Fiscal Capacity and Inequality: Evidence from Brazilian Municipalities*

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Abstract

We argue that in young democracies, wealthy elites can limit their taxes by constraining the fiscal capacity of the state. Corrupting local officials and undermining fiscal capacity are some of the mechanisms by which high-income earners can lower their own tax liabilities, even when voters favor higher *de jure* levels of taxation. The incentive to undermine fiscal capacity is especially compelling when inequality is high, as the median voter is likely to support higher progressive taxation and redistribution. Using data from over 5,500 Brazilian municipalities, we show that localities with higher levels of inequality accrue less revenue from local property taxes. These results are robust to estimating a number of cross-sectional models, as well as panel models with time and municipal fixed effects. Moreover, we show that municipalities with high levels of inequality are less likely to apply to a federal grant program to increase their capacity to collect taxes.

Key Words: Fiscal Capacity, Taxation, Inequality, Democracy

Scholars often presume that governments can enforce their preferred fiscal policies. This assumption has been empirically proven to be false, as governments' ability to collect taxes varies dramatically around the world. What explains these differences across countries, and who might have an interest in maintaining low levels of tax capacity that make evasion easier?

One of the key research questions in political economy is why some countries redistribute more than others (e.g., Acemoglu et al., 2015). In particular, why do many democracies with high levels of inequality redistribute far less than the Meltzer-Richard-Romer models would lead us to expect (Romer, 1975; Meltzer and Richard, 1981)?

Most of the research on redistribution starts with the assumption that states are capable of efficiently collecting taxes and redistributing income, and thus focuses on examining the timing and impact of government decisions to implement redistributive policies. More recent studies have argued that political and economic elites in formerly autocratic regimes may undermine future political processes and limit political choices through institutional designs (Ardanaz and Scartascini, 2013; Albertus and Menaldo, 2014) or low state capacity (Acemoglu et al., 2015). Therefore, even if democratic polities are firmly in favor of redistributive policies, institutions and bureaucratic legacies may undermine the political and administrative process to *de facto* block redistribution.

In this paper, we investigate the idea that economic elites in democracies can undermine the state's ability to collect revenues and that they to do so when levels of inequality are high. Specifically, we ask whether local economic and political elites can undermine efforts to increase taxation in democracies by inhibiting the ability to collect taxes.

We think of the state's capacity to enforce tax policies as endogenous and argue that when citizens vote for higher taxes, economic elites (the wealthy) have incentives to undermine the state's ability to collect taxes. The higher the equilibrium level of redistribution would be in a world with perfect tax collection, the stronger is the incentive for economic elites to erode the state's fiscal capacity. Weakening the state's administrative and tax capacity gives economic elites a mechanism with which to constrain policy choices and *de facto* levels of taxation outside the political system.

To investigate the theoretical argument, we use data on tax revenues from over $5,500$ Brazilian municipalities. We show that, controlling for a variety of other factors, localities with higher levels of inequality raise less revenue from local property taxes. These results are robust to estimating a variety of cross-sectional models for 2000 and 2010, as well as panel models with time and municipal fixed effects. We also show that municipalities with high levels of inequality were less likely to apply to a federal grant program to increase their local tax capacity.

Fiscal Capacity & Public Spending

Research in political science and economics often starts with the premise that in democratic polities, higher economic inequality ought to be associated with political demands for redistribution. Much of this work builds on the seminal model developed by Meltzer and Richard (1981), who showed that as the difference in mean income and income of the median voter increases, levels of taxation and redistribution should rise. The idea that democracy can and would be used for redistribution when inequality exists is not new, however, and goes at least as far back as Marx. While the Meltzer-Richard model is only one specific formalization, we expect rational voters in democracies to vote for higher taxation and redistribution as long as their marginal benefit from higher rates is positive. When taxes are linear or progressive, poorer citizens ought to prefer higher taxes than the rich. More so, if the benefit of government spending is higher for poor than rich voters, the optimal tax rate for the poor increases. Contrary to these expectations, empirically there is little evidence that inequality is associated with higher redistribution in democracies (e.g., Benabou, 1996; Perotti, 1996; Kenworthy and Pontussen, 2005).

The lack of empirical support for the Meltzer and Richard (1981) model at the cross-national level is frequently noted. Some factors that possibly condition the relationship between inequality and redistribution are differences between social insurance and redistributive policies (e.g., Moene and Wallerstein, 2001), institutional structures (e.g., Persson and Tabellini, 2003; Iversen and Soskice, 2006), religion (Scheve and Stasavage, 2006), and ethnicity (Alesina and Glaeser, 2004). More recently, scholars have argued that politics in authoritarian regimes can have lasting effects on fiscal policies, potentially long after the transition to democracy. Albertus and Menaldo (2014), for example, argue that autocratic elites can shape the institutional design of subsequent democracies to influence and shape future politics – i.e., by influencing the "rules of the game" (Albertus and Menaldo, 2014). Ardanaz and Scartascini (2013) contend that higher inequality leads to more legislative malapportionment, which makes enacting redistributive policies more difficult once the democratic regime is established.

While the design of political institutions with many veto points is one strategy to inhibit redistribution in democracies, undermining state capacity with the goal to keep the state from collecting revenue may be an equally compelling strategy. Economic elites may cripple the political process by stifling the state's ability to raise revenue. Theoretical models show that non-democracies with higher levels of income inequality should see lower investment in state capacity (Besley and Persson, 2011).

Similarly, Acemoglu and Robinson (2008) argue that possible changes in *de jure* political institutions give economic elites reasons to invest in subverting the state, to "capture democracy" and gain influence over policy decisions. An inefficient state with corrupt ("captured") bureaucrats may be a valuable strategy for economic elites to safeguard themselves against the political power of the masses (Acemoglu, Vindigni and Ticchi, 2011).

In line with these explanations, we argue that economic elites in democracies can exploit and further weaken the state's ability to collect revenue in an effort to block taxation demanded by voters. We contend that in democratic systems, rich or wealthy citizens can keep levels of taxation low, using both democratic and undemocratic means. The wealthy have incentives to ensure that their interests are (over) represented and that taxation is limited. One way to do so is by undermining the state's ability to collect taxes, i.e., by constraining its fiscal capacity. Raising taxes is a complicated undertaking that involves collecting large amounts of data and requires a functioning and efficient bureaucracy (Besley and Persson, 2009). Yet many governments cannot enforce the tax policies chosen by their governing bodies (Bird and Zolt, 2008; Gordon and Li, 2009). In such settings, wealthy residents may have strong incentives to undermine the state and limit their personal tax payments by lowering the state's ability to collect taxes.

To illustrate our argument, consider a theoretical society with rich (r) and poor (p) citizens, in which the median voter sets the *de jure* tax rate and is a member of the poor. Both wealth and income are taxable. Assume all revenue is used to finance a public good, such as education, or used as direct transfers. Assuming the median voter is decisive, she should vote for higher taxes until the marginal benefit from the financed public good is equal to her marginal cost of taxation. If taxes are not regressive and revenue is used for public goods or transfers, then the optimal tax rate at which the marginal benefit equals the marginal cost for the poor rises with increasing inequality.

As the tax becomes more progressive and spending benefits poor citizens more than the rich, the effect of inequality on the tax rate ought to be more pronounced. Thus, in accordance with the standard theory, if citizens vote rationally and based on income, we should see higher levels of *de jure* taxation in states with higher levels of inequality. On the other hand, the difference between pre- and post-tax income of the wealthy elite would increase with higher levels of inequality. With this standard argument in mind, one could hypothesize that higher inequality leads to higher taxation (i.e., *de jure* tax rates) in democracies.

The distinction between *de jure* and *de facto* taxation is important for our theoretical argument. As taxes have to be administered and collected, *de jure* tax rates must not translate into the same *de facto* level of taxation. For example, with a *de jure* tax rate of 15%, even the most efficient and effective tax administration does not achieve 15% realized revenue. We define the *de facto* tax rate as the actual share of the tax base that is collected in taxes. As the capacity of the tax administration decreases, the difference between *de jure* and *de facto* tax rates becomes greater.

In a democracy with weak administrative capacity and firm entrenchment of the wealthy in the political process, elites have strong incentives to undermine the state's ability to collect taxes. As outlined above, when inequality is higher, the *de jure* tax rate is likely to rise. When *de jure* tax rates increase, however, it becomes more profitable for economic elites to combat the state's ability to assess their tax liabilities or to influence the political process through other means. Alternative avenues for influence could include bribing local tax officials who are responsible for tax assessment, placing cronies in essential positions in the local bureaucracy, or impeding the purchase of necessary tools to make tax collection more efficient. Thus, in sufficiently weak states, we contend that economic elites can undermine tax collection, and the motivation to do so increases with higher levels of inequality.

We expect these tactics to be more likely in the context of highly progressive taxes. As a given tax becomes more progressive, the rich pay a higher share of tax revenue, which increases their motivation to fight tax collection. The difference between *de jure* and *de facto* rates should thus be more significant for more progressive taxes. Similarly, as spending benefits the poor more, we expect the relationship between inequality and the *de jure* taxation to become stronger, again raising incentives for elites to fight taxation.

Based on this theoretical argument, we develop our central hypothesis. Specifically, we expect that higher inequality is associated with less fiscal capacity, and therefore less *de facto* tax revenue. Our approach contrasts with the above outlined traditional hypothesis that higher inequality is associated with more tax revenue.

Research Design: The Case of Brazil

In this paper, we use data on tax collection from over 5,500 Brazilian municipalities to investigate the empirical argument. There are several reasons for using the case of Brazil and its municipalities as the unit of analysis.

The democratization of Brazil in the mid-1980s advanced the country socially and politically (Oliven, Ridenti and Brandão, 2008). There are now few barriers to voter registration

(Limongi, Cheibub and Figueiredo, 2015), and compulsory voting ensures a turnout close to 80% (Nicolau, 2012). Since its transition to democracy, Brazil has been known for its high levels of income inequality, making it one of the most unequal democracies in the world. Inequality has been surprisingly resilient and stable throughout the transition from the military dictatorship (1964–1985) to the new democratic regime (Barros, Henriques and Mendonça, 2000; Souza and Medeiros, 2015).

The relatively recent transition to democracy and the persistence of inequality are two reasons that make it an intriguing case with which to investigate our argument. If the *standard* arguments were correct, we would have expected a stark increase in redistribution and taxation after Brazil's democratization in the 1980s. The argument we make above is one possible explanation for why this has *not* been the case.

The Case for Studying Municipalities

The Brazilian federative union is composed of 26 states and the federal district. Brazil has 5,570 municipalities, its lowest level of government, which have more political autonomy than localities in any other Latin American country (Nickson, 1995; Rodríguez and Velásquez, 1995). Most political responsibilities lie with the federal union or states, yet the 1988 constitution gave substantial autonomy to the municipalities (Andrade, 2007; Baiocchi, 2006; Samuels, 2004). In line with the increase in political authority, municipalities can institute and collect taxes within their jurisdiction and use the revenue to implement local policies (Arretche, 2004; Andrade, 2007).

The municipalities are largely funded by transfers from the federal and state governments. These transfers have significantly declined, however, leading to budget shortfalls and low revenues in many municipalities. One of the most critical local tax sources is the taxation of property and land in urban areas, the *Imposto Predial e Territorial Urbano* (IPTU): the urban land and building tax. This tax is solely available to municipalities, and its importance as a local revenue source has increased significantly (De Cesare and Ruddock, 1999).

We aim to investigate whether elites use low levels of administrative capacity, as well as undermine it further, to limit their taxation. To do so, we focus on the case of the property tax in Brazilian municipalities. While the IPTU is one of the principal sources of local revenue in Brazil (property taxes represent an average of 30% of the local tax revenue) (Smolka and Furtado, 1996; De Cesare and Ruddock, 1999), comprehensive studies of this tax indicate that it is still overlooked and has unrealized potential (De Cesare and Ruddock, 1999; Afonso and Araújo, 2006; Afonso, Araújo and Nóbrega, 2013).

While property taxation is a tax on wealth, we believe our theoretical argument, which is primarily about income inequality, still applies here. The IPTU is the second most important local revenue source available to municipalities (Afonso, Araújo and Nóbrega, 2013) and has the potential to be highly progressive. Therefore, if voters observe high levels of inequality and as a result demand more taxation and spending, the IPTU is the primary local mechanism to raise these funds. Moreover, administration of the property tax requires high administrative capacity (Bahl and Martinez-Vasquez, 2008; Kelly, 2013), making it a worthwhile endeavor for elites to engage in actions to undermine the collection of these taxes.

The distributive effects of the tax and relevant spending instruments are similarly important. We have strong reason to believe that the property tax is progressive by design, and that municipal spending largely benefits the poor. First, after the new constitution was enacted in 1988, a progressive property tax system was considered a potential policy mechanism to overcome urban social inequalities and attain equity (De Cesare, 2012; De Cesare and Smolka, 2004; Carvalho, Jr., 2015). After a period of legal ambiguity, a constitutional amendment was passed in 2000, that explicitly allowed progressive tax rates for the IPTU (Carvalho, Jr., 2013). In reality, however, the IPTU has been found to be a regressive tax (Carvalho, Jr., 2006, 2015; Afonso, Araújo and Nóbrega, 2013).

Several causes for the regressivity of the IPTU have been suggested. Directly in line with our argument, one significant reason for its regressive nature is the poor collection of the IPTU. This is due to administrative mismanagement, administrative inefficiency, the high cost of maintaining the property register, and the discrepancy between the government's real estate evaluations and their market value (De Cesare, 2005; Carvalho, Jr., 2006, 2015). Tax exemptions for large companies and tax evasion are also responsible for the high regressivity (De Cesare and Smolka, 2004; Carvalho, Jr., 2006).

De Cesare (2005) and Afonso, Araújo and Nóbrega (2013) found that changes in IPTU rates depend on the approval of councilors in the municipal legislature. Not surprisingly, property owners in wealthier areas regularly resist higher rates, and even more so if the revenue will be invested in poorer areas of the municipality (De Cesare, 2005; Afonso, Araújo and Nóbrega, 2013). Similarly, organized groups of landowners tend to pressure public authorities to minimize their fiscal burden (Afonso, Araújo and Nóbrega, 2013). This is exacerbated by the fact that new valuations of properties have to be approved by the municipal legislatures, giving the wealthy an avenue to undermine the administrative process of tax collection (Carvalho, Jr., 2013). Thus, at least part of the regressivity of the IPTU is due to differences in the *de jure* and *de facto* tax rates.

If properly enforced, the IPTU has the potential to be redistributive and the exact mechanisms outlined in this manuscript, i.e., elite resistance against higher taxes, are at least partially responsible for its regressivity. In addition to the potential progressivity of the tax itself, government spending at the municipal level primarily benefits the poor. In other words, the marginal benefit of additional spending is higher for the poor than the rich. For example, the most significant share of local budgets is spent on education, with health spending being second. Municipalities primarily finance preschools and primary schools as well as education infrastructure and school lunches (Gadenne, 2017).[1] While not directly redistributive transfers, we contend that spending on these goods is redistributive in nature and has greater benefits to poorer segments of society.

In line with our argument, Gadenne (2017) finds that investments allocated to modernize local tax administrations do increase tax revenue. The additional income is spent on the provision of public goods, with three-quarters of the extra revenue going towards public education. This results in an eight percent increase in locally-funded school infrastructures and six percent more children enrolled in municipal schools (Gadenne, 2017).

Measuring Fiscal Capacity Using the Property Tax

Property taxes are difficult to enforce for both administrative and political reasons (Bahl and Martinez-Vasquez, 2008; Kelly, 2013). According to Kelly (2013), we can decompose total property tax revenue into two parts. First, the total level of potential revenue, which equals the tax rate applied to the total tax base, i.e. *de jure* tax rate above. The second, equally

[1] According to data from the Brazilian Ministry of Finance (National Treasury (DFOFM), 2017), the share of public goods spending that goes to education and health grew from 25% and 11% in 1990 to 34% and 17% in 2000, and 41% and 32% in 2010, respectively.

important, determinant of total revenue is made up of "administration-related variables." These variables are the coverage ratio, i.e., the share of properties captured in the municipality's registry; the valuation ratio, i.e., the ratio of valuation in the taxpayer registry to the market valuation of properties; and the collection ratio, i.e., the percent of levied taxes that are collected. While tax rates and the base are both relevant determinants of the tax revenue collected by the state, the administrative capacity is fundamental for property taxes to raise significant revenue (Kelly, 2013; Bahl and Martinez-Vasquez, 2008).

Calculating IPTU liability (i.e., the valuation) requires several types of information, such as property size, location of the property, property use, front and backyard area, property construction standard, etc. (Carvalho, Jr., 2006). Before valuation, properties must be registered in the municipal cadaster. Carvalho, Jr. (2006) estimates that only 60% of the urban real estate in Brazil is registered. Another important aspect of property tax collection is the frequency of assessment, i.e., how often does the administration update/assess the value of properties? The Brazilian central government recommends evaluating property values every five years, with yearly adjustments. The guidelines do not seem to be regularly followed, however. For example, while Porto Alegre in the 1990s had more regular assessments than other municipalities, the assessed values of residential properties were only 19.2% of their sales prices (De Cesare, 2012).

While it is almost impossible to accurately and reliably measure fiscal capacity, we use realized property tax revenue as a proxy for local fiscal capacity. We assume that given the control variables included in the regression models below, at least some of the variation in the *policy-related variables* are held constant across our cases. For example, we include controls for local GDP, population size, and share of the rural population, which ought to explain differences in the tax base. We add controls for revenue needs (i.e., transfers from the federal government, oil revenue) and political determinants (left-leaning mayors), which should at least partly account for differences in tax rates.[2] Lastly, we discuss some robustness checks based on smaller samples with more direct measures of administrative capacity.

Kelly (2013, 147) identifies the incompleteness of property registries (cadasters) as the most pressing administrative issue when it comes to property tax collection in developing countries, with a lack of "necessary political will to *collect and enforce the property tax*" (emphasis added) as an additional major hurdle. Anecdotal evidence suggests that municipalities in Brazil find it difficult to increase their administrative capacity. As De Cesare and Ruddock (1999) point out, wherever localities aim to increase the quality of assessment and revenue of the property tax, they are met with strong opposition. Qualitative evidence of tax fraud and incompetence in local government tax collection is easy to find. For example, in 2014, the public prosecutor's office of São Paulo was investigating companies suspected of carrying out a fraud scheme in the city's IPTU collection in partnership with tax collectors (IPTU inspectors). The inspectors calculated the correct tax, but recorded only half the area when visiting buildings. The other half of the tax was paid as a bribe to the inspectors. While the bribe was paid once, the scheme guaranteed a tax bill that was 50% of the *de jure* amount for all subsequent years (Estadão, 2014).

Similarly, a group of employees in the São Paulo City Hall was accused of fraud and irregularities concerning charges of the Service Tax and the IPTU. Members of the group defrauded the IPTU, by making changes to the cadaster, which was estimated to have cost

[2]Unfortunately, complete data on tax rates at the local level are not available.

city hall about half a billion Brazilian reais (approximately 160 million $US in today's value) (G1-Globo, 2013).

Other examples of fraud and local difficulties with tax collection include charges of public servants making improper changes to the collection system (G1-Globo, 2012), fraud schemes in the city of Campinas (collection of less than 10% of property values), and the municipality of Taboão da Serra (Folha de São Paulo, 2011). These tax evasion schemes cost at least R$ 15 million for Campinas (Folha de São Paulo, 1999) and caused a minimum loss of R$10 million to Taboão da Serra, a municipality with more than 250,000 inhabitants (Folha de São Paulo, 2011).

Some reader may question the use of property tax at the local level as the unit of analysis. The majority of taxes are levied at the federal level, which raises the question whether elites would try to undermine local capacity. We believe that the collection of local property taxes is nevertheless highly relevant for this study. First, these taxes, if properly enforced, are likely to be progressive. Based on the theoretical argument, all else equal, elites ought to prefer paying lower property taxes. Additionally, undermining the local property tax administration in the respective municipality is most likely easier and less costly than attempting to do so at the federal level. Thus, the marginal benefit of undermining tax capacity may be highest at the local level. While we lay out a general argument above, we believe that if it holds true, we should find evidence of these processes at the local level. Given the large variation in inequality and tax revenues in municipalities across Brazil, we think these represent an excellent test case for our argument.

Empirical Strategy: Data & Models

To investigate whether high-income earners use low levels of fiscal capacity to limit redistribution and taxation in high-inequality municipalities, we collected data on tax revenues, political, and socioeconomic variables for the years 1990, 2000, and 2010 from different sources. The dependent variable, our proxy for fiscal capacity at the local level, is the property tax revenue collected by municipalities. The measure of revenue collection comes from the Brazilian Ministry of Finance, released by the National Treasury Secretariat, and is made available by the Institute of Applied Economic Research (IPEA, 2016).[3]

Brazil exhibits high geographic variation in both inequality and tax collection. Our preferred measure of income inequality in the municipalities, the Gini coefficient, ranges from 0.28–0.8 in Brazil for 2010. The use of subnational data allows us to hold many variables constant across observations. For example, we do not have to worry about differences in the political system affecting our results.

We include several control variables in the regression model to account for possible confounders and partial out tax rates and tax base. First, we add a control for municipal GDP to account for the fact that higher inequality may be caused by increasing incomes, while more affluent municipalities have a larger tax base, and are more likely to be more efficient at

[3]Based on personal communication with IPEA, some ambiguity about the meaning of zeros in the IPTU revenue data exists. It is possible that some observations with a value of zero are actually missing data, while for other observations the zeros are meaningful values that indicate zero revenue. This issue mostly applies to the panel model. We use the original data in the main text but undertake additional robustness checks in the online Appendix in section F.

revenue collection. We also control for population size. Brazilian municipalities are heterogeneous regarding their size, economic condition, and capacity to tax. Studies have shown that municipal size is positively correlated with property tax revenue (Gomes, Alfinito and Albuquerque, 2013; Avellaneda and Gomes, 2014). Both of these measures were gathered from the Brazilian Institute of Geography and Statistics (IBGE, 2016).

Since municipalities are only allowed to collect property taxes from urban areas, it is pertinent for us to account for differences in urbanization. Hence, we control for the share of the population living in rural areas. We also include a measure of municipal spending on housing and urbanization. The inclusion of this variable is important, as spending on housing and urban development affects real estate evaluations and increases the base for calculating the IPTU tax. A second relevant fiscal variable included in our models is the level of transfers from both the federal and state governments to each of the municipalities (Brollo et al., 2013; Litschig and Morrison, 2013). Data on transfers and housing spending was gathered from the Institute of Applied Economic Research (IPEA, 2016). Additionally, we control for municipal revenue from oil exploration (royalties). Royalty payments made to municipalities in which oil has been discovered and explored increased from R$167 million in 1997 to R$4.7 billion in 2008 (Monteiro and Ferraz, 2012). Royalty payments are associated with an increase in the number of municipal employees (Monteiro and Ferraz, 2012) and municipal revenues (Caselli and Michaels, 2009). Similar to intergovernmental transfers, we expect that royalties from oil exploration undermine local governments' incentives to increase their own revenue capacity and may also affect inequality.

In addition, in our cross-sectional models, we include an indicator variable with a value of 1 if the mayor of the municipality is from a left party, and 0 otherwise. The inclusion of this variable is an attempt to understand whether left-leaning parties are more likely to raise the fiscal capacity/redistributive taxation and whether they are able to achieve this goal. Given our theoretical argument, we do not expect left-leaning party governance to have a strong effect on *de facto* tax revenue. Additionally, this control may partial out some of the differences due to *de jure* tax rates. Political data were collected from the Superior Electoral Court (TSE do Brasil, 2016), and leftist parties were classified based on surveys and roll-call vote studies of Brazilian legislators (Power and Zucco Jr., 2009, 2012; Samuels and Zucco Jr., 2014; Saiegh, 2015).

We were able to collect these variables for the years 2000, 2010, and approximately 1990. We first estimate cross-sectional models for both 2000 and 2010. We estimate standard ordinary least squares (OLS) regressions for the cross-sectional models, but calculate standard errors clustered by states. The dependent variable (*IPTU revenue*) and the independent variables *housing*, *GDP*, *transfers*, *oil revenue*, and *population* were log transformed to reduce the right-skewness of their distributions.[4]

In addition to the cross-sectional models for two time periods (2000 and 2010), we also estimate a panel model for 1991, 2000, and 2010, in which we include municipal and year fixed effects. Using the unit-specific intercepts, we aim to control for unobserved confounders that do not vary over time or across units.

[4]To avoid creating missing values, prior to taking the log we add 1 to the values of *IPTU*, *housing*, *oil revenue*, and *transfers* variables.

Empirical Analysis: Results and Discussion

Figure 1 illustrates our general findings in the cross-sectional models. The plot displays the coefficient estimates for our cross-sectional model for 2010 with standard errors clustered by state.[5]

Our results consistently lend support to our hypothesis. Particularly, the coefficient for inequality (*Gini*) is estimated to be negative and is statistically significant in all models. Higher inequality is associated with lower property tax revenue, i.e, as inequality rises a municipality's ability to collect IPTU from its citizens decreases. For example, according to the results displayed in Figure 1, holding all covariates at their median value and increasing inequality from the 25th percentile value (0.45) by one standard deviation (to 0.52) is associated with a decrease in logged IPTU revenue from 10.92 to 10.49.

In line with our expectations, the coefficient for GDP is precisely estimated and positive, which indicates that richer municipalities can raise more revenue from property taxes. In contrast, the larger the share of the population living in rural areas, the lower the revenue from the IPTU.

The results for population size are somewhat surprising. Higher population size may be associated with lower revenues. The estimates for intergovernmental *transfers* are also

[5]Table A.1 in the Appendix presents the estimation results for six different models for the 2000 and 2010 data. All models were estimated using OLS. Models 2 and 4 were estimated computing robust standard errors, and Models 3 and 6 were estimated computing standard errors clustered at the state level. We also estimate all models based on data that is multiple imputed using Gaussian copulas (Hoff, 2007). The results are shown in Table A.2 in the Appendix and suport the results presented here.

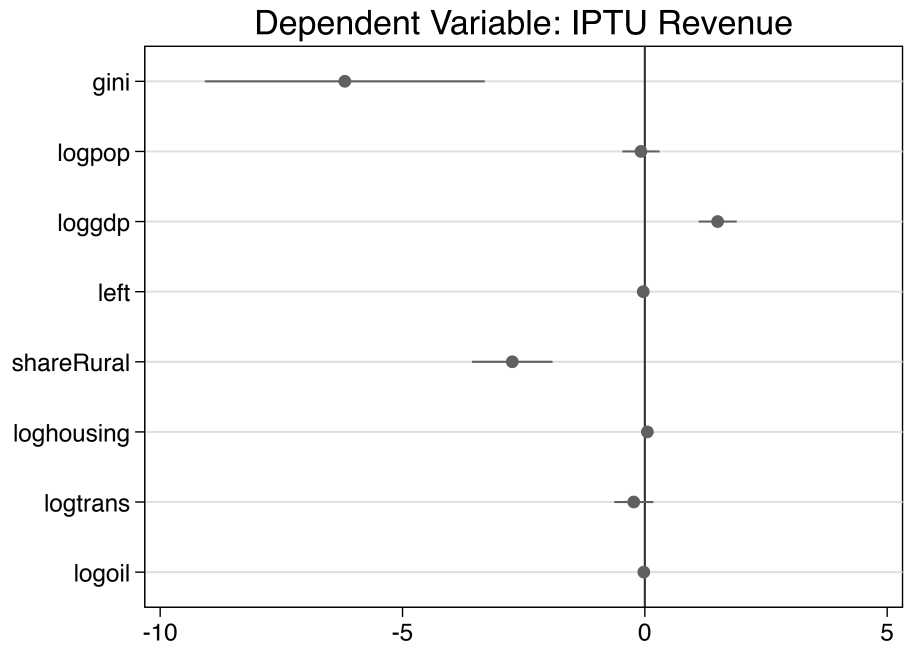

Figure 1: Coefficient Estimates from Model 6 of Table A.1 in Appendix A. Cross-Sectional Model for 2010 with non-imputed data. Standard errors clustered by state. Dependent variable: IPTU revenue in Brazilian reais (logged). The negative and significant estimate for Gini indicates that, as inequality increases the state's ability to raise revenue from citizens decreases substantially.

not precisely estimated in models with clustered standard errors. The results do indicate that municipalities that are more dependent on transfers collect lower revenues from the IPTU. These results are similar to our findings for *oil revenue*. Throughout all models, the coefficient for oil revenue is estimated to be negative, but the precision of the estimates varies across the different models. Also as expected, mayors from left-leaning political parties are not associated with higher revenues: the coefficient for leftist party mayor is very small, inconsistent, and estimated with high uncertainty.[6]

In the Supplementary Online Appendix in section B, we provide additional evidence for

[6]As an additional robustness check, Table A.3 in the Appendix displays the results from four spatial autoregressive models. Overall, the results from the spatial models are consistent with the findings presented above.

the robustness of these results by adding several potentially relevant controls and estimating bivariate models without controls. The results do not change subtantially for any of these specifications. The effect of inequality remains negative and significant when we add controls for voter turnout, competitiveness of the mayoral race, other municipal tax revenues, share of the population vulnerable to poverty[7], share of municipal GDP produced in the industrial sector, number of families that benefit from the cash transfer program (Bolsa Família), or the size of the cash benefits. The estimated effect of inequality is negative and statistically significant in all of these specifications, except when we include total logged cash benefits paid out and cluster standard errors by state. In that particular model, the coefficient on inequality is significant only at the 10% level. Lastly, we can add GDP growth over the previous decade to our cross-sectional models and the results remain substantially the same.

To provide further evidence for the robustness of our results and alleviate concerns about the dependent variable, we also estimate several models with other potential measures of fiscal capacity at the municipal level. For some of these, however, the sample size is reduced significantly. The results are presented in section C in the Appendix. First, we show that the cross-sectional results are robust to calculating our dependent variable as the ratio of IPTU revenue to municipal GDP or as a ratio to total municipal tax revenue. We also provide the results when using revenue from a different local tax source (ITBI, a tax on property transfers) as the dependent variable. The results do not change substantially.

Lastly, we also create a variable measuring the ratio of registered properties for which the property tax was paid to total registered properties (collection rate). These data are collected

[7]Variable is defined as the share of the population with incomes less than R$255.00 a month.

for 1998. While imperfect, we use this measure as an alternative dependent variable for our cross-section of 2000 (the closest year for which we have data). Again, the relationship with inequality is estimated to be negative and significant.

Panel Model Estimation

So far, we have shown that across different municipalities, higher inequality is robustly associated with less municipal revenue collected from property taxation. These findings lend support to our theoretical argument that in higher-inequality districts, wealthy elites undermine the state's ability to collect taxes. The results are robust to including many potential confounders as controls.

Nevertheless, other potential factors may affect both tax capacity and inequality. In this section, we present evidence based on a simple panel model at the municipal level for 1991, 2000, and 2010, with both municipal and year fixed effects.[8] By including both municipal and time fixed effects we can control for unobservables at the municipal level that do not vary over time, as well as shocks in time that do not change across the different municipalities.[9] Given these additional parameters, the results from the three-period panel model can serve as an additional check on the results presented above.

[8]Since several variables are not available for 1990, we use 1991 as our earliest observation. In addition, we could not find data for municipal GDP for the early 1990s. We thus have to rely on a GDP measurement from 1985 in the panel data for 1991.

[9]Since inequality within a municipality may also create incentives to redraw municipal boundaries, we conduct an analysis using a sub-sample based on municipality age. The results, presented in Appendix E, indicate that a possible split of municipalities due to high inequality does not seem to be driving our results.

We specify the following model for the three-period panel data:

$$y_{it} = \alpha_i + \gamma_t + \beta \mathbf{X_{it}} + \delta G_{it} + \epsilon_{it}, \tag{1}$$

where α_i and γ_t are municipality- and year-specific intercepts, $\mathbf{X_{it}}$ is a matrix of time-varying covariates, and β is a vector of the corresponding estimated coefficients. G_{it} is the main variable of interest, the Gini coefficient for municipality i at time t. Based on our theoretical argument, we expect its coefficient δ to be negatively signed. We present the results based on standard errors clustered at the state level.

Figure 2 displays the results from the three-period panel model. Growth in population and transfers over time are associated with higher levels of tax revenue and the 95% confidence intervals do not include zero. The coefficients for GDP, share of the rural population, and logged spending on housing are very close to zero and not significant at conventional levels. Most importantly, the coefficient for inequality is negative, and its 95% confidence interval does not cover zero. An increase in inequality over time is associated with less municipal revenue from property taxes. This finding gives additional credence to the theoretical argument.[10]

As a robustness check, we estimate the same model in a two-period panel for 2000 and 2010.[11] Surprisingly, once we add year fixed effects, the coefficient for inequality is estimated

[10]Some of the municipalities in our sample were created after 1990. We, therefore, subset the data to those municipalities created prior to 1985. The results remain the same if we do not subset.

[11]For the two-period panel model, we subset the data to municipalities created before 2000 (results shown in Table D.1 in the Appendix).

to be positive in the two-period model with controls (2000 and 2010). This suggests that a something changed in high inequality municipalities between 2000 and 2010. It is possible that the introduction of the federal cash benefits program Bolsa Família in 2003 led to these changes, though there is no clear way to test this. Since Bolsa Família was started in 2003, we can not include it as a covariate in the panel models. As we discussed above, however, the results in the cross-section for 2010 are robust even when controlling for Bolsa Família benefits. [12]

As with the cross-sectional model, we estimate the three-period panel model as a bivariate model with unit and year fixed effects. We also add a linear time trend and a quadratic time-trend to the three-period panel model. The results remain the same. Lastly, we estimate the two-period panel model using data on the collection rate (i.e., the ratio of paid to levied taxes) for 180 municipalities. These data were originally collected by Carvalho, Jr. (2017). Our general finding: a significant and negative relationship of inequality with fiscal capacity remains. On average, the greater the inequality, the smaller the IPTU collection rate. The results of these robustness checks are presented in section D of the Appendix.

[12] We thank an anonymous reviewer for alerting us to the possible effects of the Bolsa Família program. Table D.1 in the Appendix also displays the results for both panel models when the data are multiple imputed using Gaussian copulas (Hoff, 2007). The results are mostly unchanged, and in fact, the effect of inequality on property tax revenue is estimated to be stronger.

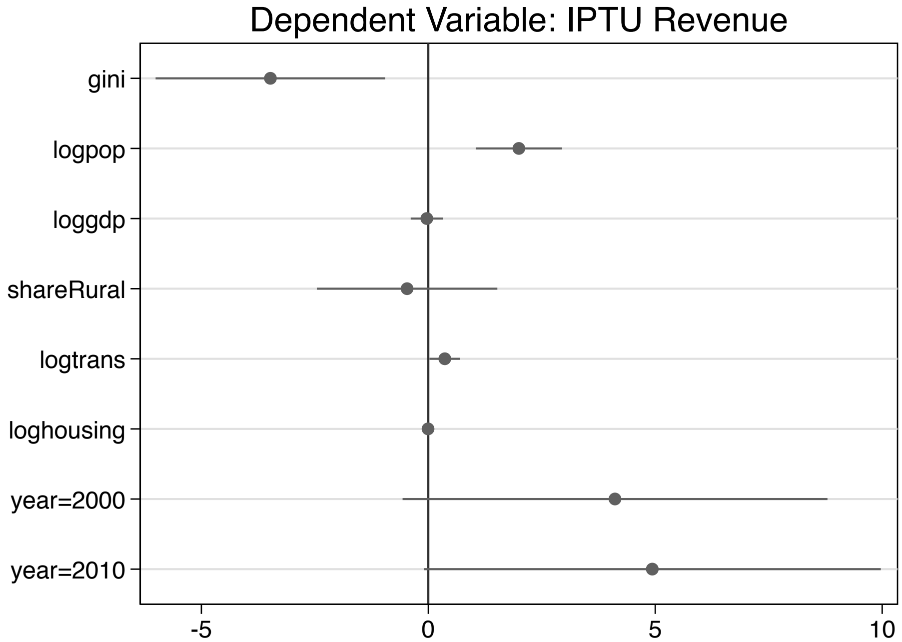

Figure 2: Coefficient Estimates from Model 1 of Table D.1 in Appendix D. Panel Model (1991, 2000, 2010) with year and municipal fixed effects, standard errors clustered at the state level. Dependent variable: IPTU revenue in Brazilian reais (logged). The results are consistent with the cross-sectional model, indicating that increases in inequality are associated with lower capacity to collect taxes.

Selection on Unobservables

In this section, we briefly discuss a sensitivity analysis of the regression results, as suggested by Oster (2017). We estimate how strong selection on unobservables compared to observables would have to be if the effect of inequality is due to bias. Two concepts are required. The first is the "relative degree of selection on observed and unobserved variables" (δ), i.e., how much more important are the variables included in the regression models compared to unobservables. Generally, Oster (2017) suggests considering results to be robust if $\delta > 1$. Secondly, R_{max} is defined as the maximum attainable R^2 for the particular regression, if all relevant variables were included. Of course, the most conservative test is with R_{max} set to one, the highest possible R^2. Based on empirical evidence using the results of randomized experiments, Oster (2017) suggests that a R_{max} of 1.3 times the R^2 from the relevant regression might be more appropriate. We estimate δ for each of three regression models of interest using the highest possible values of R_{max}, $R_{max} = 1$.

Table 1: Selection on Unobservables

	2000	2010	Panel Model
$R_{max} = 1$	$\delta = 1.92$	$\delta = 2.62$	$\delta = 4.82$

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
Test for 2000 from Cross-Sectional Model 3 of Table A.1 in Appendix A.
Test for 2010 from Cross-Sectional Model 6 of Table A.1 in Appendix A.
Test for Panel Model from Panel Model 1 of Table D.1 in Appendix D.

The relevant values are displayed in Table 1. The results imply that it is unlikely that our results are due to selection on unobservables, as the estimated δ for all three models are above the critical value of 1, even when we use the maximum possible value of one for R_{max}.

Applications to Capacity-Building Program

The empirical analyses and the robustness checks in the previous section have provided evidence in line with our theoretical argument. Nevertheless, questions may remain with regards to our dependent variable and the identification of the theoretical mechanism. In this section, we investigate if inequality levels influenced whether municipal governments applied for grants to improve their tax administration.

In 1997, the Brazilian federal government initiated the Modernization Program of the Tax Administration (PMAT), with the goal of improving municipalities' tax administration. The foremost objective of the program was to increase municipalities' revenues by improving tax registration and collection processes, modernizing taxpayer services and enhancing municipalities' fiscal responsibility and capacity (Afonso et al., 1998; Guarneri, 2002). The program focuses on the modernization of information technology, computer equipment, training of human resources, specialized technical services, and the physical infrastructure of municipalities' public administration (Guarneri, 2002; Corrêa, 2009).

The financial funds of the program are provided to the municipalities by the Brazilian Development Bank (BNDES) through credit lines opened by BNDES financial partner institutions. The current financing amount limit is either a maximum of R$60 million per municipality or R$36 per capita (the financing accepted is based on the lower value of these criteria) (Corrêa, 2009).

Gadenne (2017) has taken advantage of the program to show that higher levels of fiscal capacity – and, ergo, local tax revenue – cause positive changes in municipal education infrastructure. If our argument is correct, we should find that municipalities with higher levels of inequality are less likely to apply to the program (even though their revenues are lower). We, therefore, estimate the probability that a municipality joins the PMAT program until 2010 as a function of its inequality level (Gini coefficient) and controls included in our previous models (all measured in 1991). We also include municipal revenue raised from IPTU collection as a control. According to our argument, the elites' constraint on the state should be stronger under higher levels of inequality. Thus, we expect that the greater the municipality's inequality, the lower the likelihood it will apply to PMAT.

As shown in Table 2, the results support this expectation. Across linear probability, logit models, and when we cluster standard errors by state (Models 2 and 4), the coefficient on inequality is negative and precisely estimated. Greater inequality appears to be associated with a lower likelihood of application to PMAT, a finding that is also reflected in the work

Table 2: Municipal Applications to the Capacity-Building Program (PMAT)

	Dependent variable: PMAT Application			
	(Model 1) OLS	(Model 2) OLS	(Model 3) Logit	(Model 4) Logit
Gini	-0.242***	-0.242***	-2.786**	-2.786**
	(0.050)	(0.070)	(1.166)	(1.230)

Notes: Dependent variable: Binary variable PMAT (1 = municipality applied to PMAT, 0 = municipality didn't apply to PMAT).
All four models include controls for IPTU revenue (logged), population (logged), GDP (logged), rural share, transfers (logged). Full Table is displayed in Table C.6 in Appendix C. Model 1 and Model 3 with robust standard errors. Model 2 and Model 4 with standard errors clustered by state.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

by Gadenne (2017). For space reasons we omit the control variables from the Table, but full results are presented in Appendix C.

These results are consistent with our expectation that more unequal municipalities will have a lower capacity to collect taxes. Although PMAT currently reaches all regions of Brazil, the program is heavily concentrated in the less unequal south and southeast regions of the country (Corrêa, 2009; Grin, 2014). While the south and southeast have received 73.4% of all established contracts in 2009, municipalities in the north and northeast regions of Brazil (more unequal) account for only 3.8% of the contracts (Grin, 2014). After 13 years, the fact that only 369 municipalities (6.63% of the Brazilian municipalities in 2011) participate in the PMAT reveals a low acceptance of the program among municipal governments in general (Grin, 2014).

Conclusion

Some of the most famous formal models in political economy make the prediction that taxation ought to increase with inequality in democracies (Romer, 1975; Meltzer and Richard, 1981). Yet in many cases, scholars do not find the stated relationship to be true. We argue that this may be explained by wealthy elites undermining the state's ability to collect taxes in highly unequal democracies, especially when the state's capacity is already limited.

To investigate this proposition, we use data on property tax revenue, inequality, and other economic variables from over 5,500 municipalities in Brazil. Using cross-sectional, as well as panel models, and undertaking a variety of robustness checks, we show that municipalities with higher levels of inequality have lower levels of fiscal capacity/raise less revenue from the local property tax. The evidence is consistent with our theoretical argument. We do acknowledge, however, that we can not yet identify the exact causal mechanism and that other potential explanations are possible. On the other hand, our results are strengthened by the fact that municipalities with higher inequality were also significantly less likely to apply for federal programs that could aid their tax collection efforts.

If wealthy elites do actively undermine tax administration in highly unequal societies, this should have consequences for how we view democratic policy-making and the delivery of public goods. A democratic political system is no panacea: even if the will of the voters may be translated into policies, the state is not always able to properly enforce the policy choices made. On the other hand, it may be that as democracies stabilize and become further removed from their authoritarian origins, they can slowly diminish the influence of elites and increase capacity. This possibility should be further investigated in future cross-national work. Similarly, as we argue in the paper, we think that our findings are generalizable to national level politics. Yet, subsequent studies ought to investigate whether the lack of evidence in line with the Meltzer and Richard (1981) model cross-nationally can be explained by the theoretical argument made here.

Lastly, future research should further consider the exact mechanisms by which economic elites can undermine the state's capacity to collect revenues and enforce policies. Better understanding of these processes will help us gain a better grasp of the difficulties of policy-making in (young) democracies and thus the threats to their existence. Additionally, further research ought to investigate how limited state capacity can influence the nexus between voters and politicians. For example, low levels of capacity may impact voters' preferred policies and evaluation of politicians, especially when it comes to taxation and public goods.

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References

Acemoglu, Daron, Andrea Vindigni and Davide Ticchi. 2011. "Emergence and Presistence of Inefficient States." *Journal of the European Economic Association* 9(2):122–208.

Acemoglu, Daron and James Robinson. 2008. "Persistence of Power, Elites, and Institutions." *American Economic Review* 98(1):267–293.

Acemoglu, Daron, Suresh Naidu, Pascual Restrepo and James A. Robinson. 2015. Democracy, Redistribution, and Inequality. In *Handbook of Income Distribution*, ed. Anthony B. Atkinson and François Bourguignon. Vol. 2 Amsterdam: Elsevier chapter 21, pp. 1885–1966.

Afonso, José Roberto, Cristóvão Correia, Erika Amorim Araújo, Júlio Ramundo, Maurício David and Rômulo Santos. 1998. "Municípios, Arrecadação e Administração Tributária: Quebrando Tabus." *Revista do BNDES* 10:1–36.

Afonso, José Roberto and Erika Amorim Araújo. 2006. Local Government Organization and Finance: Brazil. In *Local Governance in Developing Countries*, ed. Anwar Shah. Washington: World Bank pp. 381–418.

Afonso, José Roberto, Erika Amorim Araújo and Marcos Antonio Nóbrega. 2013. *IPTU no Brasil: Um Diagnóstico Abrangente*. Vol. 4 São Paulo: Instituto Brasiliense de Direito Publico IDP Ltda; FGV Projetos.

Albertus, Michael and Victor Menaldo. 2014. "Gaming Democracy: Elite Dominance during Transition and the Prospects for Redistribution." *British Journal of Political Science* 44(3):575–603.

Alesina, Alberto and Edward L. Glaeser. 2004. *Fighting Poverty in the US and Europe: A World of Difference*. Oxford, UK: Oxford University Press.

Andrade, Luis Aureliano de. 2007. O Município na Política Brasileira: Revisitando Coronelismo, enxada e voto. In *Sistema Político Brasileiro: Uma Introdução*, ed. Lúcia Avelar and Antônio Octávio Cintra. São Paulo: Editora Unesp pp. 243–260.

Ardanaz, Martin and Carlos Scartascini. 2013. "Inequality and Personal Income Taxation: The Origins and Effects of Legislative Malapportionment." *Comparative Political Studies* 46(12):1636—1663.

Arretche, Marta. 2004. "Federalismo e políticas sociais no Brasil: problemas de coordenação e autonomia." *São Paulo em Perspectiva* 18(2):12–26.

Avellaneda, Claudia and Ricardo Gomes. 2014. "Is Small Beautiful? Testing the Direct and Nonlinear Effects of Size of Municipal Performance." *Public Administration Review* 75(1):137–149.

Bahl, Roy and Jorge Martinez-Vasquez. 2008. The Determinants of Revenue Performance. In *Making the property tax work: Experiences in developing and transitional countries*, ed. Roy Bahl, Jorge Martinez-Vazquez and Joan Youngman. Cambridge: Lincoln Institute of Land Policy pp. 35–57.

Baiocchi, Gianpaolo. 2006. *Decentralization and Local Governance in Developing Countries: a comparative perspective*. Cambridge: MIT Press.

Barros, Ricardo, Ricardo Henriques and Rosane Mendonça. 2000. "Desigualdade e Pobreza no Brasil: Retrato de uma Estabilidade Inaceitável." *Revista Brasileira de Ciências Sociais* 15(42):123–142.

Benabou, Roland. 1996. Inequality and Growth. In *NBER Macroeconomics Annual 1996*, ed. Ben Bernake and Julio J. Rotemberg. National Bureau of Economic Research.

Besley, Timothy and Torsten Persson. 2009. "The Origins of State Capacity: Property Rights, Taxation, and Politics." *American Economic Review* 99(4):1218–1244.

Besley, Timothy and Torsten Persson. 2011. *Pillars of Prosperity: The Political Economics of Development Clusters*. Princeton: Princeton University Press.

Bird, Richard M. and Eric M. Zolt. 2008. "Tax Policy in Emerging Countries." *Environment and Planning C: Government and Policy* 26:73–86.

Brollo, Fernanda, Tommaso Nannicini, Roberto Perotti and Guido Tabellini. 2013. "The Political Resource Curse." *American Economic Review* 103(5):1759–1796.

Carvalho, Jr., Pedro H. B. 2006. "O IPTU no Brasil: Progressividade, Arrecadação e Aspectos Extra-Fiscais." IPEA Discussion Paper 1251.

Carvalho, Jr., Pedro H. B. 2013. "Property Tax Performance in Rio de Janeiro." *Journal of Property Tax Assessment & Administration* 10(4):19–36.

Carvalho, Jr., Pedro H. B. 2015. "Distributive Aspects of Real Estate Property and its Taxation Among Brazilian Families." IPEA Discussion Paper 184. http://repositorio.

ipea.gov.br/bitstream/11058/4956/1/DiscussionPaper_184.pdf (Accessed September 18, 2017).

Carvalho, Jr., Pedro H. B. 2017. Property Tax Performance and Potential in Brazil PhD thesis Faculty of Economic and Management Sciences at the University of Pretoria.

Caselli, Francesco and Guy Michaels. 2009. "Do Oil Windfalls Improve Living Standards? Evidence from Brazil." https://www.nber.org/papers/w15550.pdf (Accessed March 2017).

Corrêa, Letícia. 2009. "Atuação do BNDES nos investimentos na gestão do setor público: estudo do caso Pmat–Santo André (SP)." *BNDES Setorial: Setor Público* 30:211–236.

De Cesare, Claudia. 2005. O Cadastro como Instrumento de Política Fiscal. In *Cadastro Multifinalitário como Instrumento de Política Fiscal e Urbana*, ed. Diego Erba, Fabrício Oliveira and Pedro Lima Jr. Brasília: Ministério das Cidades.

De Cesare, Claudia. 2012. "Improving the Performance of Property Tax in Latin America." Cambridge: Lincoln Institute of Land Policy (Working Paper).
URL: *http://www.lincolninst.edu/sites/default/files/pubfiles/improving-performance-property-tax-latin-america-full_0.pdf (Accessed March 2017)*

De Cesare, Claudia and Les Ruddock. 1999. The Property Tax System in Brazil. In *Property Tax: An International Comparative Review*, ed. William McCluskey. United Kingdom: Ashgate Publishing Ltd chapter 13, pp. 266–282.

De Cesare, Claudia and Martim Smolka. 2004. "Diagnóstico sobre o IPTU." Cambridge: Lincoln Institute of Land Policy (Working Paper).

Estadão. 2014. "MP investiga 84 empresas beneficiárias de fraude no IPTU em SP.". http://sao-paulo.estadao.com.br/noticias/geral,mp-investiga-84-empresas-beneficiarias-de-fraude-no-iptu-em-sp,1125251?success=true (Accessed January 31, 2017).

Folha de São Paulo. 1999. "Sindicato pede abertura de inquérito.". http://www1.folha.uol.com.br/fsp/campinas/cm25029913.htm (Accessed January 31, 2017).

Folha de São Paulo. 2011. "Três vereadores são presos em Taboão.". http://www1.folha.uol.com.br/fsp/cotidian/ff0405201118.htm (Accessed January 31, 2017).

G1-Globo. 2012. "Polícia prende 13 suspeitos de fraude na arrecadação do IPTU em Cuiabá.". http://g1.globo.com/mato-grosso/noticia/2012/11/policia-prende-13-suspeitos-de-fraude-na-arrecadacao-do-iptu-em-cuiaba.html (Accessed January 31, 2017).

G1-Globo. 2013. "Escutas indicam que fiscais também fraudaram o IPTU em São Paulo.". http://g1.globo.com/sao-paulo/noticia/2013/11/escutas-mostram-que-fiscais-tambem-fraudaram-o-iptu.html (Accessed January 31, 2017).

Gadenne, Lucie. 2017. "Tax Me, But Spend Wisely? Sources of Public Finance and Government Accountability." *American Economic Journal: Applied Economics* 9(1):274–314.

Gomes, Ricardo, Solange Alfinito and Pedro Albuquerque. 2013. "Analyzing Local Government Financial Performance: Evidence from Brazilian Municipalities 2005-2008." *RAC - Revista de Administração Contemporânea* 17(6):704–719.

Gordon, Roger and Wei Li. 2009. "Tax Structures in Developing Countries: Many Puzzles and a Possible Explanation." *Journal of Public Economics* 93(7-8):855–866.

Grin, José Eduardo. 2014. "Trajetória e avaliação dos programas federais brasileiros voltados a promover a eficiência administrativa e fiscal dos municípios." *Revista de Administração Pública* 48(2):459–480.

Guarneri, Lucimar. 2002. "Modernização da gestão pública: uma avaliação de experiências inovadoras." *BNDES Social* 4:9–103.

Hoff, Peter D. 2007. "Extending the Rank Likelihood for Semiparametric Copula Estimation." *Annals of Applied Statistics* 1(1):265–283.

IBGE. 2016. "Brazilian Institute of Geography and Statistics." `http://www.ibge.gov.br/` (Accessed January 2016).

IPEA. 2016. "Institute of Applied Economic Research." `http://www.ipeadata.gov.br` (Accessed January 2017).

Iversen, Torben and David Soskice. 2006. "Electoral Institutions and the Politics of Coalitions: Why Some Democracies Redistribute More Than Others." *American Political Science Review* 100(2):165–182.

Kelly, Roy. 2013. Property Tax Collection and Enforcement. In *A Primer on Property Tax:*

Administration and Policy, ed. Williim J. McCluskey, Gary C. Cornia and Lawrence C. Walters. West Sussex, UK: Blackwell Publishing Ltd chapter 6, pp. 141–171.

Kenworthy, Lane and Jonas Pontussen. 2005. "Rising Inequality and the Politics of Redistribution in Affluent Countries." *Perspectives on Politics* 3(3):449–471.

Limongi, Fernando, José Antonio Cheibub and Argelina Figueiredo. 2015. Participação Política no Brasil. In *Trajetórias da Desigualdade: Como o Brasil Mudou nos Últimos Cinquenta Anos*, ed. Marta Arretche. São Paulo: Editora Unesp/CEM chapter 1, pp. 23–50.

Litschig, Stephan and Kevin Morrison. 2013. "The Impact of Intergovernmental Transfers on Education Outcomes and Poverty Reduction." *American Economic Journal: Applied Economics* 5(4):206–240.

Meltzer, Allan H. and Scott F. Richard. 1981. "A Rational Theory of the Size of Government." *The Journal of Political Economy* 89(5):914–927.

Moene, Karl Ove and Immanuel Wallerstein. 2001. "Inequality, Social Insurance, and Redistribution." *American Politial Science Review* 95(4):859–874.

Monteiro, Joana and Claudio Ferraz. 2012. "Does oil make leaders unaccountable? Evidence from Brazil's offshore oil boom." http://www.parisschoolofeconomics.eu/docs/ydepot/semin/texte1213/CLA2012DOE.pdf (Accessed March 2017).

National Treasury (DFOFM). 2017. "Municipal expenditure." Brazilian Ministry of Finance.

Nickson, R. Andrew. 1995. *Local Government in Latin America*. Boulder: Lynne Rienner Publishers.

Nicolau, Jairo. 2012. *Eleições no Brasil: do Império aos Dias Atuais*. Rio de Janeiro: Zahar.

Oliven, Ruben, Marcelo Ridenti and Gildo Marçal Brandão, eds. 2008. *A Constituição de 1988 na Vida Brasileira*. São Paulo: Editora Hucitec.

Oster, Emily. 2017. "Unobservable Selection and Coefficient Stability: Theory and Evidence." *Journal of Business & Economic Statistics* pp. 1–18.

Perotti, Roberto. 1996. "Inequality, Redistribution and Growth: What the Data Say." *Journal of Economic Growth* 1(2):149–187.

Persson, Torsten and Guido Tabellini. 2003. *Economic Effects of Constitutions*. Cambridge, Mass.: Cambridge University Press.

Power, Timothy and Cesar Zucco Jr. 2009. "Estimating Ideology of Brazilian Legislative Parties, 1990-2005: A Research Communication." *Latin American Research Review* 44(1):218–246.

Power, Timothy and Cesar Zucco Jr. 2012. "Elite Preferences in a Consolidating Democracy: The Brazilian Legislative Surveys, 1990-2009." *Latin American Politics and Society* 54(4):1–27.

Rodríguez, Alfredo and Fabio Velásquez, eds. 1995. *Municípios y Servícios Públicos: Gobiernos Locales en Ciudades Intermédias de América Latina*. Santiago: Ediciones Sur.

Romer, Thomas. 1975. "Individual welfare, majority voting, and the properties of a linear income tax." *Journal of Public Economics* 4(2):163–185.

Saiegh, Sebastián. 2015. "Using Joint Scaling Methods to Study Ideology and Representation: Evidence from Latin America." *Political Analysis* 23(3):363–384.

Samuels, David. 2004. The Political Logic of Decentralization in Brazil. In *Decentralization and Democracy in Latin America*, ed. Alfred Montero and David Samuels. Indiana: University of Notre Dame Press pp. 67–93.

Samuels, David and Cesar Zucco Jr. 2014. "The Power of Partisanship in Brazil: Evidence from Survey Experiments." *American Journal of Political Science* 58(1):212–225.

Scheve, Ken and David Stasavage. 2006. "Religion and Preferences for Social Insurance." *Quarterly Journal of Political Science* 1(3):255–286.

Smolka, Martim and Fernanda Furtado. 1996. "Argumentos para a reabilitação do IPTU e do ITBI como instrumentos de intervenção urbana (progressista)." *Revista Espaço & Debates* 39(16):87–103.

Souza, Pedro and Marcelo Medeiros. 2015. "Top Income Shares and Inequality in Brazil, 1928-2012." *Journal of the Brazilian Sociological Society* 1(1):119–132.

TSE do Brasil. 2016. "Tribunal Superior Eleitoral do Brasil." `http://www.tse.jus.br/` (Accessed January 2017).

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Supplementary Online Appendix: Fiscal Capacity and Inequality: Evidence from Brazilian Municipalities

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July 17, 2018

A Appendix: Additional Models

Table A.1: Inequality and Fiscal Capacity in Brazilian Municipalities (Cross-Sectional Models for 2000 and 2010) – Non-imputed Data

	Dependent variable: IPTU Revenue (log)					
	Model 1 2000	Model 2 2000 (robust)	Model 3 2000 (cluster)	Model 4 2010	Model 5 2010 (robust)	Model 6 2010 (cluster)
Gini	-3.657***	-3.657***	-3.657***	-6.190***	-6.190***	-6.190***
	(0.579)	(0.619)	(0.922)	(0.493)	(0.624)	(1.396)
Population (log)	-0.994***	-0.994***	-0.994***	-0.080	-0.080	-0.080
	(0.087)	(0.105)	(0.349)	(0.075)	(0.081)	(0.185)
GDP (log)	2.230***	2.230***	2.230***	1.503***	1.503***	1.503***
	(0.074)	(0.091)	(0.226)	(0.059)	(0.068)	(0.190)
Left Party	-0.100	-0.100	-0.100	-0.033	-0.033	-0.033
	(0.087)	(0.086)	(0.122)	(0.058)	(0.059)	(0.059)
Rural Share	-2.823***	-2.823***	-2.823***	-2.734***	-2.734***	-2.734***
	(0.197)	(0.209)	(0.488)	(0.158)	(0.182)	(0.401)
Housing and Urbanization (log)	0.008	0.008	0.008	0.052***	0.052**	0.052*
	(0.017)	(0.018)	(0.027)	(0.015)	(0.023)	(0.027)
Transfers (log)	-0.071	-0.071	-0.071	-0.228*	-0.228*	-0.228
	(0.140)	(0.181)	(0.365)	(0.123)	(0.134)	(0.195)
Oil Revenue (log)	-0.033***	-0.033***	-0.033	-0.020***	-0.020***	-0.020
	(0.011)	(0.012)	(0.031)	(0.007)	(0.008)	(0.018)
Constant	-0.679	-0.679	-0.679	2.391**	2.391*	2.391
	(1.250)	(1.532)	(2.883)	(1.162)	(1.226)	(1.864)
N	4845	4845	4845	4269	4269	4269
R^2	0.507	0.507	0.507	0.641	0.641	0.641

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
Model 2 and Model 5 with robust standard errors.
Model 3 and Model 6 with standard errors clustered by state.
The negative and significant estimates for Gini in all models indicate that, as inequality increases, the state's ability to raise revenue from citizens decreases substantially.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.2: Inequality and Fiscal Capacity in Brazilian Municipalities (Cross-Sectional Models for 2000 and 2010) – Imputed data

	Dependent variable: IPTU Revenue (log)					
	Model 7 2000	Model 8 2000 (robust)	Model 9 2000 (cluster)	Model 10 2010	Model 11 2010 (robust)	Model 12 2010 (cluster)
Gini	-3.736***	-3.736***	-3.736***	-6.491***	-6.491***	-6.491***
	(0.584)	(0.615)	(0.894)	(0.519)	(0.639)	(1.388)
Population (log)	-1.117***	-1.117***	-1.117***	-0.366***	-0.366***	-0.366*
	(0.076)	(0.084)	(0.278)	(0.068)	(0.079)	(0.189)
GDP (log)	2.070***	2.070***	2.070***	1.327***	1.327***	1.327***
	(0.063)	(0.073)	(0.220)	(0.055)	(0.063)	(0.183)
Left Party	-0.097	-0.097	-0.097	-0.055	-0.055	-0.055
	(0.088)	(0.087)	(0.122)	(0.062)	(0.063)	(0.073)
Rural Share	-2.876***	-2.876***	-2.876***	-2.912***	-2.912***	-2.912***
	(0.197)	(0.208)	(0.475)	(0.168)	(0.188)	(0.386)
Housing and Urbanization (log)	0.011	0.011	0.011	0.061***	0.061**	0.061**
	(0.017)	(0.019)	(0.028)	(0.018)	(0.024)	(0.028)
Transfers (log)	0.345***	0.345***	0.345***	0.396***	0.396***	0.396***
	(0.073)	(0.080)	(0.086)	(0.083)	(0.102)	(0.099)
Oil Revenue (log)	-0.032***	-0.032***	-0.032	-0.023***	-0.023***	-0.023
	(0.011)	(0.012)	(0.029)	(0.007)	(0.008)	(0.018)
Constant	-4.193***	-4.193***	-4.193***	-3.383***	-3.383***	-3.383***
	(0.749)	(0.790)	(0.993)	(0.830)	(0.996)	(1.088)
N	5114	5114	5114	4580	4580	4580
R^2	.	.	.	.	.	.

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
Model 8 and Model 11 with robust standard errors.
Model 9 and Model 12 with standard errors clustered by state.
The results are consistent with the models using non-imputed data: The negative and significant estimates for Gini in all models indicate that as inequality increases, the state's ability to raise revenue from citizens decreases substantially.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.3: Results from Spatial Autoregressive Models

	Dependent variable: IPTU (log)			
	Model 1	Model 2	Model 3	Model 4
	2000 Binary	2000 Row-standardized	2010 Binary	2010 Row-standardized
Gini	−2.859***	−1.437***	−5.304***	−3.446***
	(0.563)	(0.551)	(0.488)	(0.474)
Population (log)	−0.805***	−0.277***	−0.077	0.255***
	(0.083)	(0.084)	(0.073)	(0.071)
GPD (log)	1.844***	1.535***	1.358***	1.094***
	(0.074)	(0.074)	(0.058)	(0.058)
Left Party	−0.049	−0.116	−0.038	−0.070
	(0.084)	(0.082)	(0.057)	(0.055)
Rural Share	−2.770***	−2.426***	−2.776***	−2.546***
	(0.170)	(0.166)	(0.155)	(0.151)
Housing and Urbanization (log)	0.001	0.003	0.047***	0.046***
	(0.016)	(0.016)	(0.015)	(0.014)
Transfers (log)	−0.053	−0.103	−0.198*	−0.251**
	(0.136)	(0.133)	(0.120)	(0.116)
Oil Revenue (log)	−0.019*	−0.036***	−0.013**	−0.028***
	(0.011)	(0.011)	(0.006)	(0.006)
Intercept	−0.438	−3.961***	2.281**	−0.368
	(1.208)	(1.176)	(1.139)	(1.099)
N	4838	4838	4261	4261
Log-Likelihood	−11,220.330	−11,124.920	−8,278.976	−8,151.819
σ^2	6.027	5.693	2.849	2.642
Akaike Inf. Crit.	22,462.660	22,271.840	16,579.950	16,325.640
Wald Test (df = 1)	239.216***	479.604***	132.134***	416.207***
LR Test (df = 1)	238.898***	429.717***	131.314***	385.629***

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
This table shows the results from four spatial autoregressive models with neighbors based on contiguous boundaries between the municipalities, using 2000 and 2010 cross-sectional data. The results in Model 1 and Model 3 are based on a binary neighbor matrix, while the results in Model 2 and Model 4 are based on a row-standardized weights matrix. The results are in line with our findings: the coefficients for inequality (*Gini*) are still substantively meaningful, negative, and precisely estimated.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Bivariate Cross-Sectional Models: Benchmark to Compare the Results

	Model 1 2000	Model 2 2000 (robust)	Model 3 2000 (cluster)	Model 4 2010	Model 5 2010 (robust)	Model 6 2010 (cluster)
Gini	-5.402***	-5.402***	-5.402**	-7.468***	-7.468***	-7.468***
	(0.745)	(0.735)	(2.417)	(0.594)	(0.623)	(2.377)
Constant	12.085***	12.085***	12.085***	14.607***	14.607***	14.607***
	(0.410)	(0.399)	(1.533)	(0.295)	(0.297)	(1.160)
N	5304	5304	5304	5211	5211	5211
R^2	0.010	0.010	0.010	0.029	0.029	0.029

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).

Model 2 and Model 5 with robust standard errors.

Model 3 and Model 6 with standard errors clustered by state.

To increase confidence in the results, we present OLS estimations without any controls, as a benchmark to compare the results. The results are consistent with our previous models including controls.

Standard errors in parentheses. Two-tailed test.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B Appendix: Additional Controls

Table B.1: Original Cross-Sectional Models Including the Control Variable "Turnout"

	Dependent variable: IPTU Revenue (log)			
	Model 1 2000 (robust)	Model 2 2000 (cluster)	Model 3 2010 (robust)	Model 4 2010 (cluster)
Gini	-3.202*** (0.627)	-3.202*** (0.851)	-6.019*** (0.632)	-6.019*** (1.375)
Turnout	3.343*** (0.789)	3.343*** (1.067)	1.316** (0.566)	1.316* (0.752)
Population (log)	-0.833*** (0.109)	-0.833** (0.339)	-0.014 (0.084)	-0.014 (0.187)
GDP (log)	2.162*** (0.093)	2.162*** (0.223)	1.497*** (0.068)	1.497*** (0.186)
Left Party	-0.109 (0.086)	-0.109 (0.118)	-0.025 (0.059)	-0.025 (0.060)
Rural Share	-2.807*** (0.207)	-2.807*** (0.467)	-2.689*** (0.181)	-2.689*** (0.393)
Housing and Urbanization (log)	0.006 (0.018)	0.006 (0.026)	0.052** (0.023)	0.052* (0.028)
Transfers (log)	-0.081 (0.180)	-0.081 (0.360)	-0.272** (0.135)	-0.272 (0.200)
Oil Revenue (log)	-0.035*** (0.012)	-0.035 (0.031)	-0.020*** (0.008)	-0.020 (0.019)
Constant	-4.466** (1.769)	-4.466 (3.146)	1.322 (1.296)	1.322 (1.598)
N	4844	4844	4250	4250
R^2	0.509	0.509	0.642	0.642

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
$Turnout = \frac{\text{total number of voters in the municipal election}}{\text{total number of the electorate in the municipal election}}$
Model 1 and Model 3 with robust standard errors.
Model 2 and Model 4 with standard errors clustered by state.
The results from models including the independent variable *turnout* are consistent with our previous models: more unequal municipalities have a lower capacity to collect taxes.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.2: Electoral Competition (Cross-Sectional Model for 2010)

	Model 1	Model 2 (robust)	Model 3 (cluster)
Gini	-6.305***	-6.305***	-6.305***
	(0.509)	(0.645)	(1.410)
Electoral Competition	0.310	0.310	0.310
	(0.203)	(0.192)	(0.191)
Population (log)	-0.049	-0.049	-0.049
	(0.078)	(0.083)	(0.185)
GDP (log)	1.533***	1.533***	1.533***
	(0.061)	(0.070)	(0.195)
Left Party	-0.030	-0.030	-0.030
	(0.059)	(0.060)	(0.061)
Rural Share	-2.700***	-2.700***	-2.700***
	(0.163)	(0.188)	(0.392)
Housing and Urbanization (log)	0.049***	0.049**	0.049*
	(0.016)	(0.024)	(0.028)
Transfers (log)	-0.294**	-0.294**	-0.294
	(0.128)	(0.139)	(0.195)
Oil Revenue (log)	-0.017***	-0.017**	-0.017
	(0.007)	(0.008)	(0.019)
Constant	2.916**	2.916**	2.916
	(1.201)	(1.261)	(1.834)
N	4074	4074	4074
R^2	0.642	0.642	0.642

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).

$\textit{Electoral Competition} = \frac{\text{elected candidate's vote share - runner up candidate's vote share}}{\text{total number of the electorate in the municipal election}}$

Model 2 with robust standard errors, and Model 3 with standard errors clustered by state.

The results for the models that include the independent variable *electoral competition* are consistent with our previous results: more unequal municipalities have a lower capacity to collect taxes.

Standard errors in parentheses. Two-tailed test.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.3: Vulnerability to Poverty (%), Cross-Section and Panel Models

	Model 1	Model 2	Model 3	Model 4	Model 5
	2000	2000	2010	2010	1991-2000-2010
	(robust)	(cluster)	(robust)	(cluster)	(FE & cluster)
Gini	-2.982***	-2.982***	-5.302***	-5.302***	-3.142**
	(0.617)	(0.883)	(0.631)	(1.358)	(1.167)
Vulnerability to Poverty (%)	-0.021***	-0.021***	-0.015***	-0.015***	-0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)
Population (log)	-0.751***	-0.751**	0.069	0.069	2.024***
	(0.106)	(0.337)	(0.079)	(0.173)	(0.464)
GDP (log)	1.950***	1.950***	1.304***	1.304***	-0.043
	(0.096)	(0.223)	(0.070)	(0.169)	(0.171)
Left Party	-0.103	-0.103	-0.006	-0.006	
	(0.086)	(0.119)	(0.058)	(0.058)	
Rural Share	-2.596***	-2.596***	-2.479***	-2.479***	-0.412
	(0.205)	(0.424)	(0.181)	(0.336)	(1.004)
Housing and Urbanization (log)	0.014	0.014	0.052**	0.052*	-0.005
	(0.018)	(0.026)	(0.023)	(0.027)	(0.015)
Transfers (log)	-0.029	-0.029	-0.162	-0.162	0.371**
	(0.178)	(0.352)	(0.131)	(0.187)	(0.161)
Oil Revenue (log)	-0.024**	-0.024	-0.017**	-0.017	
	(0.012)	(0.030)	(0.008)	(0.017)	
2000					3.878*
					(2.213)
2010					4.440*
					(2.349)
Constant	0.143	0.143	2.171*	2.171	-16.439***
	(1.508)	(2.723)	(1.195)	(1.790)	(3.223)
N	4845	4845	4269	4269	8138
R^2	0.518	0.518	0.650	0.650	0.878

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).

Vulnerability to Poverty (%) = The proportion of individuals with a per capita household income equals to or less than R$255.00 per month, in Brazilian reais as of August 2010, which is equivalent to half of the average minimum salary in Brazil as of that date. The sample of individuals is limited to those who live in permanent private households.

Model 1 and Model 3 cross-sectional models with robust standard errors. Model 2 and Model 4 cross-sectional models with standard errors clustered by state. Model 5 Panel model (1991-2000-2010) with Year and Municipal fixed-effects and standard errors clustered by state.

The results for models including the independent variable *vulnerability to poverty (%)* are consistent with previous results: more unequal municipalities have a lower capacity to collect taxes.

Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.4: Bolsa Família Cash Transfer Program, Cross-Sectional Models for 2010

	Model 1	Model 2 (robust)	Model 3 (cluster)	Model 4	Model 5 (robust)	Model 6 (cluster)
Gini	-3.134***	-3.134***	-3.134*	-2.521***	-2.521***	-2.521*
	(0.500)	(0.683)	(1.587)	(0.501)	(0.670)	(1.463)
Number of Families (log)	-1.277***	-1.277***	-1.277***			
	(0.067)	(0.069)	(0.200)			
Cash Benefits Amount (log)				-1.221***	-1.221***	-1.221***
				(0.058)	(0.057)	(0.159)
Population (log)	1.727***	1.727***	1.727***	1.732***	1.732***	1.732***
	(0.118)	(0.116)	(0.373)	(0.112)	(0.104)	(0.322)
GDP (log)	0.753***	0.753***	0.753***	0.686***	0.686***	0.686***
	(0.068)	(0.073)	(0.204)	(0.068)	(0.072)	(0.194)
Left Party	-0.011	-0.011	-0.011	-0.018	-0.018	-0.018
	(0.055)	(0.057)	(0.053)	(0.055)	(0.056)	(0.053)
Rural Share	-2.356***	-2.356***	-2.356***	-2.242***	-2.242***	-2.242***
	(0.153)	(0.179)	(0.230)	(0.152)	(0.178)	(0.230)
Housing and Urbanization (log)	0.045***	0.045**	0.045*	0.043***	0.043*	0.043*
	(0.015)	(0.023)	(0.026)	(0.015)	(0.022)	(0.025)
Transfers (log)	-0.072	-0.072	-0.072	-0.031	-0.031	-0.031
	(0.118)	(0.127)	(0.206)	(0.117)	(0.126)	(0.193)
Oil Revenue (log)	0.001	0.001	0.001	0.002	0.002	0.002
	(0.006)	(0.007)	(0.017)	(0.006)	(0.007)	(0.016)
Constant	-1.870	-1.870	-1.870	2.946***	2.946***	2.946
	(1.137)	(1.188)	(2.084)	(1.106)	(1.132)	(1.851)
N	4269	4269	4269	4269	4269	4269
R^2	0.669	0.669	0.669	0.675	0.675	0.675

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).

Model 2 and Model 5 with robust standard errors.

Model 3 and Model 6 with standard errors clustered by state.

The results when including the number of families that receives the Bolsa Família cash transfer (*number of families*) or the amount of cash benefits in Brazilian reais (cash benefits amount) are consistent with our previous results: more unequal municipalities have a lower capacity to collect taxes.

Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.5: GDP Growth

	Model 1 2000	Model 2 2000 (robust)	Model 3 2000 (cluster)	Mode 4 2010	Model 5 2010 (robust)	Model 6 2010 (cluster)
Gini	-2.286***	-2.286***	-2.286**	-5.798***	-5.798***	-5.798***
	(0.661)	(0.702)	(0.909)	(0.492)	(0.630)	(1.326)
GDP Growth	-0.143***	-0.143***	-0.143***	-0.240***	-0.240***	-0.240**
	(0.027)	(0.043)	(0.046)	(0.024)	(0.075)	(0.088)
Population (log)	-0.750***	-0.750***	-0.750**	-0.221***	-0.221***	-0.221
	(0.098)	(0.130)	(0.279)	(0.076)	(0.083)	(0.181)
GDP (log)	2.316***	2.316***	2.316***	1.629***	1.629***	1.629***
	(0.081)	(0.101)	(0.214)	(0.060)	(0.075)	(0.196)
Left Party	-0.085	-0.085	-0.085	-0.015	-0.015	-0.015
	(0.091)	(0.091)	(0.110)	(0.057)	(0.058)	(0.059)
Rural Share	-2.939***	-2.939***	-2.939***	-2.563***	-2.563***	-2.563***
	(0.229)	(0.241)	(0.463)	(0.158)	(0.188)	(0.377)
Housing and Urbanization (log)	0.002	0.002	0.002	0.057***	0.057**	0.057**
	(0.020)	(0.022)	(0.031)	(0.015)	(0.023)	(0.027)
Transfers (log)	-0.504***	-0.504**	-0.504	-0.219*	-0.219	-0.219
	(0.148)	(0.228)	(0.320)	(0.122)	(0.135)	(0.179)
Oil Revenue (log)	-0.036***	-0.036***	-0.036	-0.020***	-0.020**	-0.020
	(0.011)	(0.013)	(0.031)	(0.006)	(0.008)	(0.017)
Constant	2.293*	2.293	2.293	2.018*	2.018	2.018
	(1.294)	(1.880)	(2.649)	(1.155)	(1.228)	(1.648)
N	3695	3695	3695	4243	4243	4243
R^2	0.546	0.546	0.546	0.649	0.649	0.649

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
$GDP\ Growth = \frac{GDP - GDP_{t-1}}{GDP_{t-1}}$
Model 2 and Model 5 with robust standard errors.
Model 3 and Model 6 with standard errors clustered by state.
Results for models including the independent variable *GDP growth* are consistent with those reported previously: more unequal municipalities have a lower capacity to collect taxes.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.6: Adding ITBI and Total Tax as Independent Variables into the Original Cross-Sectional Model for 2010

	Model 1 IPTU	Model 2 2010 (robust)	Model 3 2010 (cluster)	Model 4 2010	Model 5 2010 (robust)	Model 6 2010 (cluster)
Gini	-6.190***	-6.190***	-6.190***	-5.154***	-5.154***	-5.154***
	(0.493)	(0.624)	(1.396)	(0.442)	(0.534)	(0.998)
ITBI (log)				0.288***	0.288***	0.288***
				(0.012)	(0.026)	(0.037)
Total Tax (log)				0.673***	0.673***	0.673***
				(0.042)	(0.059)	(0.127)
Population (log)	-0.080	-0.080	-0.080	0.051	0.051	0.051
	(0.075)	(0.081)	(0.185)	(0.066)	(0.067)	(0.136)
GDP (log)	1.503***	1.503***	1.503***	0.535***	0.535***	0.535***
	(0.059)	(0.068)	(0.190)	(0.061)	(0.074)	(0.153)
Left Party	-0.033	-0.033	-0.033	-0.040	-0.040	-0.040
	(0.058)	(0.059)	(0.059)	(0.051)	(0.052)	(0.049)
Rural Share	-2.734***	-2.734***	-2.734***	-1.701***	-1.701***	-1.701***
	(0.158)	(0.182)	(0.401)	(0.144)	(0.172)	(0.345)
Housing and Urbanization (log)	0.052***	0.052**	0.052*	0.006	0.006	0.006
	(0.015)	(0.023)	(0.027)	(0.014)	(0.021)	(0.018)
Transfers (log)	-0.228*	-0.228*	-0.228	-0.426***	-0.426***	-0.426**
	(0.123)	(0.134)	(0.195)	(0.112)	(0.125)	(0.167)
Oil Revenue (log)	-0.020***	-0.020***	-0.020	-0.015**	-0.015**	-0.015
	(0.007)	(0.008)	(0.018)	(0.006)	(0.007)	(0.016)
Constant	2.391**	2.391*	2.391	2.518**	2.518**	2.518
	(1.162)	(1.226)	(1.864)	(1.046)	(1.094)	(1.521)
N	4269	4269	4269	4265	4265	4265
R^2	0.641	0.641	0.641	0.715	0.715	0.715

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).

ITBI = Tax Revenue on Real Estate Transfers in Brazilian reais.

Total Tax = Total taxes revenue collected by the municipality.

Model 2 and Model 5 with robust standard errors.

Model 3 and Model 6 with standard errors clustered by state.

Results for models including the independent variable *ITBI* are consistent with previous models: more unequal municipalities have a lower capacity to collect taxes.

Standard errors in parentheses. Two-tailed test.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.7: Industry Value Added as Percentage of GDP

	Model 1 2000 (robust)	Model 2 2000 (cluster)	Model 3 2010 (robust)	Model 4 2010 (cluster)	Model 5 1991-2000-2010 (FE & cluster)
Gini	-4.229***	-4.229***	-6.529***	-6.529***	-3.443**
	(0.629)	(0.979)	(0.627)	(1.422)	(1.261)
Industry (% GDP)	-2.908***	-2.908***	-1.960***	-1.960***	-1.778***
	(0.394)	(0.804)	(0.241)	(0.341)	(0.524)
Population (log)	-1.140***	-1.140***	-0.198**	-0.198	1.788***
	(0.103)	(0.359)	(0.080)	(0.178)	(0.452)
GDP (log)	2.475***	2.475***	1.668***	1.668***	0.066
	(0.099)	(0.264)	(0.074)	(0.200)	(0.175)
Left Party	-0.140	-0.140	-0.037	-0.037	
	(0.086)	(0.117)	(0.059)	(0.057)	
Rural Share	-2.947***	-2.947***	-2.750***	-2.750***	-0.818
	(0.210)	(0.461)	(0.180)	(0.397)	(0.858)
Housing and Urbanization (log)	0.016	0.016	0.054**	0.054*	-0.003
	(0.018)	(0.028)	(0.023)	(0.028)	(0.015)
Transfers (log)	-0.112	-0.112	-0.227*	-0.227	0.370**
	(0.180)	(0.367)	(0.133)	(0.189)	(0.159)
Oil Revenue (log)	-0.023*	-0.023	-0.017**	-0.017	
	(0.012)	(0.030)	(0.008)	(0.017)	
2000					3.884*
					(2.209)
2010					4.673*
					(2.376)
Constant	-0.566	-0.566	2.153*	2.153	-15.652***
	(1.517)	(2.898)	(1.210)	(1.752)	(2.909)
N	4845	4845	4269	4269	8138
R^2	0.513	0.513	0.646	0.646	0.879

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).

Industry (% GDP) = Industry value added, as % of GDP.

We could not find data for *municipal GDP* and *Industry (% GDP)* for the early 1990s. We thus have to rely on a GDP measurement from 1985 in the panel data for 1991.

Model 1 and Model 3 cross-sectional models with robust standard errors. Model 2 and Model 4 cross-sectional models with standard errors clustered by state. Model 5 Panel model (1991-2000-2010) with Year and Municipal fixed-effects and standard errors clustered by state.

Results for models including the independent variable *Industry (% GDP)* are consistent with our results reported in the manuscript: more unequal municipalities have a lower capacity to collect taxes. The results are consistent when dropping the 10 observations below 0 and 4 observations above 1 for *Industry (% GDP)*.

Standard errors in parentheses. Two-tailed test.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C Appendix: Additional Dependent Variables

Table C.1: IPTU as a Ratio DV, Cross-Sectional Models for 2010

	Model 1 $\frac{IPTU}{GDP}$	Model 2 $\frac{IPTU}{GDP}$ (robust)	Model 3 $\frac{IPTU}{GDP}$ (cluster)	Model 4 $\frac{IPTU}{Tax}$	Model 5 $\frac{IPTU}{Tax}$ (robust)	Model 6 $\frac{IPTU}{Tax}$ (cluster)
Gini	-5.156**	-5.156***	-5.156*	-0.432***	-0.432***	-0.432***
	(2.213)	(1.766)	(2.911)	(0.034)	(0.035)	(0.073)
Population (log)	0.418	0.418	0.418	0.017***	0.017***	0.017
	(0.344)	(0.299)	(0.399)	(0.005)	(0.006)	(0.012)
Left Party	-0.439*	-0.439*	-0.439	-0.002	-0.002	-0.002
	(0.266)	(0.254)	(0.365)	(0.004)	(0.004)	(0.004)
Rural Share	-9.056***	-9.056***	-9.056***	-0.178***	-0.178***	-0.178***
	(0.689)	(1.028)	(2.947)	(0.011)	(0.011)	(0.045)
Housing and Urbanization (log)	0.206***	0.206***	0.206*	0.002*	0.002*	0.002
	(0.070)	(0.048)	(0.120)	(0.001)	(0.001)	(0.002)
Transfers (log)	0.520	0.520	0.520	-0.083***	-0.083***	-0.083***
	(0.439)	(0.429)	(0.569)	(0.009)	(0.009)	(0.019)
Oil Revenue (log)	0.083***	0.083	0.083	-0.002***	-0.002***	-0.002
	(0.029)	(0.064)	(0.136)	(0.000)	(0.000)	(0.001)
GDP (log)				0.068***	0.068***	0.068***
				(0.004)	(0.004)	(0.014)
Constant	-6.608	-6.608	-6.608	0.888***	0.888***	0.888***
	(4.563)	(5.012)	(6.577)	(0.081)	(0.089)	(0.196)
N	4269	4269	4269	4267	4267	4267
R^2	0.113	0.113	0.113	0.344	0.344	0.344

Notes: Dependent variables: IPTU Revenue/GDP (Model 1, Model 2, and Model 3); IPTU Revenue/Total tax revenue (Model 4, Model 5, and Model 6)
Model 2 and Model 5 with robust standard errors.
Model 3 and Model 6 with standard errors clustered by state.
Results when using an alternative measures of tax capacity (IPTU as a ratio of GDP and as a ratio of total tax) are consistent with previous results: more unequal municipalities have a lower capacity to collect taxes.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.2: Alternative Local Tax: Original Cross-Sectional Model for 2010 and Model Using ITBI as Dependent Variable

	Model 1 IPTU	Model 2 IPTU (robust)	Model 3 IPTU (cluster)	Model 4 ITBI	Model 5 ITBI (robust)	Model 6 ITBI (cluster)
Gini	-6.190***	-6.190***	-6.190***	-4.378***	-4.378***	-4.378***
	(0.493)	(0.624)	(1.396)	(0.566)	(0.673)	(1.502)
Population (log)	-0.080	-0.080	-0.080	-0.341***	-0.341***	-0.341*
	(0.075)	(0.081)	(0.185)	(0.085)	(0.093)	(0.173)
GDP (log)	1.503***	1.503***	1.503***	1.865***	1.865***	1.865***
	(0.059)	(0.068)	(0.190)	(0.067)	(0.077)	(0.219)
Left Party	-0.033	-0.033	-0.033	0.062	0.062	0.062
	(0.058)	(0.059)	(0.059)	(0.066)	(0.064)	(0.079)
Rural Share	-2.734***	-2.734***	-2.734***	-1.782***	-1.782***	-1.782***
	(0.158)	(0.182)	(0.401)	(0.181)	(0.193)	(0.354)
Housing and Urbanization (log)	0.052***	0.052**	0.052*	0.062***	0.062***	0.062*
	(0.015)	(0.023)	(0.027)	(0.017)	(0.021)	(0.030)
Transfers (log)	-0.228*	-0.228*	-0.228	-0.685***	-0.685***	-0.685**
	(0.123)	(0.134)	(0.195)	(0.141)	(0.150)	(0.271)
Oil Revenue (log)	-0.020***	-0.020***	-0.020	-0.019**	-0.019**	-0.019
	(0.007)	(0.008)	(0.018)	(0.007)	(0.008)	(0.020)
Constant	2.391**	2.391*	2.391	6.917***	6.917***	6.917**
	(1.162)	(1.226)	(1.864)	(1.332)	(1.397)	(2.520)
N	4269	4269	4269	4267	4267	4267
R^2	0.641	0.641	0.641	0.524	0.524	0.524

Notes: Dependent variables: IPTU Revenue (logged) (Model 1, Model 2, and Model 3);
ITBI Revenue (logged) (Model 4, Model 5, and Model 6)
ITBI = Tax Revenue on Real Estate Transfers in Brazilian reais.
Model 2 and Model 5 with robust standard errors.
Model 3 and Model 6 with standard errors clustered by state.
Results using an alternative local tax *(ITBI)* as our dependent variable are consistent with our previous models: more unequal municipalities have a lower capacity to collect tax.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.3: Correlation Matrix

	IPTU	ITBI
IPTU	1.0000	
ITBI	0.9702 0.000	1.0000

Considering the high positive correlation between IPTU and ITBI (Pearson's r = 0.97) it is not surprising that the results using ITBI as the dependent variable are consistent with the main results from our original models.

Table C.4: IPTU Collected by Number of Buildings as DV, 2000

	DV: IPTU Collected (By Buildings)	
	Model 1	Model 2
	(robust)	(cluster)
Gini	-0.391***	-0.391***
	(0.063)	(0.076)
Population (log)	-0.163***	-0.163***
	(0.010)	(0.022)
GDP (log)	0.149***	0.149***
	(0.008)	(0.021)
Left Party	0.002	0.002
	(0.009)	(0.009)
Rural Share	0.124***	0.124**
	(0.021)	(0.057)
Housing and Urbanization (log)	0.003*	0.003
	(0.002)	(0.003)
Transfers (log)	0.001	0.001
	(0.015)	(0.013)
Oil Revenue (log)	-0.007***	-0.007***
	(0.001)	(0.002)
Constant	0.526***	0.526***
	(0.130)	(0.101)
N	4005	4005
R^2	0.175	0.175

Notes: Dependent variables: $\frac{\text{total number of buildings that paid IPTU}}{\text{total number of buildings that could be charged}}$

Model 1 with robust standard errors. Model 2 with standard errors clustered by state.

The results when using *IPTU Collected by buildings* as our dependent variable are consistent with those in our previous models: more unequal municipalities have a lower capacity to collect taxes.

Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.5: IPTU Collection Rate as DV

	Dependent variable: IPTU Collection Rate						
	Model 1 2000	Model 2 2000 (robust)	Model 3 2000 (cluster)	Model 4 2010	Model 5 2010 (robust)	Model 6 2010 (cluster)	Model 7 Panel (2000-2010) (FE & cluster)
Gini	-0.735**	-1.047**	-1.047*	-0.613**	-0.676**	-0.676*	-1.460**
	(0.315)	(0.428)	(0.556)	(0.250)	(0.317)	(0.392)	(0.544)
Population (log)		-0.092	-0.092		-0.088**	-0.088***	0.085
		(0.056)	(0.055)		(0.042)	(0.024)	(0.192)
GDP (log)		0.098	0.098*		0.162***	0.162***	-0.134***
		(0.061)	(0.048)		(0.046)	(0.044)	(0.032)
Left Party		-0.039	-0.039		-0.055*	-0.055**	-0.054***
		(0.035)	(0.029)		(0.028)	(0.025)	(0.016)
Rural Share		-0.237	-0.237		-0.349**	-0.349**	-0.975*
		(0.325)	(0.379)		(0.158)	(0.159)	(0.506)
Housing and Urbanization (log)		0.013	0.013		-0.003	-0.003	0.003
		(0.018)	(0.017)		(0.005)	(0.005)	(0.002)
Transfers (log)		0.003	0.003		-0.042	-0.042	0.043
		(0.083)	(0.086)		(0.079)	(0.069)	(0.053)
Oil Revenue (log)		-0.001	-0.001		-0.007***	-0.007***	0.010***
		(0.004)	(0.004)		(0.002)	(0.002)	(0.002)
2010							0.018
							(0.058)
Constant	0.910***	0.606	0.606	0.937***	0.633	0.633	1.421
	(0.176)	(0.532)	(0.652)	(0.130)	(0.609)	(0.556)	(1.968)
N	180	142	142	180	142	142	238
R^2	0.030	0.201	0.201	0.033	0.352	0.352	0.498

Notes: Dependent variables: IPTU Collection Rate as measured by Carvalho, Jr. (2017).
Model 2 and Model 5 with robust standard errors.
Model 3 and Model 6 with standard errors clustered by state.
Model 7 with year and municipality fixed-effects and standard errors clustered by state.
Results when using *IPTU Collection Rate* as our dependent variable are consistent with the results presented in the manuscript: more unequal municipalities have a lower capacity to collect taxes.
Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.6: Full Table: Municipal Applications to the Capacity-Building Program (PMAT)

	Dependent variable: PMAT Application			
	Model 1 OLS (robust)	Model 2 OLS (cluster)	Model 3 Logit (robust)	Model 4 Logit (cluster)
Gini	-0.242***	-0.242***	-2.786**	-2.786**
	(0.050)	(0.070)	(1.166)	(1.230)
IPTU Revenue (log)	0.057***	0.057***	0.449***	0.449***
	(0.007)	(0.010)	(0.084)	(0.126)
Population (log)	0.032***	0.032***	0.231**	0.231
	(0.006)	(0.009)	(0.114)	(0.196)
GDP (log)	0.019***	0.019**	0.489***	0.489***
	(0.005)	(0.008)	(0.099)	(0.138)
Rural Share	-0.035*	-0.035	-0.699*	-0.699
	(0.019)	(0.026)	(0.423)	(0.526)
Transfers (log)	-0.017***	-0.017**	-0.209***	-0.209
	(0.004)	(0.008)	(0.069)	(0.131)
Constant	-0.270***	-0.270***	-8.390***	-8.390***
	(0.057)	(0.067)	(1.042)	(1.560)
N	4047	4047	4047	4047
R^2	0.193	0.193		
Log-likelihood			-755.391	-755.391

Notes: Dependent variable: Binary variable PMAT (1 = municipality applied to PMAT, 0 = municipality didn't apply to PMAT).
Model 1 and Model 3 with robust standard errors.
Model 2 and Model 4 with standard errors clustered by state.
Results when *PMAT* as our dependent variable indicate that greater inequality is associated with a lower likelihood of application to PMAT.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D Appendix: Panel Models

Table D.1: Panel Fixed Effects Models (1991, 2000, and 2010)

	Dependent variable: IPTU Revenue (log)			
	Model 1 1991-2000-2010 (non-imputed)	Model 2 1991-2000-2010 (imputed)	Model 3 2000-2010 (non-imputed)	Model 4 2000-2010 (imputed)
Gini	-3.479***	-5.118***	0.805	0.084
	(1.220)	(1.113)	(0.622)	(0.665)
Population (log)	1.996***	1.455***	0.642	0.042
	(0.459)	(0.435)	(0.494)	(0.511)
GDP (log)	-0.033	0.026	0.654**	0.697***
	(0.171)	(0.168)	(0.238)	(0.207)
Rural Share	-0.468	-0.801	-2.809**	-2.662**
	(0.959)	(0.789)	(1.012)	(1.089)
Housing and Urbanization (log)	-0.006	-0.080***	0.013	0.033*
	(0.015)	(0.025)	(0.015)	(0.016)
Transfers (log)	0.363**	0.349***	0.188	0.293***
	(0.163)	(0.081)	(0.305)	(0.078)
2000	4.113*	5.404***		
	(2.257)	(1.023)		
2010	4.936*	6.271***	1.107***	0.902***
	(2.427)	(1.072)	(0.376)	(0.132)
Constant	-17.067***	-11.379***	-6.170	-2.545
	(3.167)	(3.704)	(5.916)	(4.685)
N	8138	9706	8599	9154
R^2	0.878		0.358	

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
Year and Municipal fixed-effects included in all models. Standard errors clustered by state.
The results of Model 1 and Model 2—including all the data—are consistent with the cross-sectional models, indicating that more unequal municipalities have a lower capacity to collect tax. The estimates for *Gini* in Model 3 and Model 4—2000 and 2010 data only—are not significant.
We dropped municipalities that were founded after 1985, resulting in a smaller number of observations in Model 1, i.e., those municipalities that did not exist for part of the time period used in the panel. The results do not change significantly if we do not drop these municipalities.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table D.2: Bivariate Fixed Effects Panel Models: Benchmark to Compare the Results

	IPTU (1991-2000-2010)	IPTU (1991-2000-2010)	IPTU (2000-2010)	IPTU (2000-2010)
Gini	-16.745**	-3.479***	-13.298***	0.805
	(6.696)	(1.220)	(1.083)	(0.622)
Population (log)		1.996***		0.642
		(0.459)		(0.494)
GDP (log)		-0.033		0.654**
		(0.171)		(0.238)
Rural Share		-0.468		-2.809**
		(0.959)		(1.012)
Transfers (log)		0.363**		0.188
		(0.163)		(0.305)
Housing and Urbanization (log)		-0.006		0.013
		(0.015)		(0.015)
2000		4.113*		
		(2.257)		
2010		4.936*		1.107***
		(2.427)		(0.376)
Constant	16.149***	-17.067***	16.921***	-6.170
	(3.518)	(3.167)	(0.565)	(5.916)
N	9378	8138	8655	8599
R^2	0.028	0.878	0.128	0.358

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).
Year and Municipal fixed-effects included in all models. Standard errors clustered by state.
The coefficient on inequality is larger in the bivariate models and remains significant. For the bivariate model, even the two-period panel model (2000-2010) results are in line with our argument.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table D.3: Original Panel Models (1991-2000-2010) with Municipality-specific Linear and Quadratic Time Trends

	DV: IPTU Revenue	
	Model 1 (Time Trend)	Model 2 (Time Trend^2)
Gini	-3.317**	-3.479***
	(1.296)	(1.220)
Population (log)	1.829***	1.996***
	(0.427)	(0.459)
GDP (log)	-0.100	-0.033
	(0.202)	(0.171)
Rural Share	-0.426	-0.468
	(1.015)	(0.959)
Transfers (log)	0.685***	0.363**
	(0.062)	(0.163)
Housing and Urbanization (log)	0.018	-0.006
	(0.021)	(0.015)
Time Trend	0.425**	9.050
	(0.172)	(5.395)
Time Trend^2		-1.646
		(1.047)
Constant	-16.929***	-24.472***
	(3.177)	(6.540)
N	8138	8138
R^2	0.876	0.878

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged). All models with municipality fixed-effects and standard errors clustered by municipality.
This table shows the results for a panel model with both linear and quadratic time trends instead of year fixed effects. The results do not change substantially. Our independent variable of interest is still substantially large and significant.
Standard errors in parentheses. Two-tailed test.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

E Appendix: Sub-sample Analysis

Between 1982 and 2007, the number of municipalities in Brazil increased by 41 percent. It could be problematic for our analysis if the split of municipal units was somehow associated with the level of inequality. In general, the increase in the number of municipalities has been attributed to a number of different factors.

Since income is often concentrated geographically, it is possible that a redrawing of municipalities could split the older municipality into two very different new municipalities. For example, one high inequality municipality could be split into two low inequality units. Or it could be split into one high inequality and one low inequality municipality. To rule out the possibility that our results are affected by these splits, we first show the densities of our main independent variable of interest, inequality, for subsamples of municipalities split up by on municipality age (until 2010).

Figure E.1 depicts the distribution of years since each municipality in our dataset was created. The trimodal distribution reveals the thee most often values in our data: 1. municipalities over 70 years old; 2. municipalities between 40 and 60 years old, and; 3. municipalities between 10 and 20 years old.

Figure E.2, in turn, shows the distribution of the GINI coefficient by municipality ages in decades of age. The non-relationship between age and inequality (captured by the relatively similar distributions in each graph) indicates that a possible split of municipalities due to high inequality are most likely not driving our results.

In addition, we run our original model on a sub-sample of those municipalities that were created prior to 1970. The results are presented in column 2 in Table E.1 and are consistent

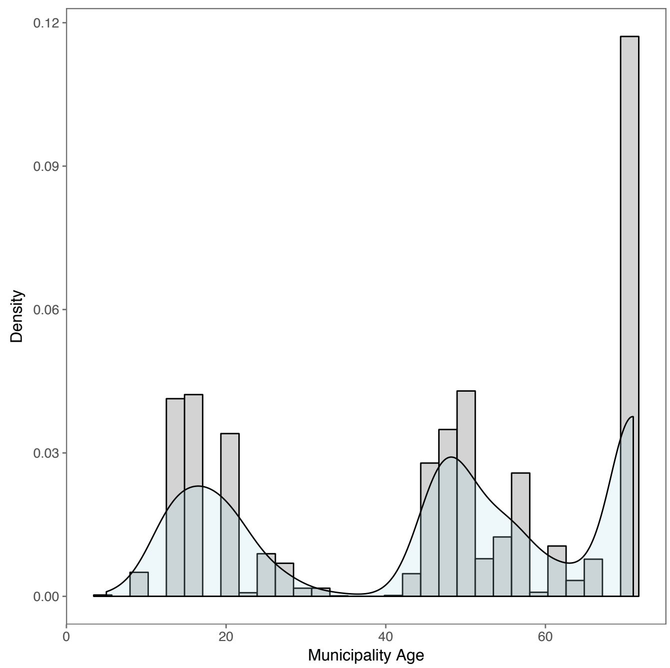

Figure E.1: Municipality Age in 2010: This plot shows the distribution of years since each municipality in the data set was created.

with those in the original sample (column 1). The results for the sub-sample analysis are consistent with the results using our original sample: a consistent negative effect of inequality on municipal IPTU revenue.

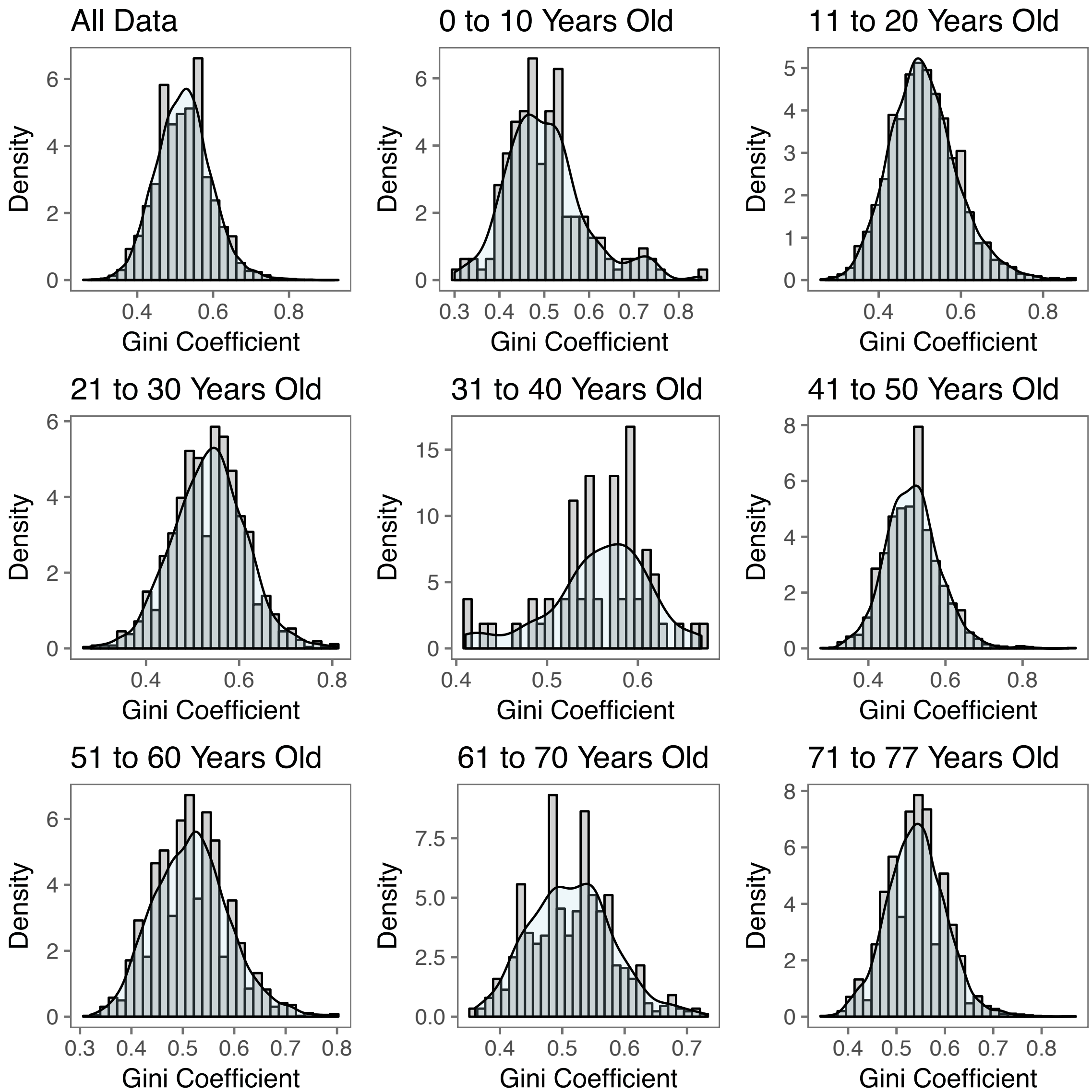

Figure E.2: GINI Coefficient by Municipality Age in 2010: This plot shows the distribution of the GINI coefficient by municipality ages (in decades of age). The non-relationship between age and inequality (captured by the relatively similar distributions in each graph) indicates that the split of municipalities due to high inequality is most likely not driving our results.

Table E.1: Sub-Sample Analysis Based on Municipality Age (until 2010)

	DV: IPTU Revenue (log)	
	Model 1 (Original 2010 Cross-Sectional Model)	Model 2 (Sub-Sample Model)
Gini	-6.190***	-4.880***
	(1.396)	(1.336)
Population (log)	-0.080	0.023
	(0.185)	(0.154)
GDP (log)	1.503***	1.570***
	(0.190)	(0.208)
Left Party	-0.033	-0.006
	(0.059)	(0.061)
Rural Share	-2.734***	-2.874***
	(0.401)	(0.390)
Housing and Urbanization (log)	0.052*	0.049
	(0.027)	(0.031)
Transfers (log)	-0.228	-0.437**
	(0.195)	(0.186)
Oil Revenue (log)	-0.020	-0.028
	(0.018)	(0.018)
Constant	2.391	3.690**
	(1.864)	(1.650)
N	4269	3337
R^2	0.641	0.677

Notes: Dependent variable: IPTU Revenue in Brazilian reais (logged).

Models with standard errors clustered by state.

The results for the sub-sample analysis are consistent with the results using our original sample: a consistent negative effect of inequality on municipal IPTU revenue.

Standard errors in parentheses. Two-tailed test.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

F Appendix: Zero Values in the Dependent Variable

Our measure of IPTU revenue collection, made available by the Institute of Applied Economic Research (IPEA), is in the current Brazilian currency called *real* (in plural, *reais*). The *real* was introduced on July 1, 1994. The data for 1991, therefore, was converted by IPEA from the former currency *cruzeiro* to *reais*, and also deflated to controlling for the high inflation in Brazil in 1991. In personal correspondence with the IPEA staff responsible for the data collection, they acknowledged that zero values in the revenue data should mean that no revenue was collected, but could not rule out the possibility that some of these zero values should actually be missing values. This is in addition to the missing values that do exist in the data.

We therefore decided to conduct an additional robustness check to our results. In an attempt to identify observations with actual zero revenue, we used the data on IPTU revenue in nominal values (in their original currencies), as originally released by the Brazilian Ministry of Finance through the National Treasury Secretariat. For the robustness check we created a corrected version of the IPTU revenue variable. We set values in the original IPTU data to NA (missing value) if the corresponding observation in the nominal IPTU data is NA.

This correction reduces the number of zero values in the data significantly—specifically, by about two-thirds for 1991. The original data have $1,527$ zeros in 1991, 458 in 2000, and 71 in 2010. The replacement of zeros with NA when the nominal data is missing, results in 443 zeros for 1991.

Given that only the data for 1991 is affected, we present the panel model with these changes in Table F.1. We are calling this changed dependent variable *IPTU_corrected (log)*. The first model is the fixed effects panel model (1991-2000-2010) using the corrected dependent variable with non-imputed data, i.e., dropping the missing observations. The second column shows the results when the corrected dependent variable is also imputed, i.e., the original zero values that were set as missing observations are replaced with imputed values.

While the magnitude of the coefficient for *Gini* in the panel model is smaller than from our original panel model, the results from the analysis using our new dependent variable *IPTU_corrected (log)* are consistent with the results we found originally: a consistent negative effect of inequality on municipal IPTU revenue in both models (either using non-imputed or imputed data). In addition, the selection on unobservables test results in a δ value of 3.34 for the non-imputed panel model.

Table F.1: Replacing the observations in our original dependent variable (IPTU revenue) to NA (missing value) when the observation is NA in the original data using nominal values

	Dependent variable: IPTU_corrected (log)	
	Model 1	Model 2
	FE Panel Model	FE Panel Model
	(1991-2000-2010)	(1991-2000-2010)
	Non-Imputed Data	*Imputed Data*
Gini	-2.851***	-3.614***
	(0.994)	(0.945)
Population (log)	2.283***	2.096***
	(0.481)	(0.398)
GDP (log)	0.081	0.120
	(0.127)	(0.120)
Rural Share	-0.927	-1.033
	(0.765)	(0.673)
Housing and Urbanization (log)	0.007	-0.068***
	(0.014)	(0.022)
Transfers (log)	-0.581	-0.841***
	(0.484)	(0.279)
2000	13.796**	17.562***
	(5.472)	(3.037)
2010	15.881**	20.080***
	(6.057)	(3.344)
Constant	-16.369***	-13.076***
	(2.868)	(3.073)
N	8102	9221
R^2	0.879	.

Notes: Dependent variable: *IPTU_corrected (log)*.

Both models with standard errors clustered by state and fixed-effects. The results for the analysis using *IPTU_corrected (log)* as the dependent variable are consistent with the results using our original dependent variable: a negative effect of inequality on municipal IPTU revenue in both models.

Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$