

Regional Inequality in Brazil

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Abstract

We combine survey, tax and national accounts data to estimate the state-level income distribution in Brazil since 2006. The Southeast is the region where the income distribution is most concentrated, and the North and the South the least. At the state level, Amazonas, Rio de Janeiro and São Paulo stand out: the top 1% gains around 28% of total pretax income and the top 10% almost 60%. We examine the inheritance and gift tax as one explanation for the state differences in income distribution. Using administrative data from one state, we document that transfers are extremely concentrated, but the tax revenues represent a small fraction of the total amount transferred. Besides, analysing one reform, we find little to no behavioural response once the tax is in place. Our results indicate that Brazil's inheritance and gift tax is underexplored as a mechanism to raise revenues and reduce income inequality efficiently.

JEL Codes – D30, D640, H240, R120

Keywords – Income Distribution, Regional Inequality, State Tax, Gift Taxation, Inheritance Taxation

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Introduction

The income level and its distribution can considerably vary between country regions. However, most studies have focused on measuring the income distribution at the national level. This approach can limit our understanding of inequality, especially when considering large countries. Brazil is an emblematic case. It has an area almost as extensive as Europe and more than 200 million inhabitants. Internal economic differences are equally huge. For instance, the gap between the Brazilian state with the highest and the one with the lowest Gross Domestic Product (GDP) per capita, respectively São Paulo and Maranhão, is similar to the one between Chile and Honduras, the two extremes in Latin America¹. Due to this heterogeneity, a necessary step to understand Brazil's inequality is moving to a finer geographical decomposition of the income distribution.

This study addresses the interconnection between national and state-level income inequality. Our central question is: what is the state-level decomposition of income distribution in Brazil? To answer this question, we combine survey, national accounts, and tax data to construct new state-level measures of the income distribution in Brazil. The methodology follows the Distributional National Accounts guidelines, whose core goal is to provide income distribution measures consistent with macroeconomic aggregates and harmonized across countries and time (Alvaredo et al. 2020). Our results measure the income distribution after accounting for the social insurance system but before the operation of the tax and transfer system.

Several authors have investigated Brazil's spatial inequalities before. Reis (2014) and Bucciferro and Ferreira de Souza (2020) offer a long-term perspective on income inequality between states, measuring it from the late 19th century to the beginning of the 21st-century; Zamberlan Pereira (2020) takes into account local prices to measure differences in real wages in the early 20th century; and Azzoni (2001) constructs a measure to evaluate the long-run income convergence between states. Previous analysis of within-state inequality includes Bértola et al. (2009), which looks at the years 1872 and 1920; Azzoni (1999), which covers the period between 1960 and 1991; and Góes and Karpowicz (2017) that analyzes the years between 2004 and 2014 with an approach to adjust for spatial price differences. More generally, our work relates to a larger effort of constructing Distributional National Accounts (DINA)

¹The World Bank (2021) estimates that Chile's GDP per capita in 2018 was \$24,700 in PPP dollars, second only to Panamá in Latin America. In Honduras, it was \$5,800, the lowest in the region. Using World Bank's PPP conversion, we calculate that the GDP per capita was \$6,250 in Maranhão and \$21,700 in São Paulo. Brazil's national average was \$15,000.

globally (World Inequality Database 2021), and in particular, it relates to Morgan (2018) that built Brazil's DINA at the national level.

We make three main contributions. First, the new estimations cover the income of top groups more accurately due to the combination of surveys with tax data, which provides a detailed picture of high-income earners in each state. Previous results solely considered the income captured in surveys, which usually misses a considerable part of capital incomes. This limitation is relevant because capital incomes are more concentrated than labour incomes, and states have different proportions of the two, possibly distorting the comparisons.

Second, our measure accounts for the entire national income, while surveys only capture a fraction. In particular, it incorporates money that does not appear in bank accounts but is part of individuals' income. The most prominent example is undistributed profits. This money effectively belongs to the companies shareholders, independently of being distributed as dividends or staying in firms' accounts. So to have an accurate picture of inequality, we must attribute it to shareholders (Piketty et al. 2018).

Third, the methodology allows us to compare regional inequality levels between Brazil and other countries consistently. The fact that survey data only captures a fraction of national income limits the international comparability of previous results in the literature. In particular, we compare Brazil with the US, which also has a federal system and shares a similar size, population and income distribution. Our results indicate that the dispersion in within-state inequality levels is lower in Brazil than in the US, despite Brazil having higher differences in average income between states.

Overall, we find some variation in the income distribution within the five Brazilian regions, but the differences are not marked. Our benchmark results show that the Southeast is the region where the income distribution is most concentrated, and the North and the South the least. In 2018, the top 1% received 24% of the total income in the Southeast. In the North and the South, the figure was 22%. There are material differences at the bottom of the distribution. While in the Northeast, the bottom 50% gained 7%, it gained close to the double in the Center-West, 12%. Besides, we identify no relevant change in income distribution within regions from 2006 to 2019.

The state-level analysis reveals a higher heterogeneity. Amazonas (AM), Rio de Janeiro (RJ) and São Paulo (RJ) have an exceptionally high share of total income flowing to the top of the distribution. In these states, the top 1% share surpasses 25%, reaching as high as 30%, and the top 10% share is close to 60% in most years. On the other end, we have Amapá (AP), Acre (AC), Rondônia (RO) and Santa Catarina (SC), where the top 1% share usually

stays below 20%, and the top 10% stays close to 50%. Despite the significant differences in average income between states, we find that the within-state inequality explains almost all the national inequality. However, we should not interpret this result as an indication that regional inequalities are less critical (Kanbur 2006). Foremost, it indicates that income is highly concentrated in all states. Besides, we find no clear relationship between average income and patterns of income distribution. This finding goes against a subnational form of Kuznets curve linking development stage to inequality levels.

A natural question that arises from comparing the states is the determinants behind their differences in income distribution. In addition to classical historical explanations (Furtado 1959), an obvious candidate is tax federalism. In Part 2, we analyze the extent to which inheritance and gift taxation can explain differences in income distribution between Brazilian states and its potential redistributive impact. The inheritance and gift tax is a plausible choice for two reasons. First, it is the only direct tax on total wealth in Brazil. Second, it is a state-level tax.

We should clarify that the second part is a complement to the first. The objective is to examine in more detail one possible explanation and point to a policy that might influence the state-level income distribution. Hence, it should be seen as a first step in relating tax policy to states' income distribution. Moreover, the second part focuses mainly on one state, Pernambuco. The reason is twofold. First, Pernambuco made a tax reform in 2015 that allows us to examine the behavioural responses to the inheritance and gift tax. Second, we have microdata covering all inheritance and gift transfers for this state since 2010. Despite this restriction, we believe the results give lessons for all other states due to the similar institutional background.

Pernambuco's tax reform in 2015 changed the tax on gift and inheritance transfers from flat rates of 2% and 5%, respectively, to a unified progressive schedule with rates between 2% and 8%. We divide the analysis of the reform into two parts. First, we quantify the timing response during the transition period between the tax approval and its implementation. We use a differences-in-differences strategy exploring the fact that the reform only affected transfers above a certain threshold. Second, we quantify the intensive margin response to the tax. In this case, we use a bunching strategy, comparing the distribution of transfer amounts before and after the reform. Since there was no tax kink before the reform, we can associate an excess mass at these points to responses to the tax and retrieve local elasticities.

To the best of our knowledge, this is the first published work to measure behavioural

responses to Brazil's inheritance and gift tax ². More generally, we contribute to the literature on behavioural responses to wealth-transfers taxes (Slemrod and Kopczuk 2000, Joulfaian 2006, Goupille-Lebret and Infante 2018, Escobar et al. 2019, Montserrat 2019, Glogowsky 2021), and wealth taxes in developing countries (Londoño-Vélez and Ávila-Mahecha 2021). Besides, the combination of the micro-funded estimations with descriptive statistics on the transfers increases our knowledge of the distributional impacts of Brazil's tax system, which is an important policy contribution.

We find little to no behaviour response on the intensive margin for inheritances. For gifts, the intensive-margin tax elasticity is statistically different from zero in only one out of the four kinks. Indeed, bunching is harder for inheritance transfers because it is difficult to precisely control the amount transferred at death. However, this result is surprising for gifts, given that they are easier to tailor. We quantify a strong timing response during the transition period. Our preferred result indicates an increase in transfers quantity of 1.189 log points in the bracket that passed from 2 to 8 per cent tax rate. This result suggests that individuals quickly adapt the timing to avoid higher rates. Analyzing the transfers, we document they are highly concentrated, with 1% accounting for half of the total amount transferred between 2010 and 2019. Besides, the tax revenue is weak, representing only 1.74% of the total amount transferred during the period. The picture we draw combining these figures and the behavioural responses indicates that the inheritance and gift tax is underexplored as a revenue source and could influence income distribution more otherwise.

The rest of the paper is organized as follows. Part 1 presents the state-level distributional national accounts for Brazilian states. It starts with a description of the data in section 1.1, followed by a brief overview of the income concepts used in the study in section 1.2. Section 1.3 presents the methodology, including the assumptions behind the estimations. Finally, we discuss the results in section 1.4. Part 2 starts by introducing the institutional background of Brazil's inheritance and gift taxes in section 2.1. It follows presenting the data in section 2.2, the methodology in section 2.3, and the results in section 2.4. Finally, section 2.5 discusses the implications of our findings for tax revenues and income distribution in Brazil.

²In June 2021, it was brought to my knowledge that Gedeão Locks, PhD candidate at Université de Paris 1 Panthéon-Sorbonne, had been working in parallel on a similar project analysing behavioural responses to inheritance and gift taxation in more Brazilian states.

1 Distributional National Accounts

1.1 Data

We use three primary sources to construct Brazil’s state-level Distributional National Accounts (DINA): household surveys, tax tabulations, and national accounts data. All databases are publicly available online. This section overviews each of them.

1.1.1 Survey data

The first data source is the *Pesquisa Nacional de Amostras de Domicílios* (PNAD). The PNAD was an annual national survey produced by the *Instituto Brasileiro de Estatística e Geografia* (IBGE), Brazil’s statistical bureau. It contains questions on income and its sources, as well as employment status and household characteristics. We use the surveys conducted between 2007 and 2015¹.

After 2016, the IBGE replaced the PNAD with the *Pesquisa Nacional de Amostras de Domicílios Contínua* (PNADC), a quarterly survey with a rotating panel². Both the PNAD and the PNADC are representative of the national and the state level. Despite the differences between the two surveys, there is no significant discontinuity for our purposes. The only point worth noticing is that the PNADC added questions that allow a more nuanced differentiation between unemployment benefits, financial income and social transfers. It also added more detailed information on secondary jobs. Therefore, we can estimate these items more precisely after 2016. In Appendix A.1, we detail the survey variables used.

1.1.2 Tax data

The second source is tax tabulations from the *Receita Federal*, Brazil’s tax authority. They cover the period from 2006 to 2019, with one table for each state-year pair, totalling 378 tables. They portray the universe of tax returns, grouping them into centiles³. For the top 1% of state tax filers, we have a more granular division into groups of 0.1%. For the top 0.1%,

¹There is no survey for 2010, since IBGE did not conduct the PNAD in census years.

²We use the annual database that groups the first visit in each household as it is the one that contains more detailed data on income.

³Couples may declare together. However, in practice, this option usually is not fiscally beneficial when both have positive taxable incomes.

we have a further division into groups of 0.01%. The income variable used to rank taxpayers sums the gross taxable income, including incomes subject to special taxation regimes, with distributed profits and dividends, which are not taxed in Brazil⁴. This income variable does not include unemployment benefits, the non-taxable share of pensions and some forms of non-taxable investment gains. However, on average, they represent no more than 5% of the total reported income and are unlikely to impact the ranking significantly. Finally, the tabulations contain the average and the cutoff income of each fractile.

1.1.3 National accounts

The third data source is national accounts, which are constructed by IBGE. They are available up to 2018. More specifically, we use the *Contas Econômicas Integradas* (CEI) complemented by the *Tabela de Recursos e Usos* (TRU) for the data on imputed rents. The databases follow the standards set in the System of National Accounts (United Nations 2010). Namely, all the aggregates are divided into five sectors: non-financial corporations (S11), financial corporations (S12), government (S13), households (S14), and non-profit institutions serving households (S15)⁵.

In addition, starting in 2010, IBGE also provides national accounts at the state level, called *Sistema de Contas Regionais*. However, they are a simplified version. First, they do not disaggregate into the five sectors, containing only the sum for the total economy (S1). Second, it does not break down the aggregates as finely as the complete national accounts. More precisely, we have values for wages and salaries (D11), employers' social contributions (D12), taxes less subsidies on production and imports (D2-D3), and operating surplus plus mixed income (B2 + B3)⁶. Given the limitations with the state-level accounts, we use them jointly with the national ones.

Finally, since the Brazilian national accounts do not contain information on depreciation, we also use the Consumption of Fixed Capital (CFC) measure provided by the *Instituto de Pesquisa Econômica Aplicada* (IPEA), a public institution responsible for economic analysis. Júnior and Cornelio (2020) details how they constructed the database. Interestingly, the estimations are available by subgroups: residential, infrastructure, machinery, and a category englobing other forms of capital. This subdivision allows us to perform a more detailed procedure when attributing depreciation across sectors.

⁴The Receita Federal refers to this income concept as RB2.

⁵Throughout the text, we refer to the codes of the System of National Accounts (SNA) to support the exposition.

⁶In SNA's terminology, the state-level national accounts present only the generation of income account.

1.2 Income Concepts

This section introduces the income concepts that guide the construction of the Distributional National Accounts. These concepts mostly come from the System of National Accounts. We focus on the economic intuition behind our choices and the description of their composition in Brazil.

1.2.1 Fiscal Income

The Fiscal Income corresponds to the sum of all incomes that an individual should report in the personal tax returns. It includes all taxable income but also non-taxable incomes that tax filers should disclose. In Brazil, this second group comprises dividends, unemployment benefits, and exempted labour and pension incomes. However, the Fiscal Income remains an incomplete measure. It does not account for money that individuals do not directly receive but constitute part of their resources.

We briefly discuss two notable examples: undistributed profits and imputed rents for owners-occupiers. Undistributed profits effectively belong to the firms' shareholders, but they do not enter their personal tax returns. Not taking them into account would give an incomplete view of the income distribution (Piketty et al. 2018). Besides, it would bias the inequality estimation between countries and over time, given that the advantages of distributing or retaining profits depend on the tax system. The case is similar for imputed rents for owners-occupiers. Although individuals do not receive rents from the houses they own and live in, the housing services still constitute a relevant gain. Besides, not accounting for this element would make the inequality measure sensitive to different asset compositions. In other words, if people have a higher share of housing than other assets generating an equivalent income. Both undistributed profits and imputed rents are part of the National Income. So the Fiscal Income does not give figures consistent with the ones commonly used in the public debate and in assessing economic growth. To guarantee a consistent and comparable measure of the income distribution, we must pass from the Fiscal Income to the National Income.

1.2.2 National Income

In our analysis, the central aggregate income concept is the Net National Income (NNI), as defined in the SNA. It is equal to the GDP (B1, S1) plus the net foreign income (NFI)

minus the consumption of fixed capital (CFC). Although GDP appears more in the public debate than the NNI, we believe the second is more meaningful when describing the income distribution. This section explains this choice and the procedure to pass from the GDP to the NNI.

Net Foreign Income

The intuition behind adding the NFI is that it affects the actual income available for country residents. We may subdivide the NFI between the net compensation of employees from abroad (D1, S2) and the net property income from abroad (D4, S2). The first is usually very small in Brazil, representing an average inflow of 0.02% of GDP between 2007 and 2018. The second tends to be more significant and negative, accounting for an average outflow of 2.3% of GDP in the same period. These two components are not in the state-level national accounts. Hence, we should make an assumption when attributing the national figures across the states. We assume that states' net compensation of employees from abroad (D1, S2) are proportional to their shares in salaries and wages (D1, S1), and their net property income from abroad (D4, S2) is proportional to the item that sums the operating surplus plus the mixed income (B2+B3, S1).

Consumption of Fixed Capital

The CFC is the amount necessary to replace capital stock depreciation, which means no one can consume or accumulate it. In practice, not subtracting the CFC would artificially inflate the income of capital owners as we would account for the cost of replacing the depreciated stock as part of their incomes. We can subdivide the CFC according to the capital type. We define two main groups: residential and non-residential, which combines infrastructure, machinery, and other forms of non-residential assets. Between 2007 and 2018, the residential CFC corresponded on average to 2.3% of GDP and the non-residential CFC to 9.9%.

We subtract the residential CFC from the operating surplus of the household sector (B2, S14) since this item sums imputed rents and households' incomes from leased residences. The residential CFC corresponded to approximately 33% of this item in the period. The division of the CFC between the two subcomponents, imputed rents and leasing income, is proportional to their share in the household operating surplus (B2, S14). Concretely, imputed rent is the major part, accounting on average for 88% of the item.

In the case of the non-residential CFC, we subtract it proportionately across the gross national income of firms (B5, S11 + S12), the government gross operating surplus (B2, S13),

and the capital share of mixed income (B3, S14), which we settle as 30%. In practice, the average division of non-residential CFC between the three previous items is, respectively, 86%, 5% and 9%. By subtracting the CFC, we obtain values net of depreciation costs for these three items. The net national income of firms (B5n, S13), which are the undistributed profits, corresponded to approximately 4.7% of the NNI in the period, the government net operating surplus (B2n, S13) to 1.1% and the net mixed income (B3n, S14) to 9.4%.

Net National Income decomposition

We can decompose the NNI into several items. It is essential to have their magnitudes in mind to understand their relative importance. Table 1.1 presents this decomposition. The first column shows the code of each item in the state-level national accounts. The second and the third columns show, respectively, the name and the code in the national-level national accounts. The last column gives their average share between 2006 and 2018.

The largest item is wages and salaries, corresponding to 41.3% of the NNI. Employers' social contributions are also significant, accounting for another 10.7%. Among the incomes grouped in the operating surplus plus mixed income item, the most substantial part corresponds to corporations' interest and distributed income, with a share of 14.6% of the NNI. Imputed rents, mixed incomes and households' undistributed profits are also sizable, with shares of 5.1%, 9.4% and 4.7% respectively. The government capital incomes and the property income paid have a negative signs. The first is negative because the government pays more interest than receives it, and the second because it is a payment, reducing the individuals' income. At the bottom, there are the items related to the social security system. As the state-level national accounts are a simplified version, they do not contain this breakdown⁷. Notice that the social security part sums to zero by definition since it is a redistribution of the total income. Social security benefits in cash and other social insurance benefits are a large item, totalling 18.1% of the NNI. Pensions are the bulk of this value, but the item also includes unemployment benefits and other smaller social security benefits.

1.2.3 Pre-tax income

A final clarification relative to the income concepts is that we focus on the pre-tax, post replacement income (henceforth pre-tax income) and restrict the analysis to adults⁸. The

⁷The items of the social security system are in the secondary distribution of income account, which the state-level national accounts do not contain.

⁸We define adults as individuals above 20 years old following Alvaredo et al. (2020).

Table 1.1: Net National Income decomposition

State-level national accounts	National-level national accounts	SNA code	Share (%)
D11	Wages and salaries	D11, S14	41.3
D12	Employers' social contributions	D611 + D612, S14	10.7
B2 + B3	Imputed rents	part of B2n, S14	5.1
	Households' net leasing income	part of B2n, S14	0.7
	Mixed Income, net	(B3n, S14)	9.4
	Interest and distributed income of corporations	D41 + D42, S14	14.6
	Investment income disbursements	D44, S14	1.5
	Households' undistributed profits	B5n, S11 + S12	4.7
	Property income paid	D4, S14 received	-5.9
	NPISH sector income	B5n, S15	0.3
	Government capital income	B2n + D4n, S13	-1.4
D2-D3	Taxes less subsidies on production and import	D2-D3, S13	19
Social security system	Social security benefits in cash and other social insurance benefits	D621 + D622, S14	18.1
	Employers' social contributions	D611 + D612, S14	-10.7
	Employees' social contributions	D613/D614, S14	-2.5
	Pension and other social insurance surplus	D61-(D621+D622), S14	-4.9

Source: Authors' elaboration based on Brazil's national accounts from IBGE. *Interpretation:* Between 2006 and 2018, the average share of wages and salaries in the NNI was 41.3%.

pre-tax income is the sum of all incomes accruing to individuals before the operation of the tax and transfer system but after the operation of the social insurance system. Naturally, it sums up to the NNI.

We focus on this concept for two reasons. First, the Brazilian pension system functions on a pay-as-you-go model, which means that current contributors finance current beneficiaries. Not including pensions would artificially increase inequality because pensioners do not have retirement savings in their names despite having contributed in the past. Second, as previously pointed, the state-level accounts are a simplified version of the national accounts. Concretely, the state-level accounts do not have the items that record the operation of the taxes and transfers system. As such, we would have to make an increasing number of assumptions to obtain the state-level post-tax income distribution. To keep the inequality estimations as reliable as possible, we prioritized the pre-tax income definition.

1.3 Methodology

The methodology follows the Distributional National Accounts guidelines (Alvaredo et al. 2020). In short, the procedure has three steps. First, we correct the survey data using the tax tabulations so that it reflects top incomes accurately. Then we add National Income items that the corrected survey data do not include. Finally, we guarantee that all the components match the National Income. This section overviews these steps, explaining the assumptions behind them.

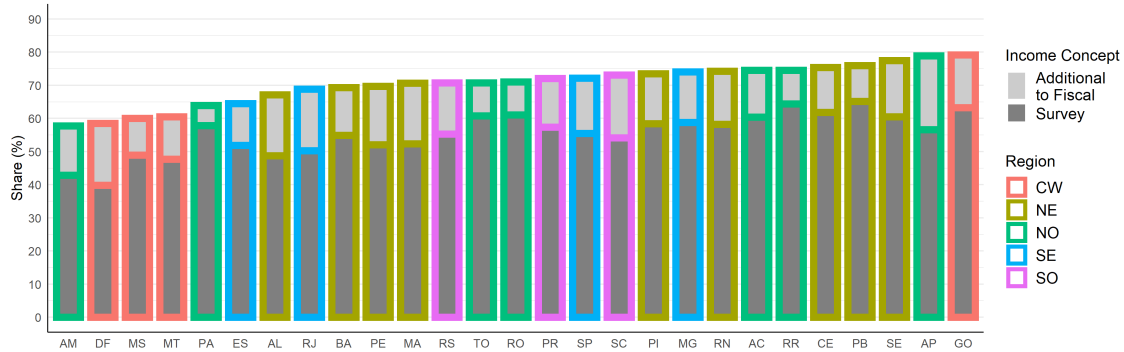
1.3.1 Combining survey and tax data

Due to its nature, survey data has limitations in portraying the top of the income distribution. The first reason is that nationally representative surveys rarely sample very affluent households as they are a tiny share of the population. We refer to this problem as a sampling error because, in theory, we could solve it by having larger samples. The second reason is that even when surveys sample these households, they generally have higher underreporting and higher non-response rates than the rest of the population. We refer to this problem as a non-sampling error, as it persists no matter the sample size. In addition, statistical offices may adjust outliers. In our case, IBGE top-codes PNADC's job income six standard deviations above the average income in the metropolitan area where the respondent resides.

In contrast, tax data portrays the universe of high-income individuals. Despite misreporting being a reality, this problem is arguably less present than in survey data since evasion may lead to legal penalties. In Brazil, though, tax data only cover a small share of the population. Hence, we must use both survey data and tax data to picture the income distribution entirely.

To combine both data sources, first, we use the survey data to construct an income variable as close as possible to the income definition used in the tax tabulations. This new variable includes the income from all jobs, financial gains, and the portion of pensions higher than the exemption threshold. We explain how we define these variables in Appendix A.1. We also add the bonus salary for formal workers, called *13^o salário*, which the survey data does not include. Once we harmonized the income definition between the survey and the tax tabulations, we combine them using the method proposed by Blanchet et al. (2018). In short, the method has two steps, one to deal with non-sampling error and another one for sampling error. The first step reweights the survey observations so that its top income shares align with those observed in the tax data. This procedure corrects the non-sampling error. The second step creates new observations at the top of the distribution to account for groups in

Figure 1.1: Fiscal Income share of Net National Income, 2018



Source: Authors' computations combining surveys, tax data and national accounts. Interpretation: In 2018, the survey income expressed approximately 50% of Rio de Janeiro's (RJ) NNI and the Fiscal Income almost 70%.

the tax data with an income that surpasses the highest one in the survey. This procedure corrects the sampling error. Importantly, the method preserves the survey consistency in terms of household composition and selected socio-demographic characteristics.

After the correction, we have an income variable that includes taxable incomes and some forms of non-taxable incomes. To get the Fiscal Income, we use the survey data to add tax-exempted pensions and unemployment benefits, which were not in the harmonized income variable. Figure 1.1 shows NNI's share expressed by the uncorrected survey data and the Fiscal Income in 2018. On average, the Fiscal Income captures 15 percentage points more than the raw survey data. The percentages for the Fiscal Income vary from 58 for Amazonas (AM) to 80 for Goiás (GO), with a median of 71%. Besides, there is no clear pattern between regions, indicating that the differences are due to state-level idiosyncrasies. As we discuss further, Fiscal Income tends to represent a lower share of the NNI in states where capital income is relatively more important, but it is not a general rule.

1.3.2 From Fiscal Income to National Income

As discussed in section 1.2.1, the Fiscal Income still misses a considerable part of the National Income. This section explains how we pass from the Fiscal Income to the National Income, focusing on the assumptions behind each step.

Social contributions

We start with social contributions. As we explained in section 1.2.3, the pretax income definition considers the income distribution after the operation of the social security system. As such, we should subtract social contributions from individuals' incomes. Since the income variables of the survey and the tax tabulations are net of employers' social contributions, this item is not an issue. However, our variable incorporates employees' social contributions, which corresponds in the SNA to households' actual social contributions and supplements (D613-D614, S14). We estimate contributions based on the legislation, using worker's income, employment status and sector in the survey⁹. Then we obtained wages net of social contribution subtracting the estimated values. Notice that by subtracting the employee social contributions from wages, we implicitly assume that its economic incidence falls on workers.

Imputed rents, investment income and undistributed profits

We must also account for parts of the National Income that do not directly flow to individuals but ultimately constitute their incomes. The first item is imputed rents for owner-occupiers. As explained in section 1.2.1, although individuals do not receive it in money, it still constitutes a relevant gain. We use data on observed rents and household characteristics available in the survey to predict the imputed rents. The predicting variables include the residence location, the number of rooms, the quality of the materials used in construction, possession of home appliances, and family income. For couples, the imputed rent is equally divided between both individuals.

The second item we must account for is the investment income disbursements. It subdivides in investment incomes payable to pension entitlements (D442, S14), investment incomes attributable to insurance policyholders (D441, S14) and investment incomes attributable to collective investment fund shareholders (D443, S14). Concretely, this income belongs to the investors. Absent more refined data, we assume that wages and financial income capture the distribution of these investments. We add investment incomes payable to pension entitlements (D442, S14) based on wages and the other two subitems based on financial income¹⁰.

The third missing component is undistributed profits (B5n, S11 + S12). We should add them because profits belong to firms' shareholders irrespective of being distributed or retained for reinvestment. Households, however, are not the only shareholders. So we divide these

⁹The rates of employees' social contributions vary from 8% to 11% of the gross wage for formal workers.

¹⁰Before 2010, Brazil's national accounts groups the three subitems of investment income disbursements, so we assumed the repartition in these years is the same as in 2010.

profits between the household (S14), the government (S13), and the foreign sectors (S2), using their equity and investment funds share (AF5). The procedure assumes that this variable reflects the macro ownership structure of the economy¹¹. Between 2010 and 2018, on average, the share of undistributed profits of each sector was, respectively, 48%, 36% and 16%. Then, we distribute the household share of undistributed profits based on financial income. The assumption is that the observed financial income proxies the right to these profits.

Property income paid, government income, and taxes on production

The household sector property income paid is the sum of interest payments made by individuals. We should subtract this item to not overestimating the income of debtors. For instance, consider an individual that bought her house with a loan. We attributed to her the respective imputed rent. However, since she took a loan to buy the house, she must pay interests. Not accounting for these interests would artificially inflate her income. Ideally, we would like to subtract this item from the interest payers, but we do not have this information. So we distribute them proportionally to the final income, not affecting the income distribution measure. This assumption underestimates inequality if poorer individuals have relatively larger and more expensive debts than richer ones, resulting in higher interest payments as a share of total income. This possibility seems plausible, which implies that a proportional allocation is a conservative approach.

The government gains a part of the national income. However, the government income indirectly belongs to its citizens. So to match the net national income, we should add the items attributed to the government - namely, the government share of undistributed profits, the government net primary income (D4, S13), and the pension and other social insurance surpluses (D61 – (D621+D622), S14)¹². We distribute them in proportion to the final income, so these items also do not affect the income distribution measure¹³.

In addition, there are the net production taxes received by the government (D2-D3, S1). We also distribute them in proportion to the final income. Notice, however, that the relative value of this item considerably varies across states. So it affects the between-states and the national-level income distribution despite not changing the within-state income distribution.

¹¹For the years before 2010, equity and investment funds share (AF5) is not available in Brazil's national accounts, so we use the shares for the closest year, 2010.

¹²We also included in this group the NNI of the NPISH sector, which corresponds to only 0.3% of the NNI. The implicit assumption is that this sector serves the households in proportion to their incomes.

¹³We attribute the social insurance surpluses (D61 – (D621+D622)) to the states in proportion to their share in the net production taxes received by the government (D2-D3, S13) before dividing them between the individuals. The logic is that the government must pay for this deficit with taxes, and some states have higher effective taxes than others.

Rescaling to the National Income

Last, we rescale the survey incomes that do not precisely match the national accounts due to methodological or measurement differences. In the case of wages (D11, S14), we matched directly at the state level. Capital incomes are less straightforward than wages because the state-level national accounts group them in a single item. We adopt a two-step procedure. First, we match the items nationally using Brazil's national accounts, which finely subdivides capital income. Then, we rescale to match the state-level operating surplus plus mixed income (B2 + B3, S1). In Appendix A.2, we discuss the procedure in more detail and present an alternative approach.

1.4 Results

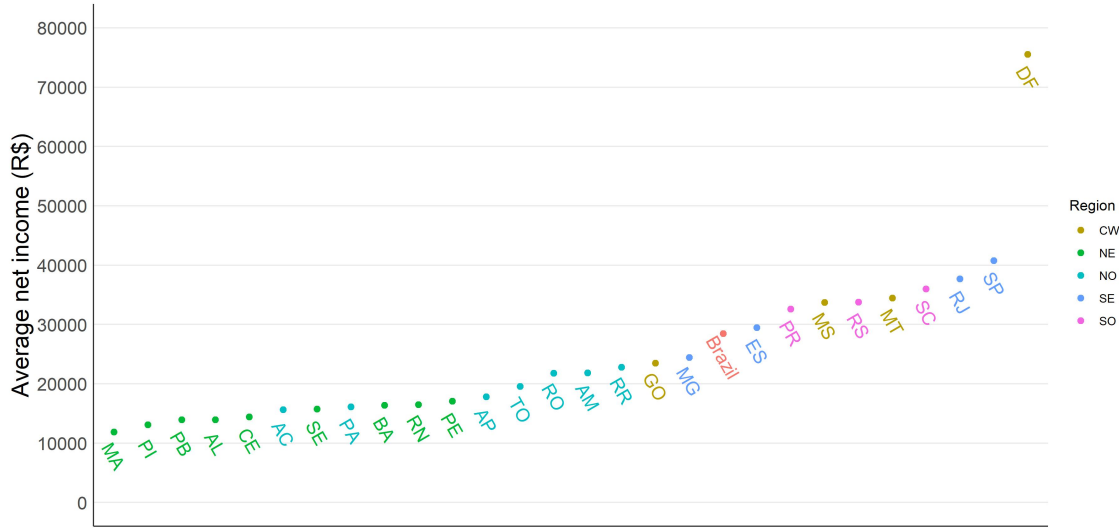
Average income

We start presenting the differences in average income. Figure 1.2 shows states' average net national income in 2018. This measure reflects Brazil's huge internal heterogeneity. The national average is just below R\$30,000, but the dispersion is considerable. The differences between regions are also marked. At the very bottom, there are northeast states such as Maranhão (MA), Piauí (PI), Alagoas (AL), and Paraíba (PB), with an average income below R\$15,000. Still below the national average, but already around R\$20,000, there are northern states such as Tocantins (TO), Amazonas (AM), Rondônia (RO), and Roraima (RR). Close to the national average, we see the centre-west states of Goiás (GO), Mato Grosso do Sul (MS), and Mato Grosso (MT). At the top, we have the three states from the South, Paraná (PR), Rio Grande do Sul (RS) and Santa Catarina (SC), and two from the Southeast, Rio de Janeiro (RJ) and São Paulo (SP). Brasília (DF), the capital, is a clear outlier, with an average income almost three times larger than the country average. Due to its particularity, we treat Brasília separately in the following regional-level analysis.

Regions

To better grasp the difference in the economic structure, Figure 1.3 shows the decomposition of the Net National Income between labour, capital, and production taxes in each region. Nationally, the shares are, respectively, 58%, 24% and 18%. The Centre-West, a region where intensive agriculture is especially strong, has the highest participation of capital income, almost 28%. For the Southeast, the main difference comes from production taxes that account

Figure 1.2: Average National Net Income of Brazilian states



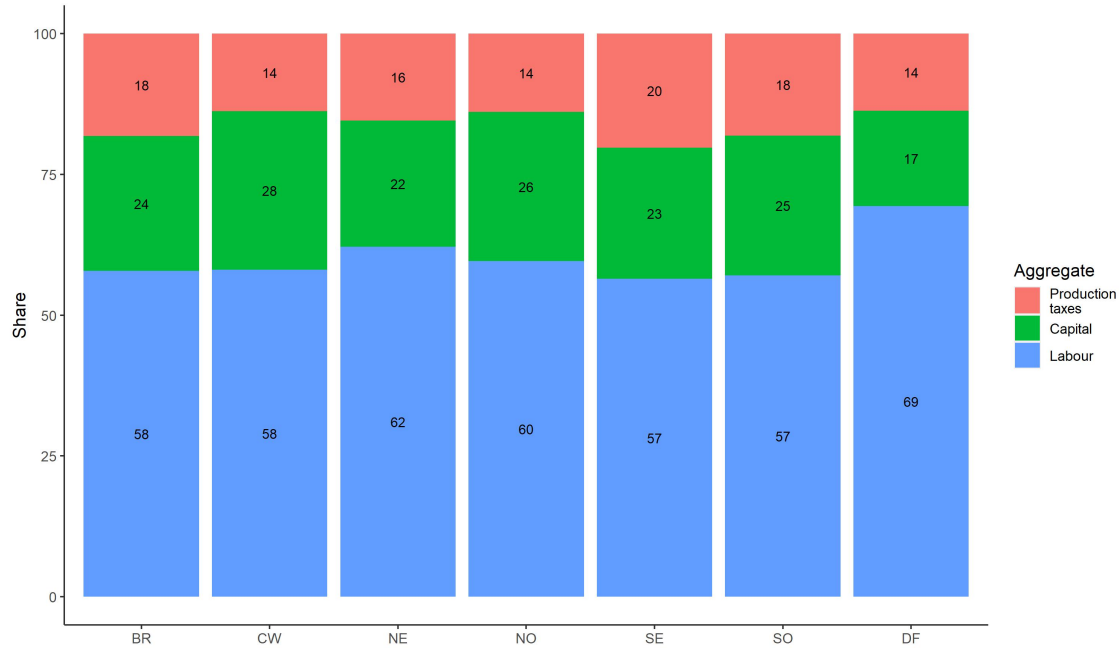
Source: Authors' computations combining surveys, tax data and national accounts.

for 20% of its NNI. A more extensive formal sector, resulting in higher effective taxes on production, may partially explain this pattern. The North, on the contrary, has a relatively low share of taxes on production, just above 14%, and the South has a repartition very close to the national average. Again, Brasília is an outlier with the highest share of labour income, 69%, due to the prevalence of federal public servants. Table A.2 in the appendix shows the same decomposition for each state. This table supports the explanation for Figure 1.1 according to which the Fiscal Income tends to represent a lower share of the NNI in states where capital income is more relevant such as Amazonas (AM), Mato Grosso do Sul (MS), Mato Grosso (MT), Pará (PA), and Espírito Santo (ES).

After getting a better idea of NNI's composition in each region, we analyze the within-region income distribution. Figure 1.4 shows the income share of four groups in each region: the bottom 50%, the middle 40%, the top 10% to 1% and the top 1%. Panel A shows the results using the raw survey data. In the survey, the Northeast and North are the regions where the top 1% has the highest share of total income, 15%, while the Center-West is where it has the lowest, 11%. The top 10% follows a similar pattern. The Northeast has the highest figure 50%, and the Center-West has the lowest along with the South, 42%.

Panel B shows our final estimations. The share of the top 1% is almost ten percentage points higher after the corrections. Apart from Brasília, the top 1% share goes from 22% in the North and the South to 24% in the Southeast. The Center-West and the Northeast

Figure 1.3: Decomposition of regional Net National Income

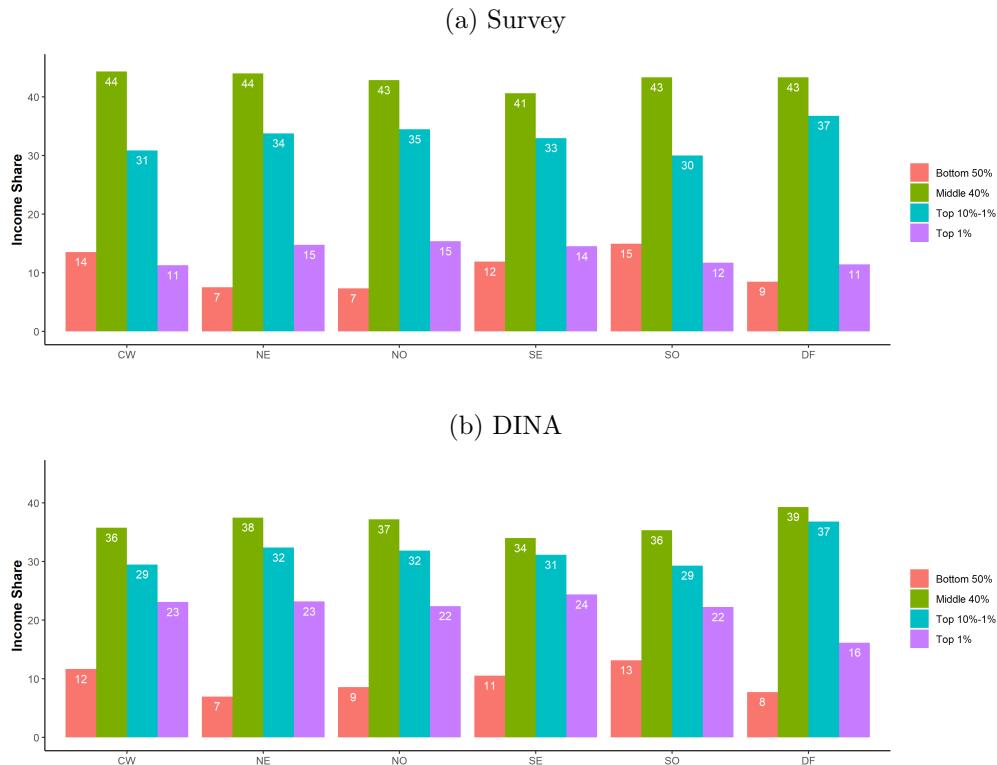


Source: Authors' computations combining surveys, tax data and national accounts.

stay in the middle with 23%. The top 10%, which corresponds to the sum of the groups top 10%-1% and top 1%, follows a similar pattern. It varies from 51% in the South to almost 55% in the Southeast and the Northeast. There is minor variation in the middle 40% share, which stays around 36% in all regions. Finally, significant differences at the bottom 50% compensate for the differences at the top. The bottom group gains only 7% of the net income in the Northeast, which is a bit more than half the group share in the South, 13%. Overall, the pattern indicates that the income distribution within each region is similar. Brasília (DF), in its turn, has very different figures. The top 1% concentrates a significantly lower fraction, 16%. However, the top 10% is in line with other regions due to a higher share of the 10%-1% group. The middle 40% also has a comparatively high share, 39%, which leaves a percentage lower than the national average to the bottom half, 8%.

Looking at the time evolution in Figure 1.5, we observe that the previous patterns are similar in the entire period. The Southeast consistently has the highest and Brasília the lowest share for the top 1% group. Additionally, the figures remained roughly stable for all regions during the 2006-2019 period. In the top 10%, Brasília (DF) is the only one that presents a clear tendency, with a decline from 60% to a little above 50%. Overall, the shares stay between 52% and 58%. Again, the Southeast has the higher figures, close to 60% in

Figure 1.4: Income distribution of Brazilian regions, 2018



Source: Authors' computations combining surveys, tax data and national accounts. *Interpretation:* In 2018, the 50% poorer individuals living in the Southeast received 11% of the region's national income.

most years. The North and the South alternate at the bottom with values around 52%. The overall stability draws attention because, in the 2006-2019 period, the regions did not have the same story at the macro level. On one side, the Center-West and the North experienced continuous growth in aggregate income, with an average close to 3% per year. On the other, the Southeast almost stagnated with an average increase lower than 1% per year.

1.4.1 States

When we look at the state level, there is more variation than at the regional level. Figure 1.6 shows the top shares at the state level. They go from 16% in Brasília (DF) to 30% in Amazonas (AM) for the top 1% and 48% in Santa Catarina to 60% in Amazonas (AM) for the top 10%. Besides, we see differences within the regions. The most striking one is in the North. Amazonas (AM) is the state with the highest top 1% share in Brazil in 2018, 30%,

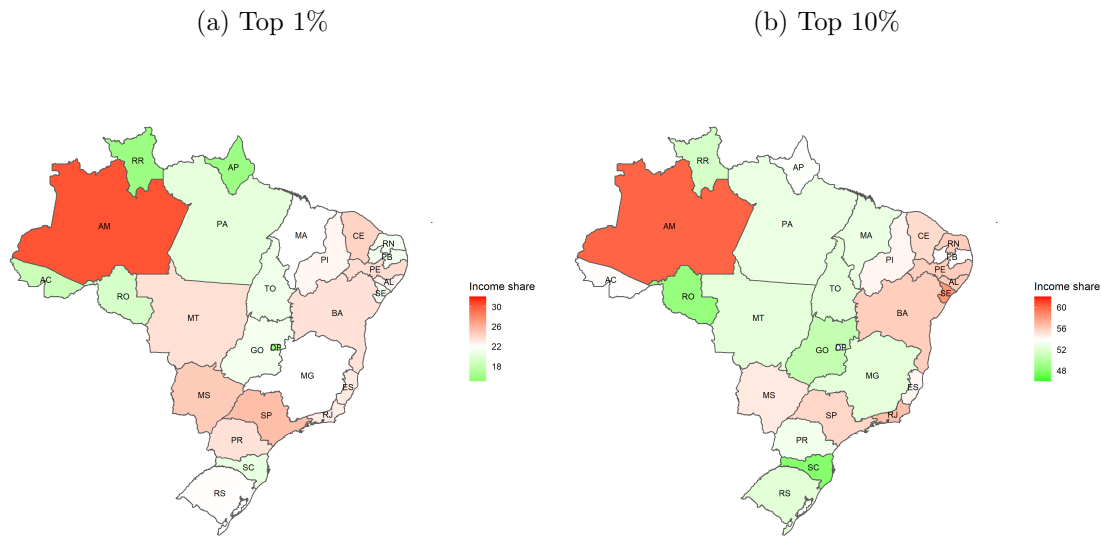
Figure 1.5: Top income shares of Brazilian regions, 2006-2019



Source: Authors' computations combining surveys, tax data and national accounts. *Interpretation:* The income share of the 1% richest individuals living in the Northeast fluctuates around 24% of the region's national income.

while all other states in the region are below the national median. Amazonas (AM) is the Brazilian state where the industrial sector importance is relatively higher due to the Zona Franca de Manaus, a federal tax-free zone. Indeed, in 2018, the industrial sector represented 34% of Amazonas GDP, while only 20% nationally. This difference leads to a relatively higher importance of capital income, which is more concentrated, contributing to a higher top 1% income share. In the South, Santa Catarina (SC) has a lower figure than its neighbours, 20%. The same is true for Goiás (GO) in the Center-West, with 21%. In Goiás's case, the difference may be due to the contiguity with Brasília (DF). Indeed, approximately 22% of the state population lives in cities part of Brasília's metropolitan area. The Northeast states, in turn, are more homogenous, with an average of around 23%. In the Southeast, São Paulo stands out as one of the states with the highest top 1% shares in Brazil, 25.5%. High participation of capital income explains this result. While the state represents roughly

Figure 1.6: Top income shares of Brazilian states, 2018

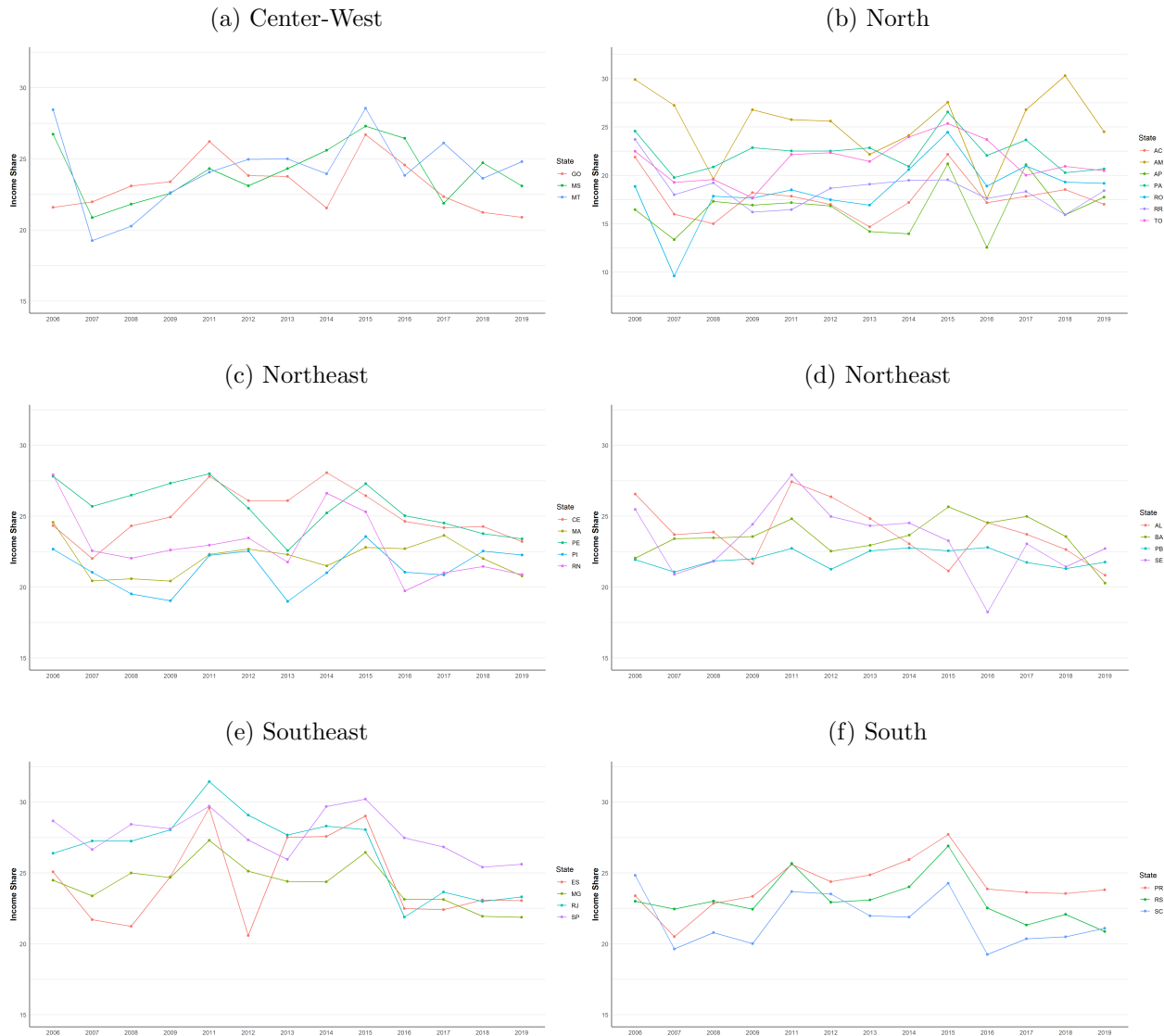


Source: Authors' computations combining surveys, tax data and national accounts.

32% of the capital income in national accounts, its residents concentrate almost 45% of the capital incomes captured in the corrected survey data. When we look at the top 10%, the overall picture changes little. The South becomes more homogenous. In the North, Amazonas (AM) continues to be an outlier, with the top 10% reaching an income share of 60%. In the Southeast, Rio de Janeiro (RJ) and São Paulo (SP) have high shares, while the Northeast states present a homogenous figure around 56%.

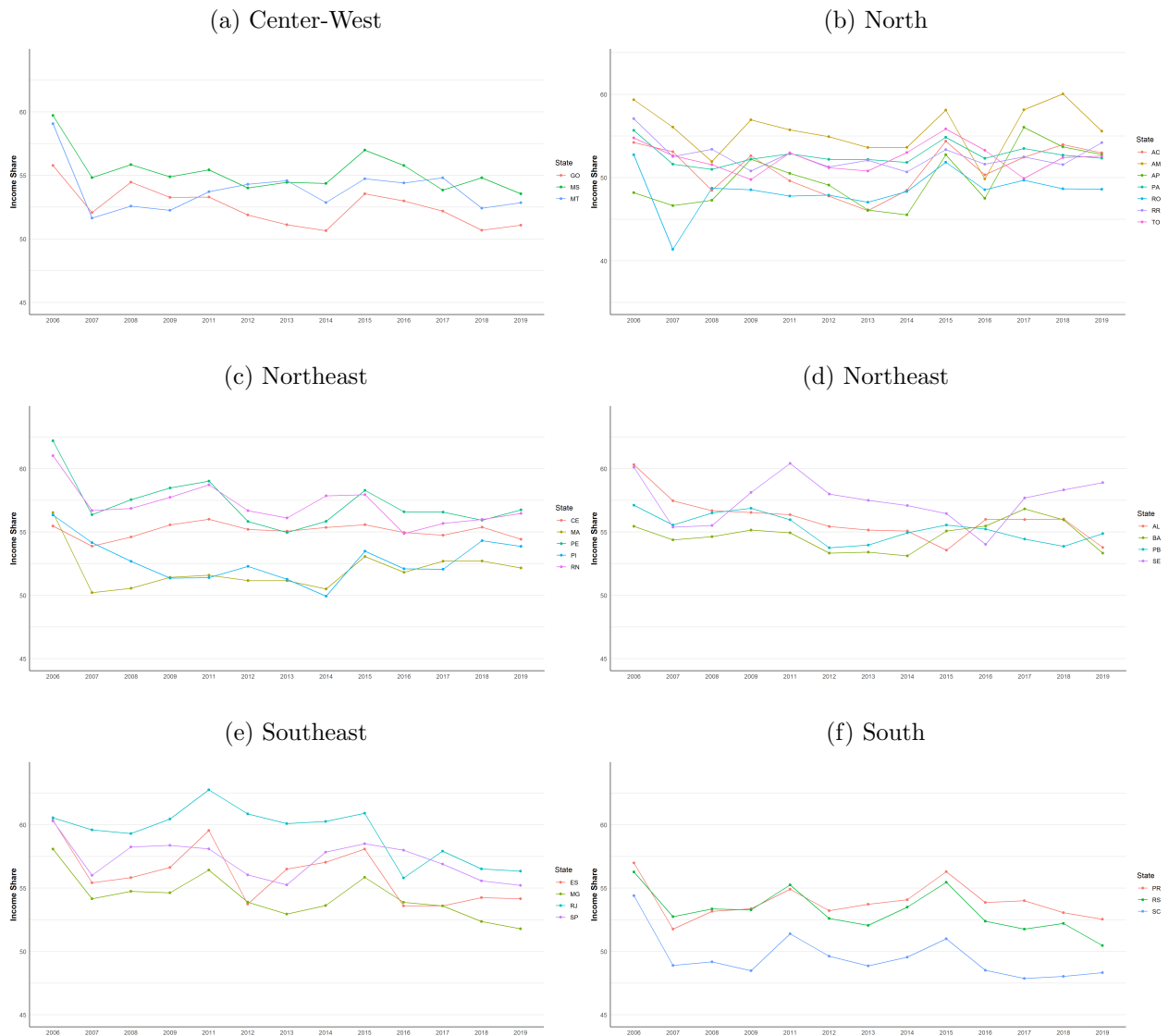
Figure 1.7 shows the evolution of the top 1% income share in each state. Smaller states, notably in the North and the Northeast, present higher fluctuations since unusually high gains can affect their distribution easier. Overall, the evolution reinforces the results we presented for 2018. São Paulo (SP) has consistently high shares, and Northeast states have similar figures among them. In the North, Amazonas have higher values than other states in most years. However, the difference was more prominent than usual in 2018. Figure 1.8 shows the evolution for the top 10%. Rio de Janeiro (RJ) stands out with values passing 60% in several years. Indeed, its case is similar to São Paulo's, with a relatively high share of capital income. Among the lowest, we see two very different states, Maranhão (MA) and Santa Catarina (SC). While the first is the poorest on per capita terms, the second is the fourth richest. More generally, we find no evident relation between state development and inequality level. This point weakens an explanation in line with Kuznets curve theory.

Figure 1.7: Top 1% income share of Brazilian states, 2006-2019



Source: Authors' computations combining surveys, tax data and national accounts. We divide Northeast states into two panels for better visualization.

Figure 1.8: Top 10% income share of Brazilian states, 2006-2019



Source: Authors' computations combining surveys, tax data and national accounts. We divide Northeast states into two panels for better visualization.

1.4.2 Inequality decomposition

Figure 1.9 compares two different counterfactuals for the top 10% and the bottom 50%. The solid line shows the actual share of the group. The dotted line shows the percentage we would observe if all states had an average income equal to the national average. In other words, if there were no between-states inequality. The dashed line shows the percentage we would observe if we divided the income equally within states. In other words, if there were no within-state inequality. The shares barely change when we eliminate the between-state inequality. However, when there is no within-state inequality, the top 10% drops from 56% to 15%, and the bottom 50% triples from 10% to 35%.

A Theil index decomposition of between and within inequality attributes 99% of the national income inequality to differences within states. However, this kind of measure is limited. The between-inequality component only captures different means across groups. As Kanbur (2006) points out, they do not account for shared public goods nor the absence of normative justifications to these inequalities. These two points are especially true considering that we are analyzing subnational entities. As such, these results should not serve as an argument to disregard the relevance of between-state inequality in Brazil. Instead, they reinforce that the share of income captured by top groups is very high in all the states.

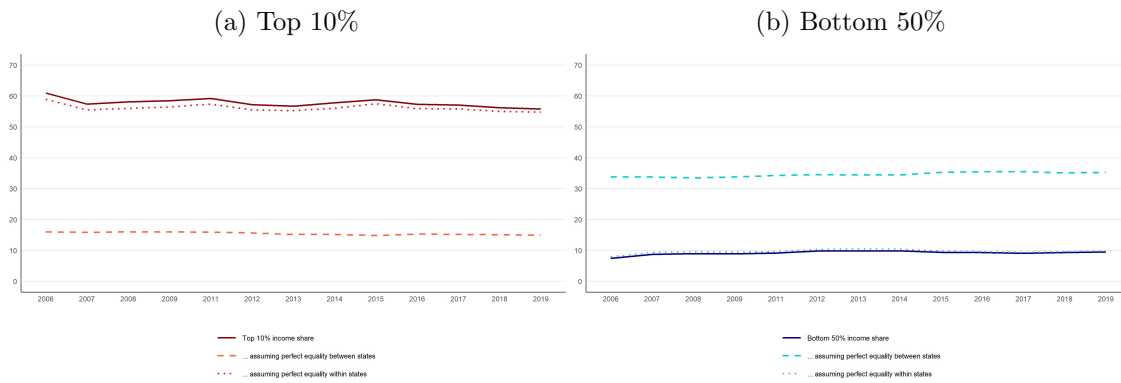
Moreover, states are considerably different in the income necessary to enter their top 1%. The first column of Table 1.2 shows the ratio between the minimum income to enter the top 1% nationally relative to the state-level threshold. We see a clear division between the south and the north of the country, replicating the average income. In São Paulo (SP) and Rio de Janeiro (RJ), an individual needs to gain around 25% more to be part of the state top 1% than the national top 1%. In Brasília (DF), individuals must gain two times more. In the other extreme, we have the Maranhão (MA), in which the threshold is just half the national one. The values are not as low but still below the national for all the North and Northeast states. The second column of Table 1.2 shows the ratio between the state participation in Brazil's top 1% relative to the state share in the total population. For instance, we can say that the Piauí (PI) have only 32% of the participation we would expect in the national top 1% if the number was proportional to the state population. The third column of Table 1.2 shows the ratio between population share in Brazil's top 1% relative to the state share of the National Income. Some states, such as Rio de Janeiro (RJ), São Paulo (SP) and Espírito Santo (ES), continue to be over-represented. These Southeast states have elevated ratios due to the combination of high average incomes and high within-state concentration.

Table 1.2: Top 1% ratios, 2018

State	Ratio		
	Threshold	Population	GDP
Center-West			
DF	2.06	4.82	2.03
GO	0.73	0.58	0.70
MS	1.09	1.25	1.04
MT	1.04	1.03	0.88
Northeast			
AL	0.65	0.53	0.90
BA	0.67	0.48	0.78
CE	0.62	0.46	0.83
MA	0.47	0.32	0.63
PB	0.62	0.45	0.80
PE	0.68	0.64	0.95
PI	0.57	0.38	0.67
RN	0.68	0.68	1.03
SE	0.72	0.49	0.80
North			
AC	0.61	0.42	0.64
AM	0.76	0.63	0.77
AP	0.81	0.61	0.88
PA	0.61	0.41	0.63
RO	0.72	0.57	0.73
RR	0.78	0.67	0.82
TO	0.65	0.56	0.78
Southeast			
ES	1.05	1.10	1.08
MG	0.86	0.77	0.88
RJ	1.27	1.52	1.19
SP	1.22	1.41	1.06
South			
PR	1.06	1.06	0.96
RS	1.06	1.10	0.92
SC	0.99	0.97	0.84

Source: Authors' computations combining surveys, tax data and national accounts. *Interpretation:* The threshold ratio captures the relation between the state-level and the national-level threshold to enter the top 1%. For example, in 2018, the threshold to enter the top 1% in Acre (AC) is 61% of the national threshold. The population ratio captures how much the state is represented in the top 1% compared to its population share. For example, Acre (AC) has 42% of the share in Brazil's top 1% compared to what we could expect if its share in this group were proportional to its population share. The GDP ratio captures how much the state is represented in the top 1% compared to its GDP. Acre (AC) has 64% of the share in Brazil's top 1% compared to what we could expect if its share in this group were proportional to its GDP share.

Figure 1.9: Between and within-state inequality decomposition in Brazil, 2006-2019



Source: Authors' computations combining surveys, tax data and national accounts.

1.4.3 Comparison with USA

A comparison with the USA is natural. Brazil and the US are both continental-size countries with large populations and very high inequality levels. Besides, the two follow a federal system, which gives a logical subnational unit to analyze. There are also differences. A notable one is the average NNI, which is 3.5 times higher in the US than in Brazil. Nevertheless, this section is primarily interested in comparing the income distribution within the countries. As such, absolute values are less relevant for our purposes. For the comparison, we use the US state-level income distribution estimations from Sommeiller and Price (2018), which are available in the World Inequality Database.

First, we notice that the disparities in average income in the US are a little less pronounced than in Brazil. In 2018, the average GDP was two times larger in the richest US state, Massachusetts, than the poorest, Mississippi. In Brazil, the ratio was close to three and a half¹⁴. As in Brazil, the capital, DC, has an exceptionally high average income, \$160,000 US dollars, more than three times the country average of \$50,000 US dollars.

Before we dig into the comparison of the within-state inequality levels, we should make a few remarks. First, the US state-level series are available only for the top 10% and top 1% shares and not the entire income distribution. Second, they use the Fiscal Income concept, whereas we use the Net National Income for the Brazilian series. As previously discussed, the National Income is a more extensive measure. Nevertheless, we believe this point should not affect the comparison of the relative difference in within-state inequality. Finally, the US

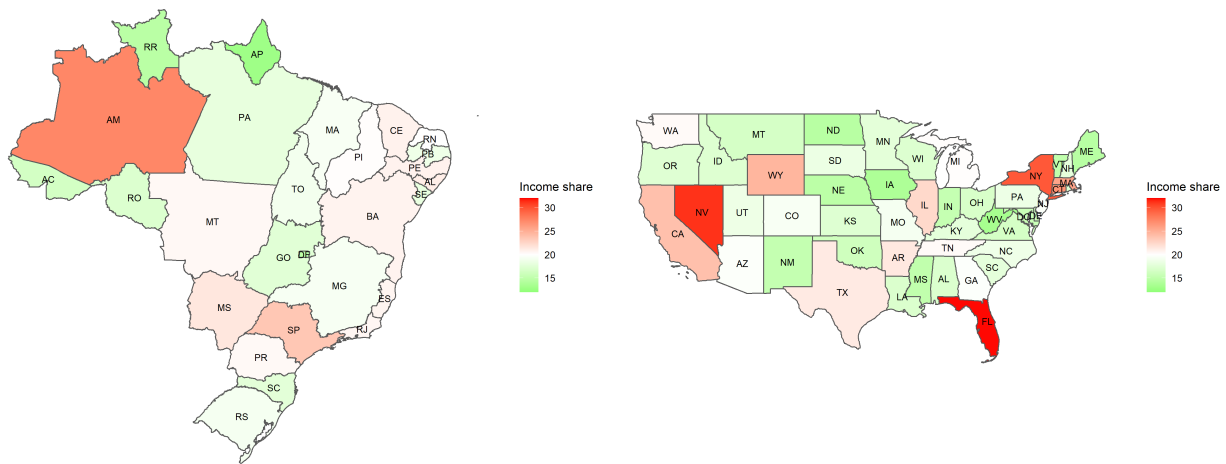
¹⁴Sommeiller and Price (2018) do not compute the state-level average NNI. Since we are interested in the relative dispersion, using GDP should give a satisfactory approximation.

series use an equal-split concept, which equally divides the income among spouses. So for comparability, this section presents the results for Brazil using the equal-split definition. As expected, top shares with equal split are slightly lower than the previous results, but it does not change the overall picture of the state-level income distribution in Brazil.

Figure 1.10 shows the top 1% share in each country. First, the overall level is similar in both countries. In Brazil, the median top 1% income share is 19.3%, while in the US, it is 17.8%. However, there is more dispersion across states in the US than in Brazil. The US has five states with income shares higher than 28% - Florida, Nevada, New York, Connecticut and Massachusetts. Brazil only has one, Amazonas. On the other end, Brazil has only three states with shares below 16%, while the US has ten. The story is similar if we look to the top 10% income shares. Brazil states have a slightly higher median than the US ones, 50.5% compared to 46.5%. We remember, however, that we should analyze absolute differences with caution since the numbers do not use the same income concept. Despite this remark, one point is clear: within-state income distributions are more dispersed in the US. In Brazil, the state-level top 10% shares are between 45% and 57%, while they go from 38% to 62% in the US. Florida, Nevada, New York, and Connecticut stand out again with top 10% income shares above 55%. In Brazil, Amazonas is the only one to pass this threshold. However, in line with the lower dispersion, two-thirds of Brazilian states are above 50%, while less than one in four among US states.

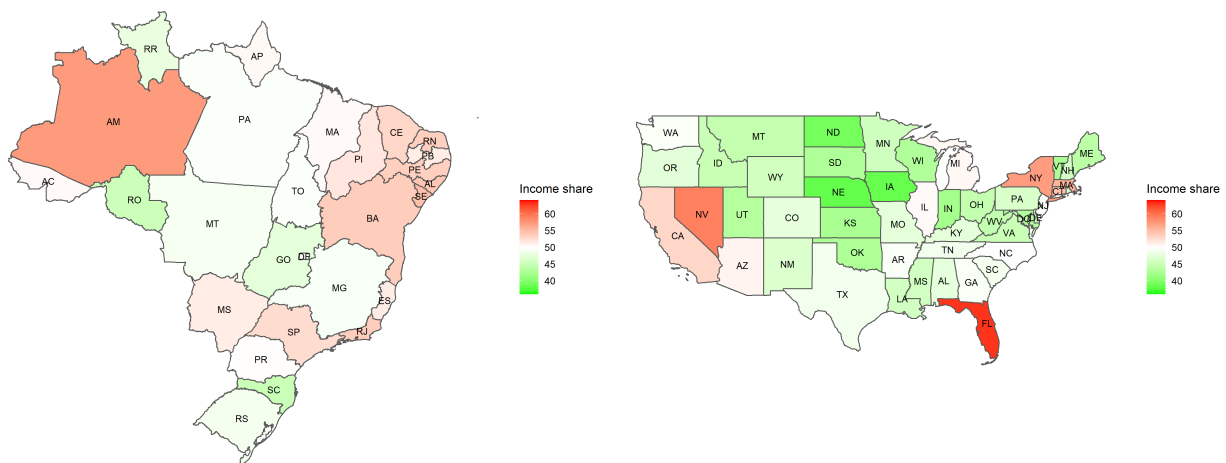
As mentioned, the two countries have a federal system. The extension of subnational autonomy, however, is not the same. States have more autonomy in the US than in Brazil. For instance, fiscally, US states can set income taxes, whereas Brazilian states cannot. The greater independence reflects in higher relevance of the subnational entities in the total tax revenue. Comparing Brazil's and the US's official figures for 2018 (Receita Federal 2020, Mayo et al. 2020), we see that local and state governments corresponded to 36% of tax revenue in the US, while only 31% in Brazil. Besides, the composition of these revenues is as crucial as the share. In the US, personal income taxes are 24% of subnational governments' tax revenue, property taxes 31%, and sales and gross receipts taxes 35%. There is no state-level income tax in Brazil, and sales and gross receipts taxes correspond to almost three-quarters of local and state governments tax revenues. As such, Brazil subnational governments have less room to impact inequality through tax policy. This difference may partially explain the higher dispersion of inequality levels across US states compared to Brazil. However, the topic deserves further investigation.

Figure 1.10: Top 1% income share: Brazil and US, 2018



Source: World Inequality Database and authors' computations combining surveys, tax data and national accounts. We restricted the US map to the continental territory for easier visualization.

Figure 1.11: Top 10% income share: Brazil and US, 2018



Source: World Inequality Database and authors' computations combining surveys, tax data and national accounts. We restricted the US map to the continental territory for easier visualization.

2 Inheritance and gift taxation

The point of departure for Part 2 is the results in Part 1 showing the differences in income distribution within Brazilian states. In this sense, the second part is a complement to the first. Various factors might explain these differences. However, we cannot cover them all. So we focus on one specific question: what is the potential of the inheritance and gift tax to affect state-level income distribution? The inheritance and gift tax is a plausible choice for two reasons. First, it is the only tax on total wealth in Brazil. Second, it is a state-level tax. To answer the question, we analyze a reform in Pernambuco using microdata on transfers. In doing so, we make two main contributions. First, we measure the behavioural response to the tax. Second, the results combining the micro estimations with stylized facts have relevant policy implications both from a revenue and a distributive perspective.

2.1 Institutional background

2.1.1 Inheritance and gift taxation in Brazil

Brazil's current inheritance and gift tax, called *Imposto sobre Transmissão Causa Mortis e Doação de quaisquer Bens ou Direitos* (ITCMD), was introduced by the 1988 Constitution. The text established that this tax is a state-level responsibility, meaning that the states set the tax schedule and receive its revenues. The only limitation is a national ceiling on the top tax rate. The Federal Senate, which has the attribution to fix the ceiling, set it at 8% in 1992.

Indeed, there is some variation in the tax across states and years. Figure 2.1 shows the average top statutory tax rate for inheritances and the number of states with a progressive tax according to transfer size¹. The average was 4.6% in 1989. It remained stable over time, before an increase of over one percentage point in 2016. In 2020, it was close to 6%. The number of states adopting progressive taxes also evolved. It went from 6 back in the tax implementation to 17 in 2020, mainly due to an increase in 2016. The evolution for gifts is roughly equal but with an average top tax rate around one percentage point below the one for inheritances throughout the period. The numerous tax changes in 2016 were not a coincidence. They relate to the electoral cycle and Brazil's economic crisis between 2015 and

¹Some states also defined progressive taxes depending on the kinship. In these cases, we considered the closest kinship degree.

2017. Newly elected state governments enter office in 2015 under intense pressure to recover revenues, and they implemented tax reforms in 2016.

In line with the modest statutory tax rates, the inheritance and gift tax revenues are relatively low. Figure 2.2 shows the ITCMD's average share among state-level tax revenues between 2015 and 2020^{2,3}. The participation is below 1% in seventeen states. States from the North and the Northeast form the majority of this group. Indeed, in these two regions, Ceará (CE) is the only exception, with an average of 2%. Considering the entire country, Rio de Janeiro (RJ) has the highest share, 3%. Relative to Brazil's total tax revenue, the inheritance and gift tax revenue corresponded only to 0.32% in 2018⁴. Among OECD countries, the average is a little above 0.5% (OECD 2021). This comparison puts Brazil below but not entirely out of line with international peers.

Despite the relatively low numbers, the weak tax collection may represent an opportunity. The federal and state governments face increasing pressure to find new revenue sources to reduce their deficits and finance expenses. As an illustration, combining all government levels, the primary deficit reached 12% of GDP in 2020 amid the expenses related to the COVID crisis, and the federal government projects continual deficits in the following years. In addition to the budgetary side, taxes on intergenerational transfer may have long-run effects in reducing inequalities. As such, we can attribute them a higher relevance than what their revenue share suggests.

2.1.2 Inheritance and gift taxation in Pernambuco

Pernambuco has 9.6 million inhabitants, the 7th largest population among Brazilian states. Economically, it has the 10th largest GDP and an average income of around 60% the national average, the highest in the Northeast region. In addition, its income distribution is slightly more concentrated than the majority of other states. In 2018, the top 1% income share was 24%, and the top 10% was 56%. The bottom 50% only received 8% of the total.

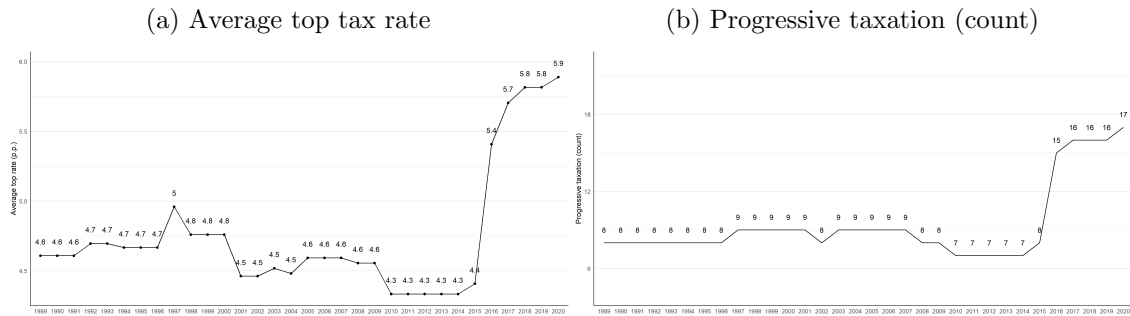
Historically, Pernambuco changed its tax on inheritance and gifts a few times over the past decades. Between 1966 and 1982, Pernambuco had a flat tax with a rate of 2%. They

²In addition to the ITCMD, the states establish the *Imposto sobre Circulação de Mercadorias e Serviços* (ICMS), a tax on sales and services that is their primary revenue source, and the *Imposto sobre a Propriedade de Veículos Automotores*, a tax on vehicles. States can also define social contributions from their public servants, but we do not include this item in the computation.

³Carvalho Junior (2018) compiled the average participation of the ITCMD for the period between 2001 and 2015.

⁴The total revenue used to calculate this share includes social contributions, which correspond to approximately 35% of the sum. Hence, the inheritance and gift tax revenue is about 0.5% of total tax revenue excluding social contributions.

Figure 2.1: Inheritance tax evolution in Brazil, 1989-2020



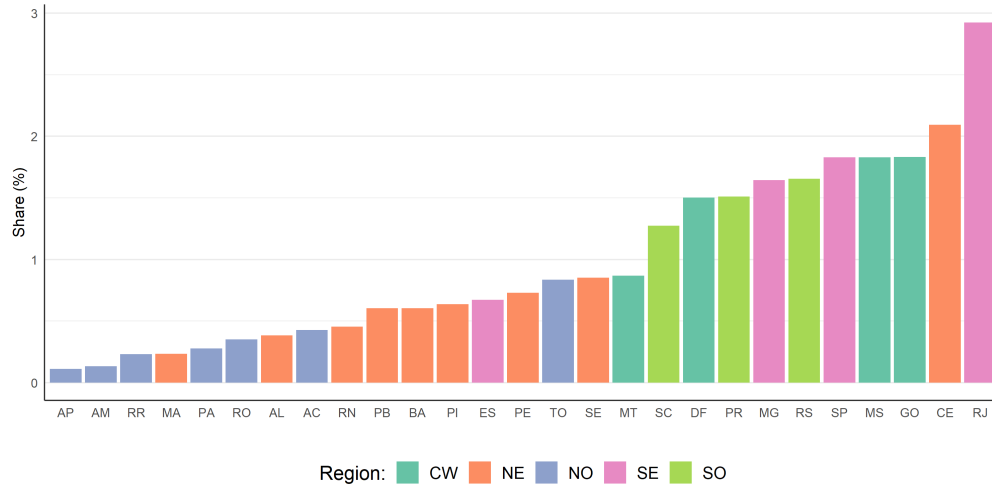
Source: Authors' elaboration based on state laws. *Interpretation:* In 2020 the average statutory top rate on inheritance transfers among Brazilian states was 5.9%, and seventeen of them had progressive schedules.

raised the tax to 4% in 1983. This schedule remained until 1997, when the tax became progressive, with rates varying from 4% to 8%. They reversed the progressive schedule in 2001, implementing a flat rate of 5% for both gifts and inheritance. In 2008 there was the last change before the reform we analyze. They reduced the rate for gifts to 2%. Unfortunately, we cannot analyze any previous reforms quantitatively because the transfer registers are not digitally available before 2010. In political terms, we can have a taste of the motivations behind the tax modifications. The first reform after Brazil's re-democratization, the one that implemented a progressive tax schedule in 1997, was done in the government of Miguel Arraes, a notorious left-wing politician. A government assembling a coalition between the centre and the right did the reversal in 2001. The reduction in gift tax rates in 2008 was made by a centre-left government, which at first may seem contradictory. However, the years before the reform were marked by a great economic boom, making the fiscal situation comfortable at the time.

The first step of the reform we analyze was on September 21 2015, when Pernambuco's government sent the reform proposal to the state congress. The bill included changes in all state-level taxes and not only the ITCMD. The objective was to increase revenues to compensate for losses caused by a national economic recession⁵. The state parliament quickly voted and approved the law on September 31. It was not a coincidence that Pernambuco's government chose to send the reform three months before the end of the year. Brazil's Constitution establishes that, after the law approval, governments should wait 90 days or the following year, whichever is longer, to implement a tax rate hike. Hence, the new inheritance

⁵Brazil's GDP decreased by 3.5% in 2015 and 3.3% in 2016.

Figure 2.2: Average share of inheritance and gift tax in state-level tax revenues, 2015-2020



Source: Authors' elaboration based on state fiscal reports. *Interpretation:* Between 2015 and 2020, inheritance and gift tax revenue represented on average 3% of Rio de Janeiro's government tax revenue.

and gift tax schedule was only valid on January 1 2016.

Table 2.1 presents the tax schedule before and after the reform. Before the reform, the tax on gifts was 2% and on inheritances 5%, both with an exemption threshold of R\$7,400⁶. The reform established a unified schedule for gifts and inheritances. The exemption threshold rose to R\$50,000. Between R\$50,000 and R\$200,000, the marginal tax was 2%; between R\$200,000 and R\$300,000, 4%; between R\$300,000 and R\$400,000, 6%; and above R\$400,000, 8%. Hence, the reform did not affect gifts between R\$50,000 and R\$200,000, increasing the tax for higher values. For inheritances, the reform increased marginal taxes for transfers above R\$300,000 and reduced them otherwise⁷.

The tax base did not change after the reform. It includes all assets, with valuations at market prices, except for closed companies, which valuations are at book value. The law exempts one inherited residential property if the receiver does not own one already. In addition, the brackets are annually adjusted for inflation, making the brackets for 2017, 2018, 2019 and 2020 slightly higher than for 2016.

A final comment concerns modifications of the tax after 2015. There were no changes in the law. However, in November 2017, the government implemented a debt renegotiation program for unpaid taxes on gift transfers. Debtors had until March 2018 to settle unpaid

⁶The 2008 law established an exemption threshold of 5k with a yearly correction by inflation.

⁷To give an international reference on the magnitudes mentioned, the Brazilian Reais to US Dollar (Euros) market exchange rate was 0.252 (0.231) on January 1 2016, and the World Bank PPP rate for 2016 was 0.46.

Table 2.1: Tax schedule before and after the reform

(a) Inheritance taxation			(b) Gift taxation		
Thresholds	Before	After	Thresholds	Before	After
5000	Exempted	Exempted	5000	Exempted	Exempted
50000			50000		
200000		2	200000		2
300000		4	300000		4
400000		6	400000		6
>400000		8	>400000		8

Source: Authors' elaboration based on Pernambuco's laws. *Interpretation:* A inheritance transfer of 250k would face a marginal tax of 2% before the reform and 4% after.

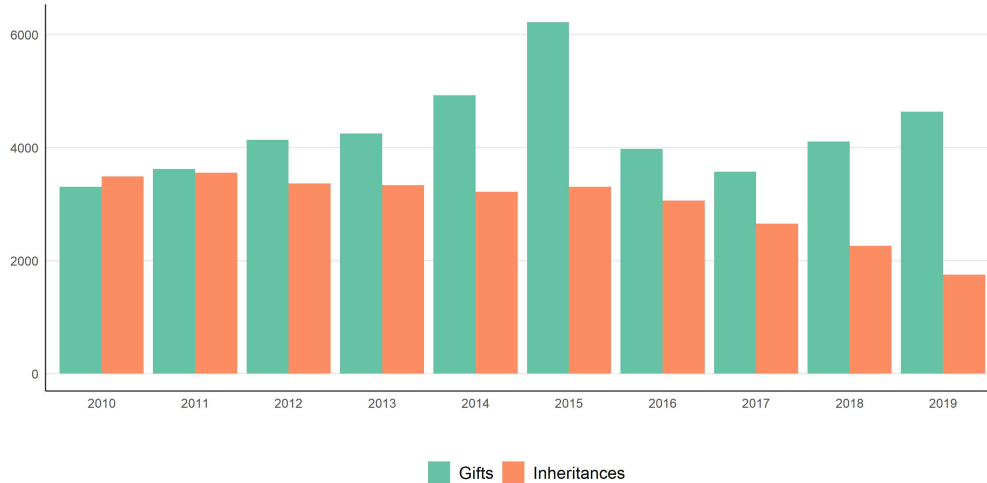
taxes with a discount. This discount included writing off fines and a 50% reduction in marginal rates for payments in one lump sum and 25% for payments in instalments. There is no reason to believe that individuals anticipated this debt renegotiation program, but we discuss the implications of this point to our results in the following sections.

2.2 Data

We have the universe of gift and inheritance transfers registered by Pernambuco's Secretary of the Treasury since 2010, the year when they implemented a digital system. The dataset records the transfer from the perspective of the sender. It contains the transfer and asset type, the amount, the transfer date, the number of receivers, the tax liability, and payment status. There are 72791 observations between 2010 and 2019, being 42781 gifts and 30010 inheritances. Figure 2.3 shows the yearly evolution. The number of inheritance transfers remained stable at around 3,200 until 2016, then it declines slowly every year. For gift transfers, the number increases from 3,500 in 2010 to a pick of 6,200 in 2015, and then it fluctuates around 4,000.

Over the analyzed period, 2010 to 2019, the total amount transferred was 61.8 billion reais, 39.7 billion in gifts and 22.1 billion in inheritances. On average, the yearly flow is equal to 4.5% of Pernambuco's GDP. Table 2.4 presents the total amount transferred each year divided by asset type. We grouped the assets into six categories: residential properties, non-residential properties, money, vehicles, and *others*. We include houses and apartments in the residential properties category, and in the non-residential category, we group farms, undeveloped land, buildings, and commercial properties. The item named money has both cash and bank account deposits. Vehicles account for all types of vehicles such as cars, boats

Figure 2.3: Count of inheritance and gift transfers, 2010-2019



Source: Authors' elaboration with data from Pernambuco's Secretary of the Treasury.

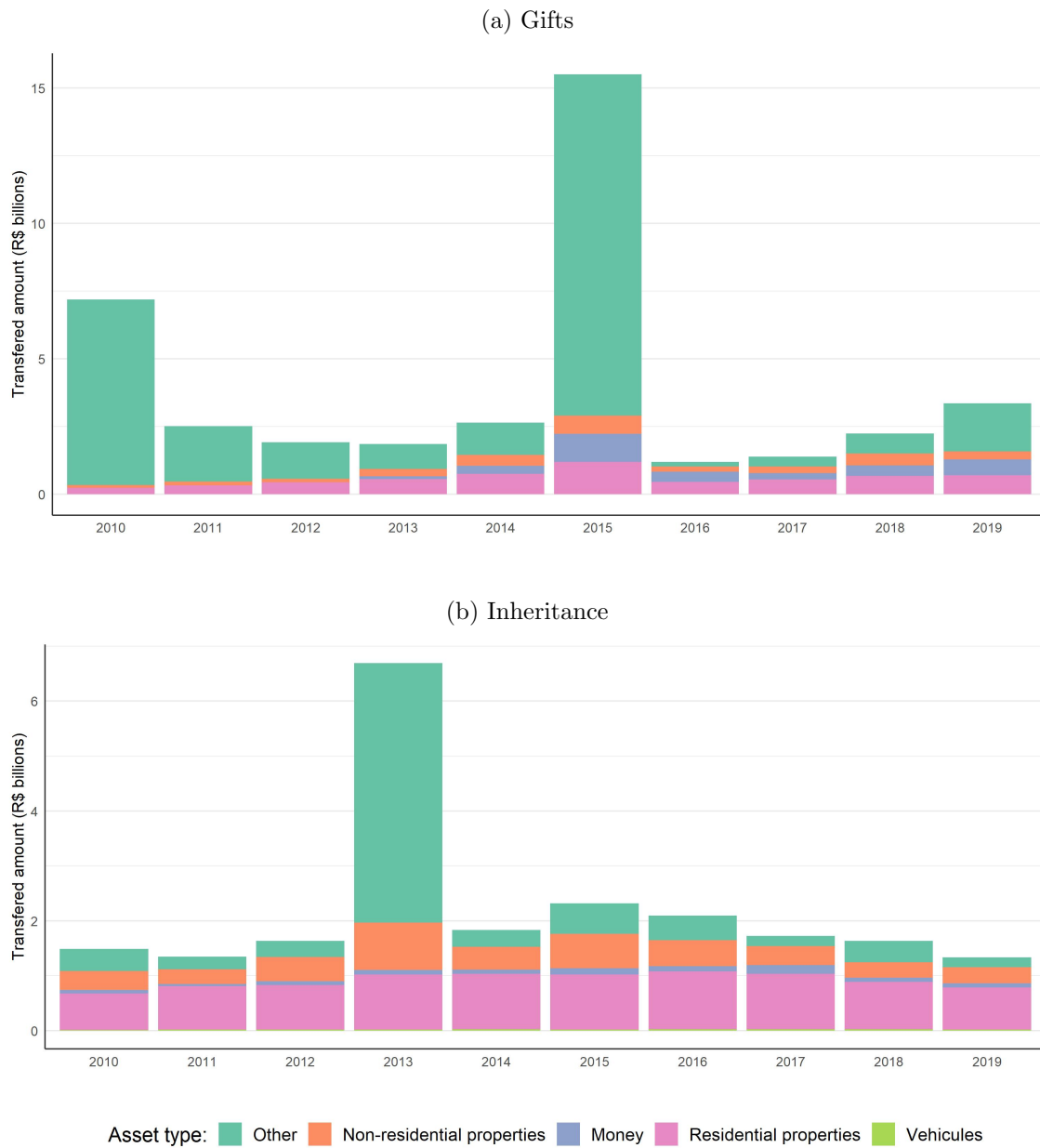
and aeroplanes. *Others* incorporates all remaining types of assets. Unfortunately, we do not have a breakdown for this last category. We can infer it includes assets such as stocks, investment funds participations, and other forms of financial wealth that do not appear in previous groups.

For gifts, two years stand out: 2010 and 2015. The pick in 2015 coincides with the approval of the reform analyzed. For inheritances, 2013 was an outlier due to two exceptionally high estates totalling five billion. *Others* drives these three atypical cases. In addition, we can see that residential properties usually correspond to the largest share of inheritances, more than half in most years. Non-residential properties come second. Money is a small share, and *vehicles* is negligible. For gifts, residential properties come after *others*, followed by non-residential properties and money.

2.3 Methodology

The empirical analysis has two fronts. One examines the increase in the number of transfers between the reform approval and its implementation. The other investigates the responses once the tax was in place. This section explains the two strategies.

Figure 2.4: Amount of inheritance and gift transfers, 2010-2019



Source: Authors' elaboration with data from Pernambuco's Secretary of the Treasury.

2.3.1 Timing response

The reform created a time discontinuity. Transfers before January 1 2016, were much less taxed than from that day on. The difference was as high as six percentage points for transfers above R\$400,000. From the reform approval to its implementation, individuals had three months to transfer under the lower taxes. This transition gave strong incentives to move up transfers. It is important to quantify this response to understand who benefited the most from the transition time.

We use a differences-in-differences strategy taking advantage that the reform did not change the tax rate for gifts between R\$50,000 and R\$200,000. The intuition is that there were no incentives to move up transfers in this range. Hence, we can use the trend of this bracket as a counterfactual to the others. The assumption is that the number of transfers in the brackets would have followed a parallel trend without the reform. Importantly, we have reasons to believe the control group is a relevant counterfactual. For instance, improvements in enforcement or changes in the macroeconomic situation, two factors determining the number of transfers, probably equally affect all groups. In the following section, we also present empirical evidence in favour of the assumption.

We estimate the following equation:

$$c_{bt} = \gamma_b + TransitionPeriod_t * \gamma_b + AfterReform_t * \gamma_b + \epsilon_{bt} \quad (2.1)$$

The subscript b and t refer, respectively, to the brackets and the weeks. The dependent variable, c_{bt} , is the log number of transfers in bracket g at time t . The variable γ_b indicates a bracket-specific fixed effect. $TransitionPeriod_t$ is a dummy variable equal to one in the weeks between November 1 and December 31, 2016, and zero otherwise. $AfterReform_t$ is a dummy variable equal to one from January 1 2016 onwards, and zero otherwise. We limit the dataset to the weeks from January 1 2011 to December 31 2016. We decided to exclude the years after 2016 to avoid the effect of the debt renegotiation program in November 2017. Finally, to ensure that slightly different pre-trends do not affect the estimation, we also present results including group-specific linear trends.

The main shortcoming with this strategy is that the treatment assignment is endogenous to movements across brackets cut-offs. In other words, the reform may affect the size of the transfers occurring in the transaction period. We adopt two strategies to avoid this problem. The first is to reduce the range of the control group to R\$50,000-R\$100,000. Increases in transfer amount due to the reform are unlikely to be large enough to change the tax bracket

of transfers in this range. So this restriction strengthens the assumption that the reform does not affect the number of transfers in the control group. In the second strategy, we do the opposite, enlarging the control group with gifts up to R\$300,000. The idea is to englobe the transfers that passed to higher groups due to the amount-increase response. However, in doing so, we also include a bracket that is affected by the tax. So the count of the control group during the transition period is probably overestimated. Concretely, it means that in this specification, the results are a lower bound.

2.3.2 Intensive margin responses

We turn to the analysis of the responses once the tax is in place. The strategy exploits the discontinuities in the tax schedule. More precisely, the kinks at R\$50,000, R\$200,000, R\$300,000 and R\$400,000. If there is a response to the changes in the marginal tax rates, we expect to observe bunching at these points. The standard bunching analysis uses the observed distribution to construct a counterfactual. This strategy is particularly complicated in our case because individuals have a strong tendency to pick "rounder" numbers as the transfer value. Hence, we could observe an excess mass at the kink points because these numbers are focal points and not due to a response to the tax. To overcome this problem, we use the distributions before the tax implementation as a counterfactual. The advantage is that the distribution before the reform accounts for focal points. The main assumption is that, absent the reform, the distribution would not have changed.

Concretely, the strategy compares the normalized excess mass of the distribution before and after the reform. The normalized excess mass is the difference between the density before and after the reform divided by the density before the reform. In other words, it is simply the percentual variation between the two periods. A value of zero means that the mass is the same before and after the reform at the point. A value of 0.5 means that the mass is 50% higher after the reform, and -0.5 means it is 50% lower.

For gifts, we restraint the analysis to 2016 to avoid considering the debt renegotiation program at the end of 2017, and we group the transfers in bins of R\$10,000. We can analyze inheritances up to 2019 because the debt renegotiation did not directly concerned them. We study each year separately because the tax brackets grew with inflation as stipulated by the law. The advantage of these changes is that we have slightly different points to test each year. To account closer for kinks that are not multiple of R\$10,000, we group the transfers in bins of R\$5,000. Finally, both for gifts and inheritances, we restricted the range to R\$20,000-R\$700,000, and the pre-reform distribution comes from 2011 to 2015. In addition,

we excluded tax-exempted transfers above R\$50,000 to consider only the transfers affected by the tax.

A final remark concerns the interpretation of the results. It is more likely to observe bunching when individuals can manipulate the variable (Kleven 2016). So, in our case, bunching is much more likely for gifts, which can be easily tailored, than for inheritances. Individuals can adjust the inheritance amount through gifts or modifying consumption and savings. However, the day of death remains highly uncertain, which complicates any planning. In addition to this last point, we should stress that our strategy gives local estimations, so the results only concern the elasticities around the kink points. It means we cannot interpret zero excess mass at the kinks as a complete lack of response to the tax. The higher kink stays below R\$500,000, which is high for most but still low for wealthy individuals. We should keep these two points in mind when interpreting the results.

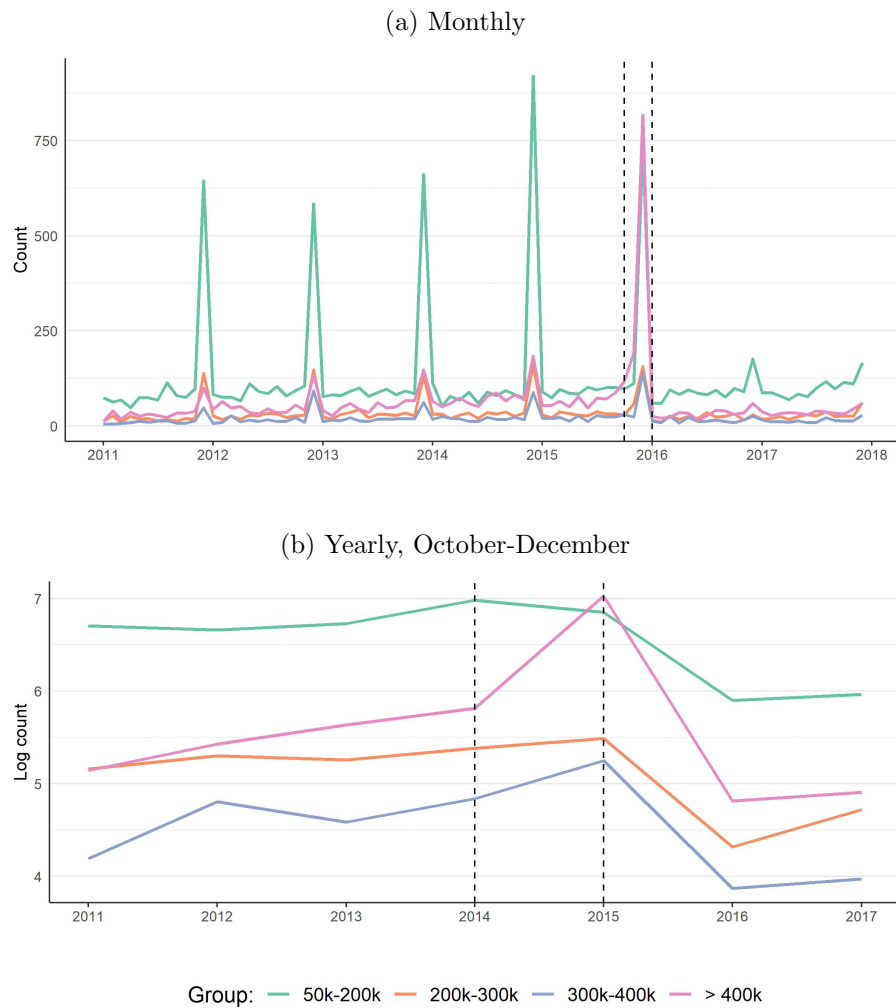
2.4 Results

2.4.1 Timing responses

We start by presenting visual evidence in favour of the parallel trend assumption and the timing response. Panel A of Figure 2.5 shows the number of gifts inside each bracket monthly. The vertical lines show the period between the reform approval and its implementation. Every year there is a spike in December in all brackets, but there is an unusually high increase in the transition period for transfers above R\$400,000, indicating a timing response. Panel B sums the gifts occurring in the three last months of each year. The picture shows that the groups follow a similar trend before the spike in 2015, and they return to a parallel path with a lower level in 2016. The overall evolution reinforces the assumption that the groups would follow a parallel trend without the reform.

To quantify the effect, we turn to the regressions in Table ???. The first column shows the basic specification. The regression confirms that the timing effect is considerable, with the weekly average number of transfers increasing by 1.162 log points in the highest bracket during the transaction period. In the bracket R\$300,000-R\$400,000, the increase was of 0.52 log points, and in the bracket R\$200,000-R\$300,000, the point estimate is 0.21 log points, but it is not statistically different from zero. After the reform implementation, we see a reduction in the number of transfers. The weekly average reduction during the year after the reform is 44% (-0.441 log points) for the transfers above R\$400,000 and 24% (-0.237 log points) for the R\$300,000-R\$400,000 interval. This reduction indicates that a part of the effect was due to a

Figure 2.5: Count of gift transfers, 2011-2016



Source: Authors' elaboration using data from Pernambuco's Secretary of the Treasury.

short-run change in the transfer timing, which is worth noticing because it suggests that the revenue loss due to the timing adjustment might dissipate quickly. Column two present the results with the group-specific linear trends. Reassuringly, the coefficients barely change. The point estimate for transfer above R\$400,000 is 1.189; for the bracket R\$300,000-R\$400,000, 0.604; and for the bracket R\$200,000-R\$300,000, 0.220.

Column three changes the control group to transfers between R\$50,000 and R\$100,000. The effect on the transaction period for the higher bracket slightly increases to 1.247 log points. The coefficient for the post period becomes -0.160, but it is no longer statistically significant. The fourth column presents the results with the enlarged control group, R\$50,000 to R\$300,000. This approach is overly cautious because it includes transfers between R\$200,000

Table 2.2: Timing response

	Log number of transfers				
	(1)	(2)	(3)	(4)	(5)
<i>TransitionPeriod_t</i> x Bracket 200-300	0.210 (0.262)	0.220 (0.263)			
<i>TransitionPeriod_t</i> x Bracket 300-400	0.520** (0.262)	0.604** (0.263)			
<i>TransitionPeriod_t</i> x Bracket 400	1.162*** (0.262)	1.189*** (0.262)	1.247*** (0.264)	1.095*** (0.238)	0.806*** (0.272)
<i>TransitionPeriod_t</i> x Bracket 1000					1.588*** (0.272)
<i>AfterReform_t</i> x Bracket 200-300	-0.155 (0.108)	-0.160 (0.105)			
<i>AfterReform_t</i> x Bracket 300-400	-0.237** (0.109)	-0.234** (0.106)			
<i>AfterReform_t</i> x Bracket 400	-0.441*** (0.108)	-0.442*** (0.105)	-0.135 (0.109)	-0.401*** (0.098)	-0.408*** (0.113)
<i>AfterReform_t</i> x Bracket 1000					-0.469*** (0.117)
Control group	50-200	50-200	50-100	50-300	50-200
Linear trend	No	Yes	No	No	No
Observations	1,422	1,422	725	725	1,041
R ²	0.549	0.576	0.179	0.486	0.589

Note: The table present the estimations from equation 2.1. The dependent variable is the weekly log number of transfers. The variables named Bracket are dummies indicating the brackets. The omitted category is the control group. *TransitionPeriod_t* a dummy variable equal to one in the weeks between 1 November and 31 December, 2016, and zero otherwise. *AfterReform_t* is a dummy variable equal to one in the weeks after 1 January 2016 and zero otherwise. The first column shows the basic results. The second column adds group-specific linear trends to equation 2.1. The third column adds group-specific linear trends to equation 2.1. The fourth and fifth columns modify the control group. The sixth column splits Bracket 400 in two, one for transfers up to R\$1,000,000 and another above it. We still name the first Bracket 400 for simplicity, but strictly we should read it as Bracket 400-1000. We name the second Bracket 1000.

and R\$300,000, which were affected by the reform. As expected, the point estimate for the transition period is slightly lower in this case, 1.095 log points, but still close to the others. The after reform coefficient is in line with previous results, -0.401. The last column subdivides the transfers above R\$400,000 into two subgroups. The first one, named Bracket 400, accounts for the transfers from R\$400,000 up to R\$1,000,000. Bracket 1000 has transfers above R\$1,000,000. Their coefficients for the transition period are 0.806 and 1.588 log points, respectively, and for the reversal, -0.408 and -0.469. This result indicates that the timing effect is more substantial for transfers with larger values.

We can use the estimations to calculate the extensive margin elasticity of the timing response. In other words, what is the percentual change in the number of transfers during the transition period caused by a one per cent change in the tax rate: $\epsilon_s = \frac{\beta_t}{1+t} \frac{\Delta t}{\Delta t}$. The tax changed from 0.02 to 0.08 for the higher group, meaning $\Delta t = 0.06$. Then, using the coefficient obtained in column one, we get an elasticity equal to 19.75. The large effect indicates that individuals strongly use the transition period to avoid higher taxes in the future.

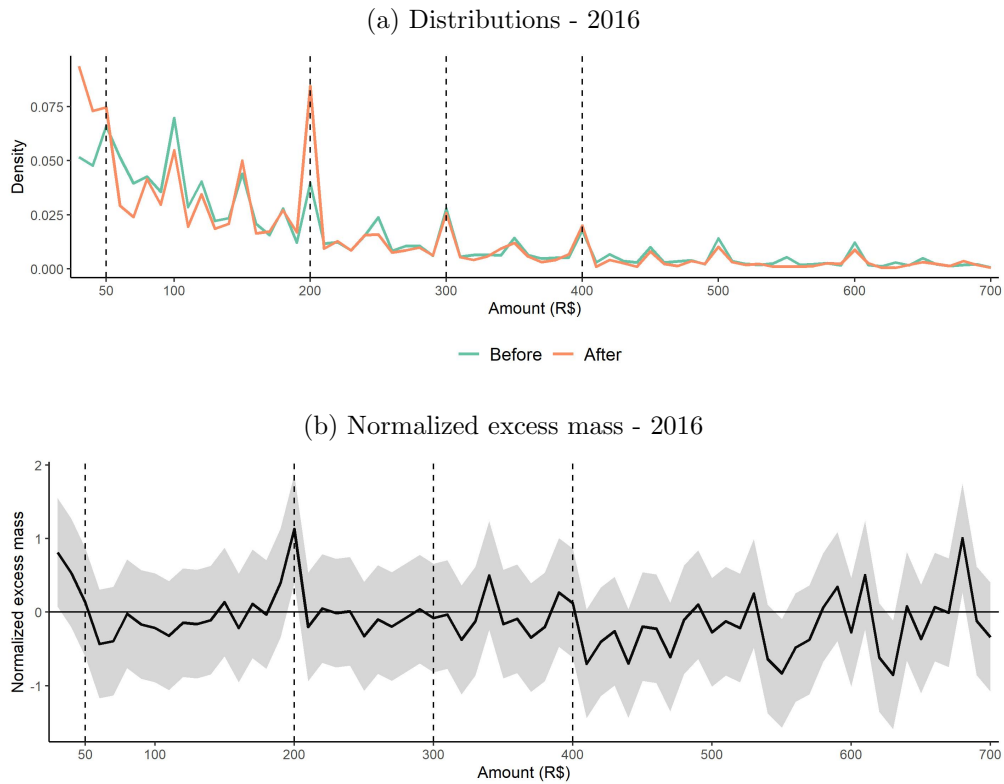
2.4.2 Intensive margin response

To understand the responses to the tax once it is in place, we analyze the intensive margin response around the four kinks of the tax schedule. Panel A of Figure 2.6 shows the distributions of inheritance amounts before and after the reform. Overall the pre- and post-reform distributions are very similar. We also confirm they are not smooth, presenting spikes at multiples of R\$50,000 and R\$100,000. This characteristic reinforces the importance of using the curve before the reform as the counterfactual. Analyzing the kink values, we see that the after-reform distribution has a higher mass than the before-reform distribution at R\$50,000 and R\$200,000. To evaluate the statistical significance, we turn to panel B that shows the normalized excess mass with a 95% confidence interval. Among the kinks, we see that R\$200,000 is the only one where the normalized excess mass is statistically different from zero, with a point coefficient of 1.14. We can use this value to retrieve the intensive margin elasticity at this point, which is equal to 2.793⁸.

Figure 2.7 shows the same graphs for inheritances. In this case, we have one figure for

⁸The bunching mass is given by $B = \int_{z^*}^{z^*+\delta z^*} h_0(z) dz \approx h_0(z^*) \delta z^*$, where $h_0(z)$ is probability density function of the gift transfers distribution, z^* is the kink point and $z^* + \delta z^*$ the location of the marginal buncher. Then, we use the equation $e = \frac{\delta z^*/z^*}{\delta t/1-t_0}$ to relate the response of the marginal buncher to the change in the marginal tax rate. The variable t_0 indicates the tax before the kink, 0.02, and δt the change, also 0.2. Finally, we use the bandwidth, 10000, and the normalized excess mass, 1.14, to get δz^* . The final equation is $e = \frac{10000 \cdot 1.14}{200000} / \frac{0.02}{1-0.02}$. For a complete discussion on recovering elasticities from bunching estimates, see Kleven (2016).

Figure 2.6: Intensive margin response, 2016: Gifts



Source: Authors' elaboration using data from Pernambuco's Secretary of the Treasury.

each year after the reform to account for the correction of bracket cut-offs due to inflation. Among all the years, the only kink-point where the excess mass is statistically higher than 0 is on the highest bracket in 2019. For all others, there is no difference. It is worth noticing that the analysis encompasses four kinks for each of the four years, totalling sixteen points. Given the high number of points analyzed and a 95% confidence interval, statistically, we may expect at least one point different from zero by chance. Given that we observe no response in fifteen out of sixteen kinks, including the higher thresholds in 2016, 2017 and 2018, the result suggests no intensive margin response to the inheritance tax in the evaluated region.

As previously discussed, it is hard to adjust the size of inheritances finely, which makes bunching unlikely. The results confirm this observation. Gifts, however, can be easily tailored most times. So it is surprising that we observe bunching just at one kink. Nevertheless, we should interpret the results with caution. First, they provide a local estimation of the response to the tax, which means they do not discard a response at other points nor diffuse responses. Second, they regard the intensive margin. In the case of gifts, it is possible that

the tax also changed the number of transfers declared, and not only their size. Third, we cannot analyze the effect of the tax hike on evasion, which is also a possible response. Despite the previous limitations, overall, the results indicate that the government could increase the tax without behavioural responses curbing revenues once it is in place.

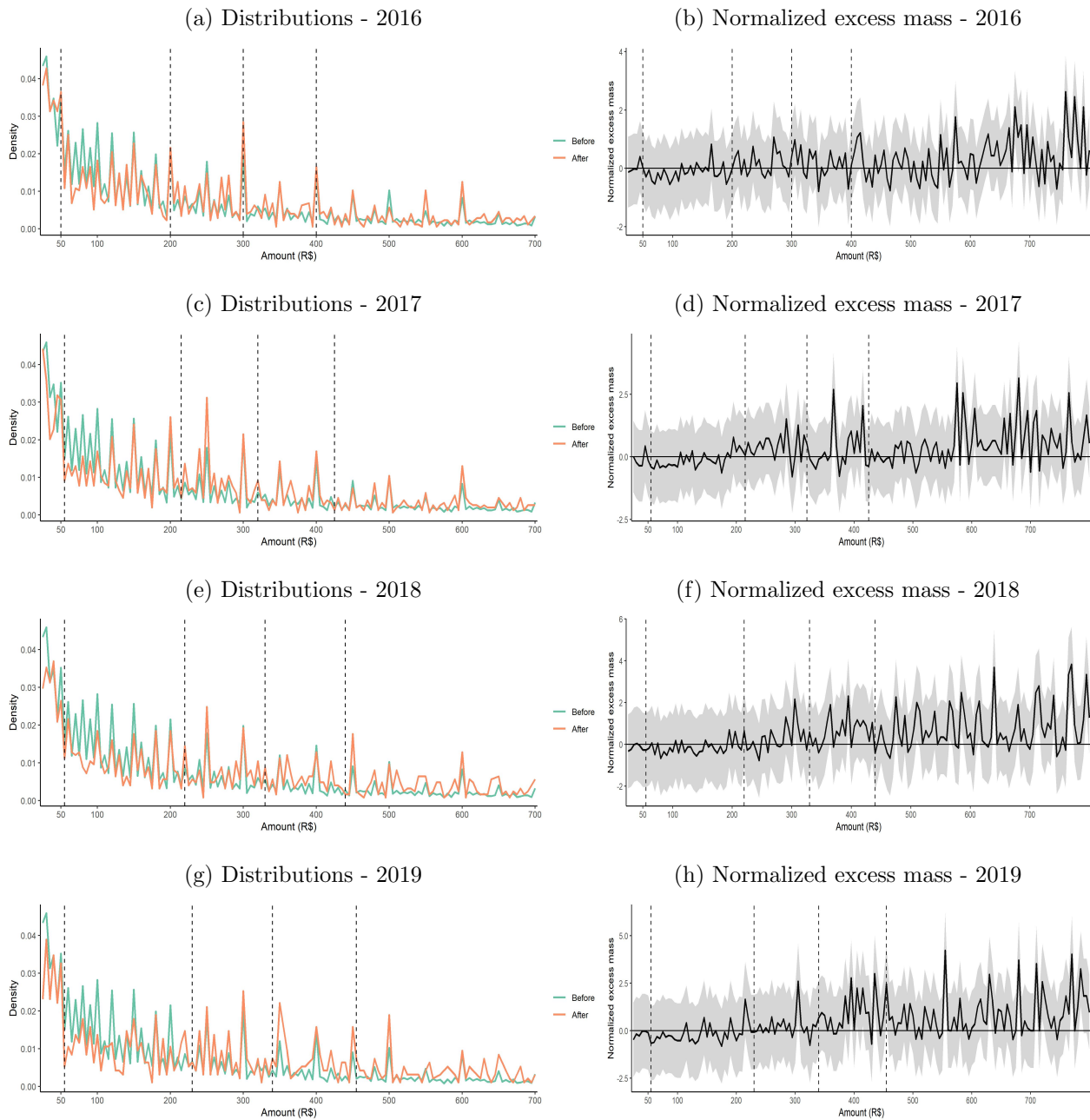
2.5 Tax revenues and income distribution

Inheritance and gift taxes may impact the income distribution in several forms. We list two. First, the tax mainly affects wealthier individuals, raising revenues for redistribution towards poorer ones. Second, it may decrease incentives to accumulate, hence wealth concentration, reducing income inequality in the long run. The first form is especially true in our case. Between 2010 and 2019, 1% of the transfers accounted for half of the total amount transferred, and ten transfers alone accounted for more than 10%.

These numbers contrast with the ones for the revenues. Between 2015 and 2019, the inheritance and gift tax revenue in Pernambuco only represented 1.74% of the total amount transferred (1.78% if we exclude exempted transfers). The value seems relatively low, especially considering that, despite the limitations, our results indicate that the government could increase the tax without significant behavioural responses limiting revenues. The numbers are also low compared to the statutory tax rates implemented in 2016, which relates to the timing response. Undoubtedly, the most critical response occurs during the transition period. Hence, to increase revenues, it is valuable to reduce it as much as possible.

Overall, the case we studied probably reflects the situation in most Brazilian states. As presented in the institutional background section, Pernambuco is the median among Brazilian states regarding inheritance and gift tax participation in state tax revenues. It probably also reflects the case of the ten states that changed the inheritance and gift tax in 2015. Currently, the effective rates and the revenues from inheritance and gift taxation seem too low to significantly impact the state-level income distribution in Brazil. However, the combination of low effective tax rates, high transfer concentration, and weak behaviour response may represent an opportunity to efficiently raise tax revenues and impact income distribution at the state and national levels.

Figure 2.7: Intensive margin response, 2016-2019: Inheritances



Source: Authors' elaboration using data from Pernambuco's Secretary of the Treasury.

Conclusion

Brazil's regional inequality is an extensively studied topic. Its importance comes from the large and persistent differences in development between states and the country high inequality levels. We present a unique view on the topic using new data and methodology to construct state-level income distribution measures. Overall, we find some variation at the regional level, but it is not marked. The Southeast is the region where the income distribution is most concentrated, and the North and the South the least. Besides, there is no significant change during the period analysed, 2006 to 2019. At the state level, in contrast, we see more nuances. Amazonas (AM), Rio de Janeiro (RJ) and São Paulo (RJ) have an exceptionally high share of total income flowing to top earners. In these states, the top 1% share reaches as high as 30%, and the top 10% share is close to 60% in most years. On the other end, we have Amapá (AP), Acre (AC), Rondônia (RO) and Santa Catarina (SC), where the top 1% share usually stays below 20%, and the top 10% close to 50%.

We cannot trace a single factor to explain the differences between the states. In particular, there is no immediate relation between the average income and the income distribution. Nevertheless, we could relate the result to states' idiosyncrasies and economic structure. Moreover, comparing Brazil with the US, we find less dispersion in within-state inequality in Brazil. We suggested the degree of fiscal federalism as one possible explanation for this difference. However, the question needs further investigation.

In connection to the discussion about fiscal federalism, the second part examines Brazil's inheritance and gift tax. This tax is a state-level responsibility, making it a possible candidate to explain the differences in the income distribution between states. To centre the analysis, we focus on one reform in Pernambuco. Using data from all transfers recorded between 2010 and 2019, we find little to no behavioural response once the tax is in place. The most relevant reaction comes from the timing response, with a substantial increase in the number of transfers during the transition period to avoid paying higher taxes in the future. Besides, we document that transfers are extremely concentrated, but the tax revenues are a small fraction of the total amount transferred. Overall, Brazil's inheritance and gift tax seems underexplored as a mechanism to raise revenues and reduce income inequality efficiently.

This research contributes to a larger picture of inequality in Brazil. However, much remains to be done. We point to two promising extensions: enlarging our series to have a longer perspective on the subnational income distribution and constructing a post-tax series

to understand the tax and transfers system's role in state-level income distribution. More generally, investigating the relationship between taxes and income distribution is a large front. Part II made one first step, but there is much more to explore.

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A Appendix

A.1 Survey variables

Table A.1 shows PNAD and PNADC variables that we used. The jobs income includes revenues from the primary, secondary and tertiary jobs. In order to define the nature of the job income, we used the variables of employment status. For workers, we define it as wages, and for the self-employed, as mixed income. In employers case, we divide the income variable between a wage compensation equal to the exemption limit of the personal income tax and capital gains equal to the remaining amount.

In the PNAD, there is not a variable specifically for financial income. We only have a variable that jointly asks for all uncovered sources of income (V1273). To disentangle the different income sources that it might include, we make a simplifying assumption. For values below one minimum wage, we define it as social assistance income. Between one and two minimum wages, we define it as unemployment benefits. For values higher than two minimum wages, we define it as financial income. PNADC have a different question for each one of these incomes. It also includes a question about income from residential leasing. Consequently, we have a better picture of these items after 2015. Finally, to determine the total capital income of an individual, we sum financial income with the capital part of employers' gains.

In other to estimate the social contributions, we use the variables on employment and social security status. Concretely, the rates vary only from 8% to 11%, so what makes the most difference is if the worker contributes to social security. PNAD only has this information for the primary job, so we can only account for contributions from the primary job. Although not ideal, this lack is less problematic as secondary and tertiary jobs tend to be rarer, less paid and more informal than primary ones. PNADC has contribution status for all jobs. Finally, both surveys include questions for pension income.

A.2 Compatibilize national accounts

The state-level national accounts not being as complete as the national ones pose a methodological issue. On the one hand, our results must match the state-level accounts for consistency. On the other hand, the operating surplus plus mixed income (B2 + B3, S1) groups several incomes that we would like to attribute to individuals separately. For example, it is plausible

Table A.1: PNAD and PNADC variables

	PNADC variable	PNAD variable
Job income	V403312, V405012, V405812	V9532, V9982, V1022
Financial income	V5007A2, V5008A2	V1273
Pensions	V5004A2	V1252, V1255, V1258, V1261
Unemployment benefits	V5005A2	V1273
Employment status	V4012, V4043	V4706, V9092
Formality status	V4029, V4048	V9042
Social security status	V4032, V4049, V4057	V9059

to attribute the undistributed profits according to the survey's capital income, but the same is not true for the government's capital incomes.

One possible way to overcome this limitation is to define the state-level value of each subitem grouped in operating surplus plus mixed income in proportion to the state share of this item. For example, we know from the state-level national accounts that Rio de Janeiro (RJ) has roughly 10% of the national operating surplus plus mixed income. Hence, we would assume that Rio de Janeiro has 10% of the national imputed rents, 10% of the national mixed income, 10% of the national government capital income, and all items grouped in operating surplus plus mixed income. Then we can appropriately attribute each income item to individuals within states. This method assumes no variation in the composition of the operating surplus plus mixed income between the states. In practice, it is implausible that there is no such variation. However, we cannot say much about its magnitude. If the magnitude of the variations is small, this approach should be a good approximation. If not, it would distort the estimations.

In the main results, we adopt a different approach. We first attribute and match the items at the national level. Then we rescale the sum so they match the state-level national accounts. This approach is equivalent to initially attribute to the states the capital income shares we observe in the survey. The fundamental assumption is that the survey data capture better the distribution of capital incomes between the states. Concretely, the most significant difference comes from São Paulo (SP). The state concentrates about 32% of Brazil's operating surplus plus mixed income, but it has around 45% of the financial income in the corrected survey. Then, in our approach, the São Paulo inhabitants initially receive 45% of the national incomes that we attribute according to financial income.

We cannot stop at this point because if a state has a relatively larger share in one subitem than its share in operating surplus and mixed income, it must have a relatively lower share in another subitem to compensate and match the aggregate. This adjustment is implicitly what

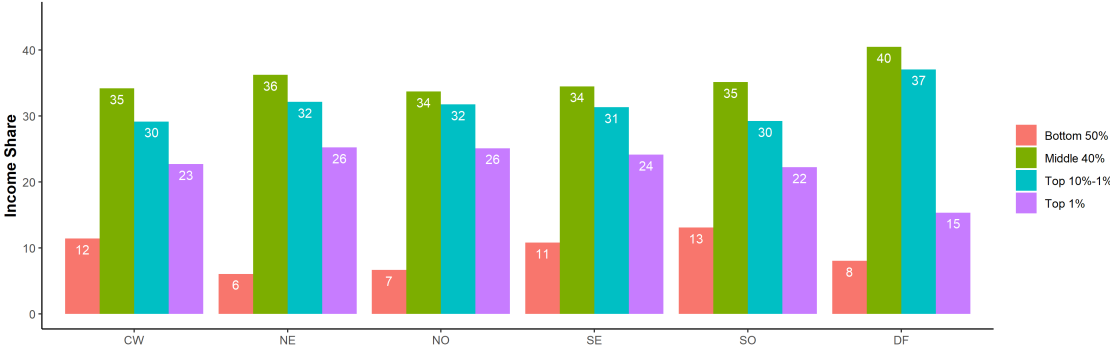
the rescaling does. To avoid that rescaling distorts the distribution of items we would like to distribute proportionally across states and individuals, we treat some elements separately. We assume that the states' property incomes paid, national income from the NPISH sector, and government capital income are proportional to the state's gross income¹. The logic is that we should distribute these incomes proportional to final income within states and between them.

To sum up, in one approach, we assume that there is no variation in the composition of the operating surplus plus mixed-income across the states. On the other approach, we assume that the survey is a better proxy of the actual composition across states. However, it has the disadvantage of being less straightforward. Despite its flaws, we chose the second method as the benchmark because we consider that the corrected survey gives a better approximation than simply assuming the composition of capital incomes is equal in all states. Mixed income, in particular, seems to be well represented as the survey almost entirely captures it vis-à-vis the national accounts.

As a complement, Figure A.1 presents the results using the other method. The main difference comes from the Northeast and the North, in which the top 1% income share increases to 26%. In this alternative approach, financial incomes such as distributed and undistributed profits implicitly have higher participation in the composition of capital incomes in these regions. The reason is that their share in Brazil's operating surplus plus mixed-income is higher than their share of capital incomes in the corrected survey. Mixed income participation decreases to compensate.

¹Ideally, we would like to distribute the mentioned incomes based on the state NNI. However, the states' NNI depends on the rescaling itself because it depends on the operating surplus and mixed income composition since different subitems have different consumptions of fixed capital. In practice, the state gross income share is very close to the NNI share.

Figure A.1: Income distribution of Brazilian regions: Alternative method, 2018



Source: Authors' computations combining surveys, tax data and national accounts. Interpretation: In 2018, the 50% poorer individuals living in the Southeast received 11% of the region's national income.

Table A.2: Decomposition of states' Net National Income

State	% NNI	% Labour	% Capital	% Production taxes
Brazil	100	58	24	18
Center-West				
DF	3.79	69	17	14
GO	2.75	59	26	15
MS	1.53	54	33	13
MT	1.97	59	28	13
Northeast				
AL	0.78	64	23	13
BA	4.09	59	25	16
CE	2.21	64	21	15
MA	1.41	62	24	14
PB	0.94	67	19	14
PE	2.72	62	20	18
PI	0.72	64	22	14
RN	0.97	63	23	14
SE	0.61	67	19	14
North				
AC	0.23	69	18	13
AM	1.45	52	28	20
AP	0.25	72	20	8
PA	2.30	59	29	12
RO	0.64	64	23	13
RR	0.20	71	19	10
TO	0.51	62	25	13
Southeast				
ES	1.98	53	28	19
MG	8.69	59	25	16
RJ	10.9	57	22	21
SP	31.4	56	23	21
South				
PR	6.24	57	26	17
RS	6.45	57	26	17
SC	4.29	58	21	21

Source: Authors' computations combining surveys, tax data and national accounts.