic food items, while also influencing consumption patterns towards healthier choices. In this sense, there is room for improvement in the newest tax proposal to achieve a more nutritional balance within Brazilian households.

.

Referências

Adhikari, B. (2020). Does a Value-Added Tax Increase Economic Efficiency? Public Economics: Taxation.

Caro, J. C., Valizadeh, P., Correa, A., Silva, A., & Ng, S. W. (2020). Combined fiscal policies to promote healthier diets: Effects on purchases and consumer welfare. Plos one, 15(1).

Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. The American economic review, 70(3), 312-326.

Fiedler, J. L., Lividini, K., Bermudez, O. I., & Smitz, M. F. (2012). Household Consumption and Expenditures Surveys (HCES): a primer for food and nutrition analysts in low-and middle-income countries. Food and nutrition bulletin, 33(3_suppl2), S170-S184.

Fiolet, T., B. Srour, L. Sellem, E. Kesse-Guyot, B. Alles, C. Mejean, M. Deschasaux, P. Fassier, P. Latino-Martel, M. Beslay, S. Hercberg, C. Lavalette, C. A. Monteiro, C. Julia & M. Touvier (2018) Consumption of ultra-processed foods and cancer risk: results from NutriNet-Sante prospective cohort. *Bmj,* 360**,** k322.

Haddad, E. A., Araújo, I. F., Sacco, J. G. (2023). Reforma Tributária no Brasil: Impactos Regionais da PEC 45/2019. TD Nereus Working Paper No. 08-2023.

Hall, K. D., A. Ayuketah, R. Brychta, H. Cai, T. Cassimatis, K. Y. Chen, S. T. Chung, E. Costa, A. Courville, V. Darcey, L. A. Fletcher, C. G. Forde, A. M. Gharib, J. Guo, R. Howard, P. V. Joseph, S. McGehee, R. Ouwerkerk, K. Raisinger, I. Rozga, M. Stagliano, M. Walter, P. J. Walter, S. Yang & M. Zhou (2019) Ultra-Processed Diets Cause Excess Calorie Intake and Weight Gain: An Inpatient Randomized Controlled Trial of Ad Libitum Food Intake. *Cell Metab,* 30**,** 67-77.e3.

Harberger, A. C. (1971). Three basic postulates for applied welfare economics: an interpretive essay, Journal of Economic literature 9(3): 785–797.

Louzada, M. L., Levy, R. B., Martins, A. P. B., Claro, R. M., Steele, E. M., Verly Jr, E., ... & Monteiro, C. A. (2017). Validating the usage of household food acquisition surveys to assess the consumption of ultra-processed foods: Evidence from Brazil. Food Policy, 72, 112-120.

Mendonca, R. D., A. C. Lopes, A. M. Pimenta, A. Gea, M. A. Martinez-Gonzalez & M. Bes-Rastrollo (2017) Ultra-Processed Food Consumption and the Incidence of Hypertension in a Mediterranean Cohort: The Seguimiento Universidad de Navarra Project. *Am J Hypertens,* 30**,** 358-366.

Monteiro, C. A., G. Cannon, R. B. Levy, J.-C. Moubarac, M. L. Louzada, F. Rauber, N. Khandpur, G. Cediel, D. Neri, E. Martinez-Steele, L. G. Baraldi & P. C. Jaime (2019) Ultra-processed foods: what they are and how to identify them. *Public health nutrition,* 22**,** 936-941.

Monteiro, C. A., G. Cannon, J. C. Moubarac, R. B. Levy, M. L. C. Louzada & P. C. Jaime (2018) The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. *Public Health Nutr,* 21**,** 5-17.

Moz-Christofoletti, M. A.; Pereda, P. Distributional welfare and emission effects of energy tax policies in Brazil, Energy Economics, Volume 104, 2021.

Pereda, P.; Oliveira, T. Duran, A. C. (2023) Ultra-processed and non-ultra-processed food price changes over the last 25 years: evidence from the metropolitan region of São Paulo, Brazil. Working Paper.

Pereda, P.; Christofoletti, M. A.; Duran, A. C.; Louzada, M. L.; Ng, S. W. (2024) Equity-Driven Fiscal Policies: Taxing Ultra-Processed Products and Subsidizing Minimally Processed Foods, Working Paper.

Pollak, R. A., & Wales, T. J. (1981). Demographic variables in demand analysis. Econometrica: Journal of the Econometric Society, 1533-1551.

Rico-Campà, A., M. A. Martínez-González, I. Alvarez-Alvarez, R. d. D. Mendonça, C. de la Fuente-Arrillaga, C. Gómez-Donoso & M. Bes-Rastrollo (2019) Association between consumption of ultra-processed foods and all cause mortality: SUN prospective cohort study. *BMJ (Clinical research ed.),* 365**,** l1949-l1949.

Silveira, Fernando Gaiger, et al. "Tributação indireta: alíquotas efetivas e incidência sobre as famílias." IPEA Working Paper (2022).

Srour, B., L. K. Fezeu, E. Kesse-Guyot, B. Allès, C. Debras, N. Druesne-Pecollo, E. Chazelas, M. Deschasaux, S. Hercberg, P. Galan, C. A. Monteiro, C. Julia & M. Touvier (2019) Ultraprocessed Food Consumption and Risk of Type 2 Diabetes Among Participants of the NutriNet-Santé Prospective Cohort. *JAMA internal medicine*, 10.1001/jamainternmed.2019.5942.

Vandevijvere, S., L. M. Jaacks, C. A. Monteiro, J.-C. Moubarac, M. Girling-Butcher, A. C. Lee, A. Pan, J. Bentham & B. Swinburn (2019) Global trends in ultraprocessed food and drink product sales and their association with adult body mass index trajectories. *Obesity reviews : an official journal of the International Association for the Study of Obesity,* 20 Suppl 2, 10-19.

Yuba, T. Y., F. M. Sarti, A. C. C. Campino & H. C. E. d. Carmo (2013) Evolution of the relative prices of food groups between 1939 and 2010 in the city of Sao Paulo, Southeastern Brazil (Evolucao dos precos relativos de grupos alimentares entre 1939 e 2010, em Sao Paulo, SP). *Revista de saude publica,* 47, 549-559.

Wang, X., Ouyang, Y., Liu, J., Zhu, M., Zhao, G., Bao, W., & Hu, F. B. (2014). Fruit and vegetable consumption and mortality from all causes, cardiovascular disease, and cancer: systematic review and dose-response meta-analysis of prospective cohort studies. Bmj, 349.

OECD (2023). Redesigning Brazil's consumption taxes to strengthen growth and equity. Policy Brief. Available (June, 2024) at https://www.gov.br/fazenda/pt-br/acesso-a-informacao/acoes-e-programas/reforma-tributaria/estudos/brazil-tax-policy-brief-2023-final.pdf.

Appendix Tables and Figures

Table A.1: Food and beverages under 0% or discounted tax rate, MDS scenario.

Food Group	Examples
Panel A: Products with 0% tax rate	
Beans	Beans, peas, lentils, chickpeas, fava beans, etc.
Cereals	White rice, brown rice, or parboiled rice; whole corn or corn on the cob, wheat grains, oats, rye, barley, quinoa; minimally processed flours of corn, wheat, and other cereals; fresh or dry pasta made from these flours and water. Bread made from wheat flour, yeast, water, and salt.
Roots and tubers	Cassava/manioc, potatoes, sweet potatoes, baroa potatoes/arracacha, yam, taro, and other fresh or packed, fractioned, refrigerated, or frozen roots and tubers; minimally processed cassava flour; cassava derivatives (such as carimã flour, uarini flour, maniçoba and tucupi, tapioca flour).
Fruits	Fresh or packed, fractioned, refrigerated, or frozen fruits.
Meat and Eggs	Poultry, and fish (fresh, refrigerated, or frozen), and bird eggs.
Sugars, Salt, Oils, and Fats	Soy, sunflower, corn, and palm oils, among other vegetable oils; olive oil; butter; lard; white, demerara, or brown table sugar; honey; and table salt.
Milk and Cheese	Pasteurized or industrialized liquid milk, whole, semi-skimmed, or skimmed milk powder.
Nuts (oleaginous)	Cashew nuts, baru nuts, Brazil nuts (Pará nuts), walnuts, almonds, peanuts, hazelnuts, and other nuts without salt or sugar.
Vegetables and Greens	Fresh or packed, fractioned, refrigerated, or frozen vegetables and greens. Vegetables and greens preserved in brine or in a salt and vinegar solution; tomato extract or concentrate (with salt and/or sugar).
Coffee and Mate	Coffee and mate herb.
Panel B: Products with 60% discount in tax rate	
Vegetables and Greens (minimally processed and processed)	Vegetables and greens preserved in brine or in a salt and vinegar solution; tomato extract or concentrate (with salt and/or sugar).
Fruits (minimally processed and processed)	Fruits in syrup and crystallized fruits; jam.
Meat	Beef, pork, and canned sardines and tuna.
Cheese and Yogurt	Cheese made from milk and salt (and microorganisms used to ferment the milk) and natural yogurt.
Teas and Spices	Tea, pepper, black pepper, cinnamon, cumin, cloves, coriander, nutmeg, ginger, saffron, turmeric, among others.

Table A.2: Change in prices, all scenarios compared with the base scenario (current tax rate), all groups (All)

Group	Description	Scen 1	Scen 2	Scen 3	Scen 4	Scen 5
1	Food at home	7.4%	-6.3%	-3.8%	-2.2%	-3.0%
2	Eating outside the home	7.5%	7.5%	7.5%	7.5%	7.1%
3	Health assistance	-5.4%	-5.4%	-5.4%	-5.4%	-5.6%
4	Education	-0.2%	-0.2%	-0.2%	-0.2%	8.7%
5	Smoke	-7.9%	-7.9%	-7.9%	103.1%	103.1%
6	Housing: general	2.3%	2.3%	2.3%	2.3%	1.7%
7	Housing: housing	0.0%	0.0%	0.0%	0.0%	0.0%
8	Hygiene and personal care	-0.8%	-0.8%	-0.8%	-0.8%	-3.2%
9	Clothing	3.4%	3.4%	3.4%	3.4%	3.0%
10	Recreation and culture	8.2%	8.2%	8.2%	8.2%	7.8%
11	Bank services	7.7%	7.7%	7.7%	7.7%	7.3%
12	Personal Services	16.7%	16.7%	16.7%	16.7%	16.2%
13	Transport	-14.7%	-14.7%	-14.7%	-14.7%	5.9%
14	Others	16.9%	16.9%	16.9%	16.9%	16.4%

Table A.3: Change in prices, all scenarios compared with the base scenario (current tax rate), food at home groups (Food)

Subgroup	Description	Scen 1	Scen 2	Scen 3	Scen 4	Scen 5
1	Rice	9.8%	-13.5%	-13.5%	-13.5%	-13.5%
2	Sugar	6.0%	-16.5%	-16.5%	-16.5%	-16.5%
3	English potato	14.5%	-9.8%	-9.8%	-9.8%	-9.8%
4	Sweetened drinks	-0.6%	-0.8%	8.9%	8.9%	14.6%
5	Alcoholic beverages	-3.1%	-3.1%	-3.1%	42.6%	42.6%
6	Beef	7.7%	-6.0%	-6.0%	-6.0%	-6.2%
7	Pork	7.9%	-5.9%	-5.9%	-5.9%	-6.0%
8	Ultra-processed meats	7.7%	7.7%	24.1%	24.1%	7.3%
9	Other foods	5.8%	-3.4%	-2.5%	-2.5%	-3.4%
10	Other beverages	-1.5%	-1.5%	-1.4%	-1.4%	-3.9%
11	Sweets and cookies	6.2%	6.2%	21.0%	21.0%	5.8%
12	Cassava flour	8.3%	-14.7%	-14.7%	-14.7%	-14.7%
13	Cornflour	8.3%	-14.7%	-14.7%	-14.7%	-14.7%
14	Bean	14.5%	-9.8%	-9.8%	-9.8%	-9.8%
15	Chicken	7.5%	-15.4%	-15.4%	-15.4%	-6.4%
16	Fruits	13.2%	-10.9%	-10.9%	-10.9%	-10.9%
17	Vegetables, and greens	14.4%	-9.9%	-9.9%	-9.9%	-9.9%
18	Cow milk	14.2%	-10.1%	-10.1%	-10.1%	13.7%
19	Powdered milk	3.5%	-18.5%	-18.5%	-18.5%	3.1%

Subgroup	Description	Scen 1	Scen 2	Scen 3	Scen 4	Scen 5
20	Butter	3.5%	-18.5%	-18.5%	-18.5%	-18.5%
21	Margarine	4.9%	4.9%	21.4%	21.4%	-17.4%
22	Other Meats	10.8%	-5.4%	-5.4%	-5.4%	0.8%
23	Others in natura	8.8%	-13.9%	-13.7%	-13.7%	4.9%
24	Chicken's egg	11.8%	-12.0%	-12.0%	-12.0%	-12.0%
25	French bread	6.3%	-16.3%	-16.3%	-16.3%	-16.3%
26	Ready and semi-ready meals	7.3%	6.3%	6.7%	6.7%	5.2%
27	Spices	6.5%	1.2%	5.7%	5.7%	4.3%
28	Ultra-processed	4.3%	2.6%	9.0%	9.0%	-17.4%
29	Soy oil	4.9%	-17.4%	-17.4%	-17.4%	-17.4%

Table A4: Uncompensated elasticities, all budget groups, POF 2017-18

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Food at home	-0.806***	0.052*	0.041	0.02	0.057*	0.1	0.05	-0.186	0.102**	0.031	0.088**	-0.129	0.068**	0.045
2	Eating outside the home	-0.011	-1.063***	-0.063***	-0.064**	0.068***	-0.139**	0.073***	0.25	-0.092***	-0.081**	0.069***	0.003	-0.062***	-0.099***
3	Health assistance	-0.015	0.086***	-0.854***	0.100***	0.088***	0.185***	0.094***	-0.609	0.150***	0.127***	0.106***	-0.035	0.101***	0.126***
4	Education	-0.003	0.003	0.004	-0.91***	0.003	0.006	0.004	-0.024	0.006	0.009	0.005	-0.002	0.005	0.004
5	Smoke	0.003	0.017***	0.016***	0.016*	-0.953***	0.034***	0.018***	-0.051	0.027***	0.025***	0.022***	-0.009	0.019***	0.023***
6	Housing: general	0.015	-0.038	-0.034	-0.01	-0.029	-1.060***	-0.037	0.125	-0.05	-0.035	-0.035	-0.015	-0.021	-0.037
7	Housing: housing	-0.025	0.165***	0.154***	0.146*	0.167***	0.348***	-0.78***	-0.859	0.259***	0.247***	0.201***	-0.05	0.178***	0.227***
8	Hygiene and personal care	0.005	0.013	0.003	0.006	0.016	0.025	0.011	-0.345	0.016	0.012	0.019	0.005	0.020*	0.01
9	Clothing	-0.024***	-0.021*	-0.030***	-0.031*	-0.029**	-0.048*	-0.028**	0.109	-1.120***	-0.038*	-0.02	-0.006	-0.018	-0.041**
10	Recreation and culture	-0.013	0.004	0.006	0.014	0.007	0.012	0.007	-0.051	0.011	-0.930***	0.009	-0.008	0.007	0.01
11	Bank services	-0.012**	-0.012**	-0.014***	-0.018**	0.016***	-0.027**	0.016***	0.033	-0.016**	-0.022**	-1.08***	-0.011**	-0.014**	-0.022**
12	Personal Services	-0.013	0.006*	0.005	0.005	0.005	0.014*	0.006*	-0.02	0.010*	0.007	0.011**	0.693***	0.009**	0.007
13	Transport	-0.037	-0.071*	-0.087**	-0.105**	-0.091**	-0.159*	-0.093**	0.16	-0.105*	-0.130**	-0.093**	-0.027	-1.126***	-0.112**
14	Others	-0.024	0.026*	0.023	0.018	0.022	0.046	0.025	-0.177	0.044*	0.036	0.033*	-0.019	0.023	-0.899***

Table A5: Uncompensated elasticities, all food and beverages subgroups, POF 2017-18

	E_ij1	E_ij2	E_ij3	E_ij4	E_ij5	E_ij6	E_ij7	E_ij8	E_ij9	E_ij10	E_ij11	E_ij12	E_ij13	E_ij14	E_ij15	E_ij16	E_ij17	E_ij18	E_ij19	E_ij20	E_ij21	E_ij22	E_ij23	E_ij24	E_ij25	E_ij26	E_ij27	E_ij28	E_ij29
1 Rice	-0.799*	0.013	-0.018	0.015	0.002	-0.042	-0.007	0.024	0.01	0.012	0.024	0.1	0.003	0.028*	0.005	0.011	0.009	0.005	-0.02	0.009	0.02	-0.019	0.016	0.032	0.013	0.036*	0.318	-0.029	0.027
2 Sugar	0.004	-0.817***	0.02	0.004	0.01	-0.002	0.008	0.007	0	0.006	0.012	0.002	0	0	0.005	0.01	0.008	0.005	0.01	0.004	0.001	0.026	0.008	0.02	0.005	0.014	0.053	-0.001	0.005
3 English potato	0.011	-0.005	-1.326**	-0.001	0.002	-0.003	-0.001	0.002	-0.005	-0.002	-0.001	0.003	0.013	0.004	0	-0.001	-0.032	0	0.004	0.005	-0.005	0.013	0	-0.003	-0.001	0.002	-0.008	-0.001	-0.005
4 Sweetened drinks	0.004	0.008	-0.014	-1.017***	0.011	-0.023	-0.003	0.001	-0.002	-0.007	-0.034*	-0.008	-0.026	-0.01	-0.009	-0.021	0.011	-0.005	-0.001	0.005	-0.01	-0.015	-0.01	-0.018	-0.009	-0.006	-0.034	-0.005	-0.014
5 Alcoholic beverages	0.036	-0.04	-0.001	-0.001	-1.051***	-0.015	-0.023	-0.021	-0.022	-0.021	-0.025	-0.018	-0.024	-0.017	-0.028*	-0.041**	0.016	-0.026**	-0.015	-0.039*	-0.021	-0.009	-0.029*	-0.024*	-0.022*	-0.021	-0.024	-0.028*	-0.012
6 Beef	-0.192	-0.003	0.093	0.087	0.035	-0.75***	0.059*	0.036	0.029	0.032	0.058	-0.007	0.043	0.021	0.041	0.042	0.002	0.034	0.015	0.015	0.044	0.036	0.051	-0.013	0.03	0.035	0.064	0.02	0.081
7 Pork	0.09	-0.026	-0.041	-0.025	-0.018	-0.036	-1.076***	-0.03**	-0.028**	-0.022*	-0.015	-0.021	-0.018	-0.021	-0.028**	-0.019	0.017	-0.028**	-0.023	-0.041*	-0.019	-0.083	-0.026*	-0.025	-0.017*	-0.029*	-0.006	-0.033*	-0.021
8 Ultra-processed meats	-0.051	-0.019	0.005	-0.012	-0.013	-0.007	-0.029**	-1.047***	-0.031***	-0.023**	-0.036**	-0.038**	-0.004	-0.04***	-0.029***	-0.039***	0.003	-0.019**	-0.015	-0.019	-0.033***	-0.01	-0.03**	-0.029**	-0.024***	-0.026**	-0.064	-0.011	-0.022
9 Other foods	-0.011	-0.027	0.2	0.051*	0.042**	0.015	0.062***	0.068***	-0.89***	0.052**	0.058**	0.018	0.088***	0.012	0.064***	0.054***	-0.028	0.042**	0.04*	0.042*	0.068***	0.035	0.065***	0.002	0.045***	0.038*	0.11	0.062***	0.112*
10 Other beverages	0.001	0.026	0.077	0.054***	0.028***	0.016	0.038***	0.042***	0.038***	-0.968***	0.049***	0.04***	0.035***	0.031***	0.044***	0.042***	0.014	0.031***	0.033***	0.04***	0.04***	0.05	0.041***	0.017	0.032***	0.04***	-0.03	0.045***	0.051***
11 Sweets and cookies	-0.034	-0.034	-0.026	-0.072	-0.009	-0.023	-0.006	-0.023	-0.014	-0.018	-1.105***	-0.082	0.008	-0.044**	-0.015	-0.021	0.009	-0.016	-0.043	-0.061	-0.008	0.012	-0.016	-0.024	-0.012	-0.018	-0.035	-0.017	0.002
12 Cassava flour	0.085	-0.003	-0.005	0.007	0.002	-0.009	0.004	0.007	0	0.004	0.022*	-0.98***	-0.015	0.01	0.006	0.001	0.013	0.009*	0.002	0.007	-0.003	-0.031	0.006	-0.008	0.003	0.007	0.053	0.012	-0.011
13 Cornflour	0.006	0.003	0.022	-0.011	-0.003	-0.003	-0.003	-0.001	-0.006	-0.003	0	0.009	-1.037***	-0.007	-0.004	-0.003	0.004	-0.003	-0.006	-0.002	-0.004	0.02	-0.004	0	-0.003	0.003	-0.007	-0.003	-0.011
14 Bean	0.035	-0.005	-0.007	0.023	0.01	0.002	0.014	0.022**	0.006	0.013**	0.032**	0.026	0.028*	-0.886***	0.012*	0.017*	-0.007	0.014**	-0.001	0.024	0.017*	0.041	0.017*	0.004	0.011**	0.025**	0.071	0.007	0.024
15 Chicken	0.144	-0.027	-0.077	-0.136***	-0.076***	-0.053	-0.092***	-0.099***	-0.098***	-0.087***	-0.087***	-0.108***	-0.099***	-0.048*	-1.115***	-0.107***	0.006	-0.07***	-0.121***	-0.096***	-0.067***	-0.214	-0.099***	-0.003	-0.08***	-0.075***	-0.048	-0.089***	-0.13***
16 Fruits	0.019	-0.039	-0.037	-0.07	-0.038**	-0.014	-0.016	-0.039*	-0.021	-0.024*	-0.033*	-0.004	-0.013	-0.026**	-0.031***	-1.047***	-0.064	-0.036***	-0.008	-0.022	-0.018	-0.018	-0.022	-0.038***	-0.023**	-0.029	-0.031	-0.021	-0.017
17 Vegetables, and greens	0.005	0.017	0.154	0.008	0.002	0.002	0.005	0.01	0.004	0.011	0.009	0.027	0	0.002	0.01	0.026	-0.946***	0.008	0.004	-0.001	0.011	0.035	0.021	0.008	0.01	0.013	-0.08	0.016	0.01
18 Cow milk	-0.05	0.034	0.067	0.08***	0.061***	0.035	0.076***	0.061***	0.053***	0.053***	0.075***	0.113**	0.058***	0.06***	0.062***	0.091***	0.006	-0.969***	0.115**	0.065***	0.034**	0.089	0.067***	0.031	0.056***	0.059***	0.017	0.052***	0.08**
19 Powdered milk	-0.049	0.018	-0.009	0.011	0.007	-0.001	0.012	0.01	0.01	0.011	0.025*	0.008	0.02	-0.001	0.016	0.008	-0.003	0.021***	-0.87***	0.011	0.008	-0.026	0.013	-0.019	0.009	0.023*	0.007	0.009	-0.004
20 Butter	-0.002	0.001	-0.009	0.001	0.007	-0.002	0.008	0.004	0.003	0.005	0.015*	0.007	0.002	0.008	0.005	0.005	-0.006	0.004	0.004	-0.943***	0.006	0.013	0.006	-0.004	0.005*	0.007	0.007	0.005	0.014
21 Margarine	-0.009	0.004	-0.028	-0.011	-0.004	-0.005	-0.005	-0.009	-0.008	-0.006	-0.004	0.003	-0.007	-0.007	-0.005	-0.005	0	-0.001	-0.003	-0.009	-1.084***	-0.003	-0.008	-0.006	-0.006**	-0.006	-0.009	-0.011	0.001
22 Other Meats	-0.035	0.029	-0.043	0.011	-0.001	0.001	0.018	0.002	0.002	0.006	-0.003	-0.033	-0.036	0.017	0.013	0.004	0.019	0.007	-0.021	0.016	0.002	-0.992***	0.007	-0.013	0.003	0.01	-0.044	0.033	-0.02
23 Others in natura	-0.023	-0.06*	-0.069*	-0.096**	-0.056***	-0.065***	-0.061***	-0.072***	-0.068***	-0.056***	-0.064**	-0.07*	-0.056***	-0.061***	-0.069***	-0.055**	-0.099	-0.054***	-0.055***	-0.072***	-0.069***	-0.081	-1.119***	-0.059***	-0.053***	-0.069***	-0.006	-0.063***	-0.055***
24 Chicken's egg	0.04	0.042	0.035	0.029	0.015	-0.007	0.017	0.019*	0.007	0.011	0.021*	-0.003	0.008	0.008	0.01	0.022*	0.006	0.011	-0.014	-0.001	0.017*	-0.01	0.017*	-0.844***	0.01	0.007	0.014	0.015	0.007
25 French bread	0.084	0.119	0.344*	0.367***	0.206***	0.106	0.204***	0.27***	0.217***	0.21***	0.251***	0.209***	0.219***	0.175***	0.261***	0.265***	0.085	0.216***	0.174***	0.284***	0.272***	0.229***	0.256***	0.11	-0.811***	0.232***	-0.011	0.246***	0.25***
26 Ready and semi-ready meals	-0.067	-0.039	0.003	-0.02	-0.01	-0.006	-0.018*	-0.017*	-0.009	-0.015*	-0.019	-0.024	0.015	-0.029***	-0.014	-0.019*	-0.008	-0.012	-0.035	-0.023	-0.014	-0.03	-0.019*	0.002	-0.013*	-1.092***	-0.015	-0.021*	0.015
27 Spices	-0.058	-0.013	-0.007	-0.005	-0.002	-0.003	-0.001	-0.004	-0.003	0	-0.003	-0.011	-0.003	-0.007	-0.002	-0.002	0.012	-0.001	-0.002	-0.003	-0.003	0.006	-0.001	-0.002	-0.001	-0.002	-1.197**	-0.001	0.007
28 Ultra-processed	-0.201	-0.03	0.048	0.034	0.027*	-0.007	0.037**	0.017	0.031*	0.03*	0.033	0.067*	0.022	0.006	0.03*	0.026	0.026	0.019	0.017	0.029	0.046**	0.159	0.03*	0.023	0.025*	0.037**	-0.012	-0.957***	0.092
29 Soy oil	-0.011	0	-0.018	-0.008	0	-0.01	-0.003	-0.003	-0.009	-0.005	0	0.01	-0.015	-0.007	-0.006	-0.002	0.001	-0.004	0.006	-0.013	0.001	0.017	-0.003	0.002	-0.003	0.006	0.039	-0.015	-1.204***