BRASMOD

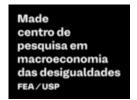## COUNTRY REPORT

BRASMOD v1.0
Brazil 2008-2023

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June 2024

Made
centro de
pesquisa em
macroeconomia
das desigualdades
FEA/USP

LabPub Laboratório de
Economia do
Setor Público

FEAUSP

Acknowledgements

Please cite as:

Bottega, A., Cabral-Perez, J. F., Forquesato, P., Rocha, F., Santos, H. (2024) BRAS-MOD v1.0 – Brazil 2008-2023. Country Report.

Contents

1 Basic information

1.1 Basic information about the tax-benefit system

Key aspects related to the Brazilian tax and benefit system include:

1. Decentralization: the current system is characterized by a decentralized administration among levels of government and different agencies. The landmark of this type of organization is the 1988 Constitution, which marked a significant change in state policy organization. One of the main changes in this regard was the decentralization of power, which aimed to ensure equity, social justice, and democratic governance. These principles still guide the state's actions to this day.

   In practical terms, the Constitution granted significant autonomy to states and municipalities, allowing them greater control over their finances and the ability to impose taxes. It also established clear divisions of responsibilities among federal, state, and municipal governments regarding revenue collection and social spending on public goods and policies.

2. Administration entities: the system is managed by various federal, state, and municipal government agencies. Here is a compilation of the main ones:

   (a) Federal Level

       i. Receita Federal (Federal Revenue Service): primary agency that administers federal taxes, customs duties, and social contributions.

       ii. Ministry of Finance and Ministry of Planning and Budget: oversees economic policy, including taxation, public finances, and budgetary matters.

       iii. National Institute of Social Security (INSS): administers Brazil's social security system.

       iv. National Treasury Secretariat (STN): responsible for managing the federal government's finances, including public debt administration.

   (b) State Level

       i. State Revenue Agencies (Sefaz): each of Brazil's 26 states and the Federal District has its own revenue agency.

       ii. National Council for Financial Policy (Confaz): a body that facilitates coordination between federal and state governments regarding tax policies.

    (c) Municipal Level

        i. Municipal Tax Departments: each municipality has its own tax department that administers and collects municipal taxes and manages local tax enforcement and compliance.

        ii. Court of Accounts (Tribunal de Contas): aims to audit public accounts and ensure legal compliance in tax administration and public spending, enforcing financial accountability. There are courts at the federal, state, and municipal levels.

3. Other general aspects: the Brazilian Real (R$) has been the currency since 1994. The fiscal year runs from January 1 to December 31. The minimum wage in Brazil is typically adjusted annually. The adjustment usually occurs at the beginning of the calendar year, and the changes often take effect on January 1.

4. The 1988 Constitution established a comprehensive social security system, including pensions, unemployment insurance, and health benefits, funded through payroll taxes and federal contributions. It also established non-monetary semi-universal benefits like health and education. The Unified Health System (Sistema Único de Saúde - SUS) was created in this context and became a universal public health system that guarantees free healthcare to all citizens. The Constitution also mandated federal support for education, with the intention of promoting free public education at the primary and secondary levels. In the following decades, various scholarships and financial aid programs for higher education were also developed. Most social programs that focused on reducing poverty and are still in place today were created at the end of the 1990s and improved in the 2000s.

The next subsections enumerate the benefits, social contributions, and taxes that form the Brazilian tax and benefit system.

1.2 Social Benefits

1. Bolsa Família (PBF): conditional cash transfer program. Eligibility involves low-income families (in poverty and extreme poverty according to poverty lines defined by Brazilian law). Conditionalities involve school attendance, vaccination, and prenatal care.

2. Benefício de Prestação Continuada (BPC): non-contributory benefit. Eligibility involves elderly (65+) or disabled individuals with low income.

3. Auxílio Emergencial: emergency financial aid provided in response to the COVID-19 pandemic.

1.3 Social Contributions

1. Contribuição Previdenciária (INSS): Social Security is paid by employees, employers, and self-employed individuals to fund the Brazilian Social Security system.

2. Contribuição para o Financiamento da Seguridade Social (COFINS): finances social security, healthcare, and social assistance. Base: gross revenue.

3. Programa de Integração Social (PIS)/Programa de Formação do Patrimônio do Servidor Público (PASEP): finances unemployment insurance and other social benefits. Base: gross revenue (PIS for private sector, PASEP for public sector).

4. Contribuição Social sobre o Lucro Líquido (CSLL): finances social security. Base: net profit.

5. Contribuição de Intervenção no Domínio Econômico (CIDE): finances specific sectors or projects, such as fuel infrastructure and technological development. Base: sales and imports of certain goods (for instance, fuel) and royalties.

6. Contribuição ao Sistema S: finances vocational training and social services organizations as SENAI, SENAC, SESI, SESC, etc. Base: payroll taxes.

7. Fundo de Garantia do Tempo de Serviço (FGTS): savings that workers can withdraw in cases of layoffs, serious illness, and other specific conditions. Base: payroll taxes.

8. Contribuição Regime Próprio de Previdência Social (RPPS): the RPPS organizes the Social Security of public servants in permanent positions, either active or retired, and pensioners who receive payments from a state entity.

1.4 Taxes

1. Federal Taxes:

(a) Personal Income Tax (IRPF): tax levied on the worldwide income of individuals residing in Brazil.

(b) Corporate Income Tax (IRPJ): tax levied on the net profits of Brazilian and foreign companies operating in Brazil.

(c) Imposto sobre Operações Financeiras (IOF): tax on financial transactions such as loans, currency exchange, insurance premiums, and credit operations.

(d) Imposto sobre Produtos Industrializados (IPI): tax on the manufacturing of goods produced domestically or imported.

(e) Imposto Territorial Rural (ITR): tax on rural properties based on their size, location, and potential for agricultural use.

2. State Taxes:

(a) Imposto sobre Circulação de Mercadorias e Serviços (ICMS): dtate-level tax on the circulation of goods and services.

(b) Imposto sobre a Propriedade de Veículos Automotores (IPVA): tax on vehicle ownership, paid annually by vehicle owners.

(c) Imposto sobre Transmissão Causa Mortis e Doação (ITCMD): tax on inheritances and donations.

3. Municipal Taxes:

(a) Imposto sobre Serviços (ISS): tax levied on the provision of services within a municipality.

(b) Imposto sobre a Propriedade Predial e Territorial Urbana (IPTU): tax levied on urban properties, including land and buildings, located within a city or town's jurisdiction. The tax is based on the property's value, location, and size.

(c) Imposto sobre a Transmissão de Bens Imóveis (ITBI): tax on the transfer of real estate properties, including land and buildings, plus any improvements made on the property.

Table 1: Simulation of benefits in BRASMOD

	Variable name	Treatment	Why not fully simulated?
Programa Bolsa Família	bfa01_s	S	
Auxílio Brasil	bfa02_s	S	
Novo Programa Bolsa Família	bfa03_s	S	
Auxílio Emergencial	bot_s	S	
Benefício de Prestação Continuada	bdioa_s	PS	No data on disabilities
Salário Família	bchmt_s	S	
Abono Salarial	bwkmc_s	PS	Incomplete data on employment
Unemployment insurance benefit	bun_s	PS	Incomplete data on employment
Pensions	poa	I	No data on contribution records

Note: 'S' policy is simulated although some minor or very specific rules may not be simulated; 'PS' policy is partially simulated due to a major lack of data; and 'I' policy is included in the microdata but not simulated.

Source: Authors' compilation.

2 Simulation examples of taxes and benefits in BRASMOD

2.1 Scope of simulation

The benefit and tax policies included in the model are presented in Tables 1 and 2. We differentiate between the components that were included but not simulated and add a short explanation of why we did not simulate them.

2.2 Order of simulation and interdependencies

Table 3 shows the order of simulation of the policies in BRASMOD. This sequence is the same for all years 2008-2023, but the 16 systems' display was omitted from the table for brevity.

Table 2: Simulation of taxes in BRASMOD

	Variable name	Treatment	Why not fully simulated?
Personal income tax	tin_s	PS	No consumption data for all years
Effective indirect tax expenditure by product	tva#_s	PS	No consumption data for all years
Employee social insurance contributions	tscee_s	PS	Limited data on contribution status
Self-employed social insurance contributions	tscse_s	PS	Limited data on contribution status
Employer social insurance contributions	tscer_s	PS	Limited data on contribution status
Business owner/manager social insurance contributions	tscot_s	PS	Limited data on contribution status

Note: 'S' policy is simulated although some minor or very specific rules may not be simulated; 'PS' policy is partially simulated due to a major lack of data; and 'I' policy is included in the microdata but not simulated.

Source: Authors' compilation.

2.3 Social benefits

2.3.1 Programa Bolsa Família (PBF) - Conditional cash transfer program (bfa01_s)

Definitions

The PBF is Brazil's main means-tested income transfer program, covering approximately 21 million families as of 2023. In 2021, the PBF was replaced by the Auxílio Brasil, a short-lived means-tested social program. However, this program was terminated and a new version of the PBF was introduced at the beginning of 2023.

Eligibility Conditions

Baseline Benefit

- Household *per capita* income below the extreme poverty line.

Variable Benefits

- Household *per capita* income below the poverty line.

- Household with children (up to 15 years old) and/or pregnant or nursing women (up to five quotas).

- Household with teenagers (16-17 years old) (up to two quotas).

Extreme Poverty Benefit

- Household *per capita* income + PBF *per capita* still below the extreme poverty line.

Table 3: Order of Simulation

Policy	Comment
uprate_br	DEF: UPRATING FACTORS
constdef_br	DEF: CONSTANTS
ilsdef_br	DEF: STANDARD INCOME LISTS
ildef_br	DEF: SPECIFIC INCOME LISTS
tudef_br	DEF: ASSESSMENT UNITS
random_br	DEF: Random variables for policy simulation
tscee_br	SIC: Employee social insurance contributions
tscse_br	SIC: Self-Employed social insurance contributions
tscer_br	SIC: Employer social insurance contributions
tsceot_br	SIC: Business owner/manager social insurance contributions
tin_br	TAX: Personal income tax (Imposto de Renda da Pessoa Física)
bchmt_br	BEN: Child means-tested benefit (Salário Família)
bdioa_br	BEN: Benefit for the poor elderly/disabled (Benefício de Prestação Continuada)
bun_br	BEN: Unemployment benefit
bwkmc_br	BEN: Wage bonus (Abono Salarial)
bsa01_br	BEN: Conditional cash transfer program (Programa Bolsa Família)
bsa02_br	BEN: Conditional cash transfer program (Auxílio Brasil)
bsa03_br	BEN: New conditional cash transfer program (Novo Bolsa Família)
bot_br	BEN: Covid-19 related social assistance benefit (Auxílio Emergencial)
tva01_br	BEN: TAX: Effective indirect tax expenditure by product as per classified in the Brazilian National Accounts (2005)
tav02_br	TAX: Effective indirect tax expenditure by product as per classified in the Brazilian National Accounts (2015)
output_std_br	DEF: STANDARD OUTPUT INDIVIDUAL LEVEL
output_std_hh_br	DEF: STANDARD OUTPUT HOUSEHOLD LEVEL

Notes: DEF = definition policy; SIC = social insurance contribution policy; TAX = tax policy; BEN = benefit policy.

Source: Authors' compilation.

Income Test

Household *per capita* income must be within the government-defined poverty line, which is updated irregularly. In addition to the means test, families must:

- Enroll school-age children in school and ensure minimum attendance.

- Ensure regular medical check-ups, including participation in vaccination programs.

Benefit Amounts

The benefit structure is summarized in Table 4:

Table 4: PBF benefit structure

Benefit Type	Description
Fixed Benefit	Granted to families in extreme poverty.
Variable Benefit	Granted for each pregnant woman, nursing mother, and child (0-15 years old), limited to five per household. Also applies to teenagers (16-17 years old), limited to two per household.
Extreme Poverty Benefit	Additional benefit to bring household income above the extreme poverty line.

Since its first implementation in 2004, the PBF has undergone multiple changes in benefit values and structure. The summary above reflects the most prevalent structure during the period covered by this model. For a detailed account of all changes since the program's inception, refer to Appendix **??**.

BRASMOD Notes

- Although official records and laws reference "family income," the definition actually corresponds to household income.

- Although the standard variable benefit applies to families with children, pregnant women, and nursing mothers, as no survey data on pregnancies is available, we can only capture households with children eligible for this benefit. While it is technically possible to approximate pregnancies by identifying households with newborn children, we consider this a minor technicality and have opted not to include this variable.

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- We simplified the calculation of the extreme poverty benefit by ignoring the 0.01 cent rounding in the law, instead rounding up the final value. That is, eligibility is based solely on whether the *per capita* household income remains below the extreme poverty line.

2.3.2 Auxílio Brasil - Conditional Cash Transfer Program (bfa02_s)

Definitions

Auxílio Brasil was a short-lived program that replaced the PBF in October 2021. It introduced a slightly different structure, centering the distribution more at the household level than at the individual level, with a fixed minimum benefit per household. While the means test remained mostly the same, there were marginal changes to benefit values and poverty thresholds.

Minimum benefit values of R\$ 400.00 and R\$ 600.00 were introduced in December 2021 and July 2022, respectively. The program was discontinued in 2023, but its minimum benefit structure influenced the new PBF.

Eligibility Conditions

Early Childhood Benefit

- Household *per capita* income below the poverty line.

- Household with children between 0 and 3 years old.

Variable Benefits / Family Composition Benefits

- Household *per capita* income below the poverty line.

- Household with children (4 to 21 years old) and/or pregnant and nursing women.

Extreme Poverty Benefit

- Household *per capita* income + PBF *per capita* still below the extreme poverty line.

Income Test

Same as PBF.

Benefit Amounts

Same as PBF (Table 4), but with the small eligibility changes described above.

BRASMOD Notes

Same as PBF.

2.3.3 Novo Programa Bolsa Família - Conditional Cash Transfer Program (bfa03_s)

Definitions

The PBF was reinstated in March 2023 (Law No. 14,601 of 2023) with several changes to its structure.

Eligibility Conditions

Baseline Benefit

- Household *per capita* income below the poverty line.

Variable Benefits

- Household *per capita* income below the poverty line.

- Household with children (up to 17 years old) and/or pregnant and nursing women.

Supplementary Benefit

- Household *per capita* income + PBF *per capita* below R$ 600.00.

Income Test

Same as PBF.

Benefit Amounts

The benefit structure was slightly altered as follows:

- Baseline benefit now also applies to families under the poverty line.

- Early childhood benefit for children under seven years old.

- Variable benefit applies to pregnant women, nursing mothers, and children aged 7 to 17.

- Extra benefit to ensure all families have at least R$ 600 of *per capita* income.

Additionally, an Extraordinary Transition Benefit was created exclusively for families that were beneficiaries of the Auxílio Brasil Program. This benefit was equal to the difference between the amount received by the family in May 2023 and what they would receive in June 2023, ensuring families did not suddenly lose income under the new program.

BRASMOD Notes

Same as PBF.

2.3.4 Auxílio Emergencial (AE) - Covid-19 Related Social Assistance Benefit (bot_s)

Definitions

AE was a COVID-19 emergency benefit aimed at mitigating the pandemic's socioeconomic effects (2020-2021). It was a temporary program with broad coverage, extended twice (September 2020 and March 2021). It was initially implemented under Law No. 13.982 and later extended and modified by Provisional Measures No. 1000 (Sep 2020) and No. 1039 (Mar 2021).

Eligibility Conditions

The benefit had different stages with varying values but largely maintained the same eligibility criteria throughout.

- Must be over 18 years old (except for teenage mothers).

- Must not have an active formal job.

- Must not receive any other government benefits, except for PBF.

- Must have a taxable income below R$ 28,559.70 in the previous year.

- Limited to two individuals per household in 2020; limited to one individual per household in 2021.

- Single mothers who were sole providers received double the benefit.

- Must not be an intern or receive scholarships from CAPES or CNPq (after April 2021).

Income Test

Household *per capita* income must be less than half the minimum wage, or total household income must be less than three times the minimum wage.

Benefit Amounts

- April to August 2020: R$ 600.00 per month.

- September 2020 to March 2021: R$ 300.00 per month.

- April 2021 to October 2021:

    - R$ 150.00 per month for one-person households.
    - R$ 250.00 per month for households with two or more people.
    - R$ 375.00 per month for households with only a female provider.

BRASMOD Notes

Another law addressed AE for single-male parents retroactively. However, we do not simulate this extension due to unclear payment dates. Additionally, teenage mothers are not included in the simulation.

2.3.5 Benefício de Prestação Continuada (BPC) - Benefit for the Poor Elderly/Disabled (bdioa_s)

Definitions

The BPC is a social benefit targeted at elderly (≥ 65) and/or disabled individuals living in poverty (with *per capita* household income below a quarter of the minimum wage). It serves over 4.7 million people. First established in Law No. 8.742/1993 (Lei Orgânica da Assistência Social - LOAS), the minimum age was later changed by Law No. 10.741/2003.

Eligibility Conditions

- Must be 65 or older, or have a disability.

- Household *per capita* income must be below 1/4 of the minimum wage.

Income Test

Household *per capita* income must be less than 1/4 of the minimum wage.

Benefit Amounts

BPC guarantees one minimum wage per month. Recipients cannot receive other social benefits themselves, but other household members may still qualify for other programs.

BRASMOD Notes

As we lack disability data, we approximate this by assuming that anyone under 65 years old who reports on the surveys to receive BPC has a disability.

2.3.6   Salário Família (SF) - Child Means-Tested Benefit (bchmt_s)

Definitions

Salário Família (SF) is a benefit granted to low-income formal workers based on the number of children they have. The benefit applies to children up to 14 years old, with no age limit if the child has a disability. Both parents are eligible, making it effectively a means-tested child benefit. SF was established by Law No. 8.213/1991 (Articles 65 to 70).

Eligibility Conditions

The benefit is granted per individual, meaning multiple family members can receive it if their income is below a set threshold.

The specific rules are:

- Must be formally employed in the private sector.

- Must have children up to 14 years old or children with disabilities (no age limit).

- Must have an income below a government-defined threshold (updated annually).

Additionally, eligible children must have up-to-date vaccination records and be enrolled in school. Both parents can receive the benefit simultaneously if they meet the income criterion. Retirees are also entitled to the benefit.

Income Test

Employment income (wage) must be below a government-defined level, which is updated annually (see Table 5).

Table 5: Salário Família Eligibility Conditions

Year	Bracket 1 (up to R$)	Bracket 2 (R$ range)
2022	1,655.98 (quota 56.47)	—
2020	1,425.56 (quota 48.62)	—
2019	907.77 (quota 46.54)	907.77 to 1,364.43 (quota 32.80)
2018	877.67 (quota 45.00)	877.67 to 1,319.18 (quota 31.71)
2017	859.88 (quota 44.09)	859.89 to 1,292.43 (quota 31.07)
2015	725.02 (quota 37.18)	725.03 to 1,089.72 (quota 26.20)
2014	682.50 (quota 35.00)	682.51 to 1,025.81 (quota 24.66)
2013	646.55 (quota 33.16)	646.56 to 971.78 (quota 23.36)
2012	608.80 (quota 31.22)	608.81 to 915.05 (quota 22.00)
2011	573.91 (quota 29.43)	573.92 to 862.60 (quota 20.74)
2010	539.03 (quota 27.64)	539.04 to 810.18 (quota 19.48)
2009	500.40 (quota 25.66)	500.41 to 752.12 (quota 18.08)
2008	472.43 (quota 24.23)	472.44 to 710.08 (quota 17.07)

Benefit Amounts

Table 5 presents the income cut-offs and corresponding benefit values per child (quota) for the years included in BRASMOD.

2.3.7 Abono Salarial - Wage Bonus (bwkmc_s)

Definitions

Abono Salarial is a wage bonus established by the 1988 Constitution (Art. 239, §3º). Employees who earn up to two minimum wages per month and work for employers contributing to the *Programa de Integração Social* (PIS) or *Programa de Formação do Patrimônio do Servidor Público* (PASEP) are entitled to an additional annual wage.

Before 2014, Abono Salarial was regulated by Provisional Measure No. 88 (1989), later converted into Law No. 7.859 (1989). From 2015 onward, modifications were introduced by Law No. 13.134 (2015).

Eligibility Conditions

- Earned up to two minimum wages per month on average.

Table 6: Abono Salarial: Value Per Months Worked in Base Year (2024)

Months Worked	Benefit Amount (R$)
1	118.00
2	235.00
3	353.00
4	471.00
5	588.00
6	706.00
7	824.00
8	941.00
9	1,059.00
10	1,177.00
11	1,294.00
12	1,412.00

- Engaged in remunerated activity for at least 30 days in the base year.

- Employer must contribute to PIS/PASEP.

- Must be registered for at least five years in the PIS-PASEP Participation Fund or in the National Worker Registry.

Income Test

Average monthly income must not exceed two minimum wages.

Benefit Amounts

- Before 2014: One minimum wage per year.

- 2015 Onwards: The benefit is calculated as 1/12 of the minimum wage in effect on the payment date, multiplied by the number of months worked in the base year. If a worker has worked 15 days or more in a month, it is counted as a full month. The benefit amount is rounded up to the nearest whole unit.

For example, Table 6 presents the payment values for 2024, where the minimum wage was R$ 1,412.00.

2.3.8 Unemployment Insurance Benefit (bun_s)

Definitions

Unemployment insurance is a benefit guaranteed by the 1988 Constitution (Art. 7, Inc. II; Art. 201, Inc. III; Art. 239). It is regulated by Law No. 7.998/1990.

Eligibility Conditions

Before 2014

- Worker was dismissed involuntarily (layed-off).

- Must have received wages for at least 6 months before dismissal.

- For self-employed workers: must have been employed by a legal entity or engaged in a legally recognized self-employed activity for at least 15 months in the last 24 months.

- Must not receive any other continuous benefits.

- Must not have any alternative source of income sufficient for self-maintenance or family support.

Changes in 2014 (Provisional Measure No. 665)

- First request: must have worked at least 18 months in the last 24 months.

- Second request: must have worked at least 12 months in the last 16 months.

- Subsequent requests: must have worked at least 6 months before dismissal.

Changes in 2015 (Law No. 13.134)

- First request: at least 12 months in the last 18 months.

- Second request: at least 9 months in the last 12 months.

- Subsequent requests: at least 6 months.

Income Test

No income test.

Benefit Amounts

Before 2014 The amount was based on National Treasury Bonus (BTN) salary brackets:

- Up to 300 BTN: 80% of the average salary (last 3 months).

- 300 to 500 BTN: 80% up to 300 BTN, plus 50% of the excess.

- Above 500 BTN: Fixed at 340 BTN.

The benefit could not be lower than the minimum wage. The duration was a maximum of 4 months per 16-month acquisition period.

Changes in 2014

The duration was modified, varying from 3 to 5 months, depending on length of service before the request.

- **First request:**

  - Four installments for those who worked between 18 and 23 months.

  - Five installments for those who worked at least 24 months.

- **Second request:**

  - Four installments for those who worked between 12 and 23 months.

  - Five installments for those who worked at least 24 months.

- **Third request:**

  - Three installments for those who worked between 6 and 11 months.

  - Four installments for those who worked between 12 and 23 months.

  - Five installments for those who worked at least 24 months.

Changes in 2015: Adjusted Duration Rules

In 2015, the rules were modified again, adjusting the duration based on employment history:

- **First request:**

  - Four installments for those who worked between 12 and 23 months.

– Five installments for those who worked at least 24 months.

- **Second request:**

  – Three installments for those who worked between 9 and 11 months.

  – Four installments for those who worked between 12 and 23 months.

  – Five installments for those who worked at least 24 months.

- **Third request:**

  – Three installments for those who worked between 6 and 11 months.

  – Four installments for those who worked between 12 and 23 months.

  – Five installments for those who worked at least 24 months.

2.4   Social contributions

The model simulates mandatory and (some) optional social insurance contributions (SICs) from employees, employers, and self-employed workers to the National Institute of Social Security (INSS).

2.4.1   Employee SIC

Employees have to contribute with a rate ranging from 7.5% to 14%, based on how much they earn. Table 7 shows the contribution schedule, with the lower threshold corresponding to the minimum wage (which is adjusted almost yearly).

Employees contribute based on a progressive rate structure ranging from 7.5% to 14%, depending on their earnings. Table 7 presents the contribution schedule for 2023, where the minimum wage of the year serves as the lower threshold, as happens in the other years too.

Table 7: Employee SIC schedule (2023)

Wage base (R$ per month)	Marginal rate
Up to 1.329,00	7,5%
1.320,01 to 2.571,29	9%
2.571,30 to 3.856,94	11%
3.856,95 to 7.507,49	14%

2.4.2 Employers SIC

Employers contribute 20% of their employees' wages to social security. However, there is an exception for domestic workers' employers, who contribute at a lower rate of 8% of the employee's salary.

2.4.3 Self-employed and Business Owner/Manager SIC

For the self-employed, contribution to social insurance is still mandatory, but they can choose between different contribution regimes, as Table Table 8 shows. The same regime choices also apply for individual facultative contributors, but we are unable to model those due to lack of data.

Self-employed individuals are also mandatorily required to contribute to social insurance, but they have different contribution regimes to choose from. These regimes are outlined in Table 8.

Table 8: Self-employed SIC regime options

Type	Contribution
Regular benefit plan	20% of wage*
Simplified benefit plan	11% of minimum wage
MEI or low income household	5% of minimum wage

*With the minimum wage as a lower limit, and a varying upper limit (R$ 7,507.49 per month as of 2023).

The main difference between the regimes is that the regular one assures retirement by contribution time, while the simplified and MEI/low income ones do not. In the later, taxpayers could only apply for retirement by age. As the type of contribution in this category depends on the individual choice, and that choice is not present in our surveys, to model self-employment contribution we need to make approximations. First, we randomly assign the eligible individuals of the regular and simplified plans 50/50 for each - assuming away the contributions by MEI. This choice was driven by the attempt to match the total revenue obtained in this category with the official records. However, we do model the contribution of low income households, which are defined by Law as the ones with household income up to two minimum wages. In practice, families attest that by registering in Cadastro Único, the federal institution that identifies and characterizes the low income households, in order to include them in benefits and evaluate their eligibility to policies in general.

Table 9: Personal income tax schedule (2023)

Tax base (R$ per year)	Marginal tax rate
0 – 22,847.76	0%
22,847.76 – 33,919.80	7.5%
33,919.80 – 45,012.60	15%
45,012.60 – 55,976.16	22.5%
55,976.17 and above	27.5%

Moreover, individuals who run businesses or are partners in owning and administering companies do not receive wages and fall under the self-employed category. In this case, they could receive only dividends or distributed profits and/or compensation called "pro labore" in Brazilian legislation. They pay no tax or social contribution over dividends but need to pay 11% over "pro labore". In the model, we are calling this category "Business owner/manager".

2.5 Personal income tax

The personal income tax (IRPF) has a progressive schedule, and individuals can choose between two different tax base regimes: a simplified version and a complete version. If they decide for the complete version, they can deduct from their taxable income an amount according to the number of dependent family members, expenditures on healthcare, education, private pensions, alimony, and necessary expenditures for their self-employment. If they opt for the simplified version, there are no tax allowances, but there is a 20% deduction on taxable income (up to R$ 16,754 per year). Table 9 shows how the tax schedule works.

Appendix C presents all PIT schedules over the years covered by the model.

2.6 Indirect taxes

We use here the effective tax rates calculated by Siqueira, Nogueira, & Souza (2010) and Silveira et al. (2022).

Indirect taxes in Brazil primarily apply to goods and services, including ICMS (state-level consumption tax), IPI (federal excise tax), PIS/COFINS (social contributions), and ISS (municipal service tax). Unlike a value-added tax (VAT), these taxes are levied at multiple stages of production and distribution, embedding them in prices with varying

incidence across products and sectors. Since indirect taxes affect households through consumption rather than directly on income, their burden is complex to estimate due to cascading effects, differentiated rates, and tax substitution regimes, necessitating an approximation method.

The Input-Output Matrix (IOM) is a key tool for analyzing economic interrelationships between production, consumption, and institutional sectors (households, government, and the external sector). It helps differentiate taxation on final demand (direct household consumption) from intermediate demand (inputs used in production), which is essential for assessing the incidence of indirect taxes on households.

Notable studies using this methodology for Brazil include those by Siqueira, Nogueira, & Souza (2001) and Siqueira, Nogueira, & Souza (2010), based on a methodology developed for Australia by Scutella (1999). The most recent one is Silveira et al. (2022).

The most recent IOM is from 2015, while the most recent POF is from 2017-2018. Although they are not from the same year, both data sets provide structural economic data, enabling effective data integration. For the 2008-2009 POF survey, the IOM from 2010 is used. IOM helps differentiate taxation on final demand from intermediate demand (goods and services used in the production process).

Thus, we estimate the tax burden using the integration between the IOM with POF (the household budget survey). The most recent IOM is from 2015, while the latest POF is from 2017-2018. Although from different years, they provide compatible structural data. For the 2008-2009 POF, the 2010 IOM was used.

Here, we use tax calculations from the 2005 and 2015 IOMs, matched with their respective POF data. A crosswalk between POF product codes and IOM classifications is available alongside the model.

3 Data

3.1 General description

The primary data sources used to build BRASMOD are the PNAD (*Pesquisa Nacional por Amostra de Domicílios*) and PNADc (*PNAD Contínua*) surveys, covering the period from 2008 to 2023. The annual PNAD was the main household survey in Brazil until 2015, when it was replaced by PNADc, which is conducted quarterly. The primary goal of PNADc is to provide quarterly labor force statistics. Both surveys have large sample

Table 10: PNAD (2008-2015) survey information

Year	File name	Collection Period	Income reference	Sample size (Households/Individuals)
2008	BR_2008_a1	10/2008-12/2008	09/2008	118,138 / 391,323
2009	BR_2009_a1	10/2009-12/2009	09/2009	121,163 / 398,869
2011	BR_2011_a1	10/2011-12/2011	09/2011	111,986 / 358,513
2012	BR_2012_a1	10/2012-12/2012	09/2012	114,906 / 362,130
2013	BR_2013_a1	10/2013-12/2013	09/2013	116,543 / 362,268
2014	BR_2014_a1	10/2014-12/2014	09/2014	119,001 / 362,446
2015	BR_2015_a1	10/2015-12/2015	09/2015	117,939 / 356,720

Source: IBGE

Table 11: PNADc (2016-2022) survey information

Year	File name	Collection Period	Income reference	Sample size (Households/Individuals)
2016	BR_2016_a1	01/2016-12/2016	2016	148,199 / 447,334
2017	BR_2017_a1	01/2017-12/2017	2017	148,647 / 445,385
2018	BR_2018_a1	01/2018-12/2018	2018	148,179 / 438,591
2019	BR_2019_a1	01/2019-12/2019	2019	147,861 / 433,535
2020	BR_2020_a1	01/2020-12/2020	2020	122,793 / 355,436
2021	BR_2021_a1	01/2021-12/2021	2021	116,923 / 335,100
2022	BR_2022_a1	01/2022-12/2022	2022	135,510 / 380,928

Source: IBGE

sizes – for example, the 2022 PNADc includes data on 135,510 households—and collect extensive demographic and socioeconomic information. However, neither survey includes data on household consumption or expenditure.

For data on household expenditures, we rely on the POF (*Pesquisa de Orçamentos Familiares*) survey. The POF is conducted irregularly (approximately every decade) and has a smaller sample size. In this version of the model, we use microdata from POF surveys conducted in 2008–2009 and 2017–2018.

Table 12: POF (2008-2009 and 2017-2018) survey information

Year	File name	Collection Period	Income reference	Sample size (Households/Individuals)
2008-2009	BR_2008_b1	01/2016-12/2016	01/2009	55,970 / 190,159
2017-2018	BR_2018_b1	01/2017-12/2017	01/2018	57,920 / 190,145

Source: IBGE

3.2 Data adjustment

Modifications to the original microdata are kept to a minimum. However, the following adjustments were made:

- Individuals identified as domestic workers were excluded from the household unit, as information about their own households is unavailable. Across all surveys and years, these excluded individuals represent less than 0.05% of the sample.

- Data cleaning was conducted to ensure consistency in household relationships. Specifically, individuals were matched to correctly assign family relations based on their reported relationship with the head of the household.

3.3 Imputations and assumptions

3.3.1 Time-period

Demographic and income variables in the surveys refer to the time of data collection:

- PNAD (2008–2015): conducted annually.

  - Income variables refer to a "reference month" (typically August or September, 2–4 months before data collection).

  - Labor force information (e.g., employment status, hours worked) refers to the same reference month as income.

- PNADc (2016–present): conducted quarterly.

  - Income variables refer to the last month before the interview.

  - Labor force information (e.g., employment status, hours worked) refers to the week prior to the interview.

- POF: data collection spans a full year.

  - The reference period for income is January 2009 for the 2008–2009 survey and January 2018 for the 2017–2018 survey.

All income variables are expressed in monthly values, as required for EUROMOD software calculations.

3.3.2 Missing income

Missing values in income variables are set to zero instead of removing the corresponding observations. This decision was made because many income-related questions in the PNADc questionnaire do not apply to all individuals. For instance, those with only one job would not have a response for income earned from a second job, leading to a missing value. Setting missing income values to zero prevents data loss while maintaining consistency.

3.3.3 Intrahousehold relations (parents, partners, etc.)

We construct a match to properly assign related individuals based on their relationship to the head of the household (using the *"Condition within household"* variables). If the household head has both children and a partner living in the household, the partner is also considered the children's parent. For example, if an individual is recorded as the child of the household head, and the head's partner is female, that partner is assigned as the mother. This assumption is reasonable within traditional household structures and aligns with the child-parent definition in social programs such as the Salário-Família. Additionally, it is consistent with EUROMOD's built-in query `IsParent`.

3.3.4 Disabilities

Neither the PNADc nor the POF surveys include direct questions about physical or mental disabilities. However, they do ask whether an individual receives the old-age/disability assistance benefit (BPC). Since the eligibility criteria for BPC include, besides the means test, either being disabled or being over 65, individuals under 65 who receive this benefit are identified as having a disability. Although this method is not perfect, it is a reasonable approximation for microsimulation purposes (Ansiliero, Constanzi, & Cifuentes 2021).

For the older PNAD surveys (2008–2015), there are no direct questions about receiving specific benefits. Instead, income from means-tested programs like BPC is included in a

broader "other sources of income" variable (V1273), which also covers investment income and other transfers. In this case, to identify BPC recipients we apply the "typical values method" (Barros, Carvalho, & Franco 2007; Souza 2013), selecting individuals whose reported income in this category matches exactly one minimum wage – the value of the BPC benefit – plus possible combinations with other social programs.

3.3.5 Marital status

The PNADc has no information relating to precise marital status. Since it is a mandatory variable for EUROMOD (`dms`), we create it assuming that those who have a partner in the household are married (`dms = 1`) and those who do not are single (`dms = 0`).

The PNADc survey does not contain direct information on marital status. Since EUROMOD requires this variable (`dms`), we infer marital status based on household composition:

- Individuals with a partner in the household are classified as married (`dms = 1`).

- Individuals without a partner in the household are classified as single (`dms = 0`).

3.3.6 Education

The variable for education status in the PNADc (V3003A) is constructed slightly differently from the mandatory categorical variable from EUROMOD (`dec`). While there are obvious correspondences between some of the categories, we made the following assumptions:

- "Regular do ensino fundamental" corresponds to "Primary education" if the individual is under 12 years old, and to "Lower secondary education" if the individual is 12 years old or older.

- Only "Mestrado" (Master's degree) and "Doutorado" (Doctorate) are considered as "Tertiary education".

3.4 Uprating

Uprating factors are sometimes applied to adjust for inflation between the monetary values in the input dataset's year and the corresponding policy year.

For the input microdata from the PNAD and PNADc surveys, no uprating is necessary because each policy year has a corresponding survey year with the same level of monetary

Table 13: Uprating factors

Index	Source
CPI: IPCA - Índice Nacional de Preços ao Consumidor Amplo (2018 = 100)	IBGE
Average wage: PNADc - Rendimento nominal habitual principal (2018 = 100)	IBGE
Average wage: PME- Rendimento nominal habitual principal (2008 = 100)	IBGE
GDP deflator (2008 = 100)	IBGE
Minimum wage	Government defined

values - but then uprating can still be used if two years are being compared in real terms. However, for the input microdata based on the POF survey, uprating is required for years other than 2008 and 2018. This is done through a series of corrections using price indices – some broad (such as Brazil's general consumer price index, the so-called IPCA) and others more specific to certain income categories (such as the national average wage). Table 13 provides a list of these uprating factors, as well as their sources.

Neither the PNAD nor the PNADc surveys contain data on household consumption. In contrast, the POF survey provides detailed information on household consumption. If the analysis requires such data, one approach is to use the POF survey for the closest available year (either 2018 or 2008) and then correct the monetary values through uprating.

3.5   Statistical matching

Another approach consists in using statistical matching techniques in order to use data from both surveys. We performed an imputation of household expenditures from the 2018 POF into the PNAD datasets from 2016-2022. The process begins by adjusting all monetary values in POF for inflation using the IPCA, ensuring consistency in price levels across datasets. Expenditures are then grouped into broader categories like housing, education, healthcare, food, and transportation, following POF's classification. To ensure meaningful comparisons, expenditure shares are computed by dividing each category's expenditures by total disposable income. Observations with extreme or implausible values, such as expenditure shares exceeding 100% for a single category or surpassing 200-300% in total, are filtered out.

Next, a hot deck matching procedure is used to impute expenditures from POF into PNAD. This is done using Mahalanobis distance, matching households based on various socio-demographic characteristics, including income, number of children, number of adults,

education levels, urban/rural status, and state of residence. Each PNAD household is then assigned expenditure shares from its closest POF counterpart. Once the matching is completed, expenditures are reconstructed at the most detailed level, using product codes, and are scaled to each PNAD household's income to estimate total household spending.

To validate the imputation, we produce summary statistics and visualizations, examining expenditure distributions across income percentiles. We also check the alignment of imputed values with categories relevant for personal income tax deductions (such as education, healthcare, and private pensions) and with broader National Accounts classifications to facilitate macroeconomic analysis.

Despite the methodological rigor, the results of the imputation appear unreliable. The visualizations suggest that the imputed expenditure shares may not align well across income distributions, possibly due to differences between the two datasets that are not fully accounted for in the matching process. The matching process is based on nearest-neighbor and hot deck imputation, which can introduce bias if POF and PNAD households differ systematically. Given these concerns, the imputed values are ultimately deemed unsuitable for use in this research. Nevertheless, all codes and matching datasets are still available in the project GitHub account, so the reader is invited to browse and try to improve them.

4 Validation

4.1 Aggregate validation

The results of the BRASMOD simulations were validated using administrative data on aggregated values of both government expenditure on social benefits and tax revenue. The ratios of simulated values to administrative data for both aggregate expenditure and tax revenue were calculated in order to assess the precision of the simulations compared to the administrative data and are presented as percentages. The validation tables are presented below, and the main discrepancies are discussed in the next sections.

The primary sources for data on government spending were the Secretaria do Tesouro Nacional (STN), Ministério da Fazenda (National Treasury Secretariat/Ministry of Finance), the Ministério do Desenvolvimento Social (Ministry of Social Development), and the Portal da Transparência, Controladoria Geral da União (CGU) (Transparency Portal, Office of the Comptroller General). Regarding tax revenue data, the sources used were the Instituto Nacional do Seguro Social (INSS), Ministério da Previdência Social (National

Institute of Social Security/Ministry of Social Security), for social contributions, and the OECD databases for Personal Income Tax (IRPF). The primary data sources used for the validation of each policy are indicated in the text.

4.1.1 Validation of social benefits

Programa Bolsa Família (PBF) - Conditional cash transfer program: on average, the simulations of the Brazilian government's aggregate expenditure on the PBF show a precision of 78% compared to the administrative data. This figure includes simulations performed using the POF data. The precision of the simulations for 2008, 2009, 2012, and 2013 is higher than 90%. The administrative data sources that support this validation exercise are the Ministério do Desenvolvimento Social (Ministry of Social Development) and the Portal da Transparência (Transparency Portal).

However, there are a number of limitations in the simulations of the PBF, as the absence of demographic data necessary for simulating benefits for pregnant and nursing women, as well as issues related to income and benefit under-reporting, as discussed in the previous sections. In the later case, to adjust the estimation we assume that 30% of households under-report their income. The distribution of income under-reporting is operated using pseudorandom numbers between 0 and 1, which are generated by the EUROMOD software policy *random_br*. Moreover, the PBF simulations depend on the results of another simulated variable, the BPC benefit, which in turn also influences the simulations' precision.

Auxílio Brasil - Conditional cash transfer program: BRASMOD simulations overestimate the expenditure on the benefit by 30% for 2021, while the precision of the simulations for 2022 reaches 76%. These simulations suffer the same limitations as the PBF, especially issues related to income and benefit under-reporting. Similarly to what is done in the PBF policy, we assume that 30% of households under-report their income. The administrative data used here were collected from the Portal da Transparência (Transparency Portal).

Auxílio Emergencial (AE) - Covid-19 related social assistance benefit: for 2020, the precision of the simulations is 92%, whereas for 2021, the simulation overestimates the expenditure on the benefit by 30%. Possible causes involve that the benefit is not simulated for teenage mothers, given the lack of sufficient demographic data to identify this group in the household. The extension of the benefit for male-single parents is also not

simulated. Again, we assumed that a certain percentage of households underreport their income, following a similar approach to that used in the PBF and Auxílio Brasil. The data for the validation were collected from the Portal da Transparência (Transparency Portal).

Abono Salarial - Wage Bonus: The results of simulations using BRASMOD tend to overestimate government expenditure on the Abono Salarial benefit by 49% on average. The years of 2015 and 2021 show the highest over-estimations, by 115% and 169%, respectively. These discrepancies can be explained by changes in the payment schedules of the benefit, as a portion of the beneficiaries did not receive the benefit in 2015, receiving it in 2016 [1]. A similar adjustment was promoted in 2021, whereby the payment for the year 2020 was transferred to 2022. As a static model, simulating institutional changes that reflect accounting maneuvers in the public budget poses certain challenges. Without the discrepancies for the years of 2015 and 2021, the benefit simulations are overestimated by 34%, on average. The data used to validate the simulated expenditure on the Abono Salarial benefit are sourced from the Secretaria do Tesouro Nacional (National Treasury Secretariat).

Seguro Desemprego - Unemployment insurance benefit: the simulations underestimate the expenditure on Unemployment Insurance. On average, the precision rate is 42%. This discrepancy also reflects data limitations, as there is no data on how many benefit installments were received or the number of Unemployment Insurance applications made by the individual in the year (important for determining eligibility). The value of the Unemployment Insurance benefit received in household sample surveys is available only from 2015 onward. Because the benefit amount ranges from a minimum (equivalent to the minimum wage set by the Brazilian government yearly) to a maximum defined by the government depending on the individuals' previous labor situation, which is not fully captured in the microdataset, a pseudorandom number generated by the random_br policy tool on the EUROMOD software is used to randomize the distribution of the benefit amount. The source of the administrative data was the National Treasury Secretariat (Tesouro Transparente, 2024).

Benefício de Prestação Continuada (BPC) - Benefit for the poor elderly/disabled: neither the PNADc nor the POF surveys have a question related to physical or mental disabilities. This limitation of the data used poses a challenge for the BPC simulations. To identify individuals who have received BPC, we use the "typical methods values" (Barros,

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[1](Resolution of the Deliberative Council of the Worker Support Fund – Codefat No. 748, of July 2, 2015).

Carvalho, & Franco (2007); Souza & Medeiros (2013)), identifying those who received precisely the BPC benefit value (monthly minimum wage), as discussed in previous sections. Thus, we capture that a person has a disability if she is under 65 and declares to receive BPC. Moreover, we assume that a certain percentage of households under-report their income in order to receive the BPC, following a similar approach to the one used in other benefit policies. On average, BRASMOD simulations for the BPC benefit show a precision of 92%, including simulations using POF. The source of the administrative data is the Ministério do Desenvolvimento Social (Ministry of Social Development).

4.1.2 Validation of tax revenue

Personal Income Tax: data for validating the simulations of the aggregate amount collected from Personal Income Tax are obtained from OECD data (OECD.Stat, 2024). The OECD maintains a database that allows the comparison of tax revenue statistics between different countries, using a well-established methodology. In Brazil, the OECD uses data and publications from the National Treasury Secretariat and the Federal Revenue Service. For the period between 2008 and 2022, the precision of the simulations, measured as the ratio of the simulated to the administrative data for tax revenue expressed as a percentage, is on average 91%. This figure does not include simulations done with the POF data, which due to observed discrepancies overestimate Personal Income Tax revenue by 49% for 2008 and 84% for 2018.

Social contributions: the sources of the administrative data used for the validations were the Relatórios Anuais da Previdência (Annual Reports of Social Security), published by the Instituto Nacional do Seguro Social (INSS), Ministério da Previdência Social (National Institute of Social Security, Ministry of Social Security). On average, simulated social contributions for employers are overestimated by 9%. The results of the simulations for employee social insurance contributions match the administrative data on social insurance contributions with an average precision of 93%.

Table 14: Aggregate validation - Social Benefits

Year	PBF			Auxílio Brasil			Auxílio Emergencial			Unemployment Benefit			BPC			Abono Salarial		
	AD (R$M)	S (R$M)	Ratio	AD (R$M)	S (R$M)	Ratio	AD (R$M)	S (R$M)	Ratio	AD (R$M)	S (R$M)	Ratio	AD (R$M)	S (R$M)	Ratio	AD (R$M)	S (R$M)	Ratio
2008	10,606.50	10,415.26	0.98	-	-	-	-	-	-	-	9,203.01	-	13,785.79	14,525.35	1.05	-	8,551.21	-
2008 (POF)		7,794.67	0.73	-	-	-	-	-	-		-	-		8,339.52	0.60	-	7,662.93	-
2009	12,454.70	11,352.29	0.91	-	-	-	-	-	-	19,646.84	11,312.80	0.58	16,859.41	17,532.91	1.04	7,280.30	10,210.65	1.40
2010 (2009)	14,372.70	11,871.98	0.83	-	-	-	-	-	-	20,779.21	12,407.63	0.60	20,104.03	19,543.50	0.97	9,029.50	11,386.07	1.26
2010 (2011)		12,033.57	0.84	-	-	-	-	-	-		9,857.31	0.47		21,063.71	1.05	9,029.50	12,778.76	1.42
2011	17,364.28	13,740.64	0.79	-	-	-	-	-	-	23,794.05	5,266.91	0.22	22,854.84	21,593.99	0.94	10,379.40	13,135.93	1.27
2012	21,156.74	19,377.92	0.92	-	-	-	-	-	-	26,576.64	13,021.67	0.49	27,434.93	27,380.44	1.00	12,302.30	16,089.23	1.31
2013	24,890.11	24,017.73	0.96	-	-	-	-	-	-	30,749.13	14,141.96	0.46	31,412.34	29,927.01	0.95	13,486.40	17,878.36	1.33
2014	27,187.30	23,075.82	0.85	-	-	-	-	-	-	37,191.55	16,680.29	0.45	35,141.43	35,906.05	1.02	16,683.30	18,583.66	1.11
2015	27,650.30	24,710.91	0.89	-	-	-	-	-	-	38,313.78	17,830.06	0.47	39,645.79	41,156.63	1.04	9,180.80	19,769.84	2.15
2016	28,506.19	17,566.21	0.62	-	-	-	-	-	-	37,666.98	15,653.49	0.42	45,637.60	30,294.16	0.66	18,346.79	23,195.93	1.26
2017	29,046.11	19,721.39	0.68	-	-	-	-	-	-	37,942.18	14,534.25	0.38	50,292.42	32,693.40	0.65	16,565.90	23,860.71	1.44
2018	30,625.64	20,488.70	0.67	-	-	-	-	-	-	36,316.48	14,486.77	0.40	52,583.30	35,677.71	0.68	17,236.84	23,957.03	1.39
2018 (POF)		18,621.20	0.61	-	-	-	-	-	-		8,178.49	0.23		37,475.07	0.71	17,236.84	-	-
2019	31,159.24	22,159.94	0.71	-	-	-	-	-	-	37,988.94	16,391.05	0.43	55,328.28	39,977.87	1.38	17,603.31	24,157.72	1.37
2020	32,001.52	16,909.81	0.53	-	0	-	293,339.78	270,390.17	0.92	39,990.99	17,526.85	0.44	58,197.29	42,919.00	1.36	19,579.78	25,946.29	1.33
2021	27,194.34	21,392.32	0.79	6,422.85	8,321.52	1.30	56,890.58	74,136.71	1.30	35,736.44	12,256.42	0.34	61,790.41	45,830.88	0.74	10,158.27	27,306.50	2.69
2022	-	-	-	69,560.55	53,136.19	0.76	3,367.93	-	-	40,706.80	15,988.19	0.39	70,879.95	59,024.89	0.83	23,564.06	36,691.27	1.56

Note: Values in millions of R$ (Brazilian Reais). AD = administrative data; S = simulated; POF indicates that the simulation was made using POF and not PNAD or PNADc; and for the year 2010, since there is no PNAD, the simulation was made using both the PNAD for 2009 and 2011.

Source: Authors' compilation.

Table 15: Aggregate validation - Taxation

Year	IRPF			Employer SIC			Employee SIC		
	AD (R$M)	S (R$M)	Ratio	AD (R$M)	S (R$M)	Ratio	AD (R$M)	S (R$M)	Ratio
2008	59,878.02	58,300.03	0.97	80,035.31	88,381.24	1.10	36,015.89	34,459.23	0.96
2008 (POF)		89,183.12	1.49		79,139.06	0.99		29,894.26	0.83
2009	60,339.14	56,514.62	0.94	86,348.00	95,001.72	1.10	38,856.60	36,475.82	0.94
2010 (2009)	71,579.34	61,326.52	0.86	103,775.24	92,286.65	0.89	46,698.86	35,295.07	0.76
2010 (2011)		62,522.59	0.75	103,775.24	100,840.42	0.97	46,698.86	38,739.03	0.83
2011	83,825.92	71,690.55	0.76	119,288.28	119,983.99	1.01	53,679.72	46,152.05	0.86
2012	93,844.85	86,543.10	0.85	131,676.83	137,610.24	1.05	59,254.57	53,152.92	0.90
2013	101,829.83	95,545.46	0.83	133,618.07	152,806.15	1.14	60,128.13	58,652.88	0.98
2014	114,638.12	108,867.01	0.90	138,330.41	167,876.69	1.21	62,248.69	64,594.71	1.04
2015	121,540.31	109,011.75	0.82	145,003.38	170,568.44	1.18	65,251.52	65,381.75	1.00
2016	133,590.22	127,283.78	0.86	151,912.69	190,138.14	1.25	68,360.71	72,424.02	1.06
2017	147,205.64	161,508.45	0.99	156,312.07	203,614.90	1.30	70,340.43	77,115.86	1.10
2018	163,741.85	169,763.32	0.92	170,796.76	211,321.23	1.24	76,858.54	79,355.96	1.03
2018 (POF)		301,532.40	1.84		163,290.95	0.96		61,811.30	0.80
2019	184,030.35	189,119.23	1.02	189,070.28	218,544.31	1.16	85,081.62	82,239.18	0.97
2020	186,211.09	198,183.01	1.06	186,780.07	214,837.22	1.15	84,051.03	71,743.43	0.85
2021	202,554.56	207,357.56	1.02	219,138.55	223,997.48	1.02	98,612.35	90,635.76	0.92
2022	228,349.11	248,099.34	1.09	278,149.59	268,279.98	0.96	125,167.31	109,503.12	0.87

Note: Values in millions of R$ (Brazilian Reais). AD = administrative data; S = simulated; POF indicates that the simulation was made using POF and not PNAD or PNADc; and for the year 2010, since there is no PNAD, the simulation was made using both the PNAD for 2009 and 2011.

Source: Authors' compilation.

4.2   Income distribution

We also validate the model results when it comes to income distribution. In this regard, Table 16 shows the Gini Coefficient for disposable and original (market) income in the first two columns, along with the series obtained from the World Development Indicators database from the World Bank.

We observe that the Gini for Disposable Income calculated with BRASMOD and the ones obtained from the World Development Indicators are slightly different but remain broadly comparable. In most years, the two series follow a similar trend, but the discrepancies fluctuate. The largest difference occurs in 2020, where the Gini for disposable income calculated with BRASMOD is 0.443, while the World Bank index reports 0.489, a gap of 0.046. This may reflect the effects of emergency aid policies that reduced inequality in disposable income but were not fully captured in the World Bank's measure, or were overestimated in the model. The later hypothesis is quite possible, as the model captures everyone that is eligible for the Auxílio Emergencial (the Covid-19 benefit), not everyone that applied and ended up getting the benefit. On the other hand, the smallest difference is observed in 2015, where both indices are nearly identical (0.499 vs. 0.519). Despite these variations, the overall patterns of inequality remain consistent, reinforcing the measures calculated with the model are consistent with others found in realiable sources.

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Table 16: Gini Index for Disposable and Original Income (2008-2022)

Year	Gini Disposable Income	Gini Original Income	World Bank Gini Index
2008	0.511	0.631	0.540
2009	0.524	0.630	0.537
2010	0.521	0.630	—
2011	0.520	0.632	0.529
2012	0.507	0.628	0.534
2013	0.504	0.629	0.527
2014	0.497	0.620	0.520
2015	0.499	0.624	0.519
2016	0.481	0.596	0.534
2017	0.493	0.612	0.533
2018	0.499	0.613	0.539
2019	0.492	0.613	0.535
2020	0.443	0.638	0.489
2021	0.475	0.629	0.529
2022	0.473	0.612	0.520

Source: Authors' compilation and World Development Indicators.

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A   Appendix - Examples of policy simulations on EU-ROMOD

In the EUROMOD software, policies are essentially simulation instructions: they take each observation (individual) from the dataset used to run the model and then alter that observation using policy functions. That alteration can be anything from assigning some variable value for that observation, modifying some existing value, or running calculations that will be used later on.

As the spine in Table 3 shows, we first define some constants (e.g., `minwage` for each year); then different income concepts as *income lists* (with `ilsdef_bra` for standard income concepts and `ildef_bra` for and specific income concepts, used for specific policies in the model); then we define the individual and the household tax units using the `tudef_bra` policy. The following policy, `random_bra`, defines random variables for some randomization in the simulations (e.g., a random variable that determines if a household under-reports their income for social program eligibility). The following policies in the policy spine are then government policies *per se*, i.e., taxes and benefits.

The first set of government policies is on the taxation side - social insurance contributions (SICs) and income tax. Figure 3 provides an example of how the policy for the employee's social insurance (`tscee_bra`) is written:

tscee_bra		on	
fx DefConst		on	
fx DefVar		on	
base_tscee	1	IF(yem<minwage, minwage-yem, yem)	
fx Elig		on	
Elig_Cond		les01=3 | les03=9	
TAX_UNIT		tu_individual_bra	
fx SchedCalc		on	
Who_Must_Be_Elig		all_adults	
base		base_tscee	
Band_UpLim	1	1693.72#m	
band_rate	1	0.08	
Band_UpLim	2	2822.90#m	
Band_Rate	2	0.09	
Band_UpLim	3	5645.80#m	
Band_Rate	3	0.11	
output_var		tscee_s	
TAX_UNIT		tu_individual_bra	

Figure 1: Excerpt of employee SIC policy (`tscee_bra`)

The first function in the policy is used to define constants for other years, and we omit it for conciseness. `DefVar` defines the variable `base_tscee`, the tax base for this specific contribution: if the individual receives less than the minimum wage, the tax base is defined as the difference between it and the individual's wage (`yem`, employment income); if not, it is simply the individual's wage. The `Elig` function is used to filter individuals who fit into the eligibility criteria for the policy. If they pass the criteria, the policy proceeds with the calculations. The next and final function `SchedCalc` is used to construct tax schedules: it takes as argument a base over which to calculate the tax and defines income bands, along with marginal tax rates for each band. For this SIC policy, Table 7 the 2023 tax schedule simulated by `SchedCalc`.

The final result of the calculation (`output_var`) is then stored in the variable `tscee_s`. Finally, the calculations and the assignment are done at the individual level, so (`TAX_UNIT` is set to `tu_individual_bra`).

The next set of simulated policies are government benefits. In order to identify all low-income families in the country for inclusion in social assistance and income redistributive programs, the Brazilian government implemented a registration system named *Cadastro Único para Programas Sociais*, or simply *Cadastro Único* (CadÚnico). It is a platform where families register and fill in their socioeconomic information to be eligible for government social programs. The registration process includes a questionnaire, which contains questions about household composition, demographic information about individual members, and values of different income variables for each individual as a means-test.

The means-test for PBF involves the sum of all income variables in the CadÚnico questionnaire. EUROMOD allows the construction of new income variables as *income lists*,

variables used to create specific income concepts for the simulation. As Figure 2 shows, using the `DefIl` policy function, we create two income lists: `il_CadUnico` and `il_CadUnico_sub`. The first includes all income variables of the CadÚnico questionnaire: employment income (`yem`), self-employment income (`yse`), old-age pensions (`poa`), unemployment benefits (`bun`), and private transfer donations (`ypt`). The second, on the other hand, is created to simulate non-reporting of self-employment income and private transfers. As explained in section 4, this is done to simulate income under-reporting by households.
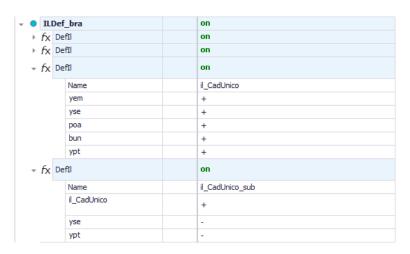

ILDef_bra		on
fx DefIl		on
fx DefIl		on
fx DefIl		on
Name		il_CadUnico
yem		+
yse		+
poa		+
bun		+
ypt		+
fx DefIl		on
Name		il_CadUnico_sub
il_CadUnico		+
yse		-
ypt		-

Figure 2: Income lists `il_CadUnico` and `il_CadUnico_sub`

B   Appendix - Evolution of the Bolsa Família

This Appendix summarizes the legislative history of the Bolsa Família Program (PBF), reviewing changes in the design of the PBF over time, including adjustments to eligibility criteria and benefit values.

B.1   2003 and 2004: Creation and Regulation of the PBF

Created by Provisional Measure No. 132, of October 20, 2003 (BRASIL 2003), [2] the PBF was intended for "conditional cash transfer actions" (art. 1 of Law No. 10,839). Within the scope of the PBF, the following cash transfer programs of the federal government of Brazil were unified: 1) Bolsa Escola (School Allowance), a cash transfer action of the National Minimum Income Program linked to Education; 2) Cartão Alimentação (Food Card), consisting of benefits of the Programa Nacional de Acesso à Alimentação (PNAA)

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[2]Provisional Measure No. 132 was transformed into Law No. 10,836, of January 9, 2004, which was subsequently regulated by Decree No. 5,209, of September 17, 2004.

(National Program for Access to Nutrition); 3) Bolsa Alimentação (Food Allowance), an action of the Programa Nacional de Renda Mínima Vinculada à Saúde (National Minimum Income Program Linked to Health); and 4) Vale Gás (Gas Assistance).

The PBF aims to promote access to the public service network, address hunger and poverty, promote integration of government actions, and "stimulate the sustained emancipation of families living in poverty and extreme poverty" (BRASIL 2004a). In this regard, two types of benefits were created:

- **Basic Benefit**, intended for family units in extreme poverty (Article 2, I, BRASIL 2004b).

- **Variable Benefit**, intended for family units in poverty with pregnant or nursing women, children between 0 and 12 years, or adolescents up to 15 years old (Article 2, II, BRASIL 2004b).

Decree 5,209 (BRASIL 2004a) also provided an **extraordinary variable benefit**, consisting of "a portion of the value of the benefits of families remaining from the Bolsa Escola (School Allowance), Bolsa Alimentação (Food Allowance), Food Card (Food Card), and Vale Gás (Gas Assistance) programs, which, on the date of their incorporation into the Bolsa Família Program, [exceeded] the maximum limit set for the Bolsa Família Program".

The following poverty thresholds were defined:

- **Extreme poverty**: monthly per capita family income of up to R$ 50.00.

- **Poverty**: monthly per capita family income of up to R$ 100.00 (1/2 of the minimum wage at the beginning of 2003).

The benefit values were defined as follows:

- **Basic Benefit**: monthly amount of R$ 50.00.

- **Variable Benefit**: monthly amount of R$ 15.00 per beneficiary, up to three quotas.

The definition of family income was as follows: "the sum of the gross income earned monthly by all family members [...], excluding income granted by official cash transfer programs" (Article 2, § 1, III, BRASIL 2004b. The law stipulated a preference for disbursing the benefit to the woman responsible for the family (Article 2, § 14).

Article 3 of Law No. 10,836/2004 stipulated granting benefits subject to conditionalities related to "prenatal exams, nutritional monitoring, health monitoring, school attendance

of 85% in regular educational establishments, without prejudice to others provided for in regulations".

In fiscal terms, the PBF would be funded by existing budget allocations for both federal cash transfer programs and the Single Registry called *Cadastro Único* (CadÚnico). Other budget allocations from the Union's Social Security Budget would be redirected to fund the cash transfer program.

The then Ministério do Desenvolvimento Social e da Luta contra a Fome (Ministry of Social Development and Fight Against Hunger) was assigned the tasks of operationalizing actions related to the PBF, as well as managing CadÚnico. Furthermore, the PBF would be executed in a decentralized manner, involving efforts from federated entities, with Caixa Econômica Federal Bank as the PBF's Operating Agent (Article 11, BRASIL 2004a). The PBF design also included blocking payments in cases of child labor in the family, proof of fraud, and non-compliance with conditionalities (BRASIL 2004a).

B.2   2006: Adjustments in poverty thresholds

After the issuance of Decree No. 5,749 (BRASIL 2006), the following (extreme) poverty thresholds came into effect:

- **Extreme poverty**: monthly per capita family income of up to R$ 60.00;

- **Poverty**: monthly per capita family income of up to R$ 120.00.

This was the first adjustment of the reference poverty thresholds, without changes in the benefit values.

B.3   2007: Adjustments in the benefit values

With the issuance of Decree No. 6,157 (BRASIL 2007), the benefit values were adjusted:

- **Basic Benefit**: monthly amount of R$ 58.00.

- **Variable Benefit**: monthly amount of R$ 18.00 per beneficiary, up to three quotas.

According to Article 2 of the referred decree, the new piece of legislation would only produce financial effects from August 1st, 2007 onward.

B.4 2008: Adjustments in benefit values and introduction of the Young Variable Benefit

Following the issuance of Provisional Measure No. 411, dated December 28, 2007, subsequently converted into Law No. 11,692, dated June 10, 2008 (BRASIL 2008c; BRASIL 2008b), a new type of benefit was introduced: the *Benefício Variável Vinculado ao Adolescente* (Young Variable Benefit), intended for adolescents aged 16 to 17. The monthly value was set at R$ 30.00 per beneficiary, with a limit of two beneficiaries per family.

Article 3 of Law No. 10,836 (BRASIL 2004b) underwent important changes regarding conditionalities (BRASIL 2008b). According to the new language, it would be necessary to prove the following:

- Compliance with "minimum vaccination calendar and health monitoring of children, pregnant and nursing women".

- School attendance of at least 85% for children and adolescents aged six to 15 and 75% for adolescents aged 16 to 17.

In Law No. 10,836 (BRASIL 2004b), the obligations on health had a generic language, being at the discretion of the regulatory body. With the new formulation, health obligations began to include proof of compliance with the vaccination calendar and nutritional monitoring for pregnant and nursing women.

Later that same year, following the issuance of Decree No. 6,491 (BRASIL 2008a), the benefit values were re-ajusted:

- **Basic Benefit**: monthly amount of R$ 62.00.

- **Variable Benefit**: monthly amount of R$ 20.00 per beneficiary, up to three quotas.

B.5 2009: Adjustments in poverty thresholds and benefit values

With the issuance of Decree No. 6,824 (BRASIL 2009a), the following values for the (extreme) poverty thresholds came into effect:

- **Extreme poverty**: monthly per capita family income of up to R$ 69.00.

- **Poverty**: monthly per capita family income of up to R$ 137.00.

However, through Decree No. 6,917 later that year (BRASIL 2009b), the (extreme) poverty lines and benefit values were readjusted:

- **Extreme poverty**: monthly per capita family income of up to R$ 70.00.

- **Poverty**: monthly per capita family income of up to R$ 140.00.

- **Basic Benefit**: monthly amount of R$ 68.00.

- **Variable Benefit**: monthly amount of R$ 22.00 per beneficiary, up to three quotas.

- **Young Variable Benefit**: monthly amount of R$ 33.00 per beneficiary, up to two quotas.

B.6 2011: Adjustments in benefit values

With the issuance of Decree No. 7,447 (BRASIL 2011a), the benefit values were adjusted to:

- **Basic Benefit**: monthly amount of R$ 70.00.

- **Variable Benefit**: monthly amount of R$ 32.00 per beneficiary, up to three quotas.

- **Young Variable Benefit**: monthly amount of R$ 38.00 per beneficiary, up to two quotas.

Through Provisional Measure No. 535 (BRASIL 2011c) the variable benefit was expanded to a maximum of five quotas per family. This was subsequently converted into Law No. 12,512 (BRASIL 2011b), which also added new penalties for fraud by public officials or ineligible beneficiaries.

B.7 2012: Creation of the Top-up Benefit to Overcome Extreme Poverty

By Provisional Measure No. 570 (BRASIL 2012b) later converted into Law No. 12,722 (BRASIL 2012a) a benefit for overcoming extreme poverty in early childhood was introduced. The benefit was designed to assist families with children aged zero to six years old and whose total monthly family income + financial benefits were equal to or less than R$ 70.00 per capita (equivalent to the extreme poverty line defined by the government in 2012).

In November of the same year, this was expanded through Provisional Measure No. 590 (BRASIL 2012c), under which families including children aged zero to 15 became eligible for the benefit.

B.8 2013: Calculation criteria for the Top-up Benefit to Overcome Extreme Poverty

Decree No. 7,931 (BRASIL 2013a) established the criteria for calculating the Top-up Benefit to Overcome Extreme Poverty.

- Each family could receive only one benefit.

- The value of the benefit was the result of the difference between R$ 70.01 and the per capita sum of family monthly income and benefits, multiplied by the number of family members, rounded up to the nearest multiple of R$2.00.

Law No. 12,817 (BRASIL 2013b) amended the original law with the aforementioned changes and also provided access to qualification programs for beneficiaries with at least 14 years old.

B.9 2014: Adjustments in poverty thresholds and benefit values

Decree No. 8,232 (BRASIL 2014) adjusted the poverty thresholds as:

- **Extreme poverty**: monthly per capita family income of up to R$ 77.00.

- **Poverty**: monthly per capita family income of up to R$ 154.00.

The benefit values were updated to:

- **Basic Benefit**: monthly amount of R$ 77.00.

- **Variable Benefit**: monthly amount of R$ 35.00 per beneficiary, up to five quotas.

- **Young Variable Benefit**: monthly amount of R$ 42.00 per beneficiary, up to a limit of two quotas.

- **Benefit for Overcoming Extreme Poverty**: the difference between R$ 77.01 and the per capita sum of family monthly income and benefits, multiplied by the number of family members, rounded to the nearest higher multiple of R$ 2.00

B.10 2016: Political turmoil and adjustments in (extreme) poverty thresholds and benefit values

On May 5, 2016, then-President Dilma Rousseff issued Decree No. 8,747 (BRASIL 2016a), which established the following thresholds for poverty and extreme poverty:

- **Extreme poverty**: monthly per capita family income of up to R$ 82.00.

- **Poverty**: monthly per capita family income of up to R$ 164.00.

The aforementioned decree also updated benefit values:

- **Basic Benefit**: monthly amount of R$ 82.00.

- **Variable Benefit**: monthly amount of R$ 38.00 per beneficiary, up to five quotas.

- **Young Variable Benefit**: monthly amount of R$ 45.00 per beneficiary up to two quotas.

- **Benefit for Overcoming Extreme Poverty**: the difference between R$ 82.01 and the per capita sum of family monthly income and benefits, multiplied by the number of family members, rounded to the nearest higher multiple of R$ 2.00.

The President was removed from office on May 12th, 2016, and the planned adjustment was not enacted. Then, on June 29th, interim President Michel Temer issued Decree No. 8,794 (BRASIL 2016b), establishing the following parameters for the PBF benefits:

- **Basic Benefit**: monthly amount of R$ 85.00.

- **Variable Benefit**: monthly amount of R$ 39.00 per beneficiary, up to five quotas.

- **Young Variable Benefit**: monthly amount of R$ 46.00 per beneficiary, up to two quotas.

- **Benefit for overcoming Extreme Poverty**: the difference between R$ 85.01 and the per capita sum of family monthly income and benefits, multiplied by the number of family members, rounded to the nearest higher multiple of R$ 2.00.

The (extreme) poverty lines were also updated:

- **Extreme poverty**: monthly per capita family income of up to R$ 85.00.

- **Poverty**: monthly per capita family income of up to R$ 170.00.

B.11 2018: Adjustments in poverty thresholds and benefit values

According to Decree No. 9,396 (BRASIL 2018), the values of (extreme) poverty thresholds for the PBF were adjusted to:

- **Extreme poverty**: monthly per capita family income of up to R$ 89.00.

- **Poverty**: monthly per capita family income of up to R$ 178.00.

And the benefit values became:

- **Basic Benefit**: monthly amount of R$ 89.00.

- **Variable Benefit**: monthly amount of R$ 41.00 per beneficiary, up to five quotas.

- **Young Variable Benefit**: R$ 48.00, monthly, per beneficiary, up to two quotas.

B.12 2019: Christmas bonus

In December 2019, Provisional Measure No. 898 (BRASIL 2019) was enacted, providing a double payment of the monthly benefit as a Christmas bonus.

C Appendix - Evolution of the Personal Income tax

This appendix compiles the evolution of the Brazilian Personal Income Tax, covering the period from 2003 to 2023. Given the purpose of programming the tax schedule on BRASMOD, we are particularly interested in identifying adjustments to the tax design, focusing on tax rates, income brackets, and deduction thresholds, as defined by Receita Federal do Brazil, Ministério da Fazenda (Tax Authority of Brazil, Finance Ministry). Table 17 below summarizes the tax schedule for each year of reference.

Table 17: Income Tax Rates and Deductions (2003–2023)

Year	Tax Base (R$)	Rate	Deduction (R$)
	Up to 12,696.00	-	-
2003	12,696.01 – 25,380.00	15%	1,904.40
	Above 25,380.00	27.5%	5,076.90
	Continued on next page		

Year	Tax Base (R$)	Rate	Deduction (R$)
2004	Up to 12,696.00	-	-
	12,696.01 – 25,380.00	15%	1,904.40
	Above 25,380.00	27.5%	5,076.90
2005	Up to 13,968.00	-	-
	13,968.01 – 27,912.00	15%	2,095.20
	Above 27,912.00	27.5%	5,584.20
2006	Up to 14,992.32	-	-
	14,992.33 – 29,958.88	15%	2,248.85
	Above 29,958.88	27.5%	5,993.71
2007	Up to 15,764.28	-	-
	15,764.29 – 31,501.44	15%	2,364.64
	Above 31,501.44	27.5%	6,302.32
2008	Up to 16,473.72	-	-
	16,473.73 – 32,919.00	15%	2,471.06
	Above 32,919.00	27.5%	6,585.93
2009	Up to 17,215.08	-	-
	17,215.09 – 25,800.00	7.5%	1,291.13
	25,800.01 – 34,400.40	15%	3,226.13
	34,400.41 – 42,984.00	22.5%	5,839.38
	Above 42,984.00	27.5%	7,786.57
2010	Up to 17,989.80	-	-
	17,989.81 – 26,961.00	7.5%	1,349.24
	26,961.01 – 35,948.40	15%	3,371.31
	35,948.41 – 44,918.28	22.5%	6,067.44
	Above 44,918.28	27.5%	8,313.35
2011	Up to 18,799.32	-	-
	18,799.33 – 28,174.20	7.5%	1,409.95
	28,174.21 – 37,566.12	15%	3,523.01
	37,566.13 – 46,939.56	22.5%	6,340.47
	Above 46,939.56	27.5%	8,687.45

Year	Tax Base (R$)	Rate	Deduction (R$)
2012	Up to 19,645.32	-	-
	19,645.33 – 29,442.00	7.5%	1,473.40
	29,442.01 – 39,256.56	15%	3,681.55
	39,256.57 – 49,051.80	22.5%	6,625.79
	Above 49,051.80	27.5%	9,078.38
2013	Up to 20,529.36	-	-
	20,529.37 – 30,766.92	7.5%	1,539.70
	30,766.93 – 41,023.08	15%	3,847.22
	41,023.09 – 51,259.08	22.5%	6,923.95
	Above 51,259.08	27.5%	9,486.91
2014	Up to 21,453.24	-	-
	21,453.25 – 32,151.48	7.5%	1,608.99
	32,151.49 – 42,869.16	15%	4,020.35
	42,869.17 – 53,565.72	22.5%	7,235.54
	Above 53,565.72	27.5%	9,913.83
2015	Up to 22,499.13	-	-
	22,499.14 – 33,477.72	7.5%	1,687.43
	33,477.73 – 44.476,74	15%	4,198.26
	44,476.75 – 55,373.55	22.5%	7,534.02
	Above 55,373.55	27.5%	10,302.70
2016–2023	Up to 22,847.76	-	-
	22,847.77 – 33,919.80	7.5%	1,713.58
	33,919.81 – 45,012.60	15%	4,257.57
	45,012.61 – 55,976.16	22.5%	7,633.51
	Above 55,976.16	27.5%	10,432.32

Source: Receita Federal, 2023.