# Exploring the Link between Corruption and State Capacity: A Case Study of Brazilian Municipalities

by

Christian David Castaño Bonilla

Under the supervision of

#### Pilar Sorribas-Navarro

Submitted in partial fulfillment for the requirements for the degree of

Master in Institutions and Political Economy

Master of Science University of Barcelona September 2023

#### Abstract

This master thesis aims to investigate the causal effect of corruption on state capacity. While the diversity of theories of the causes and implications of corruption has grown as a result of the increased availability of data, there is a surprising lack of studies attempting to identify the causal effect that corruption has on state capacity. Building on previous literature, this paper employs the difference in differences and event study methods to explain how a case study of a top-down anti-corruption program could allow for a causal analysis of the effects of a drop in corruption on future state capacity, using data from over 250 Brazilian municipalities over 9 years from 2002 to 2010. The findings suggest that a drop in corruption can actively allow for the development of state capacity through several means. With state capacity being a key part of economic development, and capacity building being a core pillar of the United Nation's Sustainable Development Goals, the findings could facilitate better-informed policy-making that could have a greater and more holistic impact on developing nations.

Keywords: corruption; state capacity; political economy; development economics; public economics

## Acknowledgements

I would like to thank Leopoldo Fergusson and Xavier Fernández i Marín for their guidance for this research project, and of course my supervisor Pilar Sorribas-Navarro for her support and especially her patience.

A mi familia y amistades les agradezco su apoyo y en particular a mi abuelita, quién me llamó a despedirse, sin saberlo.

## 1 Introduction

Countless articles have been published in the pursuit of identifying the mechanisms through which some countries were able to grow their economies to grant their citizens unprecedented wealth and improve their living standards beyond what previous civilizations thought possible. One of the newer lines of research in this area proposes state capacity to be one of the factors that allowed some nations to pull ahead and develop at a much faster pace than other economies. With this in mind, this paper aims to supplement current literature on state capacity, identifying previous levels of corruption as an indicator of future possibilities of developing capacity.

This latest pandemic exposed the weak capacities of many nations around the world, highlighting the importance of social insurance and the redistributive capacity of the public sector, which crucially depend on state capacity. While some states were able to mobilize funds to address urgent needs in their populations and had enough information to efficiently allocate the funds to the most needed sectors and even send direct deposits to personal accounts, weaker states saw their economies and populations much more affected, with the pandemic sending 97 million people into extreme poverty in 2020 alone [World Bank, 2021]. The drastic bolstering of welfare programs through deficit spending, resulting in a strong economic recovery in developed nations in 2021, stood in stark contrast with low-income countries, which due to low tax revenue and difficulty selling sovereign debt on international markets saw their economies wither and their poverty rates lose decades of progress, or spent beyond their means suffering the inflationary consequences. A similar dynamic was seen after the 2008 financial crisis, when developed nations were able to strengthen unemployment programs, as poor nations were left at the mercy of weakened currencies and lower bond ratings. While the COVID-19 pandemic was a more severe crisis than the one in 2008, future crises such as climate emergencies could be greater still, which makes the development of state capacity all the more urgent. Corruption is pervasive in many low and middle-income states, though it is also seen in some high-income nations such as those in the Mediterranean, and can take on different forms [Cervantes Nieto and Castaño Bonilla, 2023]. While the previous literature on corruption is vast, the relationship between corruption and state capacity has not been explored in depth.

The relationship between corruption and state capacity is complicated and has several feedback loops, which is why I make use of an anti-corruption initiative in Brazil that randomly selected municipalities for in-depth audits in search of corruption. Once the meticulous audits were finished, the results were sent to the head comptroller's office, and a summary was published and shared with news media to socialize the results. The random element in this case study mitigates identification concerns and creates exogenous treatment in the exposure of corruption to the public, allowing for a cleaner causal analysis. The empirical design in this paper exploits this randomization, comparing the changes in investment in tax capacity and collection efficiency in indirect taxes after a municipality is audited, using not-yet-treated municipalities as the reference group. This particular anti-corruption initiative has inspired many papers, some of which highlight how previously audited municipalities tend to have lower levels of corruption when audited later on [Avis et al., 2018]. These previous findings allow me to study how this drop in corruption affects different metrics for state capacity. Previous literature has also shown that municipalities that were exposed as being highly corrupt saw lower tax compliance in capacity-intensive revenue sources for two years, namely property taxes.

I supplement this work by using difference-in-differences methodology and creating a latent variable for fiscal capacity using the existence of different tax capacity infrastructure at the municipal level, and find that municipalities exposed as being highly corrupt invest in fiscal capacity at a higher rate that both unaudited and low-corruption municipalities, with the capacity index being 19% and 27% greater respectively. I interpret this as a reaction to lower compliance and therefore lower revenue from capacity-intensive revenue sources, meaning that municipalities are forced to invest in tax collection infrastructure if they want to maintain previous spending levels. To measure bureaucratic quality, another measure of state capacity, I use the proportion of a general indirect tax of the total municipal revenue excluding transfers to show the evolution of the efficacy of revenue collection, using the Georgian anti-corruption program as a precedent. The analysis finds that the revenue, in proportional and absolute terms, does indeed increase by around 10% when compared to control municipalities. When employing event study methodology to measure the persistence of increased collection efficacy for indirect taxes, I find that the indirect taxes collected increases for two years after the audit, before falling in proportion to overall revenue. This echoes the findings in Timmons and Garfias [2015], and complements them using the investment in fiscal capacity as a mechanism for increased property tax revenue and lower indirect tax importance.

While previous papers have studied the effects of this Brazilian initiative, to my knowledge this is the first to directly measure the effects of the audits on state capacity. The previously mentioned Timmons and Garfias [2015] paper does measure tax revenue, however it does so from a compliance and fiscal contract perspective, and does not focus on the investment in or functioning of tax collection infrastructure in a municipality. This paper presents compatible findings, but goes further and complements them by identifying tax collection infrastructure investment as a mechanism for a lack of persistence in non-compliance.

Vannutelli [2022] found that a reform that limited municipal auditors' conflicts of interest in Italy by randomly assigning them, no longer allowing mayors to hand-pick their auditors, resulted in improved municipal revenue performance across several metrics. While similar to this paper due to the analysis of anti-corruption efforts on state capacity, the study did not include a metric for the intensity of corruption. My empirical design uses the number of acts of corruption per service order in the audit as a proxy to the intensity of corruption, a variable that is more often than not represented as a perception index due to its illegal nature. This measure for corruption allows me to credibly measure the marginal effects of low or high levels of corruption on the outcomes of interest.

By comparing cities that have been randomly selected for anti-corruption audits to a similar untreated sample, this paper hopes to provide plausible causal evidence of the detrimental effect that corruption has on state capacity. The questions considered in this paper will not only fill gaps in current literature and describe new relationships between corruption and the development of state capacity, but also allow for the creation of better-designed policies that could treat problems of state capacity at the root cause, allowing for more efficient resource allocation.

The rest of this paper proceeds as follows: Section 2 reviews my theoretical argumentation. Section three introduces the institutional setting. Section 4 presents the data. Section 5 outlines the empirical strategy and explains how the empirics will exploit the events to overcome the endogeneity problem. Section 6 displays the results. Section 7 concludes.

# 2 Theoretical Argumentation

In this section, I go over the different aspects of corruption, and the relevant literature on different examples of anti-corruption initiatives. This is followed by a brief explanation of different ways to define and measure state capacity and all of its dimensions, and how corruption can have a corrosive relationship with state capacity, complicating attempts for capacity building. The section ends with my theory and hypotheses.

## 2.1 Corruption

Before exploring the various effects that corruption has on the state, it might be beneficial to define corruption. While there is no singular definition of corruption, the general consensus is that it concerns public officials in their official duties, and involves the "misuse of public power for private gain" [Zimelis, 2020]. Importantly, the private gain does not necessarily have to be directed towards the official that deviates from their responsibilities but could be destined for a private actor with vested interests. Corruption can take many forms, such as bribery, favoritism, or embezzlement, among others.

Corruption, as a political, economic, or societal phenomenon, is nothing new. The misappropriation of public funds has existed for thousands of years as Kautilya mentioned some 2,000 years ago, noting that "just as it is impossible not to taste the honey or the poison on the tip of the tongue, so it is impossible for a government servant not to eat up at least part of the king's revenue" and that "just as a fish moving underwater cannot possibly be found out either as drinking or not drinking water, so servants employed in government work cannot be found out while taking money for themselves". While most modern societies believe that ethical standards should apply to everyone and that no one should be above the law, previous societies didn't subscribe to this ethical universalism and as all public spending was allocated at the ruler's whim, any embezzlement was at most a "principal-agent problem" [Mungiu-Pippidi, 2015. The concept of corruption as a societal ill was not widespread until the last few centuries, when public institutions were created, funded by and expected to represent the interests of the populace, promote public welfare and treat its citizens equally and impersonally. In fact, historians agree that throughout history nepotism and other such practices that involved the benefit of a ruler's family and friends were expected and seen as natural. The transition from a natural state with an equilibrium of high corruption to an open-access order with an equilibrium of low corruption, being contrary to millennia of cultural tradition, therefore often requires an exogenous shock, top-down reforms, or bottom-up coordinated action [Dixit, 2018].

Corruption can be seen as an equilibrium, the result of the interactions between agents who choose the course of action that leaves them better off, given the choices of others. Since societies tend to have a more patrimonial system as default, the preexisting equilibrium incentivizes agents to engage in corrupt behavior [Fisman and Golden, 2017]. A such example would be a citizen refusing to pay a bribe to get a doctor's appointment in a corrupt country; the societal understanding that bribes are a prerequisite to accessing healthcare would result in her not getting any attention at all. In order for the refusal of paying a bribe to have positive results, there needs to be a wider societal consensus that corrupt behavior is unacceptable. In this multiple equilibrium phenomenon, people in highly corrupt societies are therefore incentivized to engage in corrupt behavior, in what is referred to as a prisoner's dilemma; if all agents cooperated to follow a rules-based system, they would derive a higher utility, however acting in their own interests they will continue to use a second-best strategy. An example of this would be businesses competing to offer the highest bribe to government officials to win a contract. While the winning company might believe that the bribe was worth it because they won the contract, the repeated action of offering ever higher bribes will mean that over time the businesses will have lower profits. In order to shift from a high corruption equilibrium to a low corruption equilibrium, where agents can enjoy the increased benefits of being honest, enough actors must coordinate to reach a critical mass of disapproval of corruption practices to reach a tipping point, where it is now in the interest of most actors to follow the rules. This can also happen as a result of the perceived costs of being a corrupt actor becoming more salient. These shocks that can affect the equilibrium can be either top-down or bottom-up.

An example of bottom-up coordination can be found in Sicily, an island known for

its powerful mafias. Local businesses were accustomed to paying a so-called "protection fee" (*pizzo*) to mafias, a lucrative activity that generated an estimated 10 billion euros per year. No longer tolerating these extortion payments, a group of activists created the Addiopizzo movement, covering Palermo in stickers that read "an entire population that pays the *pizzo* is a population without dignity". This was followed by the recruitment of businesses that committed themselves to not paying the *pizzo*, certifying them as a participating business with a banner on their storefront, and encouraging consumers to only patronize these stores. While it would be dangerous for individual business owners to refuse to pay the extortion fee, with historical precedent showing owners murdered or private property being destroyed, the mafia would find it difficult to retaliate against several stores, and the media attention would force politicians to respond. Since this program was public knowledge, agents knew that other business owners were aware of this new reality, and adapted their actions to the new expectations of the action of other business owners, in an example of contingent behavior [Dixit, 2018]. While the program is not without its flaws, it has shown much success with its activists and members not having been attacked, as has happened in the past. By coordinating among themselves, the business owners have been able to shift to the low corruption equilibrium.

A particularly useful example of a top-down approach can be found after the 2003 Rose Revolution in Georgia, former justice minister Mikheil Saakashvili was elected president on an anti-corruption platform and wasted no time in enacting drastic reforms. With the police having a reputation as one of the most corrupt sectors of the government, Saakashvili dismissed 60% of the overall payroll, and in some units fired everyone, as was the case with the highway patrol, though he made sure to carefully rehire those who were deemed honest. In order to radically change the culture within the institution, new recruits were subject to improved training and performance evaluation procedures, with their salaries being raised to remove the necessity of complimenting a low wage with bribes. A similar approach was used in other public institutions. Saakashvili began with the police because, apart from being perceived as highly corrupt, the institution had frequent contact with the public. With the need to show results quickly, he chose a target that would quickly change the public's perception. In this regard, the reforms were very successful. The sudden change in culture meant that the Georgian public expected the police to behave honestly and with integrity and in turn the police, no longer recruited into a culture of corruption, adhered to these new expectations. As a result, the share of the capital's residents that reported having paid a bribe to a public official fell from 17% in 2000 to 3.8%five years later. While the actions taken in the Saakashvili administrations can be considered successful, shooting Georgia up 65 spots in the Transparency International Corruption rankings in seven years and raising government revenue by almost 400%in four years by enforcing fines and limiting bribes, this particular approach may not be available or desirable in most countries [World Bank, 2022]. The extraordinary

mandate that allowed him to enact such immediate reforms also led to human rights abuses, an increasing perception of authoritarianism, and even his own accusations of corruption [Fisman and Golden, 2017]. While this approach can be very effective in shifting the equilibrium, the risks of accountability and eroding existing checks and balances can be significant.

Historians warn that the road to a low equilibrium has not been the same in all countries, and that not all countries can therefore make the shift with the same formula. With that being said, the general pattern shown is that most successful shifts in societies have required a change in norms and attitudes that led to most agents finding that it's in their own best interest to follow the rule of law [Basu and Cordella, 2018]. Olken [2007] details how different municipalities in Indonesia were assigned anti-corruption treatments related to infrastructure development, by either increasing grassroots participation in monitoring by local community members, or increasing the probability of being audited. His work found that top-down audits were much more successful at lowering the misappropriation of funds, while the bottom-up grassroots monitoring had limited effects. For this reason, I expect the Brazilian top-down anti-corruption initiative to provide more meaningful results.

## 2.2 State Capacity

Much like corruption, state capacity is difficult to describe, and is often defined differently across disciplines. In its broadest form, state capacity is the ability of a state to achieve its goals, be they raising revenue, spending efficiently, enforcing a monopoly of violence, providing public goods, or maintaining the rule of law. With such a broad definition, there have been several suggestions of how to measure overall state capacity, or in its absence, different dimensions of state capacity. The dimensions mentioned in the literature include fiscal capacity, administrative capacity, military capacity, informational capacity, and legal capacity, all of which have their own particular measurements such as tax revenue, bureaucratic quality, or property rights indices [O'Reilly and Murphy, 2022]. Hendrix [2010] tests several different indicators of state capacity, finding that the two best indicators to utilize are bureaucratic quality and fiscal capacity. The most commonly used metric tends to be one of fiscal capacity, as a state that wants to achieve its goals cannot do so without the resources to reach its goals. Additionally, a state must count on a robust infrastructure in order to identify potential sources of tax revenue and to subsequently expropriate it. The most common metric for this dimension is total taxes/GDP. However, since municipal GDP figures in Brazil often include tax revenues, I opt for a more direct measure of the available collection infrastructure which I will expand on later. Bureaucratic quality is often considered to include elements of efficacy in delivering government services, as a state that does not have the capacity to enact its desired policies, regardless of the available funds, cannot be considered strong in any way. To that effect, these are the two indicators that I will use in this paper.

### 2.3 State capacity and corruption

While this paper argues that corruption actively restrains the growth of state capacity, and in some cases reduces it, the relationship between these two concepts is complicated and includes several feedback loops and traps. In this section I will highlight the ways in which, through both direct and indirect mechanisms, corruption limits state capacity, and low state capacity encourages corruption.

One of the most widely used indicators for state capacity in current literature is tax revenue as a share of GDP, as states that are able to raise a large amount of tax revenue tend to need high bureaucratic capacity and require the informational capacity to identify sources of revenue. Potential public revenue can be very sensitive, as previous literature has shown. Vannutelli [2022] shows how the reform that led Italian municipalities to have highly qualified public auditors randomly assigned to instead of being handpicked by the mayor, led to improved revenue collection as measured by several indicators. As states develop an increased capacity to raise taxes, the wealthy tend to pay more tax relative to the rest of the population. For this reason, the elite tend to use their economic and political power to reduce the taxes levied by the state, limiting the state's ability to develop the necessary institutions to extract larger amounts of revenue, and the bureaucratic oversight to limit evasion or other corrupt practices. The presence of corrupt officials has not only been shown to reduce government revenues in several countries, but the evasion of taxes by hiding assets offshore can reduce tax revenues by as much as 50%, which severely limits the development of fiscal capacity [Friedman et al., 2000, Otusanya, 2011, Tanzi and Davoodi, 2001]. With limited sources, weak states tend to resort to using less-effective means of funding.

Since designing and implementing an effective taxation system requires a large amount of resources, many weak states depend on indirect taxation such as Value Added Tax as an important or even primary component in their tax structure. The low cost of implementation of VAT makes it feasible for weaker states. This less sophisticated method however, is not only easily evaded by the manipulation of sales reports, but also is not particularly economically efficient and tends to be regressive [Stiglitz, 2010]. Direct taxation such as income tax tends to raise significantly higher levels of revenue for states, while also improving their informational capacity and can be used as a redistribution policy if progressive, which is why most states that adopt a system that prioritizes direct taxation rarely regress to indirect taxes later on. High levels of corruption often translate to low tax-morale, meaning that many members of the public will go out of their away to avoid paying taxes, since they expect that their hard-earned money will only be stolen.

Not only does corruption prevent the state from building up the capacity to ex-

tract revenue, but it also encourages the capture of state processes to benefit the powerful, at the expense of overall bureaucratic quality. Since state officials receive additional income from bribes, they are directly incentivized to complicate any and all processes under their purview, slowing them down to maximize the amounts of possible rents extracted [Dincer and Teoman, 2019]. This resulting inefficiency in turn further encourages corruption, as the officials who collect bribes during the opaque administrative process will not have any incentive to simplify the processes under their purview. This relationship places countries with low legal capacity and bureaucratic quality in a sort of trap, making it extremely difficult to build enough capacity to address the corruption.

Inequality tends to be a trap that is difficult to escape, as countries that were previously more egalitarian tend to have easier transitions to states with social policies, while states with high levels of inequality tend to face significant obstacles to transition to retributive societies [Espuelas, 2015]. This level of political and economic inequality not only leads to more corruption, for example by reducing the share of women in government, but also by actively reducing state capacity [Cárdenas, 2010, Dollar et al., 2001, Swamy et al., 2001]. In fact, the relationship between corruption and inequality is reciprocal, as several studies have found, showing the bidirectional causality between corruption and inequality, further entrenching corruption's spillover effects into economic stagnation in yet another trap [Apergis et al., 2010, Dutta and Mishra, 2013].

## 2.4 Theory and Hypothesis

As demonstrated in the previous section, the effects that corruption has on a state through different mechanisms are persistent and wide-ranging. Some of these effects are not only self-enforcing, but they can also in turn increase corruption or interact with each other to maintain a weak state with a fragile economy in a feedback loop. While there are several mechanisms at work, the general pattern seems to be that influence peddling by economic and political elites lowers the initial tax revenue, which immediately lowers fiscal capacity and bureaucratic quality, and maintains the society in a deals-based equilibrium that benefits them. This first step has several cascading implications for immediate and future state capacity; lower fiscal capacity and inadequate bureaucratic quality result in lower tax revenue at the present and in the foreseeable future with a primitive tax structure, increase inefficient public spending, and reduce legal capacity, which complicates addressing corruption.

These outcomes have their own consequences, resulting in less redistribution, a larger informal sector, higher borrowing costs, less investment, and tax-base erosion which lower potential state revenues. These economic repercussions, along with less provision of public services, then increase inequality, lower the development of human capital, and dampen economic growth, all of which increase corruption and prevent the development of state capacity in a vicious circle. Since the development of state capacity is a long-term process, the presence of corruption will not only result in low state capacity at the present but also for several years in the future. With low state capacity, the opportunities for any meaningful shift in the corruption equilibrium will be significantly limited, and societies will remain in a deals-based equilibrium, with the least well-off being the most adversely affected.

As previously mentioned, top-down corruption initiatives can have stronger impacts than bottom-up civil society involvement, and are therefore more useful for a causal analysis. For this reason, along with others I will expand on, I will make use of a case study where Brazil enacted a significant top-down anti-corruption reform. The reform was not part of wider initiatives to improve state capacity but was specifically designed to curb corruption by shifting the equilibrium and changing agents' behavior, which will allow for causal analysis.

While has been previous work on these reforms, most of the relevant papers do not focus on the causal effects on state capacity. Timmons and Garfias [2015] study the effect of audits on the municipal property tax revenues, in a setting where many municipalities do not have the administrative capacity to enforce this tax, and find that audits that expose high levels of corruption results in lower tax compliance but only for two years. While their paper offers lower tax morale as the cause of lower tax compliance, it does not offer any explanations for the limited time horizon of the lower compliance. Here I would argue that municipalities that have just been exposed in a corruption scandal might have less access to revenues, as the central government would be less willing to send transfers and locals would be less willing to comply with tax obligations, especially in an environment where local administrative capacity for identifying potential sources of revenue is low. This would force municipalities to invest in tax collection infrastructure, for example a real estate cadastre, a register of land and house prices, or a register of local service providers, as they would need to secure sufficient revenue to maintain public service expenditure. Municipalities that have been audited, and have lower levels of corruption, would have less incentives to invest in tax collection infrastructure and, with corruption being a salient issue, might not be eager to announce higher tax investment. With this framework in mind, the first hypothesis that I want to test is that municipalities that were audited with high levels of corruption will see greater investment in fiscal capacity.

As mentioned in previously, fiscal capacity is not the only manner to measure state capacity, bureaucratic quality is another meaningful metric. Recalling the Georgian case, the enforcing of fees and fines meant that these funds were reaching public coffers instead of being redirected in the form of bribes to private hands. This not only directly improved bureaucratic quality but also improved public revenues. Papers covering the Brazilian anti-corruption reforms have found that municipalities that were audited more than once were found to have much lower corruption levels as a result of the increased salience of the probability of being audited and the political and legal costs that this could incur [Avis et al., 2018]. With this previous work, we can safely assume that our municipalities experience lower levels of corruption after being audited, and test the second hypothesis that municipalities that were audited will see an increase in indirect taxation revenues.

## 3 Institutional setting

In the early 2000's, the Brazilian national government began a program designed to crack down on corruption, which was perceived to be unacceptably widespread. The program was handled through the Controladoria Geral da União (CGU), and consisted of municipalities being randomly selected for audits on a televised lottery. The municipalities would then host a group consisting of approximately 10 to 15 well-paid and highly-skilled auditors, who would prepare reports with the types of irregularities found in public spending as well as the amounts, and the quality of infrastructure projects and public services. While there, the auditors also interview members and councils of the community directly to receive any complaints of corruption. After a week of investigation, the auditors send the reports to the central office of the CGU, the Accounts Tribunal, to public prosecutors, and the municipal legislature. In addition, a summary of the findings is posted online for the general public, and shared with news media. Previous work has demonstrated that this program lowered levels of corruption for audited municipalities, both through electoral pressures as well as through the increased saliency of criminal sanctions [Avis et al., 2018, Ferraz and Finan, 2011, Zamboni and Litschig, 2018]. While the audits began in 2003, this paper will focus on the audits from 2006 to 2013, due to availability of data and comparability. Figure 1 shows the amount of municipalities audited for the first time each year, and the number of municipalities that are in the dataset but not yet audited.

The random nature of the treatment assignment, in this case the audit, and municipalities' autonomy for spending allocation in one of the world's most decentralized countries make this an ideal setting for a causal analysis. The decision of investing in tax collection capacity is delegated to individual municipalities and are not mandated from other entities. This allows for a municipality-level analysis of the government response to being audited, in particular how the investment in fiscal capacity and the collection in taxes react to the treatment.

An important assumption for this setting is that the auditors are not bribed or influenced in away way to misrepresent the findings of their audit. There are several reasons why this is not likely. First, the auditors are sent from the central government which also pays their salaries, and are therefore not likely to have conflicts of interest in the local settings. Second, the auditors are selected in highly competitive public examinations and are handsomely rewarded with high salaries, reducing their need to supplement their wages with bribes. Third, the auditors sent to cities tend to travel in groups of ten and are accompanied by a supervisor, which would complicate



Figure 1: Audited Municipalities by Year

Notes: Figure shows the number of municipalities audited each year in dark grey. The number of not yet treated municipalities in the dataset is shown in light grey.

any attempt to bribe individual auditors. Previous literature has also tested whether audit results are affected when the mayors were politically affiliated with either the federal or state governments, or if the previous elections were particularly competitive, and found not relationship. Finally, the auditors are also themselves audited by the central government's audit agency [Ferraz and Finan, 2008].

Another possible area for concern would be that the audits only covered projects that included federal transfers. This leaves the possibility that public officials could still engage in corrupt practices, but only in projects that were entirely funded with locally source revenues, thereby feigning the appearance of having low corruption. Luckily this is not very likely, as most projects are financed from several different sources of funding, often including federal transfers. This, along with the fact that audits cover all sectors in most of the municipalities audited, makes it very difficult for public officials to strategically focus corruption efforts [Zamboni and Litschig, 2018].

## 4 Data

When deciding what data to use to measure both state capacity and corruption, several different indicators or indices can be chosen, all of which have their drawbacks. Fortunately, previous literature in the field has provided insight into this dilemma, with tax revenue being widely used in state capacity literature as a suitable proxy [Hendrix, 2010]. As mentioned in the Georgian case, when corruption was reduced, bribes were widely substituted by fines, which now reached public coffers. This not only classifies as fiscal capacity, due to the increased revenue, but also bureaucratic quality as the institutions were working as they were supposed to. For the purposes of this paper, I will use the revenue from the tax for general services known as the ISSQN (Imposto Sobre Serviços de Qualquer Natureza), specifically the proportion of overall municipal tax revenue that is composed by ISSQN. I do not count transfers in total revenue, to only account for the previous performance of the municipality and avoid confounding with variations in transfers. This tax, being levied on a wide variety of services, does not require significant pre-existing fiscal capacity to enforce when compared to other types of income streams, and can therefore be interpreted as a signal of bureaucratic quality. This data can be found in the Finance Ministry's publicly available municipality account database FINBRA, and I will use data from 2002 until 2010 [Secretaria do Tesouro Nacional, 2013]. Another measure of state capacity that I will use is the actual infrastructure in place to identify potential sources of revenue. The Instituto Brasileiro de Geografia e Estatística (IBGE) has published municipal surveys that have information on the tax collection infrastructure available in each municipality. Specifically, whether they have real estate cadastre, a register of land and house prices, a register of local service providers, and if this infrastructure is digitalized or not. In contrast with the ISSQN, the type of revenue collected by these tools do require substantial fiscal capacity and can be used to measure a stronger municipality. This data is not available for all years, as it was only included in the 2004, 2005, 2006, 2009 and 2012 waves of the MUNIC survey. To account for this, I first filled the data forward for the years after the first implementation of the tools, and filled the data backwards for years before the first implementation for each municipality. In this way, more than 95% of the data was available, and I later interpolated the missing values. For example when a municipality did not have a cadastre in 2006 but did in 2009, the years 2007 and 2008 were assigned 0.5 As I will explain in the following section, I created a latent variable to capture the revenue collection capacity of the municipalities, in order to allow for heterogeneity in the discrimination of each type of collection tool.

The data on the corruption audits was taken from previous literature on the topic [Avis et al., 2018]. Data on the lottery and audit dates were included for municipalities audited from between 2006 and 2013, with information on which municipalities had been previously audited. The municipalities that had already been audited, along

with those that were state capitals were removed from the analysis. By focusing on the municipalities that were treated in 2006, and studying their evolution until 2010, I was able to use municipalities audited in 2011, 2012, and 2013 as controls, leaving me with 211 control municipalities and 53 treated, spanning the years from 2002 (2004 for tax infrastructure) to 2010. This data also provided the results of the audits, with the corrupt acts per service order being my preferred specification for corruption intensity. The distribution of the corruption per service order for the 2006 treated sample is shown in figure 2.

Figure 2: Distribution of corruption intensity



Notes: Figure shows distribution of the corruption intensity for the municipalities audited in 2006.

I also procured socioeconomic and demographic characteristics to be used as controls for the analysis, including illiteracy rates, share of urban dwellers, population statistics, income per capita, and Gini scores from the IBGE. There was little variation of these statistics in the constructed dataset, as the census is conducted every ten years, which led to collinearity issues in the regressions when using fixed effects. For this reason, only municipality and year fixed effects where used. I still confirmed whether the municipalities were comparable, and found no significant differences in the municipality characteristics, which can be seen in appendix I.

## 5 Empirical strategy

The first step in my analysis will be to run a difference in differences methodology to measure the impact, if any, of an audit on the state capacity of a given municipality. As mentioned in the previous section, municipality characteristics could not be used in the regressions with fixed effects, due to collinearity issues, so I must first confirm whether the parallel pretrends condition in observed, which I expand upon in the results section. The random selection of municipalities for audits through the televised lottery helps mitigate endogeneity concerns such as selection bias; not only do all municipalities have the same probability of being selected for audit, but the reference group were eventually selected for an audit themselves, either in 2011, 2012, or 2013. Once these concerns have been addressed, I can proceed with the difference-in-differences models. My basic model is the following:

$$\hat{Y}_{it} = \alpha_i + \beta_1 audit_{it} + \gamma_t + \mu_{it} \tag{1}$$

Where  $\hat{Y}_{it}$  is the outcome of interest for municipality *i* at time *t*,  $\alpha_i$  are municipality fixed effects, *audit* is a dummy for audited municipalities in the post treatment period,  $\gamma_t$  is time fixed effects, and  $\mu_{it}$  is the error term, where I would cluster the standard errors at the municipal level. Once I have measured the effect of the audit alone, I run a second specification that allows me to measure the marginal effect of higher corruption intensity on the outcome, and explained in the following equation:

$$\hat{Y}_{it} = \alpha_i + \beta_1 audit_{it} + \beta_2 C_{it} + \beta_3 audit_{it} \times C_{it} + \gamma_t + \mu_{it}$$

$$\tag{2}$$

Here I use a similar equation to the first while adding an interaction term, where  $C_{it}$  is the intensity of corruption measured as corrupt acts per service order, and  $\beta_3$  measures the interaction between the treatment and the intensity of corruption. I again cluster the standard errors at the municipal level.

I will run the model with the selected proxies for fiscal capacity and bureaucratic quality. I expect that fiscal capacity as measured by the latent variable will increase for audited municipalities with high corruption at a higher pace than their unaudited counterparts, only after being audited. I would expect similar results from the measure of bureaucratic quality, however an increase in the intensity of corruption could lead to a drop in the proportion of ISSQN, as these municipalities would invest more in fiscal capacity, lowering the importance of ISSQN in the long run. Should these measures not differ significantly from the control, we can consider the theory to be falsified. I also include lags as placebos, modifying the data to reflect an audit in 2004 or 2005 instead of 2006 for robustness.

Finally, I run an event study analysis on the measure of bureaucratic quality. Since the municipal tax collection data was not interpolated because of its ample availability, I am able to run an event study to compare how the proportion of municipal tax that is ISSQN behaved in the years following the treatment. I am particularly interested to see how the proportion of ISSQN responds in the third year, specifically if it falls, as it might suggest that investment in other capacity might lower its overall importance. This would enhance the findings in Timmons and Garfias [2015], explaining the short-lived effect. My specification would be:

$$\hat{Y}_{it} = \alpha_i + audit_i \sum_{y=-4, y\neq -1}^4 \beta_y I(t - t_0 = y) + \beta_2 audit_{Cit} + \gamma_t + \mu_{it}$$
(3)

Where  $Y_{it}$  is the proportion of municipal tax that is ISSQN for municipality *i* at time *t*,  $\alpha_i$  are municipality fixed effects,  $audit_Cit$  is an interaction variable between the intensity of corruption and whether a municipality is treated,  $\gamma_t$  is time fixed effects, and  $\mu_{it}$  is the error term.

The variable audit is equal to 1 if a municipality was audited in 2006 and 0 otherwise. Indicator variables  $I(t - t_i^* = y)$  measure the time relative to the year of treatment,  $t_0$ , for the treated municipalities. The omitted category is y = -1, the year prior to the audit. In this specification, the coefficient  $\beta_y$  measures the change in state capacity in audited municipalities relative to our not-yet treated controls during year y, as measured in the year immediately preceding the audit (2005). In this model, the standard errors are clustered at the municipal level.

I expect that this measure of state capacity will increase for audited municipalities when compared to their unaudited counterparts, only after the implementation of their reforms. This increase will be due to increased collection efficiency, and will be short-lived as investment in tax collection infrastructure will result in a diversification of revenues. Should these measures not differ significantly from the control, we can consider the theory to be falsified.

#### 5.1 Measure of fiscal capacity: Latent variable

As mentioned previously, I create a latent variable using the existence of different binary characteristics of tax collection infrastructure to use as a measure of fiscal capacity. The different infrastructure that municipalities have available are a real estate cadastre, a register of land and house prices, and a register of local service providers. Additionally, I can see if this infrastructure is digitalized or analog, which could help distinguish different levels of capacity for each type of tax collection infrastructure.

I use the latent variable estimation approach developed by Curtis [2010] that uses Bayesian Markov-Chain Monte Carlo (MCMC) techniques to identify underlying factors and can also handle datasets with missing data points. The measurement is shown as follows:

$$y_{i,c} \sim B(\pi_{i,c})$$
$$logit(\pi_{i,c}) = \delta_{c,1} \cdot (\xi_i - \delta_{c,2})$$
$$\delta_c \sim \mathcal{N}(0,1)$$
$$\xi_i \sim \mathcal{N}(0,1)$$

The model states that the latent trait is calculated with the use of an IRT model where  $y_{i,c}$  is the observed characteristic c for the municipality-year observation i,  $\delta_2$  are difficulties and  $\delta_1$  are discriminations. The parameter of interest is  $\xi_i$ , which represents the latent fiscal capacity score of every municipality-year observation. I used JAGS from Plummer [2003] to perform the sampling and ggmcmc from Fernández-i Marín [2016] to assess convergence and factor loadings.

## 6 Results

Once done running the IRT model to create the latent variable for fiscal capacity, I scale the output be on a scale from 0 to 1, with 1 being the highest possible score of fiscal capacity. This latter scenario would mean that a municipality not only has all three tools for revenue collection, but also has them digitalized. Once this was done, I interpolated the original data assigning the missing years (2007, 2008, 2010) a value of 0.5 for each tool that was recorded as 0 in 2006 (2009) and 1 in 2009 (2012). From there, I created a weighted index that was also scaled from 0 to 1, where the existence of analog version of the collection tools were worth twice as much as the digital versions. In figure 3 I show the evolution of these two indices across the years, showing how a simple weighted index could overestimate the actual fiscal capacity as measured by the latent variable.

The results of the IRT model show that the most relevant collection tools were a digital register of land and house prices and an analog register of land and house prices respectively. In fact, a digital register of land and house prices was twice as important in terms of discrimination than an analog register, which itself was the second most important. This heterogeneous weighting will allow for a richer analysis.

Figure 3: Mean Fiscal Capacity by Year



Notes: Figure shows the average fiscal capacity of the population of municipalities by year in light grey, as measured by the latent variable. The average fiscal capacity of the municipalities as measured by a simpler weighted index is shown in dark grey.

Moving on to the difference-in-differences method, table 1 shows the results of the difference in differences that measure the effects of being audited on the relevant measures of state capacity. The first model reported on column (1) only measures effect of being audited on the latent variable for fiscal capacity without accounting for the intensity of the corruption found as per equation 1 and does not find any significant relationships. Model (2) however, which includes an interaction term for audited municipalities and the intensity of corruption as per equation 2, finds results that are significant and consistent with the first hypothesis: municipalities that were audited and were exposed as being highly corrupt, and as a result likely experienced lower compliance with taxes such as property taxes, were forced to invest more in tax collection infrastructure. Municipalities that were only audited, without being exposed as very corrupt, did not face the same incentives to increase revenue collection and, as a result of higher saliency of corruption, likely did not want to push their luck and invest in infrastructure thereby risking political backlash. As a result, a municipality that was shown to only have one act of corruption per service order would later have a value of 0.7, while a municipality that had 5 acts and was forced to invest in collection capacity would have a value of 0.89, more than 25% greater. A non-audited municipality, on the other hand, would have a fiscal capacity index of 0.75. A plot of the marginal effects of corruption intensity can be found in figure 4.

Figure 4: Marginal effect of Corruption



Notes: Figure shows the marginal effects of revealed corruption on the latent variable of fiscal capacity (Table 1 model 2). The shaded area is significant at 10%.

Moving towards my second hypothesis, where I expected that the audited municipality would see an increase in ISSQN revenues, model (5) uses equation 1 and shows that being audited does in fact result in an increase of tax collection, and the same can be said in model (6), where an interaction between being audited and the intensity of corruption with equation 2 does not result in any change in the conclusions of the model, it in fact slightly increases the size of the treatment coefficient. While the coefficient for the interaction term is negative as predicted, it is not significant. This is not surprising, as the negative relationship would only be for municipalities with high corruption, and only after they have had time to invest in fiscal capacity. Since previous literature has shown that the exposure of highly corrupt municipalities results in lower compliance from more capacity-intensive sources, and intensity does not increase the proportion of ISSQN revenue, we can interpret the increase in revenue as an improvement in collection efficiency, and not a reflection of lower revenues from other tax sources [Timmons and Garfias, 2015]. In this case, a municipality that was shown to only have one act of corruption per service order would have the ISSQN representing 1.66% of revenue while a municipality that had 5 acts and was forced

|                                    | Г       | atent Fisca | al Capacit | y       | Π            | Proportion   | of ISSQN | _       |
|------------------------------------|---------|-------------|------------|---------|--------------|--------------|----------|---------|
|                                    | 1       | 2           | 3          | 4       | 5            | 9            | 7        | x       |
| 2006 Audit                         | -0.021  | -0.084**    |            |         | $0.103^{**}$ | $0.173^{**}$ |          |         |
|                                    | (0.017) | (0.038)     |            |         | (0.050)      | (0.082)      |          |         |
| Corruption Intensity               |         | 0.016       | 0.020      | 0.015   |              | -0.035       | -0.053   | -0.051  |
|                                    |         | (0.034)     | (0.037)    | (0.036) |              | (0.378)      | (0.380)  | (0.381) |
| 2006 Audit:Corruption Intensity    |         | $0.031^{*}$ |            |         |              | -0.035       |          |         |
|                                    |         | (0.016)     |            |         |              | (0.040)      |          |         |
| 2005 Placebo                       |         |             | -0.056     |         |              |              | 0.131    |         |
|                                    |         |             | (0.056)    |         |              |              | (0.088)  |         |
| 2005 Placebo: Corruption Intensity |         |             | 0.026      |         |              |              | -0.025   |         |
|                                    |         |             | (0.021)    |         |              |              | (0.042)  |         |
| 2004 Placebo                       |         |             |            | -0.084  |              |              |          | 0.136   |
|                                    |         |             |            | (0.054) |              |              |          | (0.086) |
| 2004 Placebo: Corruption Intensity |         |             |            | 0.027   |              |              |          | -0.030  |
|                                    |         |             |            | (0.027) |              |              |          | (0.042) |
| Num.Obs.                           | 1848    | 1848        | 1848       | 1848    | 2321         | 2321         | 2321     | 2321    |
| R2 Adj.                            | 0.829   | 0.830       | 0.829      | 0.830   | 0.767        | 0.767        | 0.766    | 0.766   |

Table 1: The effect of an audit on state capacity

20

Notes: Significance: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Standard errors clustered at the municipality level are reported in parentheses. All models include municipality and year fixed effects. Fiscal capacity is measured by the latent variable created for the analysis, and the proportion of ISSQN taxes represents bureaucratic quality. Alternative variables are used for further analysis in appendix II, finding similar results. to invest in collection capacity would have a value of 1.38%, though the difference is not statistically significant.

One key assumption when running difference-in-differences estimations is that the two groups being compared where behaving in a similar manner before the intervention. To this end, models (3) and (4) on table 1 represent estimations for fiscal capacity with lags to test that the parallel trend assumption holds, with the audit taking place in 2005 and 2004 respectively. They found no significant effects, which we can take to mean that the two groups, audited and not yet audited municipalities, where in fact behaving in a similar manner before the audit. Models (7) and (8) also run lags for the proportion of ISSQN for 2005 and 2004, and they also fail to find significant results. The null findings for both outcome variables confirm the parallel trends assumption, which is illustrated in figure 5. I also run models using the weighted fiscal capacity index and the logged value of ISSQN revenue for each municipality, and find similar results (see appendix II).





Notes: Plot A shows the pretrends for the proportion of ISSQN, and plot B shows the pretrends for fiscal capacity, comparing audited and not yet audited municipalities. The error bars represent half a standard deviation.

Finally, we turn to the event study specification described in equation 3. Here, I expected the proportion of ISSQN to increase immediately following the audit, and later fall as income from capacity-intense sources increased. As seen in figure 6, the measure of bureaucratic quality improved until two years after being audited, which was the only year that had a statistically significant estimate, before falling back to comparable levels with the control municipalities. This finding is compatible with the hypothesis that municipalities that are exposed as corrupt experience lower compliance in capacity-intensive tax sources (for two years), which leads these municipalities to invest in tax collection capacity. The increase in ISSQN revenue from improved bureaucratic quality in the first two years are later overshadowed by the increase in capacity-intensive tax sources such as property tax. The table with the results from the event study can be found in appendix III.





Notes: The reference point is 2005, with year 0 being 2006, the year of the audit. The error bars represent the 90% confidence interval.

## 7 Discussion and Conclusion

While it is widely known that corruption brings many negative externalities, efforts to combat it have had differing levels of success. This, along with the intricate and complicated relationship that corruption has with state capacity and its different dimensions, makes causal analysis particularly challenging. The anti-corruption initiative mentioned in this paper however, is widely recognized as not only being highly effective, but also provides valuable resources such as random exogenous treatment and quantitative corruption measures at the municipal level, which allows for rich causal analysis. Taking advantage of this setting, I contribute to the literature providing two main findings. First, municipalities that are exposed as being highly corrupt, and suffer financial stress due to lower tax compliance in, tend to invest in fiscal capacity at a higher rate than their unaudited peers with a latent fiscal capacity measure identifying a 19% increase. Second, audited municipalities see a small but statistically significant increase in the collection of general indirect taxes, which is interpreted as a more efficient collection of revenues and improvement in bureaucratic quality.

The findings could have important policy implications, informing policy decisions regarding capacity building and development. With international development agencies attempting to encourage economic growth to improve living standards around the world, it is crucial to identify different causal mechanisms that might be actively impairing this development, while reducing efforts through the embezzlement of funds or chronic inefficient allocation of resources. Corruption could not only be hampering growth by denying states the ability to encourage growth, but until it is significantly reduced, public spending and foreign aid will be wasted leading to persistently weak states. When the world was tested by this most recent pandemic, the strongest states that had maintained excess capacity in their hospitals as a precaution should they ever require it, were able to immediately increase capacity with the so-called "accordion" method. Weaker states that had not invested in their healthcare systems saw a much steeper death rate. Since many states adjusted the severity of their respective lockdowns depending on their ICU occupation rates, states with less health capacity per capita were forced to limit movement and therefore economic activity for extended periods of time. One wonders how the people of Chad have weathered the human cost of the COVID pandemic and the economic cost of the recession, with only 12.70% of the population being fully vaccinated as of writing this paper [Johns Hopkins University, 2022].

Even if developing states are encouraged to raise more taxes and are presented with technocratic proposals designed by international organizations, they may be unable to enact them. Corruption, particularly when visible, can be an impediment not only for state effectiveness but also for the possibility of increasing tax collection. Populations in weak or corrupt states will not be highly motivated to comply with tax regulations, because of the skepticism they would harbor towards the state's ability, or intention, to effectively use their funds. Governments that do not count on popular support, or oversee a discontent population, will have difficulty raising taxes or cutting subsidies without significant backlash, as Colombia recently experienced with the proposed 2019 and 2021 tax reforms. This might be a cause for concern, as public discontent seems to be increasing worldwide, with the number of protests between 2016 and 2020 being double those between 2006 and 2010 [Ortiz et al., 2021]. Some of the most common grievances in these protests were the failure of the political system, stagnant wages, high unemployment, inadequate public services, inequality, and the failure to receive justice from the legal system, all of which are exacerbated by corruption, as mentioned in the previous sections. With high levels of discontent, states might find it more difficult to raise enough funds to prepare for future crises, such as climate change disasters.

The use of the methodology such as difference-in-differences and event studies allows for a more causal analysis of the effects of corruption on state capacity. In doing so this proposal is one of the first, to my knowledge, to attempt to isolate the effects of a reduction in corruption, the fiscal capacity and bureaucratic quality of cities. With future crises being inevitable, and states being obligated to respond accordingly, states hampered by corruption will once again be particularly vulnerable, and the severity of the crises might mean that even the rich countries might not be able to provide budget support or aid, and many of the lower-income countries are as of yet not self-sustainable. Initiatives such the Brazilian audits or the creation of anti-corruption agencies such as those in Indonesia, Botswana, or Singapore, might be invaluable assets in the development toolkit for international organizations or aid agencies, as they could build capacity, improve institutional quality, and improve state legitimacy at a time where populism and public discontent is growing.

## References

- Nicholas Apergis, Oguzhan C. Dincer, and James E. Payne. The relationship between corruption and income inequality in U.S. states: evidence from a panel cointegration and error correction model. *Public Choice*, 145(1):125– 135, October 2010. ISSN 1573-7101. doi: 10.1007/s11127-009-9557-1. URL https://doi.org/10.1007/s11127-009-9557-1.
- Eric Avis, Claudio Ferraz, and Frederico Finan. Do government audits reduce corruption? Estimating the impacts of exposing corrupt politicians. *Journal of Political Economy*, 126(5):1912–1964, 2018. ISSN 0022-3808. Publisher: University of Chicago Press Chicago, IL.
- Kaushik Basu and Tito Cordella. Institutions, Governance and the Control of Corruption. Springer, 2018. ISBN 3-319-65683-X.
- Alejandra Cervantes Nieto and Christian Castaño Bonilla. Transparency and Governance in Drug Treatment Systems: A Comparative Framework, January 2023. URL https://papers.ssrn.com/abstract=4546308.
- S McKay Curtis. BUGS code for item response theory. *Journal of Statistical Software*, 36:1–34, 2010. ISSN 1548-7660.
- Mauricio Cárdenas. State Capacity in Latin America. *Economía*, 10(2):1-45, 2010. ISSN 15297470. URL http://www.jstor.org/stable/25800045. Publisher: Brookings Institution Press.
- Oguzhan Dincer and Ozgur Teoman. Does corruption kill? Evidence from half a century infant mortality data. *Social Science & Medicine*, 232:332– 339, July 2019. ISSN 02779536. doi: 10.1016/j.socscimed.2019.05.017. URL https://linkinghub.elsevier.com/retrieve/pii/S0277953619302813.
- Avinash Dixit. Anti-corruption Institutions: Some History and Theory. In Kaushik Basu and Tito Cordella, editors, *Institutions, Governance and the Control of Corruption*, pages 15–49. Springer International Publishing, 2018. ISBN 978-3-319-65684-7. doi: 10.1007/978-3-319-65684-7<sub>2</sub>.
- Raymond Fisman, and Roberta Gatti. David Dollar, Are women re-"fairer" sex? ally the Corruption and women in government. JournalEconomic Behavior $\mathscr{E}$ 46(4):423-429,ofOrganization, December 2001. ISSN 01672681. 10.1016/S0167-2681(01)00169-X. doi: URL https://linkinghub.elsevier.com/retrieve/pii/S016726810100169X.
- Indranil Dutta and Ajit Mishra. Does Inequality Foster Corruption? Journal of Public Economic Theory, 15(4):602–619, 2013. ISSN 1467-9779. doi: 10.1111/jpet.12027.

URL http://onlinelibrary.wiley.com/doi/abs/10.1111/jpet.12027. \_eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/jpet.12027.

- Sergio Espuelas. The inequality trap. A comparative analysis of social spending between 1880 and 1930: The inequality trap. The Economic History Review, 68 (2):683-706, May 2015. ISSN 00130117. doi: 10.1111/1468-0289.12062. URL https://onlinelibrary.wiley.com/doi/10.1111/1468-0289.12062.
- Xavier Fernández-i Marín. ggmcmc: Analysis of MCMC samples and Bayesian inference. Journal of Statistical Software, 70:1–20, 2016. ISSN 1548-7660.
- Claudio Ferraz Frederico Finan. and Exposing Corrupt Politicians: The Effects of Brazil's Publicly Released Audits on Electoral Out $comes^*$ . The Quarterly Journal of Economics, 123(2):703-745,May ISSN 2008.0033-5533. doi: 10.1162/gjec.2008.123.2.703. URL https://doi.org/10.1162/qjec.2008.123.2.703.
- Claudio Ferraz and Frederico Finan. Electoral accountability and corruption: Evidence from the audits of local governments. *American Economic Review*, 101(4):1274–1311, 2011. ISSN 0002-8282.
- Raymond Fisman and Miriam A Golden. *Corruption: What everyone needs to know*. Oxford University Press, 2017. ISBN 0-19-046397-X.
- Kaufmann. Pablo Eric Friedman. Simon Johnson, Daniel and Zoido-Lobaton. grabbing hand: the determinants of unofficial Dodging the activity in 69 countries. Journal of Public Economics, 76(3):459-493,June 2000. ISSN 00472727. 10.1016/S0047-2727(99)00093-6. doi: URL https://linkinghub.elsevier.com/retrieve/pii/S0047272799000936.
- Cullen S Hendrix. Measuring state capacity: Theoretical and empirical implications for the study of civil conflict. *Journal of Peace Research*, 47(3):273– 285, May 2010. ISSN 0022-3433. doi: 10.1177/0022343310361838. URL https://doi.org/10.1177/0022343310361838. Publisher: SAGE Publications Ltd.
- Johns Hopkins University. Understanding Vaccination Progress by Country, 2022. URL https://coronavirus.jhu.edu/vaccines/international.
- Alina Mungiu-Pippidi. The quest for good governance: How societies develop control of corruption. Cambridge University Press, 2015. ISBN 1-316-43248-3.
- Benjamin A Olken. Monitoring corruption: evidence from a field experiment in Indonesia. *Journal of political Economy*, 115(2):200–249, 2007. ISSN 0022-3808. Publisher: The University of Chicago Press.

- Colin O'Reilly and Ryan H. Murphy. An Index Measuring State Capacity, 1789–2018. *Economica*, n/a(n/a), February 2022. ISSN 1468-0335. doi: 10.1111/ecca.12411. URL http://onlinelibrary.wiley.com/doi/abs/10.1111/ecca.12411. \_eprint: https://onlinelibrary.wiley.com/doi/pdf/10.1111/ecca.12411.
- Isabel Ortiz, Sara Burke, Mohamed Berrada, and Hernan Cortes Saenz. World Protests: A Study of Key Protest Issues in the 21st Century. Palgrave Macmillan, 2021. ISBN 978-3-030-88512-0.
- Olatunde Julius Otusanya. Corruption as an obstacle to development in developing countries: a review of literature. Journal of Money Laundering Control, 14(4): 387-422, October 2011. ISSN 1368-5201. doi: 10.1108/13685201111173857. URL https://www.emerald.com/insight/content/doi/10.1108/13685201111173857/full/html.
- Martyn Plummer. JAGS: A program for analysis of Bayesian graphical models using Gibbs sampling. volume 124, pages 1–10. Vienna, Austria, 2003. Issue: 125.10.
- Secretaria do Tesouro Nacional. FINBRA Municipal Accounting Data 1989 to 2012 - 2013 01 01 — Transparent Treasury, 2013.
- Joseph E. Stiglitz. Development-Oriented Tax Policy. In Roger H. Gordon, editor, *Taxation in Developing Countries*, Six Case Studies and Policy Implications, pages 11-36. Columbia University Press, 2010. ISBN null. URL http://www.jstor.org.sire.ub.edu/stable/10.7312/gord14862.6.
- Anand Swamy, Stephen Knack, Young Lee, and Omar Azfar. Gender and corruption. Journal of Development Economics, 64(1):25-55, February 2001. ISSN 03043878. doi: 10.1016/S0304-3878(00)00123-1. URL https://linkinghub.elsevier.com/retrieve/pii/S0304387800001231.
- Vito Tanzi and Hamid Davoodi. Corruption, growth, and public finances. In *The Political Economy of Corruption*. Routledge, 2001. ISBN 978-0-429-23261-9. Num Pages: 22.
- Jeffrey F Timmons and Francisco Garfias. Revealed corruption, taxation, and fiscal accountability: Evidence from Brazil. *World development*, 70:13–27, 2015. ISSN 0305-750X. Publisher: Elsevier.
- Silvia Vannutelli. From Lapdogs to Watchdogs: Random Auditor Assignment and Municipal Fiscal Performance. Technical report, National Bureau of Economic Research, 2022.
- World Bank. Global Economic Prospects, June 2021. URL https://www.worldbank.org/en/publication/global-economic-prospects.

World Bank. World Development Indicators, 2022.

- Yves Zamboni and Stephan Litschig. Audit risk and rent extraction: Evidence from a randomized evaluation in Brazil. *Journal of Development Economics*, 134:133–149, 2018. ISSN 0304-3878. Publisher: Elsevier.
- Andris Zimelis. Corruption research: A need for an integrated approach. International Area Studies Review, 23(3):288-306, September 2020. ISSN 2233-8659. doi: 10.1177/2233865920926778. URL https://doi.org/10.1177/2233865920926778. Publisher: SAGE Publications Ltd.

# 8 Appendix

I. Table A1: Comparing observables for audited and not yet audited municipalities

| Variable          | $\mathbf{N}$ | Audited, $N = 53$ | Not Yet Audited, $N = 181$ | p-value <sup>1</sup> |
|-------------------|--------------|-------------------|----------------------------|----------------------|
| Illiteracy rate   | 234          |                   |                            | 0.5                  |
| Mean              |              | 26                | 24                         |                      |
| Share urban       | 234          |                   |                            | 0.2                  |
| Mean              |              | 0.53              | 0.58                       |                      |
| Population        | 234          |                   |                            | 0.12                 |
| Mean              |              | 18024             | 21453                      |                      |
| Income per capita | 234          |                   |                            | 0.2                  |
| Mean              |              | 290               | 321                        |                      |
| GDP per capita    | 234          |                   |                            | 0.3                  |
| Mean              |              | 6006              | 7963                       |                      |
| Gini              | 234          |                   |                            | 0.054                |
| Mean              |              | 0.53              | 0.56                       |                      |

Notes: Comparing demographic characteristics between audited and non-audited municipalities in 2005, the year before the treatment. Significance: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

|                                 | Weighted Capacity Index |              | ISSQN $(\log)$ |              |
|---------------------------------|-------------------------|--------------|----------------|--------------|
|                                 | 1                       | 2            | 3              | 4            |
| 2006 Audit                      | -0.014                  | -0.061**     | 0.122*         | $0.435^{**}$ |
|                                 | (0.013)                 | (0.027)      | (0.073)        | (0.217)      |
| Corruption Intensity            |                         | 0.020        |                | 0.045        |
|                                 |                         | (0.022)      |                | (0.393)      |
| 2006 Audit:Corruption Intensity |                         | $0.023^{**}$ |                | -0.154       |
|                                 |                         | (0.012)      |                | (0.114)      |
| Num.Obs.                        | 1848                    | 1848         | 2321           | 2321         |
| R2 Adj.                         | 0.867                   | 0.867        | 0.870          | 0.871        |

II. Table A2: Alternative measures of state capacity

Notes: Alternative measures for State Capacity, using a weighted index of the tax collection infrastructure for fiscal capacity, and using log ISSQN revenue for bureaucratic quality. Significance: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Standard errors clustered at the municipality level are reported in parentheses. All models include municipality and year fixed effects.

|                              | Proportion of ISSQN |
|------------------------------|---------------------|
|                              | 1                   |
| Treated at $T = -2$          | -0.008              |
|                              | (0.050)             |
| Treated at $T = 0$           | 0.093               |
|                              | (0.143)             |
| Treated at $T = 1$           | 0.166               |
|                              | (0.145)             |
| Treated at $T = 2$           | $0.300^{*}$         |
|                              | (0.166)             |
| Treated at $T = 3$           | 0.205               |
|                              | (0.166)             |
| Treated at $T = 4$           | 0.171               |
|                              | (0.161)             |
| Corruption per service order | -0.035              |
|                              | (0.065)             |
| Num.Obs.                     | 2321                |
| R2 Adj.                      | 0.767               |

III. Table A3: Event study for the proportion of ISSQN of locally-sourced revenue

Notes: Significance: \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Standard errors clustered at the municipality level are reported in parentheses. The model includes municipality and year fixed effects. The proportion of ISSQN taxes represents bureaucratic quality.