Supporting Information

The Politics of Property Taxation:
Fiscal Infrastructure and Electoral Incentives in Brazil

Contents

A. Descriptives

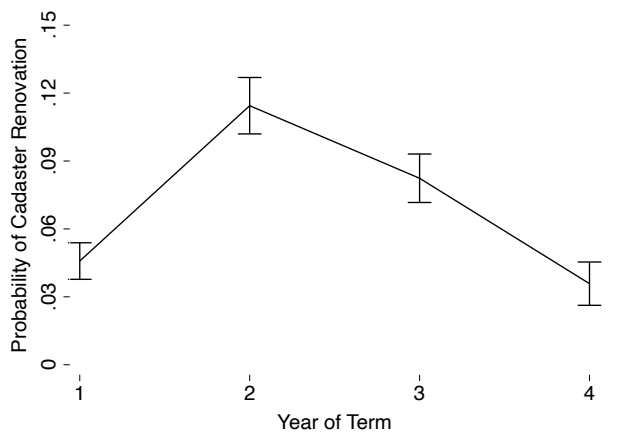
A.1 Descriptive Statistics

Table A.1: Descriptive Statistics

	All Municipalities			Municipalities with Incumbents Running for Reelection			Municipalities with Incumbents Running for Reelection in Close Elections ($h_{CCT} = 0.14$)		
	count	mean	sd	count	mean	sd	count	mean	sd
Cadaster Renovation	5401	0.42	0.49	1856	0.41	0.49	1036	0.41	0.49
Revision to Fiscal Land Values	5540	0.34	0.47	1911	0.33	0.47	1076	0.31	0.46
New IPTU Law, 2013-2015	5564	0.09	0.28	1916	0.08	0.27	1078	0.08	0.28
Population (log), 2010	5563	9.41	1.15	1919	9.42	1.11	1081	9.33	1.04
Proportion Rural, 2010	5563	0.31	0.20	1919	0.32	0.20	1081	0.33	0.20
Collects Any IPTU by 2012	5563	0.94	0.24	1919	0.93	0.25	1081	0.92	0.26
Gini, 2010	5563	0.49	0.07	1919	0.49	0.07	1081	0.50	0.07
Poverty Incidence, 2010	5561	0.23	0.18	1918	0.24	0.18	1080	0.25	0.18
Female Incumbent				1919	0.11	0.31	1081	0.12	0.32
Incumbent with College Education				1919	0.49	0.50	1081	0.49	0.50
PT Incumbent Mayor				1919	0.12	0.33	1081	0.12	0.33

A.2 Timing of Cadaster Updates within Mayoral Terms

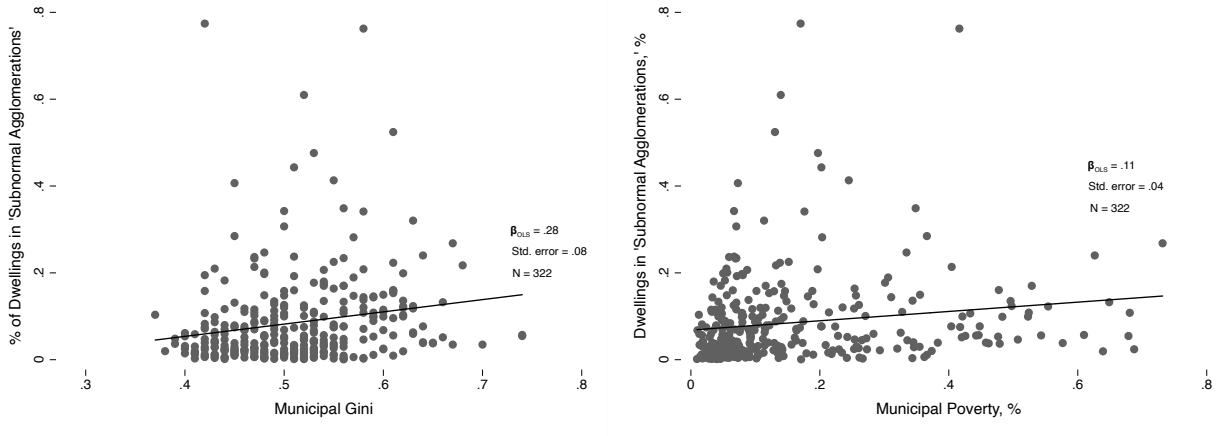
Figure A.1: Cadaster Updates by Year in Administration in Term-Limited Municipalities, 2009-2015



The graph plots the mean probability of a cadaster update in each year of a mayoral term, for the 2009-2012 and 2013-2016 administrations, with a 95% confidence intervals.

A.3 Irregular Settlements (*Aglomerados Subnormais*), Income Inequality, and Poverty

Figure A.2: *Aglomerados Subnormais*, Income Inequality, and Poverty



(a) *Aglomerados Subnormais* and Income Inequality

(b) *Aglomerados Subnormais* and Poverty

The unit-of-analysis is the municipality. *Aglomerados subnormais* are irregular settlements identified by the clustering of at least 51 dwellings with recent irregular tenure and either a lack of public services or irregular urbanization. Data from the 2010 population census.

A.4 Prior Cadaster Updates (2008-2012) and Reported Campaign Expenditures (2012)

Table A.2: Past Cadaster Updates and Reported Campaign Expenditures

	Reported Campaign Expenditures (log) in 2012		
	(1)	(2)	(3)
Cadaster Renovation (2008-2012)	-0.054	-0.046	0.016
	(0.078)	(0.075)	(0.061)
Margin of Victory, 2008		0.17	-0.063
		(0.23)	(0.16)
Number of Candidates, 2012		0.41***	0.015
		(0.037)	(0.033)
Covariates	No	No	Yes
State FE	No	No	Yes
Mean of DV	12.6	12.6	12.6
SD of DV	1.14	1.13	1.13
R sq.	0.00047	0.14	0.51
Number of Municipalities	1113	1094	1090

OLS estimations. The unit-of-analysis is the municipality. Robust standard errors in parentheses. The sample is limited to municipalities with a first-term incumbent that ran for reelection in the 2012 elections, and in which the cadaster was not renovated after 2012.
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01.$

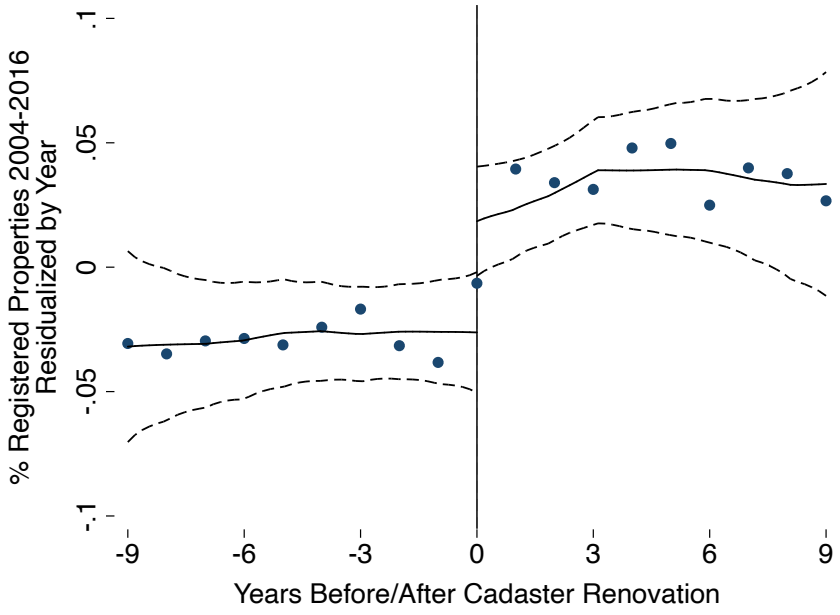
B. Additional Evidence: Mechanisms

B.1 Cadaster Updates and Property Registration Rates

In this section, we document the effect of cadaster updates on property registration rates for a sample of Brazilian municipalities. In contrast with public finance data, information on local property registration is not collected systematically by the Brazilian federal government. For this reason, we rely on two alternative sources. First, we use survey responses by local officials collected by the Lincoln Institute of Land Policy (2015) and Carvalho Jr. (2017). These responses correspond to years that range from 2008 to 2016, depending on the municipality. To leverage changes within municipalities over time, we follow Carvalho Jr. (2006) and indirectly generate a second set of approximate property registration rates in 2004.

Figure B.1: Cadaster Updates and Property Registration Rates in a Sample of Municipalities

Property registration rates increase after a cadaster update.



The figure plots Nadaraya-Watson regression of the proportion of registered properties, after partialling out year fixed effects, on the years before and after the cadaster update. Scatter points bin and average the residualized registration rates. The sample is limited to municipalities that responded surveys by the Lincoln Institute of Land Policy (2015) and Carvalho Jr. (2017). Registration rates for 2004 are estimated using census information on the number of households and business offices along with the *Pesquisa de Informações Básicas Municipais* 2004.

Concretely, we use data on the number of registered properties (*unidades prediais cadastradas*) in 2004, reported in the *Pesquisa de Informações Básicas Municipais* 2004, and divide it by the sum of the number of business offices (also in 2004, from the *Cadastro Central de Empresas* 2004) and the total number of residences, as measured by the 2000 census. Despite potential measurement error, this approximation has been found to display the expected geographic patterns (Carvalho Jr., 2006).[1] Among municipalities with at least two measurements (one in 2004, and others in 2008-2016), we construct a panel by linearly interpolating registration rates. With these data, which is available for only up to 61 municipalities, we estimate equation 1.[2]

In Figure B.1 presents the main result graphically: after partialling out year fixed effects, there is a visible increase in registration rates after a cadaster update. This pattern is borne out in the estimation results, which are presented in Table B.1. Columns 1 and 2 present the baseline results, while columns 3 and 4 include year-by-state fixed effects and the time-interacted year of last cadaster update prior to 2004 to flexibly account for differential time trends by time since the last update. All columns include a time-interacted indicator for whether the measure was obtained by the Lincoln surveys (as opposed to the Carvalho Jr. one), which display higher average registration rates, arguably due to the employed survey instrument.

Despite the small sample of municipalities, we are able to detect the effect of cadaster update. The results indicate that a cadaster overhaul leads to an increase of around 4 percentage points in registration rates, though the inclusion of additional covariates reduces the magnitude and precision of the point estimate. In contrast, other measures that local governments take to increase property tax revenue, such as revisions to the fiscal land values formulas or reforms to the local property tax laws have no effect on registration rates.

[1] Sources of measurement error include, for example, differential migration between 2000 and 2004; understatements in registration rates in municipalities where multiple residential or commercial units are aggregated into single registrations; or even overstatements in registration rates when registered units do not correspond to residences or offices (e.g., parking lots). Assuming these errors in measurement are not systematically related to cadaster updates, they would lead to a reduction in the precision of our estimates.

[2] The surveys are mostly conducted in medium or large municipalities, which might account for the relatively high baseline coverage rates in the subsample. Using the 2004 measurement, which is available for most of the country, the average registration rate is 63%, while in the panel subsample this figure is 81% .

Table B.1: Cadaster Updates and Property Registration Rates

	Property Registration Rates					
	(1)	(2)	(3)	(4)	(5)	(6)
Cadaster Renovation	0.043**	0.047*	0.039	0.028	0.034	0.021
	(0.020)	(0.024)	(0.032)	(0.044)	(0.034)	(0.047)
Revision to Fiscal Land Values Formula		-0.013		0.014		0.014
		(0.025)		(0.039)		(0.040)
Reform to IPTU Law		-0.014		-0.13		-0.18*
		(0.022)		(0.097)		(0.098)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes				
Year FE × Lincoln Sample	Yes	Yes	Yes	Yes	Yes	Yes
GDP per cap (log)	No	No	Yes	Yes	Yes	Yes
Population (log)	No	No	Yes	Yes	Yes	Yes
Year by State FE	No	No	Yes	Yes	Yes	Yes
Year FE ×						
Year of Last Pre-2004	No	No	No	No	Yes	Yes
Cadaster Update						
Within-Mun. Mean of DV	0.81	0.81	0.81	0.81	0.81	0.81
Within-Mun. SD of DV	0.058	0.054	0.063	0.059	0.063	0.059
R sq.	0.82	0.84	0.86	0.90	0.86	0.90
Observations	600	537	480	429	480	429
Number of Municipalities	61	55	61	55	61	55

OLS estimations. See equation (1) for the econometric specification. The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses. The sample is limited to municipalities that responded surveys by the Lincoln Institute of Land Policy (2015) and Carvalho Jr. (2017). Registration rates for 2004 are estimated using census information on the number of households and business offices along with the *Pesquisa de Informações Básicas Municipais* 2004. The missing values between registration rate estimates are linearly interpolated.
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

We also find a significant and sizable increase in property tax revenues as property registration rates rise. We re-estimate equation 1 including the property registration rate as an additional independent variable. Controlling for other measures that local governments can use to increase tax revenues, we find that ten percentage point increase in the property registration rates increases property tax revenues (logged) by 0.06, or roughly one within-municipality standard deviation in this sample ($\widehat{\beta} = 0.57, \text{SE} = 0.28$).

B.2 Cadaster Updates and Property Taxes

Table B.2: Cadaster Updates and Property Tax Revenue: Including Municipality-Term Fixed Effects

	Property Tax Revenue, IPTU (log)					
	2004–2015				2012–2015	
	(1)	(2)	(3)	(4)	(5)	(6)
Cadaster Update	0.11***	0.092***	0.075**	0.059*	0.073	0.057
	(0.030)	(0.031)	(0.033)	(0.034)	(0.045)	(0.047)
Revision to Fiscal Land Values Formula		0.015		0.039		0.040
		(0.037)		(0.039)		(0.045)
Reform to IPTU Law		0.18***		0.15***		0.12*
		(0.051)		(0.052)		(0.075)
Municipality X Term FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes				
GDP per cap (log)	No	No	Yes	Yes	Yes	Yes
Year by State FE	No	No	Yes	Yes	Yes	Yes
Year FE ×						
Year of Last Pre-2004	No	No	Yes	Yes	Yes	Yes
Cadaster Update						
Within-Mun. Mean of DV	11.1	11.1	11.4	11.4	11.7	11.7
Within-Mun. SD of DV	0.84	0.84	0.77	0.77	0.47	0.47
R sq.	0.90	0.90	0.91	0.91	0.96	0.96
Observations	62161	61360	49086	48475	19096	18858
Number of Municipalities	5401	5331	5121	5057	5098	5034

OLS estimations. See equation (1) for the econometric specification. The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses.
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

Table B.3: Cadaster Updates and Property Tax Revenue: Including Lagged Transfers

	Property Tax Revenue, IPTU (log)			
	2004–2015		2012–2015	
	(1)	(2)	(3)	(4)
Cadaster Update	0.12***	0.085***	0.12***	0.086**
	(0.027)	(0.028)	(0.037)	(0.038)
Revision to Fiscal Land Values Formula		0.087***		0.078**
		(0.027)		(0.037)
Reform to IPTU Law		0.15***		0.19***
		(0.036)		(0.064)
Lagged Transfers (log)	0.022	0.022	-0.069*	-0.069*
	(0.020)	(0.020)	(0.039)	(0.039)
Municipality FE	Yes	Yes	Yes	Yes
GDP per cap (log)	Yes	Yes	Yes	Yes
Year by State FE	Yes	Yes	Yes	Yes
Year FE ×				
Year of Last Pre-2004	Yes	Yes	Yes	Yes
Cadaster Update				
Within-Mun. Mean of DV	11.5	11.5	11.7	11.7
Within-Mun. SD of DV	0.70	0.70	0.47	0.47
R sq.	0.87	0.87	0.92	0.92
Observations	42994	42459	18421	18192
Number of Municipalities	5118	5054	5062	5000

OLS estimations. See equation (1) for the econometric specification. The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses. $^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

B.3 Cadaster Updates and Municipal Spending

Table B.4: Cadaster Updates and Spending in Public Works

	Municipal Spending in Public Works (log)			
	2004–2015		2009–2015	
	(1)	(2)	(3)	(4)
Cadaster Update	0.11**	0.11**	0.11*	0.11
	(0.049)	(0.053)	(0.065)	(0.068)
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes		Yes	
GDP per cap (log)	No	Yes	No	Yes
Year by State FE	No	Yes	No	Yes
Year FE × Year of Last Pre-2004 Cadaster Update	No	Yes	No	Yes
Within-Mun. Mean of DV	13.6	13.5	13.5	13.4
Within-Mun. SD of DV	1.68	1.65	1.50	1.43
R sq.	0.39	0.43	0.51	0.57
Observations	62612	49416	36313	29477
Number of Municipalities	5401	5121	5395	5116

OLS estimations. See equation (1) for the econometric specification. The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses.
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

B.4 Cadaster Updates and Other Taxes

Table B.5: Cadaster Updates and Local Services Tax Revenue

	Local Services Tax Revenue, ISSQN (log)					
	2004–2015				2012–2015	
	(1)	(2)	(3)	(4)	(5)	(6)
Cadaster Update	0.017	0.0083	0.021	0.014	0.046	0.045
	(0.016)	(0.017)	(0.018)	(0.019)	(0.028)	(0.029)
Revision to Fiscal Land Values Formula		0.0026		0.0024		-0.0022
		(0.018)		(0.018)		(0.029)
Reform to IPTU Law		0.069***		0.063***		0.061
		(0.021)		(0.021)		(0.045)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes				
GDP per cap (log)	No	No	Yes	Yes	Yes	Yes
Year by State FE	No	No	Yes	Yes	Yes	Yes
Year FE ×						
Year of Last Pre-2004	No	No	Yes	Yes	Yes	Yes
Cadaster Update						
Within-Mun. Mean of DV	12.9	12.9	13.0	13.0	13.4	13.4
Within-Mun. SD of DV	0.70	0.70	0.70	0.70	0.36	0.36
R sq.	0.85	0.85	0.87	0.87	0.89	0.89
Observations	62592	61783	49391	48774	19401	19157
Number of Municipalities	5401	5331	5121	5057	5106	5042

OLS estimations. See equation (1) for the econometric specification. The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses.
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

B.5 Heterogeneous Effect Mayoral Term-Limits, Local Linear Interactions

Table B.6: Effect of Mayoral Term-Limits on Cadaster Updates in Close Elections: Heterogeneous Effect by Income Inequality and Poverty Local Linear Interactions

	Cadaster Update, 2013-2015	
	Gini Coefficient	Gini Coefficient and % Poor
	(1)	(2)
Incumbent Won in 2012	0.14	0.14*
	(0.086)	(0.076)
Above-Median Gini	-0.0033	
	(0.079)	
Won in 2012 × Above-Median Gini	0.092	
	(0.12)	
Above-Median Gini and % Poor		0.047
		(0.081)
Won in 2012 × Above-Median Gini and % Poor		0.12
		(0.12)
Term Limit + (Term Limit × Above-Median Gini)	0.23**	
	(0.08)	
Term Limit + (Term Limit × Above Median Gini and % Poor)		0.26**
		(0.09)
Order of the Local Polynomial	1	1
Bandwidth	0.14	0.14
Mean of Control	0.41	0.41
Observations	1036	1036

OLS estimations, which include a full set of interactions with the margin of victory. The unit-of-analysis is the municipality. Conventional standard errors in parentheses. MSE-optimal bandwidths described in Calonico, Cattaneo and Titiunik (2014). $^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

Table B.7: Effect of Mayoral Term-Limits on Cadaster Updates in Close Elections: Heterogeneous Effect by Other Covariates

	Cadaster Update, 2013-2015			
	Female Incumbent	College Educ. Incumbent	PT Incumbent	% of Local Taxes in Total Revenue
	(1)	(2)	(3)	(4)
Incumbent Won in 2012	0.19***	0.14*	0.21***	0.059
	(0.064)	(0.084)	(0.064)	(0.095)
Female Incumbent	0.038			
	(0.12)			
Won in 2012 × Female Incumbent Mayor	0.014			
	(0.18)			
Incumbent with College Education		-0.11		
		(0.078)		
Won in 2012 × College Educ. Incumbent Mayor		0.099		
		(0.12)		
PT Incumbent Mayor			0.041	
			(0.12)	
Won in 2012 × PT Incumbent Mayor			-0.25	
			(0.18)	
% of Local Taxes in Total Revenue				-1.04
				(0.82)
Won in 2012 × % of Local Taxes in Total Revenue				2.30*
				(1.27)
Term Limit + (Term Limit × Female Incumbent)	0.20**			
	(0.17)			
Term Limit + (Term Limit × College Educ. Incumbent)		0.24**		
		(0.08)		
Term Limit + (Term Limit × PT Incumbent Mayor)			-0.04**	
			(0.17)	
Term Limit + (Term Limit × % of Local Taxes)				2.36**
				(1.20)
Order of the Local Polynomial	1	1	1	1
Bandwidth	0.14	0.14	0.14	0.14
Mean of Control	0.41	0.41	0.41	0.41
Observations	1036	1036	1036	1034

OLS estimations, which include a full set of interactions with the margin of victory. The unit-of-analysis is the municipality. Conventional standard errors in parentheses. MSE-optimal bandwidths described in Calonico, Cattaneo and Titiunik (2014).
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

B.6 The PMAT and Cadaster Updates

To evaluate the role of the *direct profitability condition* in explaining the prevalence of deficient cadasters, we estimate the impact of the PMAT program, which grants subsidized loans that are earmarked to modernize local tax administrations, on the probability of a cadaster update. If the main constraint to overhauling the cadaster is the cost of the investment relative to the anticipated fiscal benefit, then the PMAT should increase the probability of an update.

Table B.8: The PMAT Program and Cadaster Updates

	Cadaster Update (1998-2004)				Cadaster Update (1998-2011)			
	Only PMAT Sample 1998-2004		All Municipalities		Only PMAT Sample 1998-2011		All Municipalities	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PMAT	0.049	0.032	0.0063	0.013	-0.011	-0.018	0.0058	0.0040
	(0.049)	(0.051)	(0.030)	(0.030)	(0.027)	(0.027)	(0.021)	(0.021)
Has applied	-0.033	-0.057	-0.049	-0.052*	-0.042	-0.057**	-0.043*	-0.054**
	(0.037)	(0.038)	(0.030)	(0.029)	(0.027)	(0.026)	(0.025)	(0.024)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes		Yes		Yes		Yes	
GDP per cap (log)	No	Yes	No	Yes	No	Yes	No	Yes
Year by State FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE × Year of Last Pre-2004 Cadaster Update	No	Yes	No	Yes	No	Yes	No	Yes
Within-Mun. Mean of DV	0.61	0.61	0.62	0.62	0.78	0.78	0.78	0.78
Within-Mun. SD of DV	0.33	0.33	0.34	0.34	0.30	0.30	0.29	0.29
R sq.	0.67	0.71	0.68	0.69	0.65	0.69	0.68	0.69
Observations	1736	1736	27280	27280	4718	4718	55069	55069
Number of Municipalities	248	248	4102	4102	337	337	4102	4102

OLS estimations. Econometric specification similar to equation (1). The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses. The outcome is an indicator that takes the value of one when the cadaster is updated and in subsequent years. We lead the dependent variable (cadaster update) by one year. PMAT participation data from Gadenne (2017).
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

We use PMAT data from Gadenne (2017), which we match using official population figures to data on the last complete cadaster update by 2004 and 2015, from Instituto Brasileiro de Geografia e Estatística (2004, 2015) . We are able to match 248 out of the 249 municipalities that enter the

program by 2004, and 337 out of the 339 that enter the program by 2011.[3]

We present differences-in-differences estimates, using a similar specification to equation 1, in Table B.8. We take a one-year lead of the dependent variable, cadaster update. In columns 1 and 2, we use the set of municipalities that apply and receive the PMAT during the 1998-2004 period or up to our cadaster-update data ($N = 248$); in columns 3 and 4, we include all remaining municipalities that did not participate in the PMAT during the period as control units. We do a similar analysis in columns 5-8, but using the full set of PMAT municipalities during 1998-2011 ($N = 337$). The point estimates suggest a small impact of the program. The largest estimate, in column 1, indicates an increase in the probability of a cadaster update of 4.9 percentage points, or less than 15% of a within-municipality standard deviation; the rest of the columns indicate smaller or even negative effects. In no case are these point estimates statistically distinguishable from zero at standard thresholds.

We are interested in the onset of cadaster updates, but recognize that renovations remain effective for the next few years. To examine the robustness of our main results, which consider renovated cadasters to be updated throughout the period of analysis, we conduct two sets of additional estimations. First, we use an alternative measure of the duration of a cadaster update, where let all updates lapse after five years (and consider subsequent observations as missing if a new update is not certain). Second, we follow McGrath (2015) and use a binary onset variable while conditioning on the lagged value of the original duration-of-update outcome. The results, presented in Tables B.9, B.10 and B.11, also show no detectable impact of the program on cadaster updates.

[3]To combine the 2004 and 2015 sources for cadaster updates, we make the following coding decisions. Once a cadaster is renovated, it remains updated throughout; cadasters updates lapse if they occur prior to five years to the beginning of the panel (i.e., prior to 1998); finally, we give precedence to information from 2004 when the last update occurred in that year of before. When we alternatively let all updates lapse after five years, the results are similar to those in Table B.8, and are presented in tables B.10 and B.11.

Table B.9: The PMAT Program and Cadaster Updates
Binary Onset and Lagged Duration

	Cadaster Update Onset (1998-2004)				Cadaster Update Onset (1998-2011)			
	Only PMAT Sample 1998-2004		All Municipalities		Only PMAT Sample 1998-2011		All Municipalities	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PMAT	-0.031	-0.039	-0.020	-0.019	0.0069	0.0050	0.0083	0.0055
	(0.042)	(0.045)	(0.025)	(0.025)	(0.020)	(0.021)	(0.012)	(0.013)
Has applied	-0.053	-0.074**	-0.043	-0.048	-0.026	-0.037*	-0.031	-0.038*
	(0.034)	(0.036)	(0.030)	(0.030)	(0.022)	(0.022)	(0.021)	(0.020)
Cadaster Update (lagged)	-0.60***	-0.60***	-0.61***	-0.62***	-0.39***	-0.40***	-0.41***	-0.42***
	(0.028)	(0.030)	(0.0068)	(0.0069)	(0.015)	(0.016)	(0.0044)	(0.0047)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes		Yes		Yes		Yes	
GDP per cap (log)	No	Yes	No	Yes	No	Yes	No	Yes
Year by State FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE ×								
Year of Last Pre-2004	No	Yes	No	Yes	No	Yes	No	Yes
Cadaster Update								
Within-Mun. Mean of DV	0.66	0.66	0.68	0.68	0.82	0.82	0.82	0.82
Within-Mun. SD of DV	0.31	0.31	0.31	0.31	0.26	0.26	0.25	0.25
R sq.	0.32	0.38	0.35	0.36	0.21	0.26	0.24	0.26
Observations	1488	1488	23738	23738	4381	4381	51527	51527
Number of Municipalities	248	248	4090	4090	337	337	4102	4102

OLS estimations. The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses. The outcome is an indicator that takes the value of one only in the year when the cadaster is updated and zero otherwise. Econometric specification similar to equation (1); however, following McGrath (2015), we include a lag for a variable that takes the value of one when the cadaster is updated and in subsequent years. PMAT participation data from Gadenne (2017).
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

Table B.10: The PMAT Program and Cadaster Updates
Alternative Cadaster Update Measure

	Cadaster Update (1998-2004)				Cadaster Update (1998-2011)			
	Only PMAT Sample 1998-2004		All Municipalities		Only PMAT Sample 1998-2011		All Municipalities	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PMAT	0.061	0.073	0.031	0.049	0.038	0.047	0.044	0.053**
	(0.061)	(0.066)	(0.038)	(0.038)	(0.039)	(0.041)	(0.026)	(0.027)
Has applied	-0.049	-0.060	-0.052	-0.045	-0.022	-0.036	-0.037	-0.036
	(0.043)	(0.046)	(0.039)	(0.038)	(0.035)	(0.036)	(0.033)	(0.033)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes		Yes		Yes		Yes	
GDP per cap (log)	No	Yes	No	Yes	No	Yes	No	Yes
Year by State FE	No	Yes	No	Yes	No	Yes	No	Yes
Within-Mun. Mean of DV	0.60	0.60	0.62	0.62	0.74	0.74	0.74	0.74
Within-Mun. SD of DV	0.34	0.34	0.34	0.34	0.33	0.33	0.32	0.32
R sq.	0.55	0.58	0.53	0.54	0.57	0.61	0.57	0.58
Observations	1696	1696	26610	26610	3893	3893	43619	43619
Number of Municipalities	248	248	4091	4091	337	337	4096	4096

OLS estimations. Econometric specification similar to equation (1). The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses. The outcome is an indicator that takes the value of one the year a cadaster is updated and for the next five years; observations are considered missing afterwards if a new update is not certain. Reporting gaps between the 2004 and 2015 sources are also considered missing. We lead the dependent variable (cadaster update) by one year. PMAT participation data from Gadenne (2017).
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

Table B.11: The PMAT Program and Cadaster Updates
Alternative Cadaster Update Measure; Binary Onset and Lagged Duration

	Cadaster Update Onset (1998-2004)				Cadaster Update Onset (1998-2011)			
	Only PMAT Sample 1998-2004		All Municipalities		Only PMAT Sample 1998-2011		All Municipalities	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PMAT	-0.011	-0.019	-0.00035	0.0040	0.011	0.010	0.014	0.015
	(0.044)	(0.048)	(0.025)	(0.025)	(0.022)	(0.022)	(0.013)	(0.013)
Has applied	-0.044	-0.066*	-0.036	-0.040	-0.020	-0.031	-0.026	-0.031
	(0.035)	(0.037)	(0.030)	(0.030)	(0.023)	(0.024)	(0.022)	(0.022)
Cadaster Update (lagged)	-0.41***	-0.40***	-0.42***	-0.43***	-0.26***	-0.27***	-0.28***	-0.29***
	(0.039)	(0.041)	(0.0098)	(0.0098)	(0.018)	(0.020)	(0.0056)	(0.0058)
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes		Yes		Yes		Yes	
GDP per cap (log)	No	Yes	No	Yes	No	Yes	No	Yes
Year by State FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE ×								
Year of Last Pre-2004	No	Yes	No	Yes	No	Yes	No	Yes
Cadaster Update								
Within-Mun. Mean of DV	0.66	0.66	0.68	0.68	0.80	0.80	0.79	0.79
Within-Mun. SD of DV	0.31	0.31	0.31	0.31	0.28	0.28	0.27	0.27
R sq.	0.25	0.32	0.27	0.29	0.20	0.25	0.23	0.24
Observations	1488	1488	23738	23738	3801	3801	43590	43590
Number of Municipalities	248	248	4090	4090	337	337	4094	4094

OLS estimations. The unit-of-analysis is the municipality-year. Standard errors (clustered at the municipality level) in parentheses. The outcome is an indicator that takes the value of one only in the year when the cadaster is updated and zero otherwise. Econometric specification similar to equation (1); however, following McGrath (2015), we include a lag for a variable that takes the value of one the year a cadaster is updated and for the next five years; observations are considered missing afterwards if a new update is not certain. Reporting gaps between the 2004 and 2015 sources are also considered missing for this variable. PMAT participation data from Gadenne (2017).
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

C. Additional Evidence: Regression Discontinuity

C.1 Covariate Balance at the Election Discontinuity

Table C.1: Covariate Balance at the Election Discontinuity

	Cadaster Updates, 2013-2015								
	CCT Bandwidth								
	Gender (female==1)	College Education	PT affiliation of incumbent	Pop. in 2010 (log)	Rural (%)	Any IPTU Collected by 2012	Gini Index (2010)	Pop. in Poverty (2010)	Num. of candidates (2012)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Incumbent Won in 2012	0.015	0.018	-0.0062	-0.16	0.022	0.046	-0.000024	-0.011	-0.0081
	(0.037)	(0.054)	(0.035)	(0.11)	(0.020)	(0.030)	(0.0077)	(0.022)	(0.11)
	[0.69]	[0.75]	[0.86]	[0.15]	[0.28]	[0.12]	[1.00]	[0.62]	[0.94]
Robust Std. Errors	0.053	0.081	0.048	0.16	0.029	0.045	0.012	0.033	0.17
Robust P-Value	0.95	0.45	0.62	0.38	0.54	0.48	0.82	0.84	0.77
Order of the Local Polynomial	1	1	1	1	1	1	1	1	1
Covariate Adjustment	No	No	No	No	No	No	No	No	No
Bandwidth	0.18	0.21	0.19	0.17	0.24	0.17	0.18	0.16	0.16
Observations	1291	1385	1321	1227	1471	1228	1314	1193	1176
	IK Bandwidth								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Incumbent Won in 2012	0.0070	0.038	-0.0090	-0.14	0.021	0.048	0.0014	-0.0079	0.0037
	(0.044)	(0.064)	(0.037)	(0.13)	(0.020)	(0.032)	(0.0092)	(0.025)	(0.13)
	[0.87]	[0.55]	[0.81]	[0.26]	[0.30]	[0.13]	[0.88]	[0.75]	[0.98]
Robust Std. Errors	0.060	0.095	0.051	0.18	0.030	0.048	0.014	0.037	0.19
Robust P-Value	0.91	0.58	0.51	0.34	0.55	0.69	0.98	0.56	0.41
Order of the Local Polynomial	1	1	1	1	1	1	1	1	1
Covariate Adjustment	No	No	No	No	No	No	No	No	No
Bandwidth	0.13	0.15	0.16	0.13	0.22	0.15	0.13	0.13	0.13
Observations	996	1116	1206	1014	1427	1121	1020	995	996
	CV Bandwidth								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Incumbent Won in 2012	0.0014	-0.011	-0.0016	-0.12	0.022	0.031	0.00050	0.0099	-0.039
	(0.027)	(0.035)	(0.023)	(0.072)*	(0.014)	(0.018)*	(0.0047)	(0.013)	(0.064)
	[0.96]	[0.75]	[0.95]	[0.098]	[0.11]	[0.095]	[0.92]	[0.44]	[0.54]
Robust Std. Errors	0.037	0.046	0.030	0.091	0.018	0.024	0.0062	0.017	0.083
Robust P-Value	0.43	0.95	0.88	0.25	0.17	0.33	0.54	0.48	0.81
Order of the Local Polynomial	1	1	1	1	1	1	1	1	1
Covariate Adjustment	No	No	No	No	No	No	No	No	No
Bandwidth	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Observations	1781	1868	1868	1868	1868	1868	1868	1867	1868

See equation (2) for the econometric specification. The unit-of-analysis is the municipality. Conventional standard errors and p-values in parentheses and brackets, respectively. MSE-optimal bandwidths and heteroskedasticity-robust nearest neighbor standard errors described in Calonico, Cattaneo and Titiunik (2014). CV bandwidths described in Ludwig and Miller (2007); IK bandwidths described in Imbens and Kalyanaraman (2012). We use triangular kernels.
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01.$

C.2 Alternative Data-Driven Bandwidth Selection Procedures

Table C.2: Alternative Data-Driven Bandwidth Selection Procedures

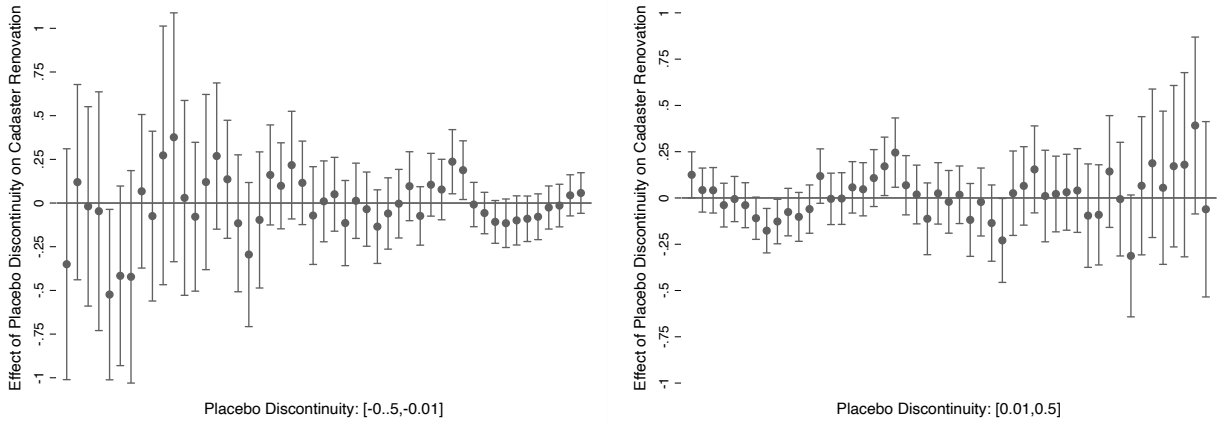
	Cadaster Updates, 2013-2015			
	CCT Two-Sided Bandwidths			
	(1)	(2)	(3)	(4)
Incumbent Won in 2012	0.13**	0.18***	0.20***	0.20**
	(0.056)	(0.064)	(0.076)	(0.086)
	[0.021]	[0.0054]	[0.0098]	[0.022]
Robust Std. Errors	0.11	0.094	0.10	0.11
Robust P-Value	0.21	0.17	0.19	0.32
Order of the Local Polynomial	0	1	2	3
Bandwidth				
Bandwidth (Left)	0.060	0.15	0.23	0.28
Bandwidth (Right)	0.043	0.14	0.22	0.36
Observations	426	1059	1383	1583
	IK Bandwidth			
	(1)	(2)	(3)	(4)
Incumbent Won in 2012	0.10**	0.16**	0.12	0.099
	(0.042)	(0.069)	(0.10)	(0.12)
	[0.015]	[0.019]	[0.23]	[0.42]
Robust Std. Errors	0.080	0.10	0.14	0.15
Robust P-Value	0.080	0.23	0.36	0.34
Order of the Local Polynomial	0	1	2	3
Bandwidth	0.089	0.12	0.12	0.15
Bandwidth (Left)				
Bandwidth (Right)				
Observations	704	920	918	1099
	CV Bandwidth			
	(1)	(2)	(3)	(4)
Incumbent Won in 2012	0.012	0.15***	0.12**	0.17***
	(0.024)	(0.055)	(0.052)	(0.059)
	[0.62]	[0.0049]	[0.017]	[0.0048]
Robust Std. Errors	0.035	0.080	0.065	0.070
Robust P-Value	0.95	0.021	0.0035	0.0048
Order of the Local Polynomial	0	1	2	3
Bandwidth	1.00	0.20	0.65	0.90
Bandwidth (Left)				
Bandwidth (Right)				
Observations	1805	1319	1765	1791

See equation (2) for the econometric specifications. The unit-of-analysis is the municipality. Conventional standard errors and p-values in parentheses and brackets, respectively. MSE-optimal bandwidths and heteroskedasticity-robust nearest neighbor standard errors described in Calonico, Cattaneo and Titiunik (2014). CV bandwidths described in Ludwig and Miller (2007); IK bandwidths described in Imbens and Kalyanaraman (2012). We use triangular kernels.
$^{*}p < 0.1,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

C.3 Placebo Discontinuity Thresholds

Figure C.1: Placebo Discontinuity Thresholds and Cadaster Updates

Arbitrary election victory thresholds reveal no effects in almost all cases.



(a) Placebo Discontinuity to the Left

(b) Placebo Discontinuity to the Right

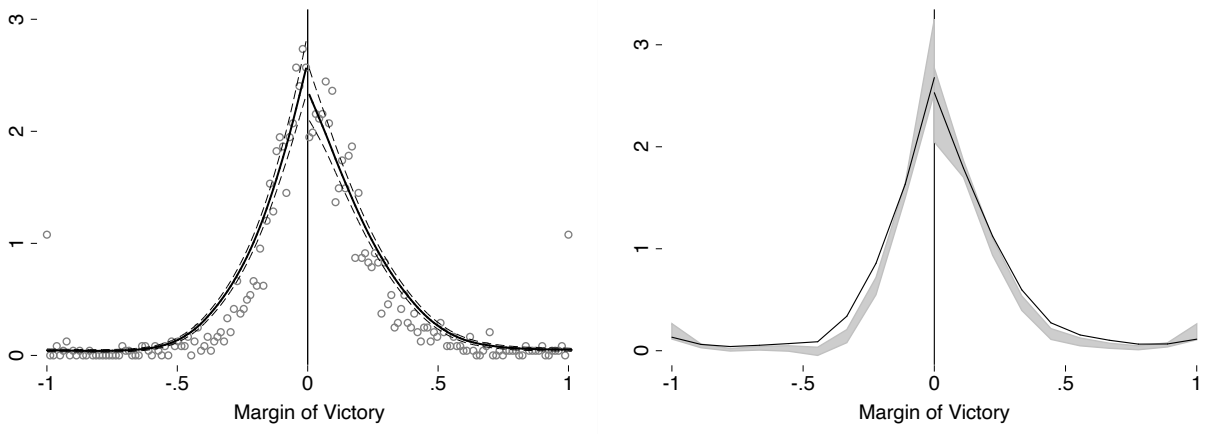
The figure on the **left** displays point estimates and 95% conventional confidence intervals on 1-st order local-polynomial RD estimates using placebo electoral threshold margins of victory to the left of the real cutoff of 0. The figure on the **right** displays similar estimates for placebo thresholds to the right of the actual cutoff. Each estimation uses the MSE-optimal bandwidths described in Calonico, Cattaneo and Titiunik (2014). We use triangular kernels.

C.4 Continuity of the Electoral Margin at the Victory Threshold

In Figure C.2, we present two related approaches to assessing the continuity of our running variable, the electoral victory margin. We first select the bandwidth using a data-driven procedure based the MSE of difference of densities in each side of the discontinuity (Cattaneo, Jansson and Ma, 2019). Next, we assess whether the electoral margin discontinuously jumps at the cutoff, using McCrary's density estimator (left panel) and a local-polynomial density estimator (right panel). We fail to reject the null of continuity in the electoral threshold using either approach.

While the jump is not significant, we see a slight bunching of observations to the left of the cutoff. Our balance tests — particularly those using the narrower IK bandwidth — focus attention on this range of the forcing variable. In Table C.1 we find no differences between municipalities where incumbent mayors barely lose and those in which they barely win.

Figure C.2: Continuity of the Electoral Margin at the Victory Threshold



(a) McCrary Density Estimator (b) Local Polynomial Density Estimator

The figure on the **left** plots the density of the margin of victory for first-term mayors running for reelection using McCrary's density estimator (McCrary, 2008). The figure on the **right** uses a local polynomial density estimator (Cattaneo, Jansson and Ma, 2019) of order 2, and includes a bias-corrected confidence interval. In both, we first select the bandwidth (0.39) based on the MSE of difference of densities in each side of the discontinuity and assume a common density, which increases the power of the continuity test.

C.5 Donut RD, Excluding Municipalities with Margin of Victory $< 1\%$

In Table C.3, we exclude municipalities with a tight margin of victory (less than one percentage point) and re-estimate the main results from Table 3. This "donut" RD helps to address concerns about unobserved sorting at the discontinuity, while requiring more extrapolation (Barreca et al., 2011; Eggers et al., 2015). These dropped observations correspond to 20% of the sample of municipalities when using a 4.4% margin-of-victory bandwidth and 7% of municipalities when using a 14% bandwidth (which correspond to the first two columns in Table 3). Reassuringly, the main estimates remain almost unchanged with this modified design.

Table C.3: Effect of Mayoral Term-Limits on Cadaster Updates in Close Elections
Donut RD, Excluding Municipalities with Margin of Victory $< 1\%$

	Cadaster Update, 2013-2015							
	No Covariate Adjustment				Covariate Adjustment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Incumbent Won in 2012	0.13**	0.18***	0.21***	0.23***	0.12**	0.19***	0.22***	0.23***
	(0.059)	(0.068)	(0.078)	(0.085)	(0.059)	(0.068)	(0.078)	(0.083)
	[0.025]	[0.0069]	[0.0059]	[0.0076]	[0.039]	[0.0063]	[0.0048]	[0.0054]
Robust Std. Errors	0.069	0.076	0.086	0.092	0.069	0.076	0.086	0.090
Robust P-Value	0.013	0.0052	0.0086	0.012	0.021	0.0046	0.0073	0.0082
Order of the Local Polynomial	0	1	2	3	0	1	2	3
Covariate Adjustment	No	No	No	No	Yes	Yes	Yes	Yes
Bandwidth	0.043	0.12	0.21	0.31	0.042	0.12	0.20	0.32
Mean of Control	0.36	0.41	0.40	0.40	0.36	0.41	0.40	0.40
Observations	371	915	1290	1511	356	896	1271	1516

See equation (2) for the econometric specifications. We exclude observations within 1% of the electoral victory threshold. The unit-of-analysis is the municipality. Conventional standard errors and p-values in parentheses and brackets, respectively. MSE-optimal bandwidths and heteroskedasticity-robust nearest neighbor standard errors described in Calonico, Cattaneo and Titiunik (2014). We use triangular kernels. Covariates include the incumbent candidate's gender, college education and affiliation to the PT; the municipalities' logged population, Gini index, and % poor in 2010; and avg. 2009-2011 logged total budget and any IPTU collection by 2012.
$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

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