TECHNICAL NOTE Nº IDB-3331

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Abstract

Despite the equity and efficiency advantages of property taxes, revenues from this source are low for most local governments in Latin America and around the world. Weak cadastral management is a well-known obstacle to collecting these taxes. Countries' cadaster systems—which are used to identify, register, and value properties—are often outdated or poorly maintained. While lack of political will and the unpopularity of property taxes could explain this weak management, it could also be attributed to low government capacity more generally, since effective property tax collection hinges on a strong cadastral administration, which is complex and costly. Data from 2016 to 2022 from thousands of Mexican municipalities reveal that as the overall capacity of local governments increases, they specifically become more capable of managing cadasters and collecting more property taxes. Moreover, low-capacity governments increase their property tax income when they delegate cadastral management to the central government. These findings support an asymmetric approach to cadastral management in which low-capacity local governments delegate this responsibility while high-capacity ones retain it to collect more property tax revenue.

JEL Codes: H71, H72

Keywords: decentralization, property tax, cadastral management, intergovernmental fiscal transfers.

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1. Introduction

In Mexico, property taxes account for a small share of local government revenue and have increased little over the past 25 years. The reasons for this low revenue stem from both tax policy and administration, and especially problems with cadastral management, including a lack of interest and inability to implement and update cadasters. Federal and state policies to incentivize tax collection and help maintain the cadaster have been inconsistent and weak (Ahmad et al., 2019). Those problems are exacerbated by social and economic differences among municipalities and regions, and are especially aggravated by political considerations (Espinosa et al., 2018; Takahashi, 2021; Unda, 2021).

The key to managing property tax lies in well-performing basic administrative functions, chiefly cadastral management, which entails identifying, registering, and appraising parcels (land and buildings). Cadaster management is complex and expensive. It is generally unpopular to implement, especially in the developing world, as demonstrated by low rates of enforcement and compliance (Martinez-Vazquez and Sepulveda, 2012; Slack and Bird, 2014).

Theoretical arguments for decentralizing versus centralizing property taxation and the cadaster function focus on two dimensions: technical capacity and incentives (Dillinger, 1991; Bird, 2015). On the one hand, higher levels of government tend to have greater technical and financial capacity, which favors centralized management of cadasters. However, the revenues collected are usually assigned to decentralized governments, which naturally have a stronger incentive to perform better. Thus, optimal assignment of property tax responsibilities, particularly in cadastral management, is an empirical question of whether technical capacity trumps incentives to perform.

In this paper, we study property taxation in Mexico to understand the determinants of municipalities' lackluster and heterogeneous property tax revenue performance. We focus on the interplay between asymmetric assignment of cadastral administration and local capacities and estimate how revenue performance differs between various configurations of these variables. We use municipal-level data for 2016–2022 and multivariate regression analysis with matching techniques to gain insight into the impact of centralized versus decentralized cadaster governance on per capita property tax collected. Mexico offers a suitable context for identifying these causal relationships because of its ad hoc, voluntary cooperation agreements for managing property taxation between state and municipal levels, agreements which cover both centralized and decentralized cadastral management.

Our findings indicate that local capacity is a key determinant of property tax collection levels. Municipalities with low organizational capacity can increase their property tax revenues by delegating their cadaster to the state government. In contrast, high-capacity municipalities that fully manage their own cadasters can collect significantly more property tax revenues than their peers that delegate this responsibility to the state.

These results suggest that, in some cases, the institutional coordination and support that states provide municipalities is working well, particularly when local governments have limited technical and financial capacities. In other cases, where local capacity is strong, it is more beneficial for municipalities to manage their own cadaster. In light of these findings, we argue that Mexico should formally adopt an asymmetric approach to cadastral management—based on local capacities—to optimize property tax collection. Similar countries considering further decentralizing their property taxation and cadastral management or recentralizing the function and responsibilities could also benefit from these findings.

The rest of this paper is organized as follows. The first section provides an overview of municipal property taxation in Mexico, describing some elements of the property tax system and presenting a brief analysis of property taxes across states and municipalities. We then review previous research on the causes of heterogeneous performance, focusing on the key role of local capacity in cadastral management. The next section presents an empirical analysis of the role of different institutional arrangements in centralized versus decentralized cadaster management, explaining differences in revenue performance in terms of local capacity and other institutional features. The last section offers some implications and recommendations for Mexico, and potentially for other countries in similar situations, to devise asymmetric assignment schemes for property taxation that are based on local capacities.

2. Context

Mexico's property tax has existed for a long time, but it has only been a municipal tax since 1983, when reforms to the Fiscal Coordination Law of 1982 transferred control of the tax from states to municipalities. The Federal Constitution provides the legal basis for Mexico's 2,477 local governments and establishes provisions for municipal governance, responsibilities, and capacities, including the authority to collect property taxes. In turn, state and municipal legislation details the property tax policy, administration design, and implementation features and mechanics, including the possibility that different municipalities within the same state could have different tax policies and administrative arrangements, including on matters such as tax rates, exemptions, and approaches to collection.[5] Although municipalities enact property tax regulations in their annual revenue laws (e.g., defining tax rates and bases), these regulations must be approved by their state congress.

[5] Other federal laws that regulate municipal responsibilities and areas of authority on taxation and budgeting include: The Fiscal Discipline Law for States and Municipalities, The General Governmental Accounting Law, The Fiscal Coordination Law, The Federal Budget and Fiscal Responsibility Law, The Annual Federal Revenues Law and The Annual Federal Budget Decree.

Municipalities assess property values in accordance with their state's cadastral law. The cadastral value takes into account the values of both land and buildings, as well as the property's nature (urban/rural), use, dimensions, number of floors, and age. In most cases, cadastral values are calculated once (when the property is registered for the first time) and may be updated if there are changes (e.g., changes in ownership or applications for permits to modify the property). Each local authority keeps a record of the properties within its jurisdiction in the municipal cadaster. New properties or improvements to existing properties are added to the cadaster following a visit by the authority to the owner or the owner to the authority. Together, the properties in the city's cadastral register constitute the tax base for that municipality.

Only 11 of Mexico's 31 states have specific regulations on updating cadasters.[6] Municipal authorities are responsible for this task, but few actually do it. Of the 2,477 municipalities surveyed in 2023, only 466 performed field inspections to update their register, and only 177 reported implementing a formal program for updating property values.

Some argue that, despite the municipal cadaster's solid legal foundation, its shortcomings are the primary cause of the lackluster performance of property taxes in Mexico (Takahashi, 2021).[7] Keeping public inventories of property up to date is a complex, costly task, especially when social dynamics lead to constant changes and high geographical dispersion of communities (e.g., migration patterns affecting growth in certain cities and states, violent acts impeding access to particular areas, etc.). Very few municipalities have the financial and technical means to assemble accurate, comprehensive, and modernized cadasters.[8]

To address these capacity problems and incentivize higher property tax collections, municipal and state governments in many parts of the country have signed agreements under which the state assumes responsibility for running the municipal cadaster and provides technical, administrative, and legal support. Local authorities remain responsible for collecting and administering the property tax and for communicating with taxpayers (although in some instances, municipalities also transfer collection responsibilities to states).

Currently, there are over 600 cooperation agreements in force in one-third of the states. Under most agreements, the state retains a percentage of the revenue collected, and the municipality receives the rest. The split depends on the agreement in each state. There is also an incentive scheme in the intergovernmental fiscal transfer system, the *Fondo de Fomento Municipal*, that gives additional resources to municipalities that sign those agreements with their respective state. Some argue that the state government lacks the

[6] These are Chiapas, Chihuahua, Durango, Guerrero, Hidalgo, México, Michoacán, Nuevo León, Puebla, Tamaulipas, and Yucatán.

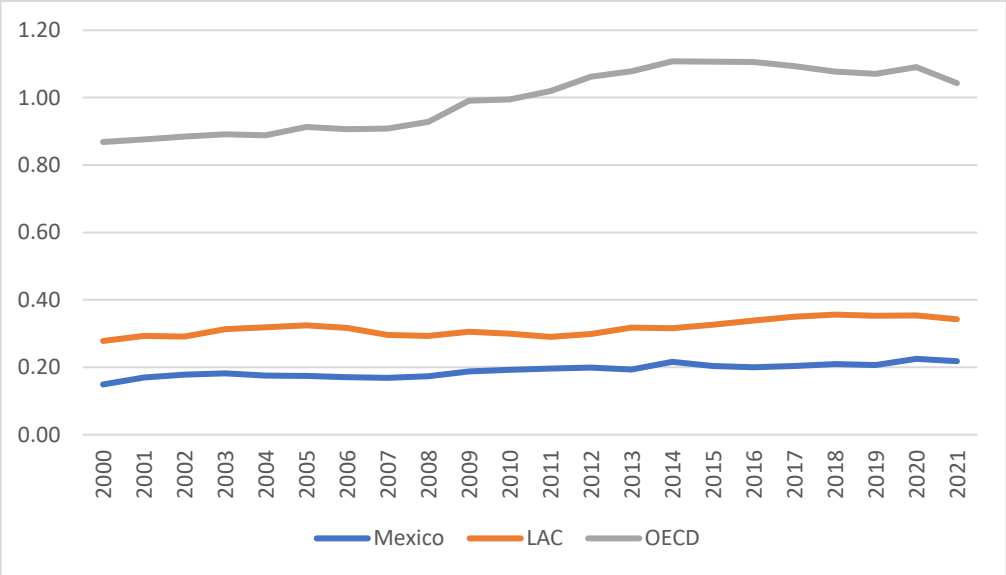
[7] Unda Gutiérrez (2021), and Sepúlveda and Martínez-Vázquez (2012), offer additional arguments on property tax performance.

[8] INEGI, 2016.

same incentive to improve tax collection, since the revenues belong to municipalities (Takahashi, 2021). Additionally, municipalities are unlikely to develop institutional capacities to perform the task by themselves if they leave it to the state government, especially if they can receive an incentive from the *Fondo de Fomento Municipal* for transferring the responsibility to the state.

Federal transfers are the main source of revenue for local governments in Mexico (72%), while the property tax is the second largest source of revenue, accounting for only 16 percent of total revenues. Property taxes are very low, and revenue levels from them have remained almost unchanged for the past 25 years, accounting for only 0.25 percent of GDP in 2024. This percentage is lower than the average for Latin American and Organisation for Economic Co-operation and Development (OECD) countries (Figure 1).

Figure 1. Property tax collected, as a percentage of GDP, 2000–2021, Mexico, Latin America and the Caribbean, and OECD (averages)



As in many parts of the developing world, in Mexico property tax collection levels vary widely across states and municipalities. Nuevo León, for example, had a difference of 5,101.4 pesos with respect to San Pedro Garza García, which collected 5,784.97 pesos per capita, and Mier y Noriega, which collected 15.76 pesos per capita. The gap was 4,279.31 pesos per capita in Quintana Roo and 2,734.47 pesos in the State of Mexico. Jalisco, Coahuila, and Querétaro also had significant differences, with 14 to 183 times more tax collected in the highest municipalities compared to the lowest. As of 2021, the majority of property taxes were levied in a few municipalities and states: 50 cities in 22 states collected 65 percent of property tax revenues. Half of those cities are in only five states: México, Jalisco, Nuevo León, Querétaro, and Chihuahua. The clear outlier is San Pedro Garza Garcia, a rich industrial city in the northern state of Nuevo Leon, followed by Tulum, a rich

tourist enclave in Quintana Roo. However, the majority of the best-performing municipalities collect less than 1,000 pesos per capita (about US$ 50).

Interestingly, property tax underperformance is not exclusive to small, rural municipalities; some major cities also had disappointing results. For example, in 2021, only 29 of the 100 cities with the highest property tax per capita had more than 200,000 inhabitants. Municipalities with populations between 50,000 and 100,000 had higher property taxes per capita than most municipalities in the other population ranges. Thus, property taxes in Mexico do not seem to be closely or exclusively tied to population size or household income. Effective tax collection may depend on factors such as the capacity and effectiveness of local authorities and the state of municipal cadasters.

3. Conceptual Framework

A large body of literature examines the determinants of property tax performance (Bird and Slack, 2004; Bahl, Martinez-Vazquez and Youngman, 2010). This research identifies key socioeconomic factors, such as the size, profile, and growth of the economic base, and population (i.e. urbanization and economic growth and employment rates, coastal or touristic versus rural location), which determine the demand for properties and property values (IMF, 2016; Espinosa et al., 2018; Unda, 2021).

Certain features of the design of intergovernmental fiscal frameworks can also discourage local tax efforts and lead to lower tax rates, undervalued properties, and less frequent reassessments. For example, fiscal transfers from the central government can undermine incentives to mobilize property tax revenue (Pineda et al, 2015; Unda and Moreno, 2015; Canavire-Bacarreza and Zúniga, 2015), leading to lower revenues and reinforcing dependence on higher levels of government. Furthermore, the availability of other local taxes and debt instruments can make these revenue sources more palatable to decision-makers than property taxes (Bonet et al., 2014). Finally, in some cases, national taxes that also capture local immovable property in their base can create taxpayer resistance, since property taxes are perceived as double taxation (Porto, 2014).

Property taxes also have intrinsic characteristics that make them hard to reform and affect the will of local authorities to tax effectively, undermining tax morale (Bird and Slack, 2015). One such characteristic is their visibility or salience. Unlike income or sales taxes, property taxes generally have to be paid directly by taxpayers in periodic, large lump-sum payments (Cabral and Hoxby, 2012), and citizens often see the rate as incommensurate with the services provided by the taxing authority (Simonsen and Robbins, 2003). Also, property taxes create liquidity challenges for some taxpayers because they reflect an imputed cash flow that may not align with the owner's current income and liquidity. This situation is particularly problematic for older people on fixed incomes whose property taxes have increased. This type of presumptive tax is also often perceived as regressive, unfair, and arbitrary (Johannesson-Linden and Gayer 2012; Bird, Slack, and Tassonyi, 2012). Property

taxes are also inelastic, since their revenues do not change as much or as fast with economic growth as other taxes. In good economic times, this inelasticity discourages local governments, as their revenues do not expand and they have to raise rates to maintain revenues in real terms. Meanwhile, during recessions, local taxpayers may again be very unhappy because their property taxes do not decline as quickly as their incomes or the value of their properties.

Political factors also disincentivize property tax revenue mobilization (Ahmad et al., 2019). Studies show that revenue collection is lower in electoral years or when electoral races are closer (Unda, 2021), when there are conflicting views or party misalignment between the executive and legislative branches (Aguilar, 2021), or when there is party affinity across levels of government (Nelson, 2000).

Of all forms of taxation, the property tax is perhaps the most dependent on administrative and technical capacity to manage the tax. Poor tax administration hinders property tax implementation and is often considered a key reason for low revenue mobilization in less developed countries. Ahmad et al. (2019) argue that the problem with property taxation in Mexico is largely administrative, while Unda (2021) finds that greater institutional capacity at treasuries and cadasters positively affects collection. Takahashi (2021) argues there is both a lack of interest and insufficient capacity among municipalities, resulting in outdated cadaster records and a high degree of tax evasion. Moreover, up-to-date property records, including the extent of the property cadaster and institutional capacities for property information management, are often unavailable. He argues that these factors translate into generous exemptions and low tax rates, obsolete and infrequent property value (re)assessments, incomplete registries and cadasters, and a lack of willingness and means to enforce the tax. The result is low revenue mobilization.

An important policy question regarding property tax administration is who should be responsible for it: the central government (or state governments in a federal system) or local governments? As discussed above, the choice comes down to the capacity to administer the tax versus the incentive to collect revenues (including the incentive to be responsible and accountable for how tax revenues are spent) (Goodfellow, 2017; Dillinger, 1991).

An argument for local administration of property taxes is that local authorities have more knowledge about where properties are located, who owns them, what renovations or additions have been made, and so on. Another argument is that local governments have an incentive to collect the taxes if they get to keep the funds. But this same proximity of local governments to their residents makes them resistant to collecting taxes or more exposed to local capture, as argued by Prud'Homme (1995). However, many local authorities simply do not have the capacity to administer the tax. For example, they perform many administrative functions manually rather than computerizing them. In some cases, the revenue base does not include all taxable properties, collection rates are low, and

enforcement is almost non-existent. Many countries have difficulty regularly updating property values, even where local administration is fairly good.

Recognizing some of these difficulties with local administration, many countries involve higher-level governments in various aspects of property tax administration, particularly assessment. National or state cadastral and tax agencies tend to have more resources and technical capacity to assess properties and collect taxes than local governments. Central tax agencies also hold substantial data on taxpayers that could support property taxation, and they may be able to enforce payments more easily because of their greater political and institutional strength. Some have argued that corruption and misuse of funds are easier to identify and punish at the central level, but there is little evidence to support this claim (Goodfellow, 2017). But even the results of central administration may leave much to be desired, since higher-level administrations often have little incentive to respond to local governments' needs for up-to-date, accurate tax base information, since they receive none of the revenues.

The international practice of property tax administration is varied. At one end of the spectrum in Latin America are countries that administer local property tax (with revenues allocated to the local governments) in a completely centralized way: Chile and the Dominican Republic—and Brazil and Uruguay for rural properties. In contrast, the administration of urban property taxes in Brazil and Venezuela is almost completely decentralized, an arrangement very similar to that in the United States. Between these two extremes are intermediate approaches where cadaster and valuation are more centralized and collection is more decentralized. Several countries with better property tax performance have asymmetric centralization of cadaster management: the largest cities retain their own cadaster and valuation, as well as the collection function, and smaller local governments rely on a centralized cadaster function. For example, in Uruguay, the central government (through the National Directorate of the Cadaster) is responsible for cadaster and valuations outside of Montevideo. In Colombia, the capital city of Bogotá and the other large municipalities have their own cadaster, but the Agustín Codazzi Geographical Institute (*Instituto Geográfico Agustín Codazzi*, IGAC) manages the cadaster for the rest of the municipalities.

Notwithstanding the theoretical and practical debates about assigning property tax administration, there is little to no empirical evidence on the relative merits of each approach or, in particular, on how local capacity affects the type of cadastral management that best improves property tax performance. This paper seeks to fill this gap by providing evidence on whether centralized or decentralized cadastral management leads to higher property tax revenue levels. The mix of central and local government cadastral management systems across municipalities in Mexico provides a natural experimental setting that makes it easier to identify how different cadastral management options within the same country impact revenue mobilization.

Subnational governments in Mexico face a conundrum because managing the cadaster is administratively complex and expensive, and, at the same time, incentives for collecting property taxes are low for both states and municipalities. In this context, who should manage the cadaster and how should this decision be made? Municipalities may benefit from delegating their cadastral management to state governments, which can reap economies of scale in managing the cadaster. State governments may also have more resources to procure the technology required for effective cadastral management, and they can also address the lack of incentives of neighboring municipalities to update cadastral values (i.e. race to the bottom competition). Given that in this situation the state government must recover the costs of managing the centralized cadaster, they may have an incentive to pressure local governments into collecting more property tax. Thus, we hypothesize that:

> *H1: Municipalities that delegate their cadaster to the state will collect more property taxes than municipalities that manage their own cadasters.*

Although from an electoral standpoint the incentives to enforce property taxes may be low, decentralization and effective property taxation can improve all aspects of governance and service delivery at the local level. Research shows that local governments that build and maintain their own infrastructure have an incentive to collect additional resources, while greater tax responsibilities can lead to more accountability from local politicians and improve governance. In this context, local governments with greater administrative, technical, and institutional capacity may benefit from managing their own cadaster:

> *H2: Municipalities with greater capacity that manage their own cadasters will outperform equivalent municipalities that delegate cadaster management to the state government.*

4. Empirical Strategy

Data

Our empirical analysis uses subnational fiscal data for municipalities across Mexico. Each year, the National Institute of Statistics and Geography (*Instituto Nacional de Estadística y Geografía*, INEGI) compiles and publishes the Public Finance Statistics for States and Municipalities (*Estadística de Finanzas Públicas Estatales y Municipales,* EFIPEM) database. It contains data from over 2,400 municipalities, is consistently updated with corrections, and standardizes line-items across municipalities and time periods, making it easier to compare property tax collection within and across municipalities. Many

municipalities do not collect property taxes because they are too small or have different arrangements based on indigenous practices (*usos y costumbres*).

To identify which municipalities have delegated their cadaster management to the state government, we extract information from the INEGI's Census of State Governments (*Censo Nacional de Gobiernos Estatales*, CNGE). The survey asks officials at each state government to list the municipalities they manage the cadaster for. The survey also asks state governments which municipalities they support in property tax collection, but this is usually a shared arrangement and is thus difficult to precisely identify and evaluate. We therefore focus on who manages the cadaster as our independent variable. The question on cadaster management first appeared in the 2017 survey, which asked state governments about their 2016 arrangements. Each subsequent annual survey asks this question, providing data from 2016 through 2022.

Estimation model

We estimate the following regression model:

$$y_{mt} = \beta_0 + \beta_1 z_{mt+2} p_{mt+3} z_{mt} p_{mt} + \boldsymbol{W}_{mt}\boldsymbol{\delta} + \boldsymbol{K}_t\boldsymbol{\zeta} + \epsilon_{tm}, \quad (1)$$

where y_{mt} is the dependent variable for municipality m in year *t*, for which we use two alternative variables (the logged values of property tax collection and the logged values of property tax per capita); β_0 is the intercept, while the variable z_{mt} is a binary variable where one indicates that the municipality manages the cadaster and zero indicates that the cadaster is delegated to the state, for each municipality m and year t. Variable *p* is an administrative capacity proxy measured by the logged value of total per capita annual expenditures for each municipality over time (discussed below). The β_3 reflects how cadastral management responsibility interacts with municipal capacity to compare revenue performance across varying degrees of capacity. Lastly, we include controls for each municipality in vector $\boldsymbol{W}_m$ and year fixed effects in $\boldsymbol{K}_t$.

Measuring administrative capacity is difficult. Data on municipal infrastructure, personnel, or technology are rare and inconsistent between municipalities of varying capacity. Thus, available proxies for capacity contain information on those most capable of reporting it. To address this, we extract the line-item value for a municipality's total annual expenditures from EFIPEM data and transform it into a per capita value.

We then use expenditures per capita as a proxy for administrative capacity, based on the assumption that municipalities that spend more per capita must have more qualified personnel and general administrative capacity to manage that spending than those with smaller budgets. There are, of course, particular nuances between municipalities with similar expenditures, but we try to control for those outliers. On average, though, more capacity should lead to more spending, and more spending demands more capacity.

We also control for potential confounders that may influence property tax collection. Municipalities of varying sizes may simply have different tax bases. We thus restrict our analysis to municipalities with more than 30,000 people for better comparability across states. This restriction reduces our sample to roughly 30 percent of all municipalities in the country, but the sample still covers over 85 percent of Mexico's population. We in turn include the logged value of each municipality's population size.

Economic development is also a predictor of property taxes: municipalities with higher levels of development have a wealthier tax base from which to extract resources. Ideally, we would include municipal GDP per capita or household income, but these data are not available at the municipal level. In lieu of GDP or income measures, we use the Marginalization Index published by the National Population Council (*Consejo Nacional de Población*, CONAPO), which serves as a proxy for a municipality's overall development level and covers indicators such as local economic output, access to education, and the quality of health services.

From CONAPO we also estimate the annual unemployment rate for each municipality to account for regional variation in workforce participation. Cadasters in geographically larger states may also cover large swaths of land, so we control for the number of municipalities in each state. We also use data from Mexico's Central Bank to control for a state's gross regional product and distinguish between poorer and wealthier regions.

In addition to the above structural factors, we control for the value of unconditional transfers from the central government. From the EFIPEM, we pull the total value of *participaciones federales,* which is the revenue-sharing mechanism the central government uses to fund municipalities. The revenue sharing is based on a formula that, among other things, rewards municipalities for collecting more of their own taxes and, for that reason, should also be correlated with property taxes; therefore, we use the per capita values of this intergovernmental transfer. Table 1 presents summary statistics.

Table 1. Descriptive Statistics

#	Variable	Mean	SD	Min	Max
1	Municipal property tax ($MXN)	$21,334,428	$103,492,903	$34	$2,491,065,112
2	Total municipal expenditures ($MXN)	$744,220,468	$1,234,982,495	$62,141,219	$12,494,995,385
3	Municipal capacity (PCA score)	0.66	1.58	-0.33	12.99
4	Municipal population	150,807	237,358	30,017	1,922,523
5	Unconditional transfers ($MXN)	$273,430,955	$476,997,658	$18,625,037	$4,767,693,706
6	Unemployment rate	0.03	0.02	0.00	0.18
7	Marginalization index score	54.35	5.11	22.22	65.27
8	Total municipalities by state	101.93	101.34	5.00	551.00
9	State GDP ($MXN)	$639,599	$463,363	$91,086	$1,608,137

Results

As shown in Figure 2, twice as many municipalities manage their own cadasters as delegate this function to their state governments. Although there is variation over time, and municipalities may enter or exit these cooperation agreements, we do not further exploit that information. From the CNGE survey data, it is difficult to parse out when cadaster arrangements are implemented or modified, hindering a temporal analysis that exploits changes in responsibility.

Figure 2: Changes in cadaster management over time

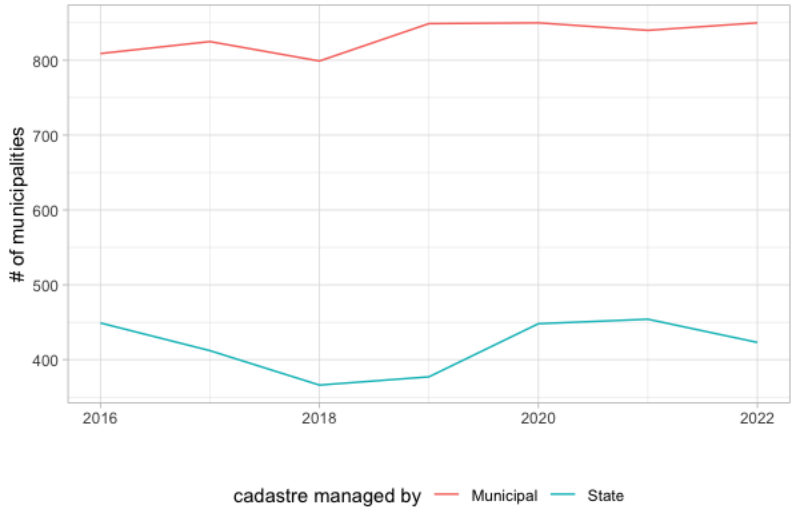


Table 2 presents the results of four different ordinary least squares (OLS) regressions, where the dependent variable is the logged value of municipal property taxes collected each year. Table 3 estimates the same OLS regressions, but with the logged values of property tax per capita. To make it easier to interpret these tables, we present the marginal effects of our independent variables of interest.

Figures 3 and 4 provide a visual representation of the results from column (1) of tables 2 and 3. Across both specifications, we observe that municipalities that manage their own cadasters vastly outperform municipalities that delegate this function to the state. We observe significant variation among the municipalities that delegate the cadaster to the state, and the wide error margins imply an unobservable confounder. This simple model may not fully capture the nuances across cases, particularly the differences in capacity between municipalities.

Figure 3

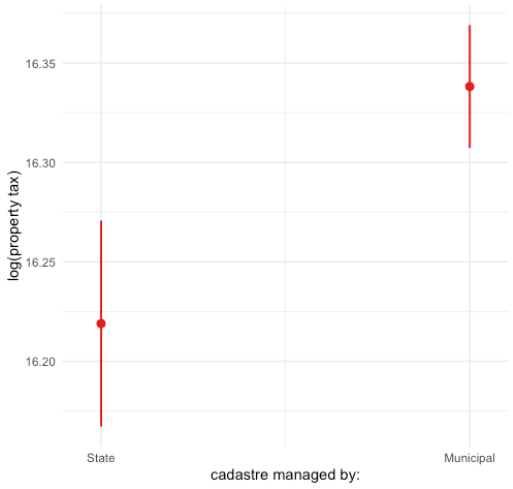
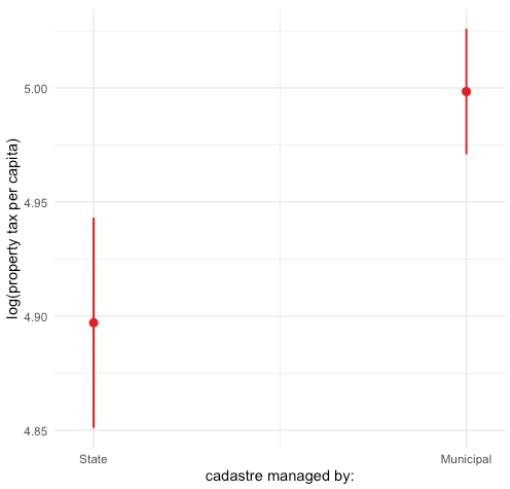


Figure 4



We estimate the interaction between the level of government that manages the cadaster and our proxy for municipal capacity—the logged value of per capita expenditures. This interaction allows us to compare the property tax revenues of municipalities with similar levels of expenditure that are differentiated by whether they delegate or manage their cadasters. As discussed above, we argue that low-capacity municipalities will have lower levels of per capita expenditure and that high-capacity municipalities will have higher per capita expenditures over time.

Figures 5 and 6 present the marginal effects from column (2) in tables 2 and 3. The red line represents the estimated property tax performance of municipalities that delegate cadaster management to the state, while the blue line represent the performance of municipalities managing their own cadaster. We observe similar patterns for both specifications. In low-capacity municipalities, as captured by the logged values of total expenditures per capita,

those that delegate their cadaster to the state outperform those that manage their own. This result contrasts with the results shown in figures 2, 3, and 4. At the other extreme, the marginal effects plots also suggest that municipalities with a high degree of capacity may benefit more from managing their own cadastral systems because they largely outperform their peers that delegate.

Figure 5

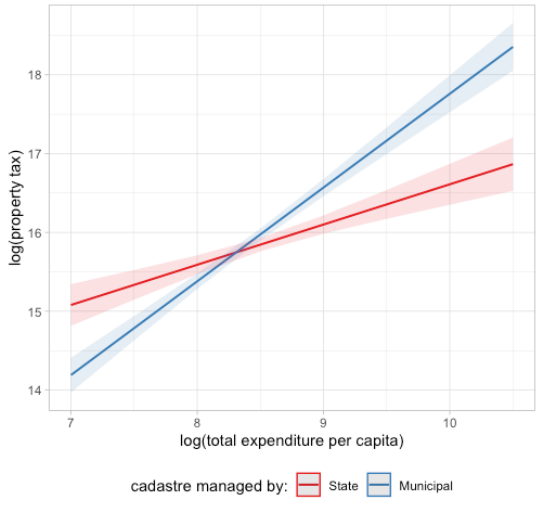
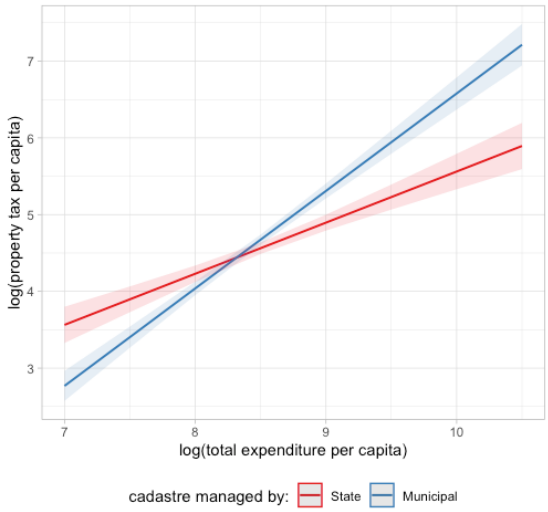


Figure 6



While these results support our second hypothesis, this approach has some flaws that limit potential inferences. In particular, there is a high degree of endogeneity: more property tax collection may lead to greater expenditures, and when spending needs are greater, more property tax needs to be collected. There is also the possibility of self-selection, where the most capable municipalities choose to manage their own cadaster, thereby reducing the pool of municipalities for comparison.

We attempt to correct for self-selection by matching municipalities with similar characteristics that differ only in whether they manage their cadaster or delegate it to the state. We use an optimal pair-matching algorithm that reduces the distance between matched samples (Hansen & Klopfer, 2006), and we restrict our sample to the year 2018.[9] In the first stage, the matching algorithm compares the distance between predictor variables and the outcome of interest. In this case, we use all our control variables to predict the likelihood that a municipality manages or delegates the cadaster, and we use the distance between cases to build a subset of similar municipalities. This approach reduces our observations from 646 across a single year to just 133 pairs, totaling 266 matched cases. We use all control variables in the matching exercise and have our treatment variable (specified as a municipally managed cadaster) interact with each control variable

[9] This was the most complete year in the sample prior to the Covid-19 pandemic.

in the full estimation to account for group-specific variation. Our control group includes municipalities that delegate their cadaster to the state level. The results are presented in column (3) of tables 2 and 3.

Figures 7 and 8 show marginal effect plots of the matched municipalities interacted by the logged per capita expenditures across both dependent variables. The overall trends hold, but the separation between cases is less pronounced given the reduction in observations. Nonetheless, this approach allows us to discern that in cases with a high degree of local capacity, matched municipalities that manage their own cadaster still outperform municipalities that delegate management to the state.

Figure 7

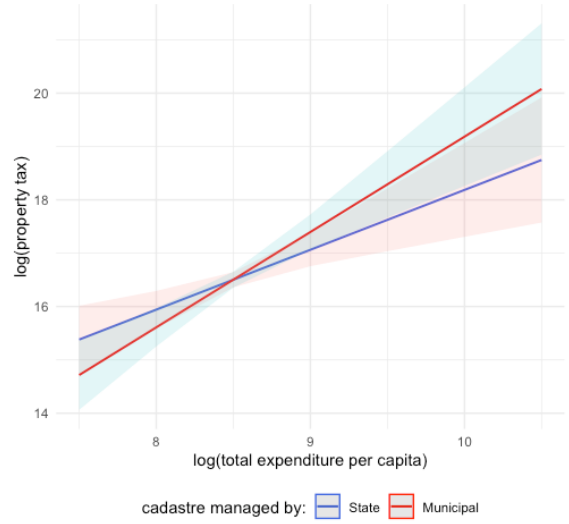
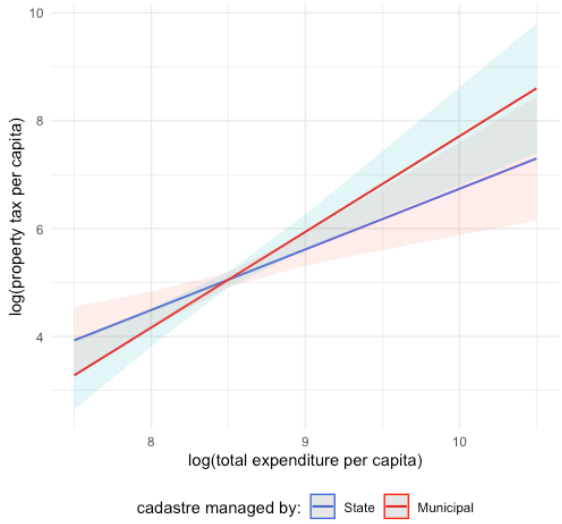


Figure 8



To make our analysis more robust, we construct an alternative variable for municipal capacity, drawing from the 2022 Census of Municipal Governments focused on the 2021 fiscal year. Although the census has questions on water works, social programs, security, and other government-related services, we focus on the organizational capacity section. This section of the survey contains about 300 questions on topics such as the number of government offices, types of fiscal management arrangements, employees per department, educational degrees of employees, number of vehicles owned, number of computers, and various other administrative items. Rather than focusing on a single response item, we used machine learning to construct a combined score of the shared variation across the 300 different measures of organizational capacity at the municipal level. The municipalities with the highest administrative capacity will generally have higher scores on these items, so we mean-center each item and then use a principal component

analysis (PCA) to combine the variation across all questions into a single index we call "municipal capacity PCA." The raw scores vary widely between the lowest- and highest-scoring municipalities, so we take the log of these values to reduce their exponential differences.

The municipal capacity PCA variable is highly correlated with the per capita municipal expenditures variable, upwards of 0.95. This result is to be expected, given that the cost of managing more employees, vehicles, and infrastructure increases total expenditure. Still, we rerun our analysis with the new capacity variable and again apply an optimal pairs matching algorithm, reducing our sample to municipalities that are similar to each other. Column (4) of tables 2 and 3 presents the results of our regression analysis with municipal capacity PCA and matching. The marginal effects plots in figures 9 and 10 visually depict the interaction between the level managing the cadaster and our new measure of capacity.

Figure 9

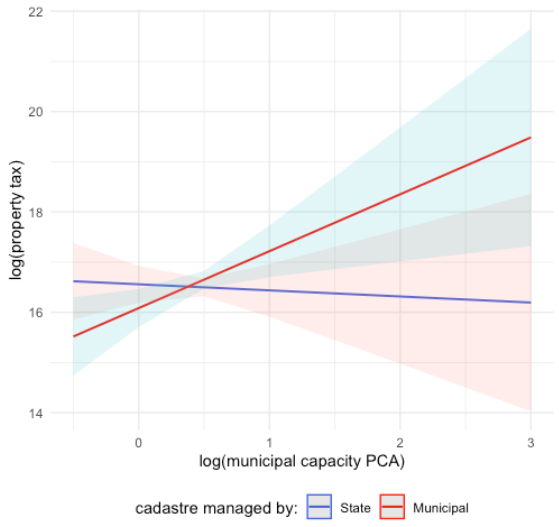
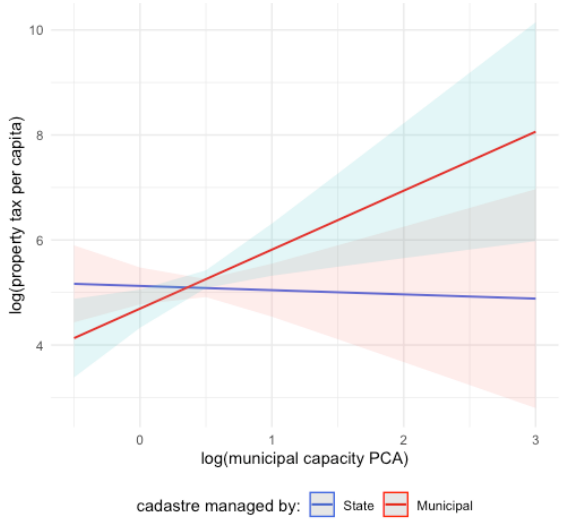


Figure 10



As highlighted in the marginal effects plots, our municipal capacity PCA variable yields similar results to the municipal expenditure variable. Municipalities with low organizational capacity can benefit from delegating their cadaster to the state government. In contrast, high-capacity municipalities that fully manage their own cadasters can collect significantly more in property taxes than their peers that delegate this responsibility. The municipalities furthest to the right obtain an estimated $160 million MXN more than municipalities that delegate cadaster management. This implies that these municipalities are using that additional capacity effectively to extract more resources for themselves. In contrast, municipalities that delegate management to the state may simply not have the infrastructure or motivation to recoup their administrative expenses, given that they can rely on the state government to manage them.

Table 2

	Dependent variable:			
	log(Property tax)			
	(1)	(2)	(3)	(4)
Constant	-19.286*** (0.617)	-15.547*** (0.943)	-13.350*** (2.524)	-11.486*** (4.065)
Municipal cadaster (ref: state)	0.119*** (0.034)	-5.645*** (0.989)	-7.390 (4.531)	3.395 (6.030)
log(Total expenditures per capita)	0.927*** (0.090)	0.511*** (0.123)	1.122*** (0.338)	
log(Municipal capacity PCA)				-0.121 (0.396)
log(Unconditional transfers per capita)	-0.012 (0.067)	-0.035 (0.067)	-0.429 (0.267)	0.310 (0.218)
Mun. marginalization index	0.258*** (0.012)	0.259*** (0.012)	0.316*** (0.034)	0.315*** (0.037)
Unemployment	1.699 (1.616)	2.010 (1.600)	-9.549*** (3.644)	-9.647*** (3.561)
log(Population)	1.299*** (0.026)	1.293*** (0.026)	0.727*** (0.154)	0.901*** (0.276)
# of municipalities in state	-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001 (0.001)	-0.001 (0.001)
log(State GDP per capita)	0.151*** (0.020)	0.147*** (0.020)	-0.596*** (0.151)	-0.468*** (0.160)
Mun. cadaster x log(Total exp. PC)		0.679*** (0.118)	0.665 (0.524)	
Mun. cadaster x log(Mun. capacity PCA)				1.255** (0.596)
Mun. cadaster x log(Uncond. transfers PC)			-0.203 (0.355)	0.057 (0.338)
Mun. cadaster x (Mun marginalization)			-0.00884	-0.064 (0.072)
Mun. cadaster x Unemployment			18.313*** (5.503)	11.063** (5.295)
Mun. cadaster x log(Population)			0.697*** (0.202)	-0.238 (0.441)
Mun. cadaster x Num. muns.			-0.001 (0.001)	-0.001 (0.001)
Mun. cadaster x log(State GDP PC)			0.805*** (0.198)	0.737*** (0.188)
Year FE	**Yes**	**Yes**	**No**	**No**
Observations	4,354	4,354	266	266
Adjusted R^2	0.797	0.8	0.825	0.806
Residual Std. Error	0.874	0.869	0.79	0.865
Note: OLS with robust SE.				***p<0.01

Table 3

	Dependent variable:			
	log(Property tax per capita)			
	(1)	(2)	(3)	(4)
Constant	-18.843*** (0.575)	-15.518*** (0.878)	-13.141*** (2.513)	-10.936*** (3.936)
Municipal cadaster (ref: state)	0.101*** (0.031)	-5.023*** (0.905)	-7.301 (4.473)	4.373 (5.790)
log(Total expenditures per capita)	1.036*** (0.080)	0.666*** (0.108)	1.123*** (0.337)	
log(Municipal capacity PCA)				-0.080 (0.386)
log(Unconditional transfers per capita)	-0.089 (0.060)	-0.00649	-0.430 (0.264)	0.298 (0.215)
Mun. marginalization index	0.244*** (0.010)	0.244*** (0.010)	0.307*** (0.032)	0.307*** (0.035)
Unemployment	2.420* (1.333)	2.697** (1.322)	-9.008*** (3.411)	-9.115*** (3.350)
log(Population)	0.294*** (0.024)	0.288*** (0.024)	-0.0384	-0.105 (0.271)
# of municipalities in state	-0.001*** (0.0001)	-0.001*** (0.0001)	-0.001 (0.001)	-0.0005 (0.001)
log(State GDP per capita)	0.139*** (0.019)	0.135*** (0.019)	-0.580*** (0.147)	-0.453*** (0.157)
Mun. cadaster x log(Total exp. PC)		0.604*** (0.108)	0.650 (0.520)	
Mun. cadaster x log(Mun. capacity PCA)				1.204** (0.584)
Mun. cadaster x log(Uncond. transfers PC)			-0.194 (0.350)	0.024 (0.329)
Mun. cadaster x (Mun. marginalization)			-0.00818	-0.078 (0.064)
Mun. cadaster x Unemployment			17.406*** (5.232)	9.802* (5.023)
Mun. cadaster x log(Population)			0.673*** (0.197)	-0.220 (0.431)
Mun. cadaster x Num. muns.			-0.002 (0.001)	-0.001 (0.001)
Mun. cadaster x log(State GDP PC)			0.784*** (0.194)	0.700*** (0.184)
Year FE	**Yes**	**Yes**	**No**	**No**
Observations	4,354	4,354	266	266
Adjusted R^2	0.618	0.623	0.587	0.579
Residual Std. Error	0.779	0.774	0.773	0.833
Note: OLS with robust SE.				***p<0.01

5. Conclusions

In this study, we examine the determinants of property tax collection in Mexico, with a focus on comparing the revenue performance of centralized versus decentralized cadastral management. We find that local capacity significantly affects the amount of tax revenue collected and, more interestingly, the performance of each approach. Specifically, we find that low-capacity municipalities raise more revenues when they delegate their cadaster management to the state government. In contrast, high-capacity municipalities that fully manage their own cadasters collect more property tax than their peers that delegate this responsibility to the state.

Achieving more effective property taxes in Mexico will remain a complex, multifaceted challenge, but our results suggest a promising trend toward a more formal, asymmetric approach to cadastral management that is differentiated based on local capacities. Our main recommendation is that municipalities that are more capable and perhaps larger and richer should administer their own cadaster, while the state should assume this responsibility for less capable, smaller, and relatively poorer municipalities. We recommend modifying the Fondo de Fomento Municipal based on this approach to better target incentives.

For other countries in similar situations that are debating whether to further decentralize property taxation or fully re-centralize, our findings could help authorities avoid these extremes that may undermine overall revenues from property tax They could also consider an asymmetrical, flexible approach based on local capacity, assigning administrative responsibility to municipalities that demonstrate capacity while centralizing management at higher levels of government for municipalities with lower capacity.

Our study does have some limitations that future research should address. In particular, there is a need to further disentangle endogeneity and self-selection bias. It is also important to incorporate other factors that could shape property tax performance, particularly different intergovernmental assignments of tax collection and enforcement. In addition, our study does not explore the extent of cooperation agreements for cadastral management between municipalities and states, and additional research is needed to identify the type of support provided by states and the nuances that enable more effective management.

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