

TAXATION OF SUGAR-SWEETENED BEVERAGES: SIMULATIONS IN A COMPUTABLE GENERAL EQUILIBRIUM MODEL FOR BRAZIL

ABSTRACT

Sugar-sweetened beverages (SSB) consumption is increasing worldwide, but higher growth rates have been seen in developing countries. Brazil is one of the Latin American countries with a higher level of consumption of SSB. The high sugar content in these beverages and regular consumption of SSB has impacts on individual health and contributes to the increased prevalence of chronic diseases such as obesity. In addition to the potential health outcomes generated by a SSB taxation policy, the effects on the economy must be examined. Considering that, the objective of this article is to analyze the wide-economy impacts of SSB tax in Brazil in the short- and long-term. To analyze these effects, we used a national dynamic Computable General Equilibrium (CGE) model calibrated for the Brazilian economy and evaluates the effects on macroeconomic indicators of production, employment, household consumption, prices and tax revenue in four scenarios. The model's database was calibrated using data from the 2015 Brazilian input-output matrix released by the Brazilian Institute of Geography and Statistics (IBGE), the sugar-sweetened beverages sector (the focus of this work) was disaggregated based on data from the Annual Industrial Survey (PIA) of 2015 considering the participation of Nectars and soft drinks in the Other food products sector and Soft drinks in Other Beverages. The final model has 124 products and 124 productive sectors. Two sets of simulations were performed in which different rates were applied to the sugar-sweetened beverages sector, with different assumptions about government spending. In the first set of simulations, it is considered that the variation in tax revenue resulting from the change in taxation does not change the total volume of government spending. In turn, in the second set of simulations, the resources collected with the tax on the sugar-sweetened beverages sector are directed to the Public Health sector, increasing public expenditures in this sector, in the same amount collected with the taxation. For each of the two sets of simulations, four policy scenarios were considered: 1) an increase of 10p.p. in the taxation of the sector from 2023; 2) an increase of 20p.p. in the taxation of the sector from 2023; 3) an increase of 30p.p. in the taxation of the sector from 2023; and 4) gradual increase from 10 to 30p.p. in sector taxation between the years 2023 and 2025. In all simulations, with the increase in taxation in the sugar-sweetened beverages sector, an increase in the sector's costs is expected, which are partially passed on to consumers in the form of price increases. The main results show negative effects for the SSB sector, with an increase in prices and a reduction in the level of economic activity. At the same time, as recommended, families reduce SSB consumption, in reaction to rising prices. When there is no change in government spending, negative results are observed in the short term in macroeconomic indicators. The introduction of a tax on SSB sector contributes to reduce household and government consumption, exports, and the price index. However, these effects contribute to a reduction in GDP in all scenarios. Over time, exports are encouraged, investments are resumed, and price indexes rise. The observed effects have repercussions on the labor market, generating a reduction in employment and wages in the short term. The fall in employment, however, is reversed in the long term, reaching the end of the period with positive variations. The wage mass, however, did not recover and maintained negative variations throughout the period. On the other hand, when the resources collected from taxation are reintroduced into the economy in the form of increased public spending, the negative macroeconomic effects are reversed, maintaining similar results for the SSB sector. Additionally, when comparing the strategy of establishing a fixed tax of 30p.p. or a gradual increase until reaching the same percentage, it is observed that the tax revenue is less affected and that in the last year of the analyzed period, the effects on the different economic indicators are slightly less expressive with the gradual increase.

Key words: Sugary sweetened beverages; taxation; macroeconomic impact; computable general equilibrium model

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1. Introduction

The study objective is to analyze the short and long-term impacts of a policy of surcharging Sugar-Sweetened Beverages (SSB) on the Brazilian economy. Sugar-Sweetened Beverages are all those non-alcoholic, non-fermented beverages, sweetened with different forms of added sugar, with low nutritional value and ready for consumption, such as soft drinks and nectars (BRASIL, 2018a), considered in this study. Such terminology complies with the sugar reduction agreement established in 2018 between the Ministry of Health and entities in the food and beverage sector in Brazil (BRASIL, 2018b).

The consumption of these drinks is increasing all over the world, with the highest growth rates observed in low and middle-income countries. Brazil occupies the tenth position among the countries with the highest consumption of sugar-sweetened beverages. At the same time, there is also a rapid increase in the incidence of obesity in low and middle-income countries, such as Brazil. The worsening of eating habits, caused by the increased consumption of low-nutrition foods and the consumption of sugar-sweetened beverages, has contributed to the growth in the incidence of chronic noncommunicable diseases (NCDs) (RONTO, WU, and SINGH, 2018). Given the high sugar content, the regular consumption of sugar-sweetened beverages is positively associated with the prevalence of overweight and obesity, as well as related diseases (diabetes, hypertension and cardiovascular diseases) (OMS, 2015).

Therefore, policies to prevent and control obesity are necessary. Among these, the taxation of sugar-sweetened beverages stands out, which has been adopted in several countries¹ as the main public policy tool to inhibit the increase in the consumption of these beverages (ALLCOTT, LOCKWOOD E TAUBINSKY, 2019). Studies have shown that a price increase caused by taxation results in a reduction in demand for these beverages (BRIDGE, GROISMAN e BEDI, 2022; CLARO *et al.*, 2012; FERRETTI e MARIANI, 2019; FINKELSTEIN *et al.*, 2013), which contributes to health gains such as reduction of cardiovascular disease and gain in quality-adjusted life years (QALY) (Wilde *et al.*, 2019). Additionally, Basto-Abreu *et al.* (2019) and Long *et al.* (2015) observed that this is a cost-effective policy to deal with the growth in the intake of sugar-sweetened beverages, which contributes to improve health and reduces health costs, with higher gains being observed among socioeconomically less favored groups (Lal *et al.*, 2017).

In addition to health aspects, macroeconomic impacts are another relevant characteristic to consider when implementing a tax policy on sugar-sweetened beverages. However, as pointed out by Mounsey *et al.* (2020) there are still few studies analyzing the macroeconomic effects of adopting this type of policy². At the same time, it is observed that these aspects support the main arguments against the policy of taxing sugar-sweetened beverages. The argument is that this type of policy harms the economy and contributes to reduce employment in the sugar-sweetened beverage sector and related sectors. Some studies have shown that the reduction in the consumption of sugar-sweetened beverages

¹ For a list of countries that have already implemented an additional tax on sugar-sweetened beverages see Table 2 of Allcott, Lockwood e Taubinsky (2019).

² Some of the existing studies were demanded by associations of beverage producers, and there are few published peer-reviewed studies addressing this issue.

resulting from an increase in the taxation of these beverages can generate losses to the economy in terms of employment and aggregate output (CANTÚ, CURIEL E VALERO, 2015; THERON, ROSSOUW E FOURIE, 2016; THSEHALA, 2020), and others have suggested that the changes in the level of employment observed are small or non-existent (GUERRERO-LÓPEZ, MOLINA E COLCHERO, 2017; LAWMAN *et al.*, 2019; MARINELLO *et al.*, 2021; MARINELLO, LEIDER E POWELL, 2021). While empirical studies that analyze the effect on employment after the implementation of the tax in Mexico and the United States showed that job losses in the taxed sector tend to be offset by job creation in non-taxed sectors. In these cases, changes in the level of employment observed were small or non-existent (Guerrero-López, Molina e Colchero, 2017; Lawman *et al.*, 2019; Marinello *et al.*, 2021; Marinello, Leider e Powell, 2021). Similarly, Powell et al. (2014) estimated the effects of a 20% SSB tax on employment for the US states of Illinois and California. The results showed that SSB taxation reduces the consumption of these beverages, with effects on employment in the SSB producing sector. Cantú, Curiel e Valero (2015) used an input-output model to assess the effect on employment, sales revenue and GDP of an 11% tax on SSB in Mexico. The authors noted that the results of this policy imply negative effects on sales in the SSB sector, a 0.04% reduction in the Gross Domestic Product (GDP), and loss of jobs associated with the beverage industry and the agricultural sector.

For Brazil, the evidence is still scarce. Cardoso (2015) analyzed the effect of a 10% tax on sugar-sweetened beverages based on an input-output model. The results showed a reduction of 6.8% in the production of sugar-sweetened beverages, a decrease of 2.1% in household consumption and an increase of 0.99% in the price index. On the other hand, the author observed an increase of 2.1% in aggregate production and an increase of 574 million reais in tax collection. Lucinda *et al.* (2020) used an input-output model with endogenous household spending and observed a negative effect of the taxation policy on added value, employment and gross production value, and employment is offset by the positive effects of spending extra tax revenue.

These evidences are based on static analysis and does not assess long-term effects. In this context, the present study aims to analyze the short-term and long-term economic impacts of the implementation of an increase in the tax on sugar-sweetened beverages in Brazil through the application of a computable general equilibrium model. For this analysis, the effects on the macroeconomic aggregates of production, employment, household consumption, prices and tax revenue were considered in four scenarios of increased taxation.

2. Methodology

The national dynamic Computable General Equilibrium (CGE) model used in the simulations was developed by the Nucleus of Studies in Urban and Regional Development at the Federal University of Paraná (NEDUR-UFPR³). It is a calibrated model for the Brazilian economy, which theoretical structure follows the Australian ORANI-G model (HORRIDGE, 2014). The model's database was calibrated using data from the 2015 Brazilian input-output matrix released by the Brazilian Institute of Geography and Statistics (IBGE) (2015a), the sugar-sweetened beverages sector (the focus of this work) was disaggregated based on data from the Annual Industrial Survey (PIA) of 2015 (IBGE, 2015b)

³NEDUR – Center for Studies in Regional and Urban Development is a research center at the Federal University of Paraná, linked to the Graduate Program in Economic Development and the Department of Economics, which aims to carry out excellent applied research in the field of Economy and its interface with Regional and Urban Science, aiming to contribute to the socioeconomic development of Brazil, as well as its regions and cities. More information about the nucleus can be obtained at www.nedur.ufpr.br.

considering the participation of Nectars and soft drinks in the Other food products sector (1.28%) and Soft drinks in Other Beverages (48.15%). The final model has 124 products and 124 productive sectors. The central structure of the model is composed of blocks of equations that determine the supply and demand relationships, derived from optimization hypotheses and market equilibrium conditions. In addition, some national aggregates are defined in these blocks, such as aggregate employment, GDP, trade balance and price indices. The productive sectors minimize production costs subject to a technology of constant returns to scale in which the combinations of intermediate inputs and primary factor (aggregate) are determined by fixed coefficients (Leontief). There is substitution via prices between domestic and imported goods in the composition of inputs, through Constant Elasticity of Substitution (CES) functions. In the composition of the primary factor, there is also substitution via prices between capital and labor by CES functions.

In the model, households consume domestic and imported goods. The choice between a domestic or an imported good is made through a CES specification (Armington hypothesis). The treatment of domestic demand is based on a linear system of spending by utility functions of the Stone Geary or Klein-Rubin type. Thus, the utility derived from consumption is maximized by this utility function. This specification represents the Linear Expenditure System (LES), in which the share of expenditures above the subsistence level for each good represents a constant proportion of the total subsistence expenditure of each household.

Government expenditures are exogenous and may or may not be associated with household consumption or tax collection. Sectoral exports respond to demand curves negatively associated with domestic production costs and positively affected by the exogenous expansion of international income, adopting the small country hypothesis in international trade. Terms of shifts in the price and demand for exports allow for shocks in the demand curves. In turn, the variation in inventories accompanies the level of production in the sectors, therefore, the volume of domestic or imported inventories of each good varies according to its domestic production. An alternative that could be used in modeling is to make the variation of stocks fixed. This is done through an appropriate choice of model closure.

The model operates with market equilibrium for all goods, both domestic and imported, as well as in the factor market (capital and labor). Purchase prices for each of the use groups (producers, investors, households, exporters and government) are the sum of base values and sales taxes (direct and indirect) and margins (trade and transport). Sales taxes are treated as ad valorem rates on basic flows. The demands for margins (transport and trade) are proportional to the flows of goods to which the margins are associated. The productive structure considers that each industry can produce several goods (secondary production), using inputs (domestic and imported) and productive factors (capital and labor).

The model has a recursive dynamic specification, in which investment and capital stock follow mechanisms of accumulation and intersectoral displacement based on pre-established rules, associated with the rate of depreciation and return. The labor market also presents an element of intertemporal adjustment, which involves variables such as real wages, current employment and trend employment. The labor market also presents an element of intertemporal adjustment, which involves variables such as real wages, current employment and trend employment. Further details of the theoretical core structure of the model can be found in Horridge (2014).

2.1 Closure

The recursive dynamics of the model implies that the database is updated year by year based on exogenous shocks and the movement of dynamic components (investment and labor market). There are two types of scenarios to be estimated, the baseline scenario, which replicates the trajectory of the economy; and policy scenarios, in which exogenous changes are applied and modify the economic trajectory, as represented by Figure 1.

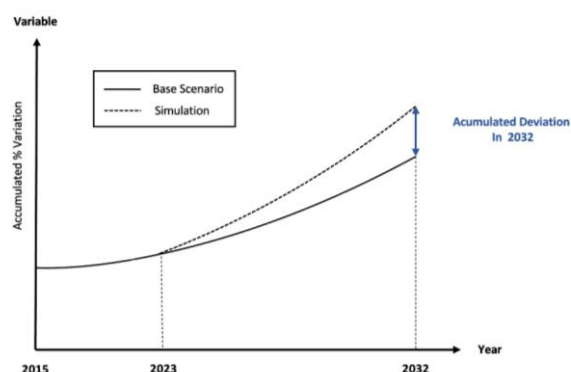


Figure 1 – Deviation from the baseline scenario

Source: Own elaboration.

Therefore, the initial structure for 2015 was updated for 2021 according to data from the quarterly national accounts (macroeconomic variables) and the Continuous National Household Sample Survey (employment), considered as exogenous shocks in the baseline scenario. As of 2022, the baseline scenario continues to be updated with GDP projection data (the other macroeconomic aggregates are kept endogenous), according to the Focus Report of March 25, 2022 (BANCO CENTRAL do BRASIL, 2022), which projects the variation of the Brazilian GDP for the 2022-2025⁴ period. For the 2026-2032 period, the final projection of the Focus Report was maintained, of GDP growth of 2% per year.

Finally, in the present study, the policy scenarios represent changes in the taxation of the sugar-sweetened beverages sector, which shift the trajectory of the sector and the economy in relation to the baseline scenario.

2.2 Simulation Strategy

Two sets of simulations were performed in which different rates were applied to the sugar-sweetened beverages sector, with different assumptions about government spending. In the model used, there is no connection between tax revenue and government spending, that is, it is assumed that government spending follows its own behavior, usually determined by political issues, and which is not necessarily related to tax revenue. Thus, in the first set of simulations, it is assumed that government spending remains at the baseline scenario level, which means that, it is considered that the variation in tax revenue resulting from the change in taxation does not change the total volume of government spending. In turn, in the second set of simulations, the resources collected with the tax on the sugar-sweetened beverages sector are directed to the Public Health sector, increasing public expenditures in this sector, in the same amount collected with the taxation. In this case, the level of government spending increases by the same amount as the revenue from sweetened drinks and all other

⁴ The projections used are: 0.50% for 2022; 1.3% for 2023; 2% for 2024 and 2025.

government spending remains unchanged from the baseline scenario. This strategy of resource allocation in Public Health was adopted in other articles in the area, such as Cardoso *et al.* (2022) and is being discussed as part of the Bill (PL 2.283/2019) which deals with the taxation of soft drinks and sugar-sweetened beverages⁵.

For each of the two sets of simulations, the following changes in taxation of sugar-sweetened beverages were simulated:

Scenario 1: Increase of 10 p.p. in the taxation of the sector from 2023;

Scenario 2: Increase of 20 p.p. in the taxation of the sector from 2023;

Scenario 3: Increase of 30 p.p. in the taxation of the sector from 2023;

Scenario 4: Gradual increase from 10 to 30 p.p. in the taxation of the sector between the years 2023 and 2025.

It is worth mentioning that in the baseline scenario, the ad valorem tax calibrated for the sector, according to the national accounts data mentioned at the beginning of the section, is around 19% related to the basic price of the sector. Thus, a 10 percentage point increase in taxation, for example, implies a tariff close to 30% related to the base value, or an increase of approximately 52% in the tax amount.

In all simulations, with the increase in taxation in the sugar-sweetened beverages sector, an increase in the sector's costs is expected, which are partially passed on to consumers in the form of price increases (the causal sequence of relationships is schematically represented in Figure 2). Faced with higher prices, consumers tend to reduce the consumption of these drinks, replacing them with other products. Consequently, a reduction in the demand for sugar-sweetened beverages is expected, accompanied by an increase in prices in the sector, and a reduction in the demand for labor.

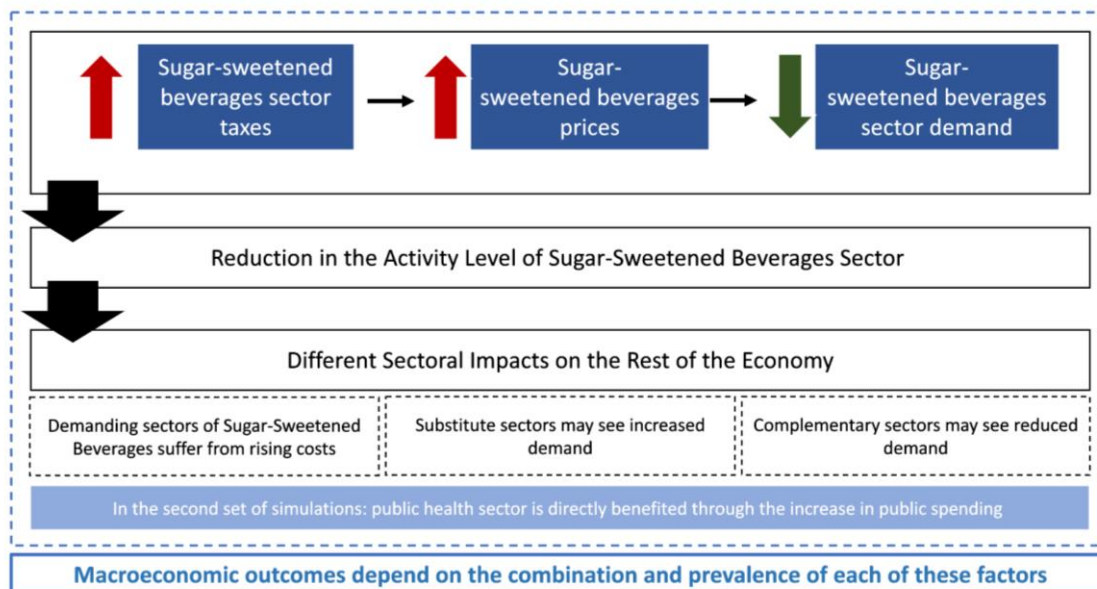


Figure 2 – Schematic representation of the causal relationships of the EGC model.

Source: Own elaboration.

⁵ Available in: [https://www12.senado.leg.br/noticias/materias/2022/05/06/cas-analisa-aumento-na-tributacao-sobre-refrigerantes-e-bebidas-acucaradas#:~:text=Refrigerantes%20e%20bebidas%20a%C3%A7ucaradas%20podem.de%20Assuntos%20Sociais%20\(CAS\)](https://www12.senado.leg.br/noticias/materias/2022/05/06/cas-analisa-aumento-na-tributacao-sobre-refrigerantes-e-bebidas-acucaradas#:~:text=Refrigerantes%20e%20bebidas%20a%C3%A7ucaradas%20podem.de%20Assuntos%20Sociais%20(CAS).). Accessed on: October 2022.

For the rest of the economy, there are at least three expected consequences: sectors that demand sugar-sweetened beverages may have an increase in production costs (depending on the importance of this product in the total cost); sectors producing substitute goods (such as other food products) tend to benefit from changes in household consumption decisions; and sectors producing complementary goods tend to show a drop in demand. The combination of these results affects the macroeconomic result, which depends on the intensity and prevalence of each of the effects described. In the scenario where tax revenue is redirected to the public health sector, this sector becomes directly benefited.

3 Impacts of taxing Sugar-Sweetened Beverages in Brazil

With the increase in taxation, the main expected direct effect on the sugar-sweetened beverages sector is on product prices (Figure 3). With the increase in taxation and considering a scenario with no change in the composition of government spending, the increase in price depends on two factors: the participation of taxation in the total cost of production and the sensitivity of demand in relation to prices. The combined result of these two effects shows that, in the first simulation year (2023), sugar-sweetened beverages prices are expected to increase by 7.33% with an increase of 10p.p. in taxation; 14.73% with an increase of 20p.p. in taxation; 22.22% with an increase of 30p.p. and 7.33% with tax gradual increase. These results correspond to deviations in relation to the baseline scenario, in other words, the increase in prices that would occur in the sector above its trend path until 2023. Over time, the effects on prices become slightly higher. In 2032, the cumulative effect over time is 8.27%; 16.67%; 25.21% and 25.29% in each of the policy scenarios, respectively.

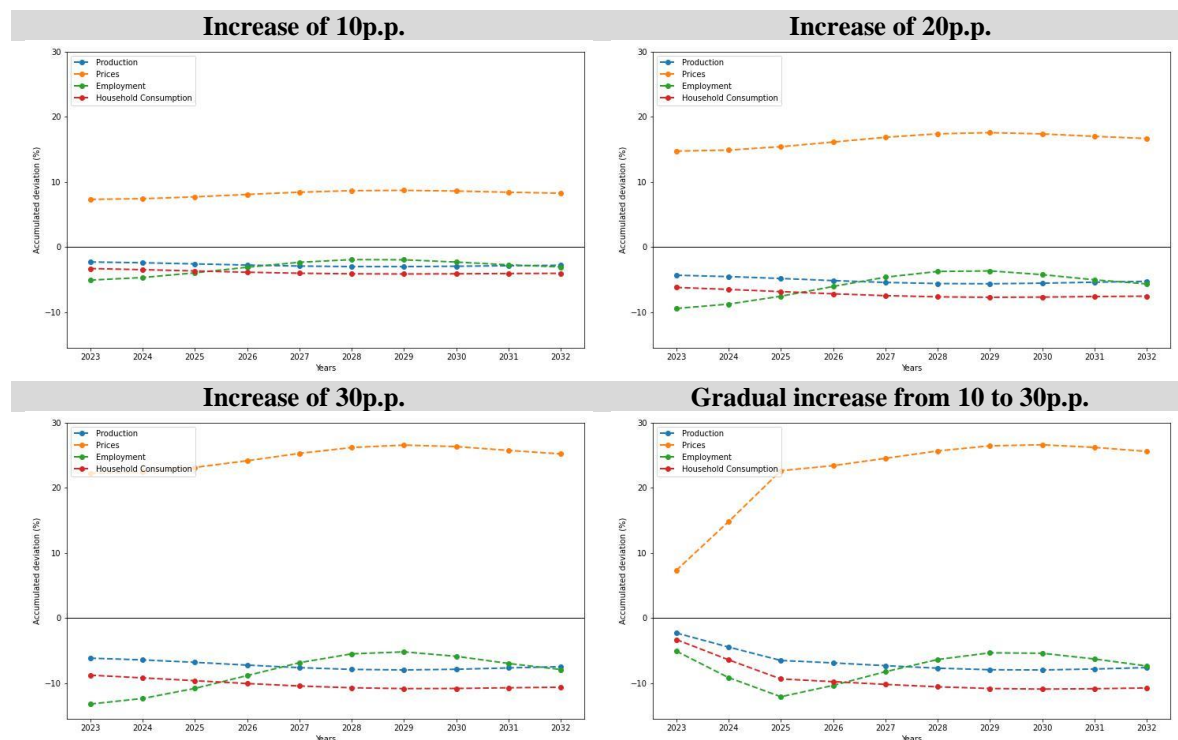


Figure 3 – Results for the Sugar-Sweetened Beverages sector with no change in government spending

Source: Own elaboration based on simulation results

Still on the sugar-sweetened beverages sector, it is estimated that there will be a drop in production, which, in terms of the accumulated deviation in 2032, varies between 2.80% in the first simulation (increase in taxation 10p.p.) and 7.60% with gradual increase in taxation between 10 and 30p.p.. These changes, as expected, are accompanied by reductions in the level of employment in the sector. In turn, it is estimated that families will reduce the consumption of sugar-sweetened beverages by 2032 by 4.03% in the first simulation, 7.54% in the second simulation, 10.62% in the third simulation, and 10.74% in the fourth simulation, when the effect of taxation is gradual. It is worth mentioning that this result shows that the effect on the reduction in household consumption is greater when compared to the reduction in production in the sector, which can be explained by the ability of families to replace these sugar-sweetened beverages with other products that are relatively cheaper.

Concerning tax collection (Figure 4), as noted earlier, a 10-percentage point increase in taxation implies an increase of around 52% in the tax amount. Since the tax is ad valorem, this effect, added to the effect of an increase in prices in the sector, causes an increase in revenue of 61.38% about the level of revenue in the base scenario, and in 2032, revenue remains 62.35% above the baseline scenario. In the case of the simulation of an increase in 20p.p. in taxation, the revenue variation in 2032 reaches 124.47%, while in the simulation of an increase of 30p.p. this variation in 2032 is estimated at 186.46% with the increase in the first year, and 187.11% with the gradual increase.

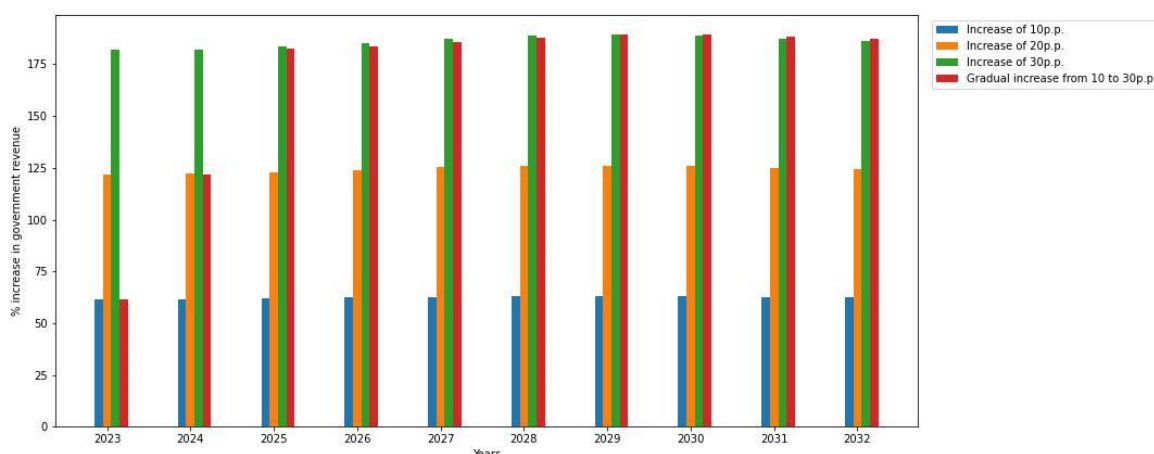


Figure 4 – Results on tax revenue in the Sugar-Sweetened Beverages industry with no change in government spending

Source: Own elaboration based on simulation results

In macroeconomic terms, the results presented in Figure 5 shows that the trajectories of all simulations are similar, varying only in the intensity of the results. In general, a small reduction in the Brazilian GDP is estimated, which varies between -0.05% with an increase of 10p.p. in taxation, up to -0.18% with the gradual increase in taxation in terms of accumulated deviation after 10 years. Household consumption closely follows the path of GDP, as do investment and imports.

Increase of 10p.p.

Increase of 20p.p.

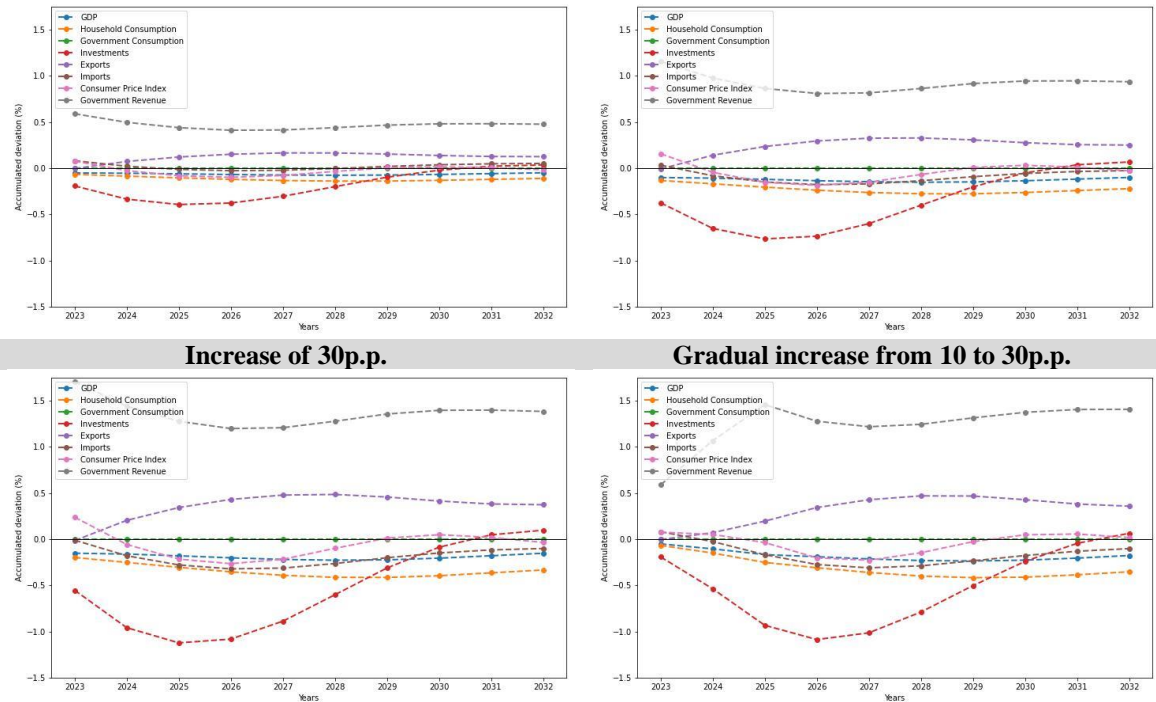


Figure 5 – Macroeconomic Results for Brazil without change in government spending
 Source: Own elaboration based on simulation results

In turn, the Consumer Price Index (CPI) has a small initial increase, caused by the effect of the increase in the price of sugar-sweetened beverages, but in the following periods, the effect is reversed due to the negative effect on employment and income in terms of aggregates, causing the national prices to be pressured downwards. This reduction in domestic prices and reduction in domestic demand has the effect of increasing the competitiveness of national products abroad, which encourages, in aggregate terms, an increase in exports, motivating export sectors to increase their production. Over time, it is possible to notice that investments recover, raising national income again and reversing the effect on the trade balance (exports versus imports) and prices at the aggregate level. The effect on government tax revenue, considering all sectors of the economy, is positive, reflecting the increase in taxation in the sugar-sweetened beverages sector. At the end of the simulation period, aggregate revenue accumulates a deviation of 0.48%, 0.94%, 1.38%, and 1.41% in each of the simulations, respectively.

In the labor market (Figure 6), the aggregate results also follow the same trends in all scenarios, with initially negative variation for national employment and a recovery trend towards the base scenario level at the end of the simulations. These changes are accompanied by declines in real wages throughout the simulated period. The initial reduction in employment is due to the general drop in the level of activity, but this drop is reversed with the resumption of investments, which encourages new hires. In turn, the reduction in real wages follows the upward trend in prices and begins to recover over time, although the accumulated result in 2032 remains negative, with reductions reaching 0.79% in the simulation of an increase in 30p.p. in the taxation of sugar-sweetened beverages.

Increase of 10p.p.

Increase of 20p.p.

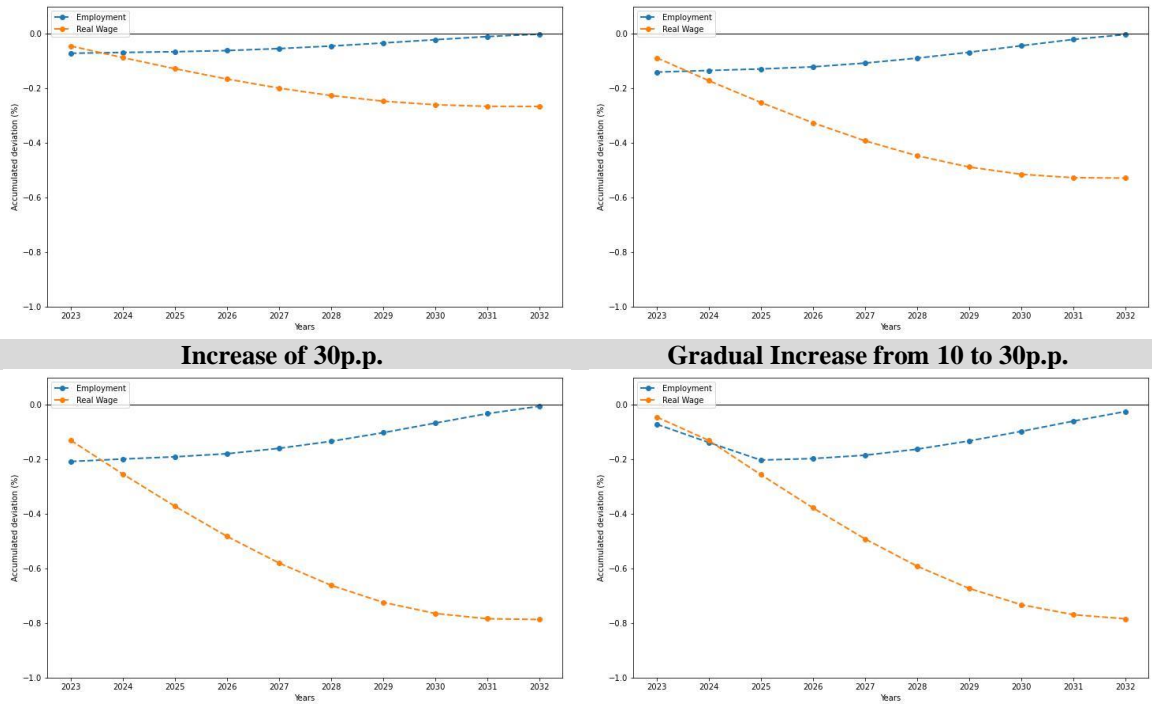
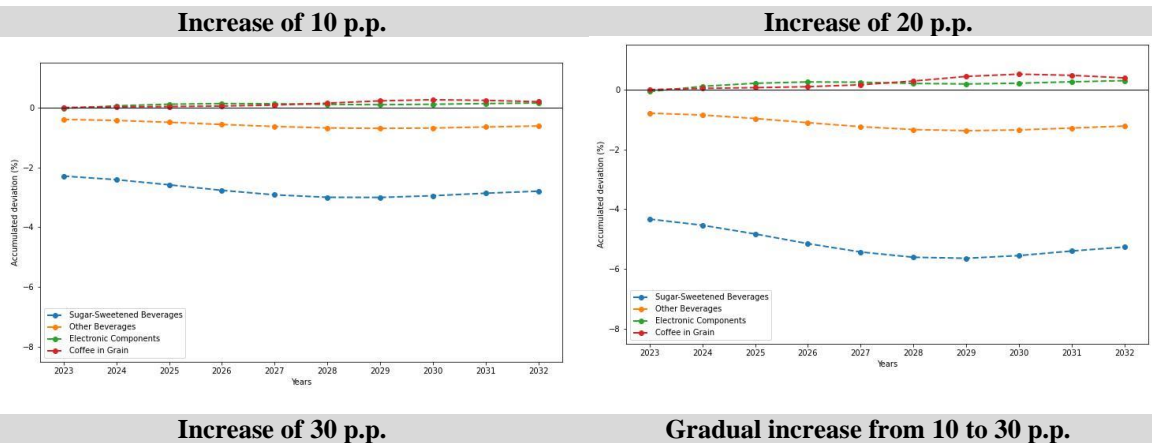


Figure 6 – Labor market outcomes for Brazil with no change in government spending
 Source: Own elaboration based on simulation results.

In sectoral terms (Figure 7), the sector most affected by the policy is the sugar-sweetened beverages, followed by the Other Beverages sector, which has (given the assumption used in the disaggregation) the same proportions in demand for inputs and products than the Sweetened Beverages sector, acting in a complementary way to it and consequently indirectly receiving the effects of the shock. In turn, the most benefited sectors (although the magnitude of the effect is low) are sectors related to exports, such as Coffee in Grain and Pig Iron and Ferroalloys, in addition to the Electronic Components sector, driven by household demand.



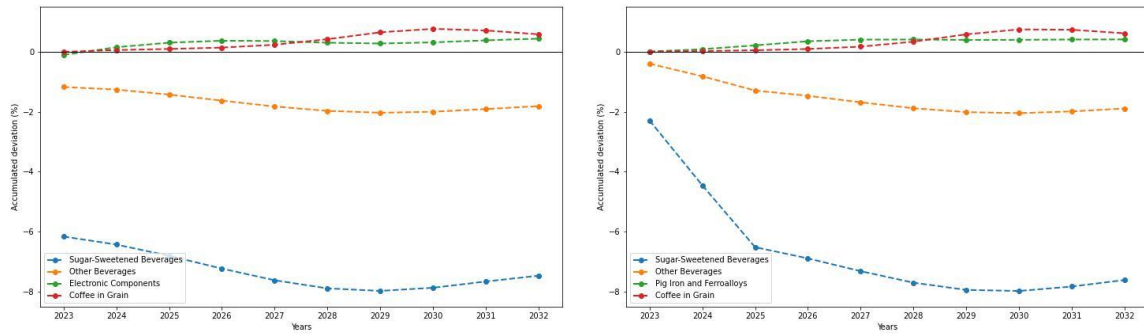
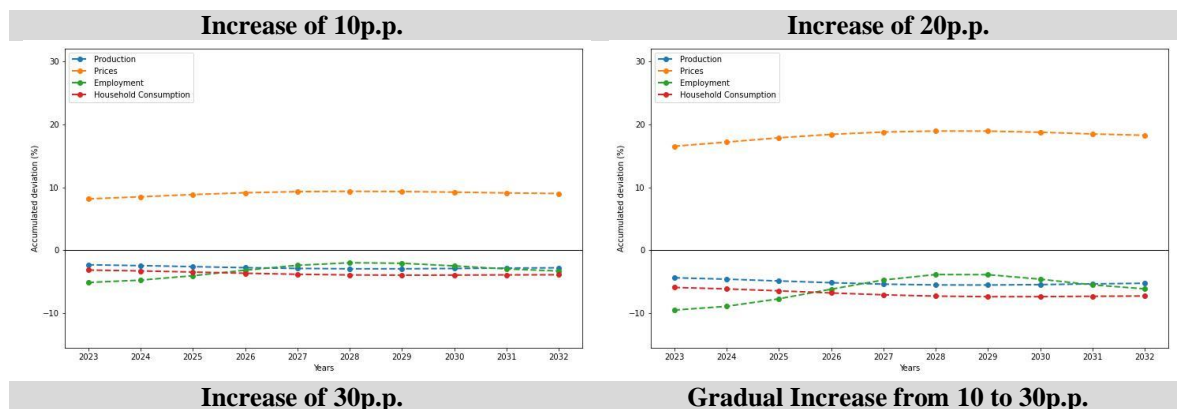


Figure 7 – Sectorial results (two sectors that grew the most and two sectors that grew the least in cumulative terms) with no change in government spending

Source: Own elaboration based on simulation results.

When there is a change in government spending with the allocation of tax revenue from sugar-sweetened beverages to the Public Health sector, in general, the negative effects on the economy are slightly reduced since the amount collected is transformed into an increase in government spending. It is noteworthy that the increase in government spending corresponds exactly to the amount collected from the policy and does not consider the total changes (direct and indirect) in the level of taxes collected.

Specifically for the sugar-sweetened beverages sector, although the magnitudes are different in this set of simulations, the logic of the results remains the same, as shown in Figure 8. That is, the price of sugar-sweetened beverages increases, between 9.00% (with the increase of 10p.p. in taxation, in % accumulated in 2023) up to 28.00% (in the simulation of gradual increase in prices); while the sector's activity level presents a reduction between 2.78 and 7.53% (in the same simulations, respectively). The level of employment follows the downward trend in the level of activity, and the reduction in household consumption is more pronounced, reaching 10.31% in the simulation of a gradual increase in taxation. In turn, the variation in the collection of the sugar-sweetened beverages sector (Figure 9) is slightly above the values estimated in the first set of simulations, since the negative effect on the sector's activity level is marginally attenuated with the increase in taxes.



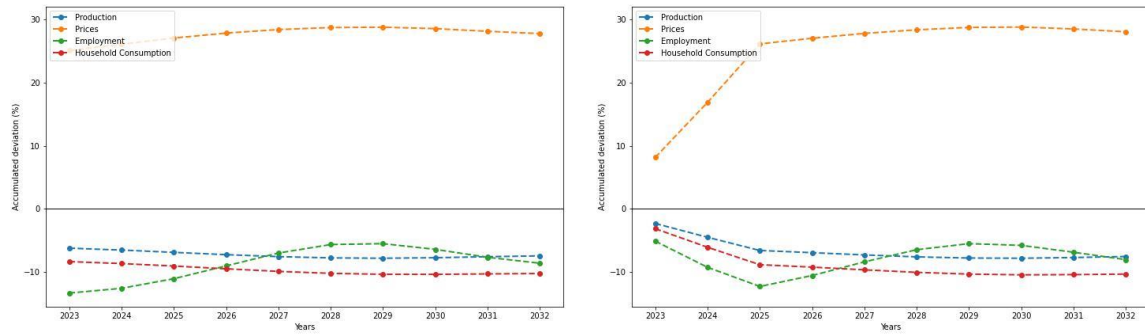


Figure 8 – Results for the Sweetened Beverages sector with changes in government spending

Source: Own elaboration based on simulation results

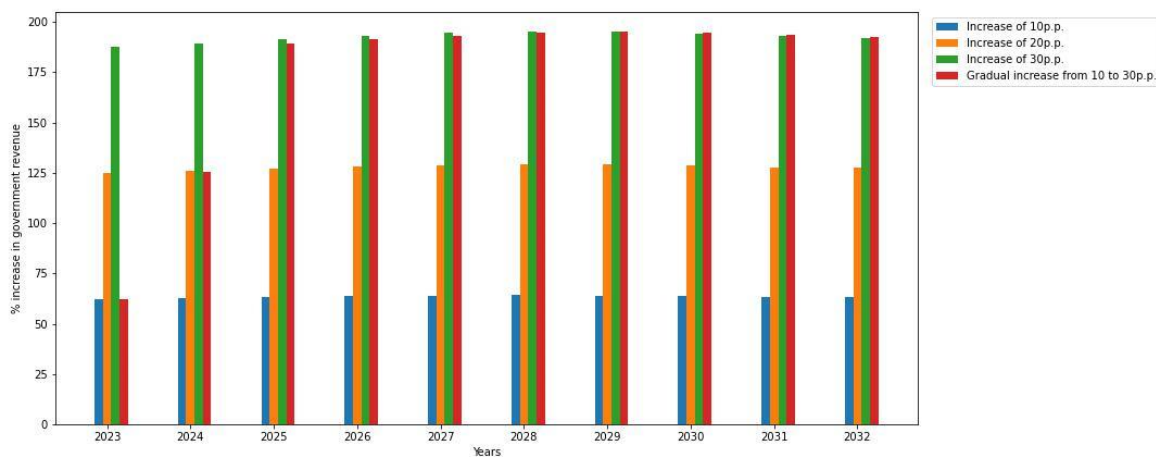


Figure 9 – Results on tax revenue in the sweetened beverage sector with change in government spending

Source: Own elaboration based on simulation results.

In macroeconomic terms (Figure 10), the increase in public health expenditures generates a direct effect on Government Consumption, which increases proportionally to the amount of revenue generated with the taxation of sugar-sweetened beverages. Values for this shock were calibrated using the results of the first set of simulations, which translated into increases in public health spending. As all other government expenditures are kept exogenous and without shocks, their values remain fixed at the baseline level. Therefore, the increase in public spending accumulates a percentage increase in terms of deviation in 2023, of 0.43% in the simulation of an increase of 10p.p. in taxation; 0.85% in the simulation of an increase of 20p.p. in taxation; and 1.27% both in the elevation simulation at 30p.p. and in the gradual simulation.

Increase of 10p.p.

Increase of 20p.p.

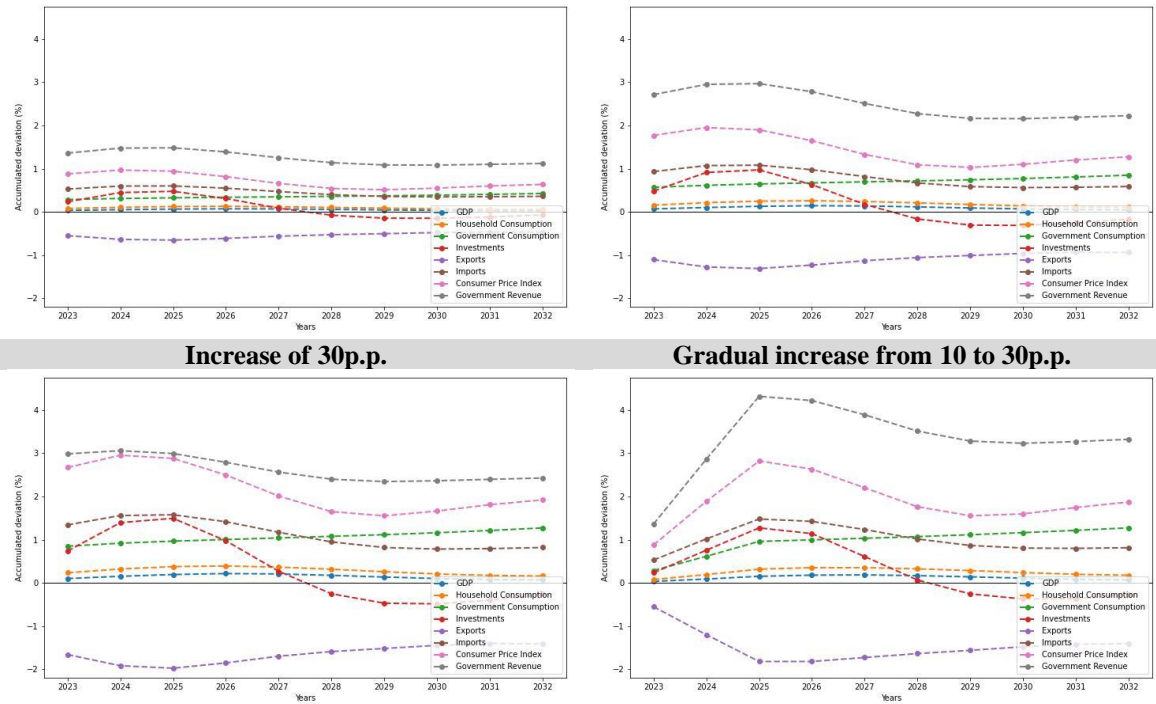
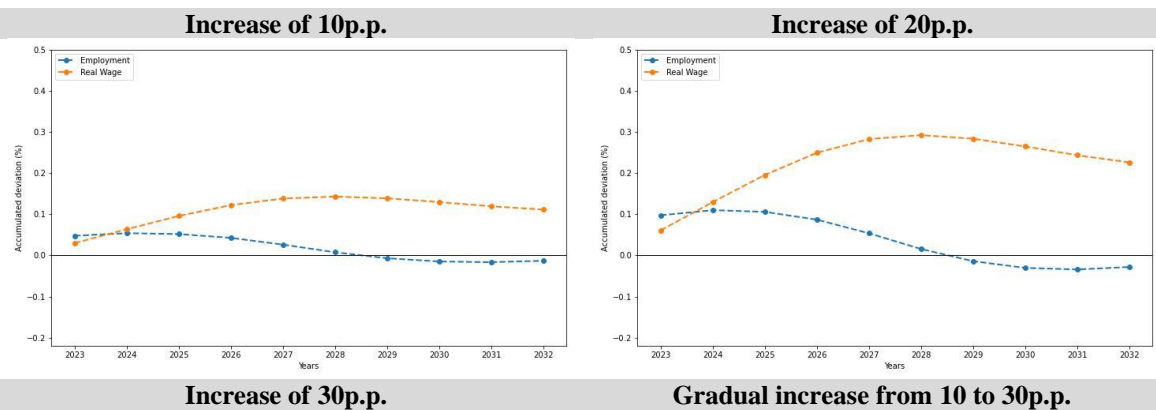


Figure 10 – Macroeconomic Results for Brazil with changes in government spending
 Source: Own elaboration based on simulation results.

Given this change, the other macroeconomic results are changed compared to the first set of simulations. When there is an increase in government spending in the amount collected from tax, the economic stimulus generates positive effects on income and employment (Figure 11), raising household demand and favoring increased investments, which, in turn, allow increases in production capacity. Even so, over the years, the investment level tends to stabilize, ending the period with negative accumulated deviations. On the other hand, the increase in income generates pressure on domestic demand, raising the level of imports and reducing exports, while domestic prices remain higher. As a combination of all these results (increase in domestic demand, counterbalanced by a deterioration in the terms of trade), the accumulated deviation in GDP remains positive in all simulations, but in small magnitudes, varying between an increase of 0.03% accumulated in 2023 for the simulation of increase in 10p.p. in taxation, up to 0.07% in simulations of an increase of 30p.p. complete and gradual.



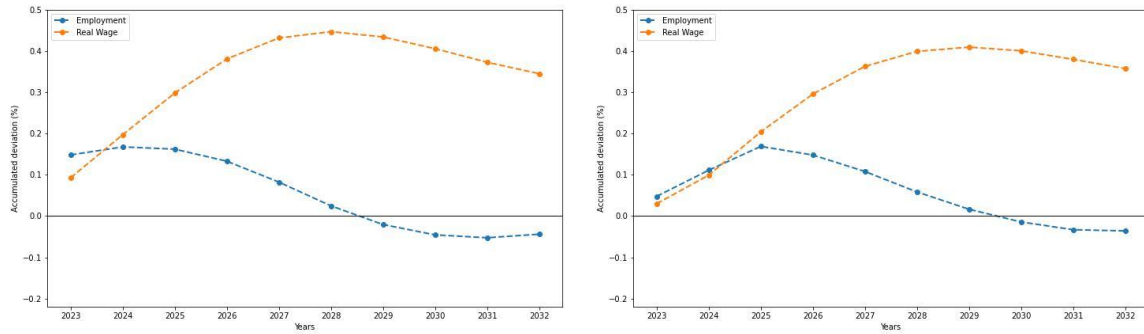
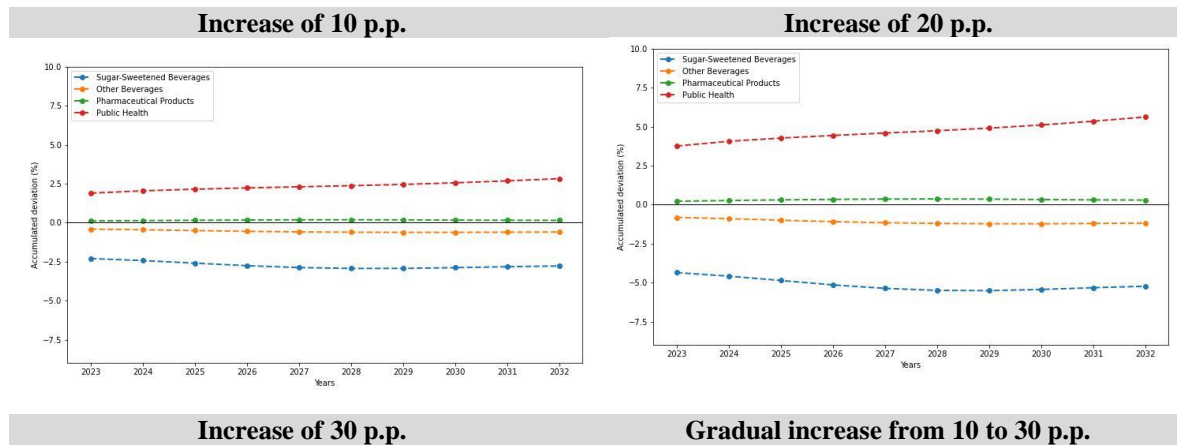


Figure 11 – Results in the labor market for Brazil with changes in government spending

Source: Own elaboration based on simulation results.

In sectoral terms, the two sectors with higher loss caused by the policy are the same: sugar-sweetened beverages and Other Beverages. On the other hand, unlike the first set of simulations, the sector that has direct benefit from the policy is the Public Health sector, which accumulates a percentage deviation of 2.82% in 2032 in the simulation of an increase of 10p.p. in the taxation of sugar-sweetened beverages; 5.62% when the increase is 20p.p.; 8.42% with an increase of 30p.p. and 8.44% with the gradual increase. The second sector that benefits the most in the first three simulations, although the magnitude is smaller (maximum accumulated growth of 0.48%), was the pharmaceutical products sector, benefited due to its direct connection with the Public Health sector. In the simulation of a gradual increase in taxation, the second sector with the highest growth was the rental sector (with an accumulated deviation of 0.48% in 2023), which occurs due to demand stimulus for families, notwithstanding, the third most benefited sector in this simulation was the pharmaceutical products sector (with an accumulated deviation of 0.46% in 2023)⁶.



⁶ The complete results for the sectors can be requested from the authors.

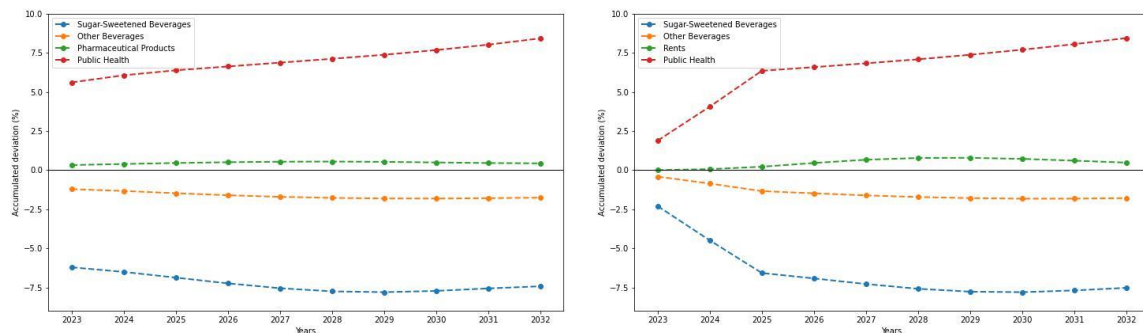


Figure 12 – Sectorial results (two sectors that grew the most and two sectors that grew the least in accumulated terms) with changes in government spending

Source: Own elaboration based on simulation results

4 Concluding Remarks

This study aimed to analyze the short- and long-term economic impacts of implementing a tax on sugar-sweetened beverages sector in Brazil. For this purpose, a computable general equilibrium model was used to estimate the effects on the macroeconomic aggregates of production, employment, household consumption, prices and tax revenue.

In the simulations carried out, four policy scenarios were considered: 1) an increase of 10p.p. in the taxation of the sector from 2023; 2) an increase of 20p.p. in the taxation of the sector from 2023; 3) an increase of 30p.p. in the taxation of the sector from 2023; and 4) gradual increase from 10 to 30p.p. in sector taxation between the years 2023 and 2025. The four scenarios were simulated with different assumptions about government spending. In the first set of simulations, it is assumed that government spending remains at the baseline scenario level, while in the second set of simulations, the funds raised from taxation on the sugar-sweetened beverages sector increase government spending in the Public Health sector.

In all scenarios considered, the results show negative effects for the SSB sector, with an increase in prices and a reduction in the level of economic activity. At the same time, as recommended, families reduce SSB consumption, in reaction to rising prices. Thus, the results obtained show the scope of the intended effect of the policy of reducing SSB consumption, which can be converted into improvements in the health of Brazilians.

Along with this, when there is no change in government spending, negative results are observed in the short term in macroeconomic indicators. The introduction of a tax on SSB sector contributes to reduce household and government consumption, exports and the price index. However, these effects contribute to a reduction in GDP of less than 0.5% in all scenarios. Over time, exports are encouraged, investments are resumed, and price indexes rise. The observed effects have repercussions on the labor market, generating a reduction in employment and wages in the short term. The fall in employment, however, is reversed in the long term, reaching the end of the period with positive variations. The wage mass, however, did not recover and maintained negative variations throughout the period. On the other hand, when the resources collected from taxation are reintroduced into the economy in the form of increased public spending, the negative macroeconomic effects are reversed, maintaining similar results for the SSB sector.

Additionally, the results show little or no difference in the trends observed in the different scenarios considered. The distinction is made only in the intensity of the effects, which vary according to the percentage increase considered. When comparing the strategy of establishing a fixed tax of 30p.p. or a gradual increase until reaching the same percentage,

it is observed that the tax revenue is less affected and that in the last year of the analyzed period, the effects on the different economic indicators are slightly less expressive with the gradual increase.

It is important to note that the simulated scenarios did not consider other benefits that may arise from taxation. An example is health improvement that can be converted into gains in human capital, as well as reductions in the cost of diseases related to the intensive use of sugar. Future analyses should consider these limitations.

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