# An Experimental Evaluation of Notification Strategies to Increase Property Tax Compliance: Free-Riding in the City of Brotherly Love

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**Abstract**

This study evaluates a set of notification strategies intended to increase property tax collection. To test these strategies, we develop a field experiment in collaboration with the Philadelphia Department of Revenue. The resulting notification strategies draw on core rationales for tax compliance: deterrence, the need to finance the provision of public goods and services, as well as the appeal to civic duty. Our empirical findings provide evidence that carefully designed and targeted notification strategies can modestly improve tax compliance.

KEYWORDS: Tax Compliance, Property Taxation, Field Experiment, Deterrence, Public Service Appeal, Appeal to Civic Duty.

# 1    Introduction

The lack of tax compliance has become a policy issue of central importance to all levels of government in developed and developing economies. In 2009, the developed economies of the OECD reported a tax non-compliance rate of 14.2, ranging from a low of 2-3 percent in Austria, Denmark, Germany, Korea, and Norway to 25 percent or more in Belgium, Iceland, Portugal, the Slovak Republic, to a high of 73 percent in Greece (OECD, 2011, Table 36). In developing economies with significant cash economies, tax non-compliance is likely much higher. The OECD estimates an average rate of tax non-compliance in non-OECD countries of 37 percent (OECD, 2011, Chart 7).

Noncompliance is a significant concern for at least four reasons. First, governments are denied the revenues needed to provide basic public services essential for ensuring the safety, health, and minimal well-being of all citizens. Second, if there is significant non-compliance and basic services are to be provided, then tax rates will need to rise on those who pay taxes. Rising tax rates for honest payers will discourage their use and desire of public services, potentially encouraging their exit from the formal economy. The negative consequences for overall economic performance can be sizable; Greece today serves as an unfortunate reminder. Third, non-compliance undermines the principle that everyone has to pay their "fair share" of taxes. The evidence suggests upper income taxpayers are more likely to be non-compliers. Finally, significant non-compliance may threaten the stability of democratic governance. When democratic governments fail to deliver essential services, impose large tax burdens on the legitimate private economy, and are viewed as capricious or actively unfair, then dictatorial alternatives may become attractive. In an important sense, tax compliance is a first order of business for efficient, fair, and democratic governance.

Tax compliance requires government to manage the taxpayer's decision to pay taxes. Taxpayers may ask: What do I owe and what happens if I don't pay? Taxpayers have the ability to influence what is owed on any tax that requires self-reporting of income or assets, such as self-reported consulting or business income. Taxing jurisdictions can in principle increase compliance by requiring less self reporting and directly assessing the tax base. Since property cannot be hidden, scuppered away to a tax haven, or concealed in an electronic data system, self- or non-reporting is less of an issue in a property tax system. Privately assessed wages, dividends, and interest income by individuals and businesses are easier to conceal to the tax authorities. However, private assessors have an incentive to report incomes truthfully as those payments are typically deductible expenses for their own taxes. The need for self-reporting is also reduced as the formal economy and the use of audited business records expands. Taxes which can take advantage of those records maximize tax compliance and are preferred for just this reason. The increased popularity of the value-added tax (VAT) over the past twenty years in economies with developing formal consumption sectors is a case on point (see Keen and Lockwood, 2010; Pomeranz, 2013). Self-reporting matters for tax compliance in developed economies as well. Kleven et. al. (2011), for example, show that tax non-compliance among Danish taxpayers is significantly higher for individuals with self-reported income.

The taxing jurisdiction can also control compliance by influencing the decision to evade, once the tax liability has been assessed. The most common strategy is the economic stick - fines and penalties. Failure to pay in time leads to interest penalties sufficiently large that there is no arbitrage advantage to waiting, and perhaps to a significant late fine as well. For long-time non-payers, fines may include the garnishment of wages, seizure of property, or jail. Early empirical studies found little impact of such penalties on aggregate tax compliance, however; see Slemrod

(2007). But more recent, nuanced studies, did find an impact of fines on both the level and speed of tax payments. Increasing fines have increased self-assessment of tax liabilities for those facing possible audits of self-reported incomes; see Kleven, et. al. (2011 and Pomeranz (2013). Hallsworth, et. al. (2014) find the speed with which taxpayers pay their liabilities can also be improved with increased fines. But fines only work if taxpayers believe they will be enforced. Large fines may be seen by taxpayers as a signal of a desperate and ineffective tax collector, as politically not viable and thus as empty threats, or in the extreme, as a breakdown of cooperative democratic governance. If so, an increase in fines may even reduce tax compliance, as indeed happened in Israel with the payment of corporate taxes; see Ariel (2012). On balance, the estimated effects of fines on tax payments have been positive, but modest in magnitude.

Given evidence as to the limited ability of economic sanctions to impact aggregate collections, attention has turned to employing non-economic or "behavioral" motivations for increasing tax compliance. Such motives are grounded in the value taxpayers place upon their role and position within the democratic community. The role may be instrumental leading to outcomes valued by the taxpayer, such as additional public services, or of value in its own right. Both provide an incentive for tax compliance.

Instrumentally, for example, if each taxpayer thought of himself as simply a single citizen within the democracy, there would be no incentive, apart from a fine, to pay for services. If fines are too low or unenforced, then free-riding is the preferred private strategy. But if each taxpayer views himself as part of a community of taxpayers and assumes all other taxpayers also think in a private way, then no services would be provided. Facing this possibility, there may arise a community, or cooperative, equilibrium in which all citizens agree to pay their taxes, as long as all others agree to pay as well. But citizens must think of themselves as representatives of their

community, not as a citizen alone; see Feddersen and Sandroni (2006). If so, the cooperative outcome can emerge. As examples, we vote, we tip in restaurants we will never visit again, and we put our litter in waste cans.

Or the citizen's role in the community may be valued in its own right, quite apart from any impact playing such a role may have on valued social outcomes. Individuals may derive satisfaction from knowing, or from having others know, that they have done their "civic duty." Duty can extend far beyond tax compliance to all forms of law abiding behavior; see Posner (2000). Consistent with theories of social norms, the more people conform to law-abiding behavior, the more likely it may be that the "marginal" citizen will conform as well; see Benabou and Tirole (2011).

Both the instrumental motive and the motive born from civic duty have been used to stimulate tax compliance. The evidence is mixed. The most careful study of the two motives was done Blumenthal et al. (2001), where two different letters were sent to Minnesota state taxpayers reminding the taxpayer when taxes were due and to report their income accurately. One letter stressed that taxes pay for important state services. The other letter emphasized that most state taxpayers correctly report their taxable income on time. There were 15,000 taxpayers in each group, and their reported taxable incomes were compared to a control group of 15,000 taxpayers who received no letter. From the work of Kleven et al. (2011) and Pomeranz (2013) we should expect the largest effect on self-reported incomes. For both letters, there were statistically significant positive and negative effects on the various categories of self-reported incomes, with no statistically significant change in aggregate taxable income over that reported by the control group. The one strong effect was a relatively large negative effect on reported income by the richest taxpayers from having received the civic duty letter.

Three more recent studies have been more encouraging as to impact of behav-

ioral appeals. In an effort to improve the speed of tax compliance for British income taxpayers, Hallsworth et al. (2014) sent either of two letters to taxpayers both encouraging them to pay their taxes on time, with one letter stressing that payment ensures important national services will be provided and a second stressing that "nine out of ten" taxpayers pay their taxes on time. Both sets of letters had a statistically significant effect in encouraging sooner tax payments, and the effects were greatest for the appeal to "civic duty" when explicitly mentioned the taxpayer's most likely reference group of fellow citizens.

Perez-Truglia and Troiano (2015) explored the impact of what they call a "shaming penalty" administered through a letter to a subset of delinquent state taxpayers reminding them that the state has placed their name on a publicly available list of tax delinquents and that only payment in full or acceptance of a payment schedule can remove their name from the delinquent list. The reminder letter made a significant positive difference to eventual tax compliance, with the greatest effects observed for taxpayers with the lowest level of taxes owed. In addition, reminding tax delinquents that there is a growing financial penalty to late payments also had a positive impact on compliance and particularly so for wage-only taxpayers whose income can be most easily attached for payment and penalties.

Finally, Besley, Jensen, and Persson (2014) estimate a dynamic model of tax compliance to explore whether more complying taxpayers encourages further compliance as implied by social norm behaviors. The theory is tested for British local government tax compliance following the tax revolt of 1990 in response to the replacement of the wealth-based property tax by a regressive poll or "head" tax. Local compliance fell from an average rate of 97 percent to 82 percent within two years. The poll tax was removed and wealth taxation restored in 1993 but it took more than ten years for tax compliance for the wealth tax to return to its original levels.

Our agenda here is to extend our understanding of tax compliance to include the payment of local property taxation. We do so by implementing a tax compliance experiment in one large U.S. city, Philadelphia. In the late fall of 2014, we assisted the City of Philadelphia's Department of Revenue (DoR) in an evaluation of their efforts to improve local property tax collection through redrafting letters reminding taxpayers that their 2014 property tax payments were overdue. The City's historical performance in tax compliance has not been good, collecting only 90 percent of assessed property tax revenues compared to an average compliance rate among large U.S. cities of nearly 95 percent.

In Philadelphia, each year's property tax payments are mailed to property owners by mid-January and are due in full by March 31st of that year. Beginning in May of the tax year, the DoR sends a common reminder letter to each late taxpayer, usually once every two months until payment is received. The common reminder letter states the taxpayer's liability and accrued interest and penalties. If payment has not been received by September of the tax year, 2 out of 3 taxpayers are assigned to either of two law firms for collection; the remaining third stays with DoR for continued efforts at internal collection. We assisted DoR with collection from their share of these "tardy" taxpayers. We proposed three additional formats for DoR's reminder letter. In addition to the listing of tax payments, interest, and penalties, the alternative letters contained a sentence that either (i) threatened the potential loss of the taxpayer's home or property if taxes were not paid, or (ii) appealed to the positive community benefits in provided public services that the taxpayer's dollars provide, or (iii), appealed to the positive benefits of fulfilling your civic duty to yourself and others by paying your taxes.

We find evidence that the letter that appealed to the benefits of fulfilling your civic duty had a positive effect on tax compliance above that of the City's standard

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reminder letter. This appeal was an effective strategy for encouraging at least some tax payment and often payment in full, and had its biggest differential and most significant impact on those residents with relatively low levels of tax debt. We also find some evidence that stressing the benefits of payment for the provision of city services may also improve tax compliance for the tax payer. The effects are most significant for tax payers that owe larger amounts of taxes. The letter that threatened the possible loss of the taxpayer's property did not significantly improve tax collection. Finally, our results suggest that a preferred overall strategy may take advantage of the differential responses of taxpayers to the treatment letters. A uniform message to all late or non-compliant tax payers is not likely to be desirable.

The rest of the paper is organized as follows. Section 2 provides a brief overview of tax compliance in U.S. cities. Section 3 provides a detailed discussion of our three treatments and the control. It also discusses the experimental design and the fidelity of its implementation. Section 4 presents a descriptive analysis summarizing the main effects of our experiment. Section 5 provides some additional analysis of discrete outcomes focusing on whether tax payers made payments at all or paid the debt back in full. Section 6 offers some conclusions and discusses future research.

## 2 Property Tax Compliance in U.S. Cities: An Overview

The property tax is one of the most important taxes for the financing of local government services in the United States. For the country as a whole, approximately 21 percent of all state and local government revenues were raised using the property tax in 2011 (Gruber, 2014). For the largest cities that percentage is much higher. The po-

tential economic advantages of the property tax are well known.[1] But so too does the tax have significant administrative advantages. With modern techniques for assessment, properties can be accurately assessed at their market values, and assessments can be easily updated at the time of each "arms-length" transaction. Thus, there is no need for taxpayer reporting of the tax base, as with income, profits, sales, or VAT taxation. Property values, based as they are on long-run economic returns, are usually less volatile than tax bases dependent on current economic activity, such as income or sales. Stable tax bases allow for stable revenue flows and thus less volatile service flows or, alternatively, tax rates.[2] Finally, when the tax base is determined by market-based assessments, the taxpayer's tax bases will have been objectively set and easily understood. There is no need for complicated tax forms or contentious appeals. This too saves on administrative costs, and one hopes, increases citizen confidence in

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[1]A well administered property tax is has two potential economic advantages, one relating to economic efficiency and the other to economic fairness. First, if households and businesses are mobile across local political jurisdiction and if local jurisdictions use their zoning powers to "sort" taxpayers by the value of their properties, then the property tax becomes the economic equivalent of a benefit tax relating taxes paid directly to the costs of the services provided (see Hamilton, 1975). This will lead to the efficient provision of local government services. The two efficiency assumptions are likely to hold in suburbs, but not in central cities. In the case of the central city, efficiency will require the tax be close to a tax on existing structures and ideally land, rather than on new investment. The tax will be least efficient in those cities with very elastic demand and supply for new construction. In declining cities with no new construction, the supply curve is inelastic, at the level of existing structures. In successful, growing cities demand for location is likely to be inelastic and new supply constrained by available land. In these two cases, therefore, the property tax remains a relatively efficient local tax. With regard to economic fairness, if the property tax is based on market value assessments, then the tax becomes a proportional tax on property wealth (see Aaron, 1975; Mieszkowski, 1972). Since property wealth increases at least in proportion to increases in income, the tax will be proportional or perhaps progressive.

[2]Any remaining volatility in revenues can be managed with rainy day funds.

the fairness of their tax payments.

Table 1: Property Tax Compliance: 2005-2014

| City | Percent Compliance Current Yr; 10 Year Average | Delinquent Tax Collected Five Year, Yearly Average |
|---|---|---|
| Large City Average | .946; .945 | .112 |
| Atlanta* | .982 ; .960 | .182 |
| Baltimore* | .960 ; .950 | .128 |
| Birmingham* | .983; .955 | - |
| Boston | .996; .992 | - |
| Buffalo* | .947; .945 | .175 |
| Charlotte | .984; .980 | - |
| Chicago* | .962; .930 | - |
| Cincinnati* | .940; .925 | .120 |
| Cleveland* | .841; .850 | .090 |
| Columbus* | .938; .920 | .075 |
| Dallas* | .989; .985 | .085 |
| Washington, DC | .985; .980 | - |
| Denver | .990; .989 | - |
| Detroit* | .683; .891 | - |
| Flint* | .654; .785 | .151 |
| Houston* | .983; .975 | .171 |
| Kansas City | .943; 938 | - |
| Los Angeles | .992; .940 | - |
| Memphis* | .984; .945 | .085 |
| Continued on next page | | |

Table 1 – continued from previous page

| City | Percent Compliance Current Yr; 10 Year Average | Delinquent Tax Collected Five Year, Yearly Average |
|---|---|---|
| Miami* | .975; .970 | .045 |
| Milwaukee* | .865; .875 | .191 |
| Minneapolis* | .985; .972 | .102 |
| Nashville | .984; .986 | - |
| New Orleans* | .948; .921 | .172 |
| New York City | .915; .925 | .041 |
| Oklahoma City | .958; .949 | .161 |
| Orlando | .991; .988 | .072 |
| Philadelphia* | .940; .880 | .125 |
| Phoenix* | .977; .965 | .130 |
| Pittsburgh* | .849; .860 | .048 |
| Portland | .942; .934 | .109 |
| Richmond* | .924; .955 | .171 |
| Riverside | .990; .982 | - |
| Sacramento | .996; .980 | - |
| Salt Lake City | .985; .980 | .140 |
| San Antonio | .989; .985 | .134 |
| San Diego | .980; .950 | - |
| San Francisco | .988; .980 | - |
| San Jose | .999; .990 | - |
| Seattle | .985; .983 | .170 |
| St. Louis* | .921; .890 | .123 |
| Continued on next page | | |

Table 1 – continued from previous page

| City | Percent Compliance Current Yr; 10 Year Average | Delinquent Tax Collected Five Year, Yearly Average |
|------|------------------------------------------------|---------------------------------------------------|
| Tampa | .959; .957 | .032 |

* City Poverty Rate is greater than or equal to .20 in 2009-2013.

*Annals of Statistics*: Each city's Comprehensive Annual Financial Report, annually over the years, 2005 to 2014.

*Percent Compliance*: Computed as the percent of property taxes levied in each fiscal year that are actually paid during the fiscal (or collection) year.

*Delinquent Taxes Collected*: Delinquent taxes not paid in the year due may be paid in subsequent years. The annual rate is computed as the average collection rate over a five year period following the year after the tax is first due. The aggregate percent of the delinquent taxes paid after five years, the typical horizon over which no further payments can be expected, can be computed as 5 x [yearly average]. The (-) indicates that data were not available to compute the rate of delinquent tax collection for that city.

Once market-based assessments are in place, the administrative issue that remains is this: Will property owners pay their taxes? Table 1 summarizes the record for property tax compliance for forty of the largest U.S. cities, plus Flint, Michigan, a poster child for weak compliance. Tax compliance is defined as the percent of taxes levied in the collection year that are paid in the year due. Taxes not paid in the collection year are then considered delinquent.[3]

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[3]A city's collection year need not correspond to the city's fiscal year. For example, in Philadelphia the collection year is the calendar year while the fiscal year runs from July 1 to June 30 of the next

Property tax compliance in these large cities over the past ten years, years that included the deepest recession in decades, has been very good. On average, these large cities collected nearly 95 percent of their property taxes in the tax year due, and the recession years did not lower collection rates at all significantly. Still the average amount of uncollected, delinquent revenues is significant too, and particularly so for the seven poorest performing cities: Cleveland (.85), Detroit (.89), Flint (.79), Milwaukee (.88), Philadelphia (.88), Pittsburgh (.86), and St. Louis (.89).

Taxes that have not been paid in the tax year become delinquent payments, and cities seek to collect those taxes through various enforcement mechanisms. The most common strategy is to send a reminder letter to the taxpayer stressing that unpaid taxes accumulate interest and penalties and need to be paid. If still unpaid, the tax bill can be given to a private collection agent with revenues shared between the agent and city or perhaps sold to the agent for immediate revenues. Or the wages of, or payment to, the tax delinquent can be garnished. Philadelphia does so for public employees and for private contractors working for the city. Finally, a tax lien can be imposed on the property to be paid when the home is sold. As a last resort, the city can seize the property and require a sheriff's sale to collect back taxes. The end result is the collection of some portion of delinquent taxes. Table 1 reports each city's

year. Tax bills are mailed in January of each collection year - the middle of the fiscal year - and are due on March 31 of that year. Payments received after March 31 are considered late payments and will incur interest and late payment penalties. All payments received by December 31 of the collection year are then recorded as taxes paid during the collection year. Payments that are not paid by December 31 are then classified as delinquent for that collection year. Since property tax payments arrive in the last half of each fiscal year, Philadelphia will use some its tax receipts to repay the short-term "cash-flow" loans of that fiscal year and then save a significant fraction of the remaining revenues for spending in the first half of the next fiscal year.

five year, yearly average for the collection of delinquent taxes.[4] The typical pattern of collection for delinquent taxes shows a relatively high success rate in the first year of delinquency, and then a very sharp decline in payments thereafter.[5] Most cities view tax bills that have been delinquent for more than five years as uncollectible. Multiplying the five year average rate reported in Table 1 by five yields the average aggregate collection rate of any one year's delinquent taxes. For the average city in our sample, this aggregate collection rate is .560 ( = .112 x 5). The better performing

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[4]The average annual collection rate for delinquent taxes was estimated from data provided by the sample cities in each city's Comprehensive Annual Financial Report. The required data was reported either as the amount finally collected from a given year's delinquent taxes - reported as "Collections in Subsequent Years" - or as all delinquent taxes collected in a year from all previous years - reported as "Delinquent Tax Collections." For cities reporting "Collections in Subsequent Years" the average annual rate was computed as ratio [Collections/(Tax Year Taxes Levied - Tax Year Taxes Collected)] then divided by 5. The assumption is that all taxes levied but not collected in the tax year are classified as delinquent and that no significant amount of delinquent taxes are collected after five years. For cities reporting "Delinquent Tax Collections" the average annual rate was computed as ratio [Collections/ $\sum$ (Tax Year Taxes Levied - Tax Year Taxes Collected)], summed over the previous five tax years. In both cases the average annual rate is an average of the actual collections in each of the five years following tax delinquency, where typically the first year rate of collection is the highest with a declining rate in years two to five. Included in "Collections" in both cases will be taxes plus interest plus penalties collected, the proceeds from the sale of tax liens to private collection agents, and the proceeds from the sheriff's sales of delinquent properties.

[5]Atlanta is one of the better performing cities in its collection of delinquent taxes and the pattern of its collection success is typical. We estimate that in the first year of delinquency for its 2005 tax collection year, the city collected 56 percent of delinquent taxes owed. That was in 2006. In 2007, the second year of delinquency for 2005 taxes, an additional 8 percent was collected. In 2008, an additional 1 percent was collected. In 2009, an additional 7 percent was collected. And in the 2010, an additional 12 percent was collected. After five years, the final amount collected of the 2005 delinquent tax owed was 84 percent. The five year annual average for 2005 was therefore .168. In subsequent years, Atlanta has done a bit better. Its annual average collection rate has been .182 for an aggregate average collection rate of delinquent taxes of .91.

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cities, such as Atlanta, may eventually collect more than 90 percent of their delinquent taxes, the poorer performing cities perhaps not much more than 30 percent.

Table 1 also indicates those cities with poverty rates greater than .20 for the period 2009-2013. The expectation is that high poverty cities should have lower rates of initial tax compliance and possibly more difficulty in collecting delinquent taxes. A comparison of the mean rates of tax compliance shows this to be case for initial collection efforts: .92 for the 22 high poverty rate cities (.94 excluding Detroit and Flint) and .98 for the 20 cities with relatively low poverty rates. The average annual ability to collect delinquent taxes in the two sets of cities is about the same (= .11), however, perhaps because the pool of delinquent taxpayers is very poor in all cities. Importantly, however, some cities with high poverty rates are very successful in collecting property taxes on time and in collecting delinquent taxes. Among the poorer cities, Atlanta, Baltimore, Houston, New Orleans, and Phoenix perform as well, and often better, than the average low poverty city. The fact that property tax compliance can be well managed in the face of difficult economic realities suggests the value of looking at the administrative strategies of successful cities and searching for new strategies as well. It is the latter agenda we pursue here, using taxpayer compliance in Philadelphia as a laboratory to experimentally evaluate four alternative collection strategies to encourage payment by tardy, soon to be delinquent, city taxpayers.

# 3 The Philadelphia Tax Experiment

## 3.1 Treatments

In Philadelphia, each year's property tax payments are mailed to property owners by mid-January and are due in full by March 31st of that year. Beginning in May of the tax year, the DoR sends a common reminder letter to each late taxpayer, usually once every two months until payment is received. The common reminder letter is impersonal and simply states the taxpayer's liability and accrued interest and penalties; see Figure 1. The only means for responding to the letter is to either send a check with the detached portion of the letter to DoR or to call a phone number given at the top of the letter, but without instructions. If payment has not been received by September of the tax year, the taxpayer is assigned to either of two law firms for collection or to the DoR for continued efforts at collection. The law firms are free to pursue the collection of the debt as they see fit. Proceeds from their efforts are shared with the City. In the past, DoR's efforts at collection from these tardy taxpayers have been limited to simply re-mailing the usual reminder letter.

In collaboration with the staff of DoR, we proposed two changes to their usual tax collection efforts. First, a generic reminder letter, that included a Spanish translation of the letter on the reverse side and also provided a list of contact numbers for taxpayers whose native language is not English, was included with the traditional tax bill.[6] This revised letter serves as our "control" treatment. Second, we offered three alternative letters to the control letter which might encourage additional tax compliance: one that threatened the potential loss of the taxpayer's home or property if taxes were not paid, a second that appealed to the positive community benefits in provided

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[6]The Spanish translation was targeted at the substantial Latino population and is available upon request. Phone contacts were also included.

public services that the taxpayer's dollars provides, and third that appealed to the positive benefits the taxpayer may feel from fulfilling their civic duty to themselves and to others by paying their taxes. Specifically:

*Treatment Letter 1: Threat:* **Not paying your Real Estate Taxes is breaking the law.** Failure to pay your Real Estate Taxes may result in seizure or sale of your property by the City. Do not make the mistake of assuming we are too busy to pursue your case.

*Treatment Letter 2: Service Appeal:* **We understand that paying your taxes can feel like a burden.** We want to remind you of all the great services that you pay for with your Real Estate Tax Dollars. Your tax dollars pay for schools to teach our children. They also pay for the police and firefighters who help keep our city safe. Please pay your taxes as soon as you can to help us pay for these essential services.

*Treatment Letter 3: Civic Appeal:* **You have not paid your Real Estate Taxes.** Almost all of your neighbors pay their fair share– 9 out of 10 Philadelphians do so. Paying your taxes is your duty to the city you live in. By failing to pay, you are abusing the good will of your Philadelphia neighbors.

The formats of the three letters were constructed to only differ in their wording of the middle paragraph; see Appendix A. Care was taken to minimize issues of communication for those with limited English literacy, ensuring that each letter was intelligible to those with a 5th grade education. Like the revised control letter, all treatment letters also included a Spanish translation as well as a list of phone lines for different language translations on the reverse side of the letter. Letters were mailed in the November mailing cycle to the still tardy taxpayers. The receipt of tax payments, or not, were recorded for 30 days, beginning five days after the mailing date.

## 3.2 Experimental Design

To ensure that the results of the experiment allow for a causal interpretation from the receipt of the letter to increased payment, great care was taken to establish a random assignment of all four letters across the pool of DoR's tardy taxpayers. Unfortunately, DoR's administration for mailing the letters did not allow for a purely random assignment of tardy taxpayers to each letter.

Our approach to randomization was constrained by the logistics of DoR's enforcement capabilities. We concluded after several discussions with our collaborators at DoR that it would be impossible in practice to assign individual properties at random to different treatments. Instead, we chose to exploit the pseudo-random assignment of properties to billing cycles and randomized treatments across them. To understand this decision it is useful to discuss the current practice of posting reminder letters by DoR.

Mailing of tardy real estate tax bills is as follows. Since it is cheaper and simpler to send all bills at once to those owners owing taxes on multiple properties, assignment to cycles is done at the owner level, so that each mailing cycle has roughly the same number of owners. Every morning, a printer at DoR taps the in-house accounting system to find all properties that a) owe taxes to the City and b) are in the current day's mailing cycle, with the numbered cycles progressing in sequence day-by-day. After identifying the bills to be printed for the day, the printer merges into the bill several other pieces of information stored with the tardy balance such as the mailing address and an in-house ID associated with the property. The bills printed each day are then brought to the City's mailing room, wherein they are stuffed into envelopes and delivered to the property owners.

Given the volume of bills printed each day and the existing infrastructure for

processing them, especially the machine-automated process of envelope stuffing, the most practical solution was to randomize treatment at the mailing cycle level, so that every bill printed on the same day would be paired with the same message. We elected to randomize 4-day cycles–for each 4-day period, we picked at random among the $4! = 24$ possible arrangements of treatments over the subsequent 4 days. Our experiment was conducted on 9 days in November 2014, between the 4th and the 25th.

While we are certain of the sanctity of our mailing cycle-level randomization process, one may be concerned about the assignment of properties to mailing cycles. Fortunately, however, the city uses a pseudo-random mechanism to assign owners to billing cycles, which means that we achieve proper full-scale two-stage randomization of the properties through our process of day-level randomization. In particular, the city assigns properties to cycles based on the last two digits of the property owner's social security number, or Employer Identification Number, or (lacking those identifiers) to a DoR nine digit identification number. We believe that this quasi-random assignment removes any significant sorting or self-selection bias in the assignment of treatment letters.

## 3.3   Implementation Fidelity

To assess whether the final implementation of our mailing of treatment letters is as intended, we leveraged a unique feature of the DoR's mailing process. The Department of Revenue regularly posts envelopes destined for addresses that are either unattended (vacant) or do not exist in the first place due to typos. Either before or after an attempted delivery to such an address, the postal service identifies these letters and returns them to the DoR, which then processes the letters and attempts, if they can

identify a suitable alternative address, to re-deliver the tax bill. We took advantage of the fact that a subset of bills made their way back to DoR to check first-hand the extent of treatment fidelity. Our final sample consists of the nine treatment days for which greater than 90% fidelity was achieved.

## 3.4 Sample Size

From this original sample of 134,888 tardy tax payments we select a final sample of 4,927 properties for our experiment. This final sample removes all properties no longer handled by DoR (= 61,170), or for which payment agreements have been reached (= 31,456), or were not part of our nine day mailing cycle (= 24,800), or which qualified for a tax abatement (= 4706), or in sheriff's sale (=4098), sequestration (= 1130) or bankruptcy (= 948), or for which we had no working address (= 1429), or had a tax bill remaining of less than $.61 (= 224).[7]

Table 2 provides some descriptive statistics of the full sample of all tardy and delinquent properties in the city – i.e., without any sample restrictions (Sheriff's Sale, etc.). It also includes full restricted sample and the sample used in our analysis.

Note in particular that this sample selection means that our sample consists only of properties that are not in the purview of the two law firms that DoR uses as collection agencies. It is therefore useful to compare briefly the properties that are kept in-house with those that are assigned to the law firms. We find that properties kept in-house have lower balances, with a median of $1,000, as compared to $1,700 overall. However, in-house properties have higher market values–the DoR median

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[7]The city operates 50 billing cycles. Each cycles has approximately 2,500 observations. Once we apply the sample selection criteria discussed above we obtain between 493 and 633 observations per day.

Table 2: Descriptive Statistics

|  | All Properties | Restricted Properties | Analysis Sample |
|---|---|---|---|
| Amount Due | 4409 | 3761 | 3465 |
| Assessed Property Value | 138867 | 242604 | 186691 |
| Value of Tax | 1586 | 3123 | 2405 |
| Length of Debt | 6 | 4 | 4 |
| % Residential | 80 | 81 | 80 |
| % w/ Phila. Mailing Address | 88 | 82 | 83 |
| % Owner-Occupied | 24 | 21 | 22 |
| Number Observations | 134887 | 29951 | 4927 |

NOTE: This table provides some descriptive statistics for all properties in Philadelphia, all properties that satisfy our sampling restrictions, and the sample used in the analysis.

is $91,000 vs. $66,100 overall. Properties handled by DoR have younger debt–an average of 4 years vs. 7 and 11 for the two law firms. Even conditional on age of debt, in-house balances are low. DoR-managed accounts are more likely to be owner-occupied, less likely to be in payment agreements, and more likely to result in a sheriff's sales. In summary, it appears that the outside firms are holding properties which, even given other characteristics, have the highest potential returns.

## 3.5 Sample Balance on Observables

To confirm whether or not we indeed achieved randomization, we performed a series of balance-on-observables tests. The null hypotheses of these tests are that a given observable data moment is identical across mailing cycles. We turn now to the results

of those tests.

Analysis of balance on observables is complicated by the random assignment at the owner level. Because there are some large holders of property – e.g., the City of Philadelphia, the Philadelphia Housing Authority, the Redevelopment Authority of Philadelphia, The University of Pennsylvania and Drexel University – a simple analysis of balance at the property level will likely be skewed by these outliers. In addition, it is not clear how to aggregate many of the property-level characteristics to the owner level meaningfully, especially geographic variables, complicating the task of testing balance at the owner level. Our compromise was to examine sample balance on the subset of properties for which a) the owner is unique, and b) any tax exemption claimed by the property is related to abatements for new construction.

Most of the observed characteristics are categorical variables, so we can test balance using standard $\chi^2$ tests. The full sample consists of letters mailed over nine days, two of which sent the Threat treatment letter, four of which sent the Public Service treatment letter, two of which sent the Civic Duty treatment letter, and one final day which mailed the control letter. This meant that of the 4,297 letters mailed, 22 percent (2/9's) where threat letters, 44 percent (4/9's) were public service letters, 22 percent (2/9's) were civic duty letters, and 11 percent (1/9) were control letters. If our treatment letters are randomly allocated across observable characteristics of properties owing taxes, then we should observe the same distribution of letters by each observable characteristic. Table 3 shows these distributions and the resulting p values for the test of the null hypothesis that the letter distribution by characteristic matches the overall distribution of letters. In each case, we cannot reject the null hypothesis that the letters have been randomly distributed by the observable characteristics shown in Table 3.

Table 3: Tests of Sample Balance on Observables

| | Threat | Service | Civic Duty | Control | $p$-value |
|---|---|---|---|---|---|
| Taxes Due Quartiles | | | | | |
| <$300 | 0.22 | 0.4 | 0.28 | 0.1 | 0.2 |
| [$300,$1300) | 0.24 | 0.47 | 0.22 | 0.08 | |
| [$1300,$3300) | 0.23 | 0.45 | 0.2 | 0.11 | |
| > $3300 | 0.18 | 0.48 | 0.23 | 0.11 | |
| Market Value Quartiles | | | | | |
| <$46k | 0.24 | 0.43 | 0.21 | 0.12 | 0.2 |
| [$46k,$82k) | 0.22 | 0.46 | 0.23 | 0.1 | |
| [$82k,$152k) | 0.21 | 0.45 | 0.25 | 0.09 | |
| > $152k | 0.21 | 0.45 | 0.24 | 0.1 | |
| Land Area Quartiles | | | | | |
| <800 sq. ft. | 0.22 | 0.45 | 0.23 | 0.1 | 0.83 |
| [800,1200) sq. ft. | 0.23 | 0.43 | 0.24 | 0.1 | |
| [1200,1800) sq. ft. | 0.21 | 0.47 | 0.22 | 0.1 | |
| >1800 sq. ft. | 0.21 | 0.44 | 0.24 | 0.1 | |
| Distribution of Properties | 0.22 | 0.45 | 0.23 | 0.1 | 0.08 |
| Expected Distribution | 0.22 | 0.44 | 0.22 | 0.11 | |
| # Rooms | | | | | |
| 0-5 | 0.22 | 0.44 | 0.23 | 0.11 | 0.32 |
| 6 | 0.21 | 0.46 | 0.23 | 0.09 | |
| 7+ | 0.22 | 0.44 | 0.24 | 0.1 | |
| Years of Debt | | | | | |
| Continued on next page | | | | | |

Table 3 – continued from previous page

|  | Threat | Service | Civic Duty | Control | $p$-value |
|---|---|---|---|---|---|
| 1 Year | 0.23 | 0.43 | 0.24 | 0.09 | 0.32 |
| 2 Years | 0.22 | 0.44 | 0.24 | 0.1 | |
| 3-5 Years | 0.2 | 0.48 | 0.22 | 0.1 | |
| 6+ Years | 0.2 | 0.47 | 0.2 | 0.13 | |
| Category | | | | | |
| Residential | 0.22 | 0.45 | 0.23 | 0.09 | 0.07 |
| Hotels&Apts | 0.2 | 0.45 | 0.23 | 0.12 | |
| Store w. Dwell. | 0.21 | 0.48 | 0.22 | 0.09 | |
| Commercial | 0.15 | 0.5 | 0.24 | 0.11 | |
| Industrial | 0.27 | 0.42 | 0.2 | 0.11 | |
| Vacant Land | 0.25 | 0.39 | 0.23 | 0.13 | |
| Expected Distribution | 0.22 | 0.44 | 0.22 | 0.11 | |
| NOTE: This table shows that there are no significant differences in the distribution of observed variables among the treatment and control samples. | | | | | |

As can be seen from Table 3 randomization appears to have been successful. The properties are strongly randomly distributed by location (their political ward, of which there are 66 in Philadelphia), category (type of property usage), property size (as measured by the number of rooms or by the size of the tract), case assignment (this variable captures, if applicable, to which outside law firm a property is assigned), and whether the property is in sequestration or has entered a payment agreement with the city. The number of properties assigned to each treatment is further exactly as expected, given the unequal number of mailing days in our treatment.

# 4    Average Treatment Effects

We consider results for three different subsamples. The first sample (I) is the full sample and consists of all 4927 observations; The second sample (II) eliminates commercial property owners, which reduces the sample to 4749 observations; the third sample (III) eliminates owners of multiple properties, resulting in a sample size of 3888.

Table 4 summarizes the impact of our experimental intervention on revenue collection. The table reports the total taxes owed, the amount generated, and the number of mailing days for the three treatments and the control groups. It also reports the percent of properties that paid the City anything and the percent that paid off their full debt in our sample period.

We also report the dollars in revenue raised per day, which ranges from \$60,292 in the control group to \$111,931 in the service treatment group. Note that the average payments per day is higher in all three treatment group. A simple difference between the treatment and the control group provides an impression of the overall effectiveness of the intervention. These estimates range from \$10,883 for the threat treatment to \$51,639 for the service treatment. Summing over all treatment groups and days suggests that our experiment generated approximately \$250,000 for the DoR in just nine days.

To conduct a formal statistical analysis and determine whether the treatments had a significant positive effect on tax collections, we estimate a regression model for each of the three samples. The basic idea is to regress the tax receipts on an intercept and the three treatment dummies. The intercept is the mean receipt in the control group and the treatment coefficients measure the change in tax collection induced by each. Table 5 reports our parameter estimates and corresponding robust standard

Table 4: Summary of Effectiveness of Treatment

| Sample | Group | Treated Days | No. Treated | Total Taxes Owed | Percent Ever Paid | Percent Paid in Full | Dollars Received | Dollars Per Day Treated | Dollars above Control Per Day | Total Generated over All Days |
|---|---|---|---|---|---|---|---|---|---|---|
|  | Threat | 1 | 499 | $1,839,826 | 14 | 8 | $71,176 | $71,176 | $10,883 | $ 10,883 |
|  | Service | 4 | 2,211 | $8,003,148 | 15 | 7 | $447,728 | $111,932 | $51,639 | $206,557 |
| I | Civic Duty | 2 | 1,142 | $3,794,900 | 18 | 12 | $152,217 | $76,109 | $15,816 | $ 31,632 |
|  | Control | 2 | 1,075 | $3,294,516 | 16 | 10 | $120,585 | $60,293 | $ 0 | $ 0 |
|  | Threat | 1 | 480 | $1,657,379 | 15 | 8 | $71,176 | $71,176 | $11,142 | $11,142 |
|  | Service | 4 | 2,122 | $7,024,458 | 15 | 7 | $288,758 | $72,189 | $12,155 | $48,621 |
| II | Civic Duty | 2 | 1,099 | $3,350,147 | 19 | 12 | $146,227 | $73,114 | $13,079 | $26,158 |
|  | Control | 2 | 1,048 | $2,930,759 | 16 | 10 | $120,069 | $60,034 | $ 0 | $ 0 |
|  | Threat | 1 | 406 | $1,437,902 | 15 | 9 | $51,309 | $51,309 | $18,011 | $ 18,011 |
|  | Service | 4 | 1,754 | $6,956,034 | 16 | 7 | $418,767 | $104,692 | $71,393 | $285,572 |
| III | Civic Duty | 2 | 891 | $3,331,168 | 20 | 13 | $130,016 | $65,008 | $31,710 | $ 63,419 |
|  | Control | 2 | 837 | $3,007,232 | 16 | 9 | $66,597 | $33,299 | $ 0 | $ 0 |

NOTE: The table shows how much additional revenues were generated by the different treatments.

Table 5: Difference in Mean Tests

| Main Sample | | |
|---|---|---|
| parameter | estimate | std error |
| Intercept | 112.17 | 17.52 |
| Threat | 30.47 | 36.18 |
| Service | 90.33 | 57.85 |
| Civic | 21.12 | 33.90 |
| Non-Commercial Sample | | |
| parameter | estimate | std error |
| Intercept | 114.56 | 17.95 |
| Threat | 33.71 | 37.46 |
| Service | 21.51 | 26.97 |
| Civic | 18.48 | 34.97 |
| Unique Owner Sample | | |
| parameter | estimate | std error |
| Intercept | 79.56 | 12.73 |
| Threat | 46.81 | 29.86 |
| Service | 159.18* | 70.50 |
| Civic | 66.35 | 38.74 |
| * indicates $p < 0.05$. | | |

errors.

Table 5 shows there is a fair bit of heterogeneity among treatments. The differences in means is \$90 for the Service treatment, \$21 for the Civic Duty treatment, and \$30 for the Threat treatment. The results are qualitatively similar for the two other samples, but there are some important quantitative differences. If we restrict attention to the subsample of non-commercial properties, we find that the Service treatment raises a much smaller amount than in the full sample. This suggests that excluding a relatively small number of commercial property owners affects the magnitude of the overall effects. If we restrict attention the properties of sole owners, all treatments appear in a more positive light as the intake of the control group drops precipitously. While the differences in means are suggestive of an average positive impact of the treatment letters on taxpayer compliance, only one of the nine key coefficients is significantly different from zero at conventional significance levels.

# 5    Analysis of Discrete Compliance Outcomes

## 5.1   Specification

To gain some additional insights into the nature of compliance, we consider two discrete compliance outcomes, denoted by $y \in \{0, 1\}$. In the first case, $y = 1$, if the taxpayer made any payment at all ("ever paid"), 0 otherwise. In the second case $y = 1$, if the taxpayer made a full payment of their taxes owed ("paid in full"), 0 otherwise. Both responses are of potential interest. Paid in full is of obvious interest to DoR as this is a measure of how well the city does in collecting taxes owed. Even the small payments measured in ever paid are of interest, however. First, every dollar helps. Second, making even a small payment, rather than no payment at all, stands

as recognition that the citizen still values, however modestly, their relationship to the city government and its governance; that is, they have not "dropped out."

We specify and estimate compliance as a logistic function of the control and three treatments, with each estimated effect measuring the treatment's impact on tax payment relative to that available from receipt of the control letter. Generally, for $y = 1$ if the individual pays their taxes, and 0 otherwise, the probability of paying taxes can be specified as:

$$Pr\{y = 1\} \ = \ \frac{exp(X'\beta)}{1 + exp(X'\beta)}$$

where $X$ is a vector of explanatory variables and $\beta$ a vector of coefficients to be estimated.

The benefits of the logistic specification, over the more familiar linear specification, is that once estimated the computed probabilities of payment are bounded between 0 and 1, and the partial effect of any of the independent variables on the probability of payment can vary according to the overall value of $X'\beta$. For our analysis, the vector of explanatory variables $X$ will include three (1,0) indicator variables for whether the taxpayer received a Threat Letter, a Service Letter, or a Civic Letter, respectively. The omitted category is receipt of the reminder control letter.

The estimated coefficient for each treatment letter will allow us to compute the marginal impact on payment of that letter over that of the usual (revised) reminder letter. A positive and statistically significant value of the coefficient for a treatment letter indicates that this letter encouraged more tax payments than did the control letter; conversely so, for a negative and statistically significant value of the coefficient.

We also explore how payment behaviors may vary across the level of taxes owed. Each taxpayer is assigned to one of four categories of tax debt: LOW (Less than $300), MODerate ($300 to $1300), HIGH ($1301 to $3300), and Very HIGH (Greater

than \$3300). The taxpayer is assigned a value of 1 if they tax bill falls within a debt level, and 0 otherwise. The omitted debt level for comparison is LOW. In addition, we allow for an interaction of each debt level with each treatment letter to explore the possible advantages of targeting treatment letters to taxpayers of varying debt levels.

Finally, while care has been taken to randomly assign the treatment and control letters across taxpayers, and our initial balance tests reported above suggest that we have been successful along the broad categories of taxes owed and years of tax debt, property values and property type, and property size and land area, the question remains of whether taxpayer compliance behaviors might vary along other attributes of the property or the taxpayer. If so, and if compliance behavior is correlated with these excluded variables, then the estimated effects on payment behavior of the treatment letters may be biased. To control for this possibility, we also include in our basic logistic regression as elements of X measures of the location of the property within one of ten city neighborhoods (each a City Council District), the exterior condition of the property (classified as a "sealed/compromised," i.e. dilapidated and dangerous), and whether the property qualified for a low income homestead exemption.

## 5.2   Results

Table 6 summarizes the estimates and the estimated standard errors for the three samples that we considered above. We report robust standard errors that are clustered to deal with multiple ownership. As can be seen from Table 6, the service appeal and the threat treatments had no significant effect on "ever paid" at the conclusion of the 30 day payment period. The Civic Duty treatment is consistently positive and statistically significant at least the 10 percent level of confidence and at the 5 percent

level for the sample of sole owners.

Table 6: Logistic Regressions – Ever Paid

|  | Full Sample | Non-Commercial | Sole Owner |
|---|---|---|---|
| Intercept | −1.69*** | −1.67*** | −1.68*** |
|  | (0.08) | (0.08) | (0.10) |
| Service | −0.07 | −0.10 | 0.04 |
|  | (0.10) | (0.10) | (0.12) |
| Civic Duty | 0.21 | 0.19 | 0.30* |
|  | (0.11) | (0.11) | (0.13) |
| Threat | −0.09 | −0.06 | −0.03 |
|  | (0.15) | (0.15) | (0.17) |
| Log Likelihood | -2136.16 | -2068.89 | -1758.95 |
| Num. obs. | 4927 | 4749 | 3888 |

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

NOTE: This table reports the parameter estimates from the basic Logit Model that uses "ever paid" as outcome.

Next we investigate whether there is heterogeneity in response to the treatment. It is plausible that tax payers who owe small amounts of money behave differently than those who owe larger amounts. To gain insight into this possibility we include in our regression for "ever paid" the indicator variables for the levels of taxes owed - LOW, MOD, HIGH, and VHIGH - and the interaction of those variables with our three treatments. The variable LOW is omitted from the regression so all results provide comparisons to the behavior of those in the higher debt levels to taxpayers in the lowest level of taxes owed. Table 7 summarizes the estimates and the estimated

standard errors for the full sample and the two subsamples.

Table 7: Logistic Regressions – Ever Paid

|  | Full Sample | Non-Commercial | Sole Owner |
|---|---|---|---|
| Balance MOD | $-0.46^*$ | $-0.52^*$ | $-0.33$ |
|  | (0.21) | (0.22) | (0.24) |
| Balance HIGH | $-1.03^{***}$ | $-0.97^{***}$ | $-1.54^{***}$ |
|  | (0.24) | (0.24) | (0.30) |
| Balance VHIGH | $-1.25^{***}$ | $-1.15^{***}$ | $-1.36^{***}$ |
|  | (0.30) | (0.30) | (0.33) |
| Service | $-0.30$ | $-0.34$ | $-0.34$ |
|  | (0.18) | (0.19) | (0.20) |
| Service*Balance MOD | 0.00 | 0.00 | 0.00 |
|  | (0.00) | (0.00) | (0.00) |
| Service*Balance HIGH | 0.06 | 0.08 | $-0.11$ |
|  | (0.16) | (0.16) | (0.18) |
| Service*Balance VHIGH | $0.40^*$ | $0.42^*$ | 0.33 |
|  | (0.20) | (0.20) | (0.21) |
| Civic Duty | 0.16 | 0.13 | 0.21 |
|  | (0.19) | (0.19) | (0.21) |
| Civic Duty*Balance MOD | $0.54^{**}$ | $0.58^{***}$ | $0.58^{**}$ |
|  | (0.17) | (0.17) | (0.18) |
| Civic Duty*Balance HIGH | $-0.08$ | $-0.07$ | $-0.19$ |
|  | (0.17) | (0.17) | (0.18) |
| Civic Duty*Balance VHIGH | $-0.49^{**}$ | $-0.45^*$ | $-0.61^{**}$ |
| Continued on next page | | | |

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Table 7 – continued from previous page

|  | Full Sample | Non-Commercial | Sole Owner |
|---|---|---|---|
|  | (0.17) | (0.17) | (0.19) |
| Threat | −0.05 | −0.01 | −0.13 |
|  | (0.26) | (0.26) | (0.29) |
| Threat*Balance MOD | 0.07 | 0.10 | 0.11 |
|  | (0.16) | (0.16) | (0.17) |
| Threat*Balance HIGH | −0.50** | −0.49** | −0.64*** |
|  | (0.17) | (0.18) | (0.19) |
| Threat*Balance VHIGH | −0.04 | −0.03 | −0.20 |
|  | (0.16) | (0.16) | (0.17) |
| Log Likelihood | -2010.55 | -1948.32 | -1639.28 |
| Num. obs. | 4927 | 4749 | 3888 |

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$. Control coefficients omitted.

NOTE: This table reports the parameter estimates from the

Logit Model with interactions that uses "ever paid" as outcome.

Table 7 shows the indicator variables for taxes owed by quartile are significantly negative - that is, the more a taxpayer owes the less likely he is to pay their taxes. The Civic Duty treatment helps to moderate this growing negative effect of tax debt, but only for those who owe a moderate amount of taxes. For taxpayers with a very large tax debt, the Civic Duty letter discourages payment. Exactly the opposite responses are observed for those who receive the Public Service letter. Those with low or moderate levels of taxes owed react negatively or not at all to the service letter, while those with high levels of taxes owed are more likely to make a contribution when

they receive the Public Service letter. The Threat letter never helps tax payment and significantly discourages payment by those with high levels of taxes owed. One can speculate as to why motives for payment are tied to the levels of taxes owed - civic duty is "price elastic" and free riding falls with larger property holdings and greater payments - but the important conclusion here is that treatment strategies need to be targeted strategies.

Table 8: Marginal Predictions – Ever Paid

|  | LOW | MOD | HIGH | VHIGH |
|---|---|---|---|---|
| Control | 23.40 | 16.10 | 9.80 | 8.00 |
| Service | 18.50 | 12.70 | 12.10 | 11.40 |
| Civic Duty | 26.40 | 15.20 | 14.40 | 8.20 |
| Threat | 22.40 | 12.20 | 13.40 | 7.10 |

NOTE: This table reports the marginal effects from the Logit Model with interactions that uses "ever paid" as outcome.

Table 8 shows the marginal predictions for the probability that properties in each treatment group and for each quartile of taxes owed will make some payment ("ever paid"). The values here represent the predicted probability of payment, computed for the "average taxpayer" as represented by the sample average level of all indicator control variables and the median values of the continuous control variables. Here we observe the final impacts of the treatments as they apply to taxpayers with different levels of taxes owed. The Civic Duty letter increases the chance of payment over the control letter for taxpayers with low debt by about 3 percentage points and for taxpayers with relatively high payments by as much 4 percentage points. The Public

Service letter is most effective for taxpayers with very high levels of taxes owed.

Next we examine whether our treatment strategies might also impact the larger matter: When do taxpayers pay their full amount of taxes owed? The ever-paid outcome does not differentiate between taxpayers that made full payment and those who made only a partial contribution.

Table 9 presents the results for the Logit specification for the outcome "paid in full" by the end of our 30 day payment period. Again the analysis is separated into that for the full sample and the two subsamples. The results are similar to those for "ever paid." The Threat letter is never effective. The Public Service letter discourages full payment while the Civic Duty letter encourages full payment.

Table 10 presents the results that allow for the influence of taxes owed - MOD, HIGH, and VHIGH - on "paid in full." Owing more taxes reduces the likelihood of paying in full and the negative effect increases with the level of taxes owed. These effects are even larger than those in the "ever paid" analysis suggesting that many tardy taxpayers in the higher quartiles of taxes owed make only partial payments when the respond (if at all) to the control and treatment letters. We continue to see the negative impact of the Public Service letter on full payment, but again, as for ever paid, the strong negative effect disappears for those with the greatest tax debts. The letter that has the greatest positive impact on encouraging full tax payment is the Civic Duty letter, and this is particularly so for those with low and moderate levels of taxes owed.

Table 9: Logistic Regressions – Paid in Full

|  | Full Sample | Non-Commercial | Sole Owner |
|---|---|---|---|
| Intercept | $-2.23^{***}$ | $-2.22^{***}$ | $-2.29^{***}$ |
|  | (0.10) | (0.10) | (0.12) |
| Service | $-0.42^{**}$ | $-0.44^{**}$ | $-0.29$ |
|  | (0.13) | (0.14) | (0.15) |
| Civic Duty | 0.24 | 0.24 | $0.41^{**}$ |
|  | (0.14) | (0.14) | (0.16) |
| Threat | $-0.21$ | $-0.18$ | $-0.04$ |
|  | (0.19) | (0.20) | (0.21) |
| Log Likelihood | -1435.15 | -1395.06 | -1175.05 |
| Num. obs. | 4927 | 4749 | 3888 |

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

NOTE: This table reports the parameter estimates from the basic Logit Model that uses "paid in full" as outcome.

Table 10: Logistic Regressions – Paid in Full

|  | Full Sample | Non-Commercial | Sole Owner |
|---|---|---|---|
| Balance MOD | −1.28*** | −1.42*** | −1.35*** |
|  | (0.27) | (0.28) | (0.31) |
| Balance HIGH | −2.32*** | −2.18*** | −3.18*** |
|  | (0.39) | (0.37) | (0.61) |
| Balance VHIGH | −3.27*** | −2.85*** | −3.83*** |
|  | (0.74) | (0.61) | (1.03) |
| Service | −0.45* | −0.49* | −0.49* |
|  | (0.19) | (0.20) | (0.22) |
| Service*Balance MOD | 0.00 | 0.00 | 0.00 |
|  | (0.00) | (0.00) | (0.00) |
| Service*Balance HIGH | −0.27 | −0.23 | −0.54* |
|  | (0.23) | (0.24) | (0.26) |
| Service*Balance VHIGH | 0.61* | 0.65* | 0.49 |
|  | (0.26) | (0.26) | (0.27) |
| Civic Duty | 0.25 | 0.22 | 0.29 |
|  | (0.19) | (0.19) | (0.22) |
| Civic Duty*Balance MOD | 1.01* | 0.99* | 1.06* |
|  | (0.42) | (0.42) | (0.46) |
| Civic Duty*Balance HIGH | −0.18 | −0.13 | −0.33 |
|  | (0.25) | (0.25) | (0.26) |
| Civic Duty*Balance VHIGH | −0.39 | −0.32 | −0.54* |
|  | (0.23) | (0.23) | (0.25) |
| Continued on next page | | | |

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Table 10 – continued from previous page

|  | Full Sample | Non-Commercial | Sole Owner |
|---|---|---|---|
| Threat | −0.07 | −0.03 | −0.05 |
|  | (0.27) | (0.27) | (0.29) |
| Threat*Balance MOD | 0.21 | 0.25 | 0.13 |
|  | (0.22) | (0.22) | (0.24) |
| Threat*Balance HIGH | −0.64** | −0.65** | −0.80** |
|  | (0.25) | (0.25) | (0.27) |
| Threat*Balance VHIGH | 0.20 | 0.22 | −0.03 |
|  | (0.22) | (0.22) | (0.24) |
| Log Likelihood | -1150.17 | -1120.45 | -919.68 |
| Num. obs. | 4927 | 4749 | 3888 |

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$. Control coefficients omitted.

NOTE: This table reports the parameter estimates from the

Logit Model with interactions that uses "paid in full" as outcome.

These impacts are seen most clearly in Table 11 (constructed as was Table 8) which presents the predicted probabilities for payment in full for the control letter and each of the three treatment letters, disaggregated by the level of taxes owed. The Civic Duty letter has strongest effect on the decision by tardy taxpayers to meet their full tax obligations.

Our study reveals there is heterogeneity in response to different treatments. A preferred overall strategy might take advantage of these differential responses of taxpayers to the treatment letters. More research is clearly needed to assess the efficiency of targeted reminding strategies.

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Table 11: Marginal Predictions – Paid in Full

|            | LOW   | MOD  | HIGH | VHIGH |
|------------|-------|------|------|-------|
| Control    | 19.90 | 6.40 | 2.40 | 0.90  |
| Service    | 13.60 | 4.00 | 2.90 | 1.20  |
| Civic Duty | 24.10 | 6.90 | 3.10 | 1.80  |
| Threat     | 18.80 | 3.50 | 4.20 | 0.90  |

NOTE: This table reports the marginal effects from the Logit Model with interactions that uses "paid in full" as outcome.

# 6   Conclusions

This field experiment evaluated three alternative notification strategies intended to increase property tax compliance. We have implemented our experiment in collaboration with Philadelphia's Department of Revenue (DoR). We feel this initial study of property tax compliance in Philadelphia has value for at least three reasons. First, it is the first study that systematically examines alternative tax compliance strategies for taxation in a large city. Second, the study of property tax compliance for which there is a known tax liability has allowed us to focus directly on motives for paying taxes. Third, great care was given to separately specify, identify, and directly compare the three common motives for tax payment that play a prominent role in the tax compliance literature.

Our findings provide tentative support that appeals both to public services provided and to a citizen's sense of civic duty can improve tax compliance. These findings are consistent with other recent tax compliance experiments (Fellner, Sausgruber, and

Traxler 2013). Providing social information about tax compliance provides a modest increase in collection (Wenzel and Taylor 2004; Wenzel 2005; Hallsworth et al. 2014).

In contrast to several papers that show the benefits of audit threats (Kleven et al. 2011; Slemrod, Blumenthal, and Christian 2001), we find no support for use of a threats over that of DoR's usual reminder of taxes owed. It would be useful to examine the benefits of an intervention with a more specific threat, such as randomly assigning tax delinquents to publicity in a local newspaper or website. Alternatively, one could add more local specificity to the notification letter. For example, one could provide information about local sheriff sales or foreclosures. More research is clearly needed to determine effective notification letters that reinforce the likelihood of fines and penalties.

There are limitations to our study, of course. Strictly speaking, our conclusions apply only to Philadelphia taxpayers, and among those citizens, only those who are tardy in paying their taxes. Second, our sample of taxpayers is small, only 4900 in total. And finally, while our focus on property tax compliance has the advantage of allowing us to more cleanly identify motives for tax payments, Philadelphia and other cities raise significant revenues from wage taxes, income and profits taxes, sales taxes, and fees. Payment compliance for cities for these other revenue instruments deserves careful analysis too. All said, however, we feel our work here is an encouraging first step towards introducing the new methodologies of tax compliance into the practice of city government finances.

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# Appendix A: Figures 1 through 5

Figure 1: Standard Due Letter

PO BOX 148
PHILA PA 19105-0148

CITY OF PHILADELPHIA
DEPARTMENT OF REVENUE

I...III.I ........ II..II....IIII...I
RICHARD ROE
5107   DUNLAP   ST
PHILADELPHIA   PA
19131

AUGUST 12, 2014

TEMP: 000359764
NOTICE SflIAllHIMOflia
Phone: (215) 686-6442

Property: 5707 DUNLAP ST

## REAL ESTATE TAX BILL
Includes payments posted through AUGUST 07, 2014

This bill represents the real estate tax liabilities for this account You must pay these liabilities immediately.
Interest, penalty, and/or additions have been calculated to the due date. Additional amounts will accrue after
that date. Only payment in full or a payment agreement will prevent enforcement action.

**THIS BILL MAY NOT REPRESENT YOUR TOTAL TAX LIABILITY**

| BRT Number | Period | Tax Due Balance | Additions/ Interest | Penalty | Charges | Total Amount Due |
|---|---|---|---|---|---|---|
| 023459700 | 2014 | 755.76 | 68.02 | 0.00 | 0.00 | 823.78 |
| Total | | 755.76 | 68.02 | 0.00 | 0.00 | 823.78 |

--------------- DETACH HERE --------------------------
RETURN THIS PORTION WITH PAYMENT

PAYMENT DUE: $823.78
ON OR BEFORE SEPTEMBER 06, 2014
AMOUNT ENCLOSED:

MAKE  CHECKS  PAYABLE  TO:

CITY OF PHILADELPHIA

NOTICE #: 5518914149812
RICHARD ROE
TEMP: 000359764

DEPARTMENT OF REVENUE
P.O. BOX 148
PHILA, PA 19105-0148
I.,.III.I,,,.-(III....I.I.II.................II.I..II..I....I

333bIl231TTQ0DD5flIflTIM140fll20000000D00D000D000DD0000D00D00DITfil]i0500

N000200n HFAl FSTATF TAX BILL 466

44

45

Figure 2: Treatment 1: Deterrence

# Not paying your
# Real Estate Taxes is
# breaking the law.

Failure to pay your Real Estate Taxes may result in seizure or sale of your property by the City.

Do not make the mistake of assuming we are too busy to pursue your case.

Contact the **Department of Revenue** as soon as possible at 215-686-6442, M-F 8:30AM-5PM, or by e-mail at <u>revenue@phila.gov</u> to arrange for payment.

---

**CITY OF PHILADELPHIA DEPARTMENT OF REVENUE**

For more information visit the Department of Revenue website at **www.phila.gov/revenue or call 215-686-6442.**

Stay connected

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Commissioner Clarena I.W. Tolson, Chief Revenue Collections Officer • 1401 JFK Boulevard, Concourse Level Philadelphia, PA 19102

Figure 3: Treatment 2: Service Appeal

# We understand that paying your taxes can feel like a burden.

We want to remind you of all the great services that you pay for with your Real Estate Tax dollars.

Your tax dollars pay for schools to teach our children. They also pay for the police and firefighters who help keep our city safe. Please pay your taxes as soon as you can to help us pay for these essential city services.

Contact the **Department of Revenue** as soon as possible at 215-686-6442, M-F 8:30AM-5PM, or by e-mail at revenue@phila.gov to arrange for payment.

CITY OF PHILADELPHIA
DEPARTMENT OF REVENUE

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Figure 4: Treatment 3: Civic Duty

**You have not paid your
Real Estate Taxes.**

Almost all of your neighbors pay their fair share--9 out of 10 Philadelphians do so. Paying your taxes is your duty to the city you live in. By failing to pay, you are abusing the good will of your Philadelphia neighbors.

Contact the **Department of Revenue** as soon as possible at 215-686-6442, M-F 8:30AM-5PM, or by e-mail at revenue@phila.gov to arrange for payment.

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DEPARTMENT OF REVENUE**

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Stay connected

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Figure 5: Control

**The enclosed bill details your
outstanding Real Estate Taxes
due to the City of Philadelphia.**

Contact the **Department of Revenue** as soon as
possible at 215-686-6442, M-F 8:30AM-5PM, or by
e-mail at revenue@phila.gov to arrange for payment.

CITY OF PHILADELPHIA
DEPARTMENT OF REVENUE

For more information visit the Department of
Revenue website at **www.phila.gov/revenue or
call 215-686-6442.**

Stay connected

Commissioner Clarena I.W. Tolson, Chief Revenue Collections Officer • 1401 JFK Boulevard, Concourse Level Philadelphia, PA 19102