Local Public Goods and Property Tax Compliance: Evidence from Residential Street Pavement*

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Abstract

This paper uses administrative property tax records and information on the rollout of first-time asphalting of streets in inhabited residential neighborhoods in Mexico to show that the provision of local public goods can improve property tax compliance rates. We put forward a simple explanation to link local public goods and property tax compliance: When citizens observe public goods being delivered, they update their beliefs about the government's quality in public good provision and become more likely to comply.

JEL Classification Codes: H26, H41.
Keywords: taxpayer behavior, property tax compliance, local public goods.

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1 Introduction

"*Why pay taxes? Why should I send them taxes when they aren't supplying services? It is sickening. ... Every time I see the tax bill come, I think about the times we called and nobody came.*" Fred Phillips, Incompliant Detroit Resident[1]

The problem of tax compliance is one of paramount importance for the proper functioning of a modern market economy, mainly because tax compliance is a necessary condition to guarantee the efficient provision of public goods.[2] This paper uses administrative property tax records and information on the rollout of first-time asphalting of streets in inhabited residential neighborhoods in Mexico to investigate whether the provision of local public goods affects property tax compliance rates.[3]

The tax compliance literature has traditionally focused on the income tax, where the main issue is whether to report income truthfully and pay the corresponding tax or to underreport income but face a possible fine. In this paper, we present what is to our knowledge the first empirical study on *property* tax compliance, which differs from the income tax literature in two important ways. The first is that because the government bills households directly, there is no scope for underreporting and the main decision a household faces is whether to pay or not to pay. The second is that property taxes in most – if not all – countries are local government taxes instead of federal ones. Because property taxes are closely linked to local government expenditures, this brings to the fore an often disregarded motive for tax compliance which is the expected benefit in terms of provision of local public goods when taxpayer contributions are *non-negligible*.

The explanation we put forth in this paper is that localized public good provision can have a

[1]Quote from MacDonald and Wilkinson, (2013).

[2]Samuelson (1954) shows that the *private* provision of public goods will be inefficiently low because each individual will have an incentive to "free ride" on the private purchases of others.

[3]Asphalting of streets is also known as road surfacing or pavement.

signaling value for taxpayers regarding (the unknown) government ability in delivering public goods. In short, citizens observe public goods being delivered, they update their beliefs about the government's quality in public good provision and in turn become more likely to comply. This simple model predicts improvements in compliance among those directly benefitted by the street pavement, which is what we observe in the data using different empirical strategies.

Others have previously studied the role of public good provision and tax compliance, albeit only theoretically (Cowell and Gordon, 1988) or in lab experiments (Alm et al., 1992; Becker et al., 1987, to cite just a few). Both strands of the literature suggest that individuals have a motive to pay taxes because they value the public goods that their taxes finance. Here, the combination of both *temporal* and *spatial* rollout of street asphalting in the city of Acayucan together with administrative data on the tax compliance histories of every plot in the city allow us to use a plot level fixed-effect regression strategy to identify the effects of pavement provision on tax compliance for plots directly affected.

We find that compliance rates increase significantly when pavement is provided by around 2 percentage points (or 19%).[4] Our preliminary results provide support for the hypothesis that providing public goods increases property tax compliance. However, any hopes that a substantial portion of infrastructure projects such as road asphalting can be automatically financed via ex-post increases in tax compliance are firmly rejected in the data. The increase in tax intakes represent an immaterial part of the construction costs. In spite of this, we point out that our findings are silent regarding possible differences in compliance rates when local administrations choose to increase property tax amounts in order to finance local public goods.

The paper proceeds as follows. In section 2 we provide a simple model of property tax compliance. In section 3 we describe the data and identification strategy. Section 4 presents

[4]Property valuations for tax assessment purposes were unaffected by the pavement provision. Tax rates were increased by inflation to keep real tax bills constant throughout the sample period.

the results, and section 5 concludes.

2 A Model of Property Tax Compliance with Local Public Goods

In the standard model of tax compliance, which uses the Beckerian economics-of-crime approach (1968), an expected utility maximizing taxpayer endowed with an exogenous income y and a well-behaved utility function u facing a tax τ must choose whether to comply and pay the tax τ or not to comply. If the taxpayer does not comply, she is punished with probability $0 < \pi < 1$ and must pay a fine q. The taxpayer will choose to comply if and only if $u(y-\tau) \geq (1-\pi)u(y) + \pi u(y-\tau-q)$, that is, if the (certain) utility of complying is higher than the (expected) utility of not complying. However, the main puzzle is that with typically observed low audit rates, low fines and reasonable risk aversion, the standard model would predict a much higher tax evasion than observed empirically.[5] Why are so many households honest?

Two main explanations have been put forward to explain why people do pay taxes. One is that people are unwilling to cheat due to social norms and morality constraints (i.e., people dislike being dishonest and hence voluntarily pay taxes). Another argues that taxpayers are unable to cheat because of third-party reporting, which makes the probability of being caught much higher than the observed audit rate. A recent study by Kleven et al. (2011) extends the standard model of (rational) tax evasion to allow for the key distinction between self-reported and third-party reported income and, using a tax enforcement field experiment in Denmark, finds evidence supporting the inability to cheat mechanism. Unfortunately, the

[5] The earliest models of tax compliance are those of Allingham and Sandmo (1972) and Srinivasan (1973). In Allingham and Sandmo (1972) the individual taxpayer problem is one of choosing the amount of reported income to maximize the expected utility given a tax rate, a probability of audit and a concave utility function. See Andreoni, Erard and Feinstein (1998), Slemrod and Yitzhaki (2002), and Alm (2012) for excellent surveys and discussions of this model and its extensions.

mechanism of third-party reporting cannot play any role for property tax compliance: While the value of the taxpayer income is private information, property values in a city are known by the local government.

We build upon the theoretical models of Allingham and Sandmo (1972) and Cowell and Gordon (1988) and the lab experiments of Alm et al. (1992) and Becker et al. (1987) to extend the standard model of (property) tax compliance by allowing local public good considerations. Individuals may voluntarily pay taxes to finance local public goods –even if there is no penalty on the failure to pay– because they recognize that they will receive something for their tax payments. Of course, this assumes that the taxpayer contribution to the local public good is not negligible. This is reasonable in our micro context of a city and its local property taxes.

The technology of the local government to provide public goods is very simple: the total amount of resources (taxes) collected from the taxpayers is multiplied by a technological parameter to deliver goods in the future. This parameter is basically the same as the "multiplier" in Alm et al. (1992), however, in our context, is unknown to the taxpayers. The taxpayers learn about this parameter when they receive a signal from the local government which takes the form of a local public good: the technological parameter is perceived to be larger for the group of taxpayers who receive a local public good. Ceteris paribus, the expected benefits of tax compliance will be higher for those who receive a local public good than for their counterparts. In other words, the delivery of a local public good affects the trade-off between the present costs and the expected benefits of complying.[6]

Our model has two periods: Present ($t = 0$) and future ($t = 1$). There are n taxpayers, $i = 1, ..., n$ grouped into $s = 1, ..., S$ streets. Each taxpayer faces a property tax $\tau_i > 0$ and must decide whether to comply ($C_{i,s} = 1$) or not ($C_{i,s} = 0$). If the taxpayer does not comply,

[6] We assume that the more visibly tax money is spent in improvements in the quality of civic life, the less likely will be the need to resort to aggressive collection methods. See Sally Powers: "Collection and Enforcement of the Property Tax" (2008).

she is punished with probability $0 < \pi < 1$ and must pay a penalty q_i at $t = 0$. In addition, the taxpayer will receive future benefits from the government, defined as the product of the technological parameter of the government $\theta(p_s)$ times the total amount of resources (taxes) collected from the taxpayers. While the technology of the government is unobserved by the taxpayers, those taxpayers on a street that receives a local public good ($p_s = 1$) assign a better technology to the local government in providing public goods in the future than those on unpaved streets ($p_s = 0$), that is, $\theta(1) > \theta(0) > 0$. Hence, in the future, the taxpayer i in street s will receive benefits $\theta(p_s) \sum_{i=1}^{n} \tau_i$ if she complies, and $\theta(p_s) \sum_{j \neq i}^{n} \tau_j$ if she does not.

The expected utility of the risk-neutral taxpayer i in street s at $t = 0$ if she complies is given by

$$EU_{i,s}^{C} = -\tau_i + \beta\theta(p_s) \sum_{i=1}^{n} \tau_i + \varepsilon_{i,s}^{C} \tag{1}$$

where $0 < \beta < 1$ is the intertemporal discount factor and $\varepsilon_{i,s}^{C}$ captures stochastic (and unobserved to the econometrician) factors that affect compliance behavior. The expected utility of the taxpayer at $t = 0$ if she does not comply is given by

$$EU_{i,s}^{NC} = -\pi(\tau_i + q_i) + \beta\theta(p_s) \sum_{j \neq i}^{n} \tau_j + \varepsilon_{i,s}^{NC} \tag{2}$$

The probability that the taxpayer complies is given by

$$P(C_{i,s} = 1 | \tau_i, p_s) = P(EU_{i,s}^{C} \geq EU_{i,s}^{NC}) = F(\beta\theta(p_s)\tau_i - (1 - \pi)\tau_i + \pi q_i) \tag{3}$$

where F is the *cdf* of $\varepsilon_{i,s}^{C} - \varepsilon_{i,s}^{NC}$. Letting $\theta(p_s) = \theta(0) + \delta p_s$ for any $\delta > 0$ and given that $q_i = \lambda\tau_i$, equation (3) can be written as

$$P(C_{i,s} = 1 | \tau_i, p_s) = F(\alpha_1\tau_i + \alpha_2 p_s \tau_i) \tag{4}$$

where $\alpha_1 = \beta\theta(0) - (1 - \pi(1+\lambda))$ and $\alpha_2 = \beta\delta > 0$.

Since $\alpha_2 > 0$ and F is a *cdf* (i.e., non-decreasing) this model delivers a clear-cut prediction, namely that the provision of the local public good increases the probability of compliance $\forall$ $\tau_i > 0$:

$$P(C_{i,s} = 1|\tau_i, p_s = 1) - P(C_{i,s} = 1|\tau_i, p_s = 0) = F((\alpha_1 + \alpha_2)\tau_i) - F(\alpha_1\tau_i) \geq 0 \quad \forall \tau_i > 0 \quad (5)$$

This prediction is the basis for the testing of our model.

The prediction regarding the impact of the property tax on the compliance rate is however ambiguous:

$$\frac{\partial P(C_{i,s} = 1|\tau_i, p_s)}{\partial \tau_i} = (\alpha_1 + \alpha_2 p_s) f(\alpha_1\tau_i + \alpha_2 p_s \tau_i) \quad (6)$$

where f is the *pdf*. Raising τ has two effects. First, it increases the present cost of complying, so that this change should make people less likely to comply. However, it also increases both the expected present penalty for not complying and the discounted future benefits of complying, so that this should make people more likely to comply. Which effect dominates depends on both the probability of punishment π and the discount rate β.

2.1 Empirical Implementation

For our empirical implementation, we first proceed by assuming that $\varepsilon^{C}_{i,s} - \varepsilon^{NC}_{i,s}|\tau_i, p_s \sim N(\alpha_0, \sigma^2)$. Then, equation (4) can be written as

$$P(C_{i,s} = 1|\tau_i, p_s) = \Phi\left(-\left(\frac{\alpha_0}{\sigma}\right) + \left(\frac{\alpha_1}{\sigma}\right)\tau_i + \left(\frac{\alpha_2}{\sigma}\right) p_s\tau_i\right) \quad (7)$$

where Φ is the standard normal *cdf*.

After estimating the probit coefficients, and defining the difference in the sample probability of property tax compliance between those in paved and those in unpaved streets as $\Delta\widehat{P}_i \equiv \widehat{P}(C_{i,s} = 1|\tau_i, p_s = 1) - \widehat{P}(C_{i,s} = 1|\tau_i, p_s = 0)$, our model predicts that:

$$\Delta\widehat{P}_i = \Phi\left(-\widehat{\left(\frac{\alpha_0}{\sigma}\right)} + \left(\widehat{\left(\frac{\alpha_1}{\sigma}\right)} + \widehat{\left(\frac{\alpha_2}{\sigma}\right)}\right)\tau_i\right) - \Phi\left(-\widehat{\left(\frac{\alpha_0}{\sigma}\right)} + \widehat{\left(\frac{\alpha_1}{\sigma}\right)}\tau_i\right) \geq 0 \quad \forall \tau_i > 0 \qquad (8)$$

As an alternative to the probit model, we assume that $\varepsilon^{C}_{i,s} - \varepsilon^{NC}_{i,s}|\tau_i, p_s$ follows a logistic distribution with mean zero and variance $\frac{\pi^2}{3}$, and estimate equation (4) using a logit model.[7]

3 Data

3.1 Property tax data

Administrative property tax data were obtained for the city of Acayucan for the years 2005-2012. There are about 16,000 plots in the city. The government-appraised property value is on average 215,092 pesos (17,174 in 2012 USD$). Property values were not updated during the study years - including for properties that received pavement. Instead, tax rates were increased for all properties to keep up with the inflation rate. Annual property tax invoices amounted to an average 196 pesos (15 in 2012 USD$). For every plot in the city, we observe whether the property tax was paid in the corresponding calendar year. On average 74% of properties paid their property taxes in the calendar year they were due. These summary statistics are presented in Table 6.

These unique administrative tax records reveal some interesting patterns. Figure 1 shows that the property tax schedule is L-shaped. This means that the city charges a minimum tax and only increases proportionately to income after a certain threshold. Figure 2 shows an increasing likelihood of compliance with property values. The range is quite large. Among

[7] The advantage of the logit model is that it allows us to control for plot fixed effects by means of the conditional logit model (e.g., Chamberlain (1980), and Hamerle and Ronning (1995)).

low valued properties compliance rates average 45% whereas they fluctuate around 70% among higher value properties. Figure 3 confirms this relationship: higher taxed properties are more likely to comply.

We use the cross section of 2012 data to analyze these relationships in Table 2. Column 1 shows that the average elasticity of tax taxes with respect to property values is around 10%. Columns 2 and 3 show the positive relationship between property values and probability of compliance. In concordance with Figure 2, the relationship is concave. Columns 4 and 5 show the positive and concave relationship between log taxes and compliance likelihood. In column 6 we control for both property value and taxes owed. The result is unambiguous: Controlling for property value, a doubling of the property tax bill reduces compliance likelihood by 10%. This suggests local authorities are on the increasing part of the Laffer curve: They could raise property taxes and still obtain more property tax intake even after accounting for some taxpayers who will stop complying.

3.2 Street asphalting

As in other Mexican cities, the administration expands its pavement grid over time via "street asphalting projects", each defined as a contiguous set of unpaved street segments connecting to the existing pavement grid. The intervention consists of first-time asphalting of residential non-arterial streets, varying in width from 8 to 15 meters, and allowing for two lanes of vehicular traffic and one or two lanes for parking. The pavement material used is either hot-mix asphalt concrete or portland cement reinforced concrete. Like most infrastructure, the lion's share of costs are borne initially: the transportation literature estimates annual cost of maintenance to be only 1.5% of construction costs (BITRE, 1978), or 0.3%-0.7% using the cost estimates in Chen, Lin and Luo (2003). After a street is paved, maintenance is a municipal responsibility and is funded from general revenues.

Street pavement in an urban context provides multiple services: it facilitates vehicle, pedestrian and cyclist movement and access, provides accessible space for vehicle parking, allows commercial vehicles to deliver goods, and has a significant impact on the visual appearance of the area. Moreover, fieldwork confirmed that congestion was not a concern − as expected given the residential nature of the streets. A valid question is then why the market does not provide street pavement to begin with. One reason is that residential street pavement is a pure public good (non-rivalrous and non-excludable), and hence, free rider incentives prevent private provision.

The city engaged in 26 street pavement projects between 2007 and 2012. Detailed data on street asphalting completion projects by the municipality allows us to identify plots that present a change in street pavement status using plot addresses from the property tax data database.

4 Results

Our main results are presented in Table 4. Column 1 is an OLS plot fixed effect specification with year dummies. It provides an estimate of tax compliance changes that occur once pavement takes place. The estimated rate change is a 1.9 percentage point increase, significant at the 5% level.

Column 2 uses a logit plot fixed effect specification (it drops always-payers and always non-payers from the estimation, hence the change in number of observations) and suggests a 19% increase in the likelihood that the household is current with property tax payments (significant at the 10% level).

The regression estimates suggested by the theory are presented in columns 3 and 4. Column 3 provides marginal effects at the sample mean from a probit regression. The coefficient of interest is the interaction of pavement and property tax, which is positive and statistically significant at the 1% level. The same result holds if we use a logit specification, as is shown in Column 4.

5 Conclusion

In this paper we provide evidence that delivery of a local public good generates increased property tax compliance. Furthermore, we find support for the hypothesis that delivery of public goods has a larger marginal effect for households with larger property tax bills, as suggested by a simple model of perceived government perceived quality where households update their beliefs when they observe public goods being delivered.

While our results provide support for the hypothesis that providing public goods increases property tax compliance, we also conclude that a substantial portion of infrastructure projects such as road asphalting cannot be automatically financed via ex-post increases in tax compliance. The increase in tax intakes represent an insignificant share of construction costs. However, this does not imply that public good delivery can generate differences in compliance rates when local administrations choose to increase property tax amounts when they deliver local public goods. We believe this may be a fruitful avenue for future research.

References

Allingham, Michael G. and Agnar Sandmo. 1972. "Income tax evasion: a theoretical analysis." *Journal of Public Economics* 1 (3-4):323–338.

Alm, James. 2012. "Measuring, explaining, and controlling tax evasion: lessons from theory, experiments, and field studies." *International Tax and Public Finance* 19 (1):54–77.

Alm, James, Gary H. McClelland, and William D. Schulze. 1992. "Why do people pay taxes?" *Journal of Public Economics* 48 (1):21–38.

Andreoni, James, Brian Erard, and Jonathan Feinstein. 1998. "Tax Compliance." *Journal of Economic Literature* 36 (2):818–860.

Becker, Gary S. 1968. "Crime and Punishment: An Economic Approach." *Journal of Political Economy* 76 (2):169–217.

Becker, Winfried, Heinz-Jurgen Buchner, and Simon Sleeking. 1987. "The impact of public transfer expenditures on tax evasion : An experimental approach." *Journal of Public Economics* 34 (2):243–252.

BITRE. 1978. "Discussion Paper on Residential Streets." *Australian Bureau of Infrastructure, Transport and Regional Economics* .

Chamberlain, Gary. 1980. "Analysis of Covariance with Qualitative Data." *Review of Economic Studies* 47 (1):225–38.

Chen, Dar-Hao, Deng-Fong Lin, and Huan-Lin Luo. 2003. "Effectiveness of Preventative Maintenance Treatments Using Fourteen SPS-3 Sites in Texas." *Journal of Performance of Constructed Facilities* 17 (3):136–143.

Cowell, Frank A. and James P.F. Gordon. 1988. "Unwillingness to pay : Tax evasion and public good provision." *Journal of Public Economics* 36 (3):305–321.

Hamerle, Alfred and Gerd Ronning. 1995. "Panel Analysis for Qualitative Variables." In

Handbook of Statistical Modeling for the Social and Behavioral Sciences, edited by Gerhard Arminger, CliffordC. Clogg, and MichaelE. Sobel. Springer US, 401–451.

Kleven, Henrik Jacobsen, Martin B. Knudsen, Claus Thustrup Kreiner, Sren Pedersen, and Emmanuel Saez. 2011. "Unwilling or Unable to Cheat? Evidence From a Tax Audit Experiment in Denmark." *Econometrica* 79 (3):651–692.

Macdonald, Christine and Michael Wilkinson. 2013. "Half of Detroit Property Owners Don't Pay Taxes." *The Detroit News* , February 21.

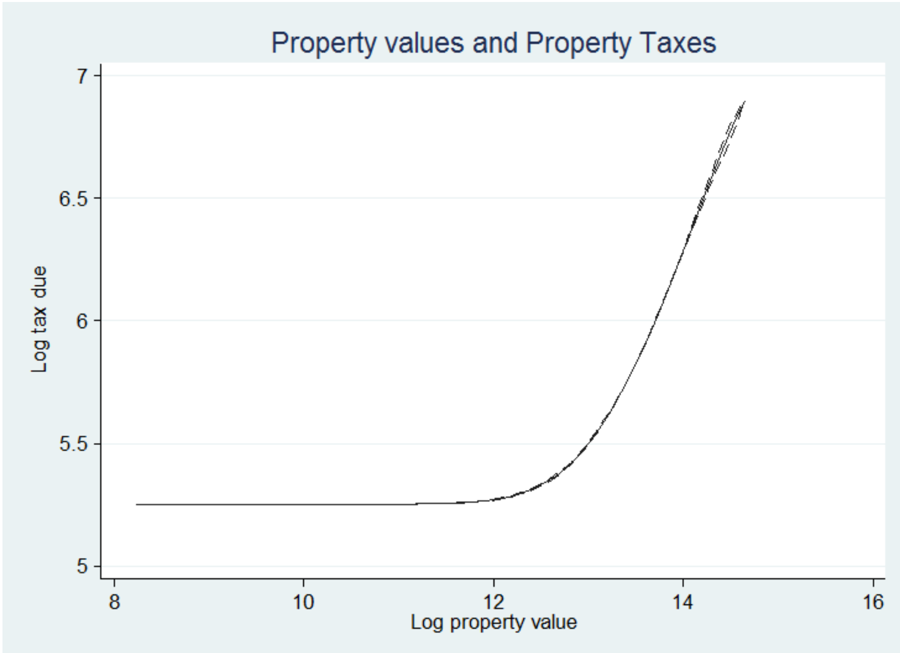
Samuelson, Paul A. 1954. "The Pure Theory of Public Expenditure." *The Review of Economics and Statistics* 36 (4):387–389.

Slemrod, Joel and Shlomo Yitzhaki. 2002. "Tax avoidance, evasion, and administration." In *Handbook of Public Economics*, vol. 3, edited by A. J. Auerbach and M. Feldstein, chap. 22. Elsevier, 1 ed., 1423–1470.

Srinivasan, T. N. 1973. "Tax evasion: A model." *Journal of Public Economics* 2 (4):339–346.

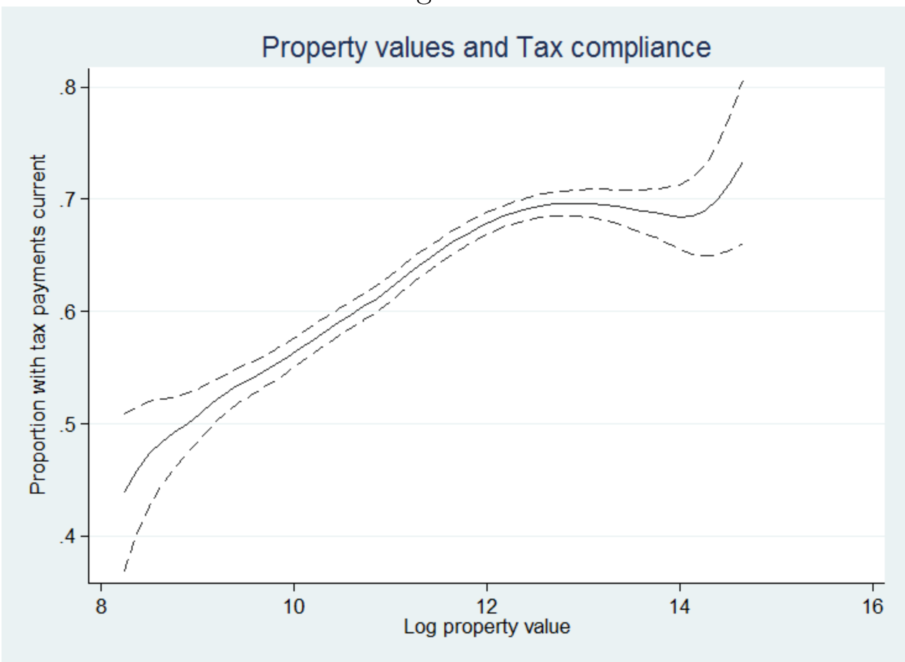
Figures

Figure 1:



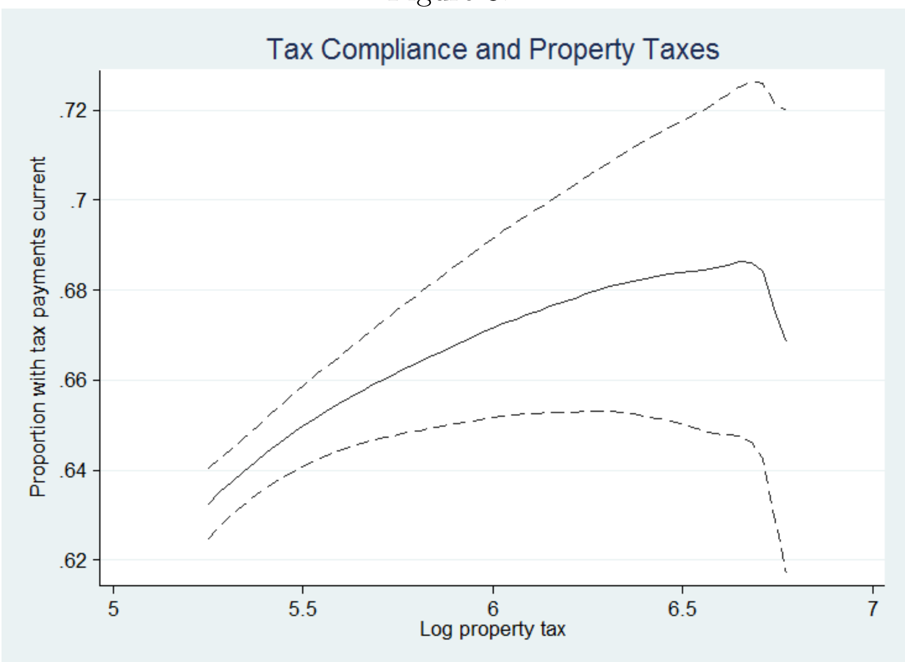
Notes:

Figure 2:



Notes:

Figure 3:



Notes:

Tables

Table 1: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.
property_value	215092.05	285145.18	3769	2304384
total_tax	196.43	96.54	142.06	874.46
tax_paymt_current	0.74	0.44	0	1
N		129548		

Table 2: Tax Compliance and Property Values (cross-section, 2012)

	ln_total_tax	ln_total_tax	Tax Paid	Tax Paid	Tax Paid	Tax Paid	Tax Paid
ln_property_value	0.0972***	0.0072***	0.0449***	0.2510***			0.0555***
	(0.0019)	(0.0006)	(0.0026)	(0.0405)			(0.0031)
D_high		-12.4722***					
		(0.1636)					
D_high_x_ln_property_value		0.9640***					
		(0.0122)					
ln_property_value_2				-0.0091***			
				(0.0018)			
ln_total_tax					0.0504***	1.2197***	-0.1097***
					(0.0140)	(0.4572)	(0.0165)
ln_total_tax_2						-0.1013**	
						(0.0396)	
Constant	4.2236***	5.1781***	0.1230***	-1.0247***	0.3690***	-2.9791**	0.5862***
	(0.0201)	(0.0062)	(0.0308)	(0.2279)	(0.0751)	(1.3110)	(0.0756)
Observations	16568	16568	16568	16568	16568	16568	16568
R squared	0.2803	0.8903	0.0176	0.0191	0.0007	0.0011	0.0201

Table 3: Tax Compliance and Pavement (Cross sectional ITT and 2SLS)

	ITT	ITT	2SLS	OLS	ITT	2SLS	OLS
	2005	2012	2012	2012	2012	2012	2012
intent to treat=1	0.0044	0.0417*			0.0507*		
	(0.0186)	(0.0247)			(0.0288)		
paved in 2012=1			0.0720*	0.0036		0.0932*	0.0321
			(0.0426)	(0.0244)		(0.0530)	(0.0286)
baseline compliance=1					0.4781***	0.4861***	0.4803***
					(0.0406)	(0.0414)	(0.0409)
Constant	0.8743***	0.6499***	0.6318***	0.6653***	0.2312***	0.1994***	0.2338***
	(0.0120)	(0.0161)	(0.0246)	(0.0171)	(0.0395)	(0.0488)	(0.0418)
Observations	1292	1490	1490	1490	962	962	962
R squared	0.0000	0.0019	.	0.0000	0.1256	.	0.1240

Table 4: Tax Compliance, Pavement and Taxes

	Plot F.E.			Theory Specification	
	(1)	(2)	(3)	(4)	(5)
	Logit	OLS	OLS	Dprobit	Logit
Paved X ln total tax				0.0246***	0.0405***
				(0.0089)	(0.0150)
ln_total_tax				-0.4633***	-0.7794***
				(0.0351)	(0.0594)
ln_property_value				0.1768***	0.2966***
				(0.0070)	(0.0118)
Paved	0.1716*	0.0313*	0.0185**		
	(0.1030)	(0.0188)	(0.0087)		
Constant		0.7697***	0.8168***	1.2958***	2.1654***
		(0.0054)	(0.0024)	(0.1505)	(0.2541)
Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	56139	56139	129548	129548	129548
Plot F.E.	Yes	Yes	Yes	No	No

Notes:

Table 5: Parallel Trends Before Pavement

	Dep.Var: Δ Tax Current				
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
Paved in future	0.0042	0.0013	0.0056	0.0086	0.0029
	(0.0086)	(0.0067)	(0.0070)	(0.0060)	(0.0066)
Constant	-0.0119***	-0.0119***	-0.0121***	-0.0122***	-0.0119***
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
Observations	28453	42802	56958	71842	86901
Year F.E.	Yes	Yes	Yes	Yes	Yes
Sample	$t \leq 2007$	$t \leq 2008$	$t \leq 2009$	$t \leq 2010$	$t \leq 2011$

Notes: Dependent variable is change in dummy for current in property tax payment status. Observations exclude years on or after pavement occurred. $Paved\ in\ future$=1 if plot eventually gets pavement in the future. Column 1 excludes plots that got pavement before 2007, Column 2 excludes plots that got pavement before 2008, etc.

Table 6: Summary Statistics Survey Data

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**N**
Tax compliance=1	0.83	0.22	0	1	701
House size (m2)	72.08	22.21	17.5	120	516
Lot size (m2)	126.26	43.36	50	250	516
Log owner estimate home value	11.93	0.74	10.45	14.65	613
Log appraised home value	11.73	0.62	10.67	13.04	516
Log per capita expenditure	6.61	0.39	5.82	7.82	693
Years of schooling	6.04	3.54	0	16	701

Table 7: Correlation between Compliance and Household Characteristics (street segment level)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS
paved	0.0449						
	(0.0299)						
House size (m2)		0.0010					
		(0.0007)					
Lot size (m2)			0.0007				
			(0.0005)				
Log owner estimate home value				0.0119			
				(0.0241)			
Log appraised home value					0.0158		
					(0.0319)		
Log per capita expenditure						0.0708**	
						(0.0272)	
Years of schooling							0.0045
							(0.0041)
Constant	0.8942***	0.8224***	0.8100***	0.7437**	0.7115*	0.4253**	0.8666***
	(0.0171)	(0.0579)	(0.0697)	(0.2904)	(0.3792)	(0.1812)	(0.0307)
Observations	701	516	516	613	516	693	701
R-Squared	0.1314	0.1271	0.1351	0.1214	0.1174	0.1443	0.1310

Notes: Dependent variable is share of street block that is current in property tax payment status.

Table 8: Heterogenous Effects by House Characteristics (street segment level

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS
paved	0.0449	0.1023	0.1963	0.0352	-0.2185	-0.4300	0.0587
	(0.0299)	(0.0960)	(0.1997)	(0.4327)	(0.5334)	(0.3074)	(0.0433)
House size (m2)		0.0012					
		(0.0009)					
Paved*House size (m2)		-0.0008					
		(0.0013)					
Lot size (m2)			0.0009				
			(0.0005)				
Paved*Lot size (m2)			-0.0012				
			(0.0017)				
Log owner estimate home value				0.0112			
				(0.0258)			
Paved*Log owner estimate home value				0.0025			
				(0.0355)			
Log appraised home value					0.0110		
					(0.0355)		
Paved*Log appraised home value					0.0226		
					(0.0454)		
Log per capita expenditure						0.0605*	
						(0.0312)	
Paved*Log per capita expenditure						0.0728	
						(0.0460)	
Years of schooling							0.0050
							(0.0044)
Paved*Years of schooling							-0.0021
							(0.0072)
Constant	0.8942***	0.8111***	0.7893***	0.7520**	0.7680*	0.4931**	0.8637***
	(0.0171)	(0.0692)	(0.0755)	(0.3107)	(0.4219)	(0.2080)	(0.0312)
Observations	701	516	516	613	516	693	701
R-Squared	0.1314	0.1348	0.1493	0.1344	0.1250	0.1536	0.1376

Notes: Dependent variable is share of street block that is current in property tax payment status.