

Detering Delinquency: A Field Experiment in Improving Tax Compliance Behavior

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Abstract

Property taxes play a central role in the financing of municipal government services. Yet, municipal governments commonly confront problems with property tax collection even when the tax base is known. There is surprisingly little evidence on what authorities can do to increase property tax compliance. This paper analyzes seven different property tax notification strategies through a randomized controlled experiment conducted with the City of Philadelphia. All seven notification strategies increase property tax compliance over the usual approach of simply sending a bill. The most effective notifications are the those that threaten to take out a lien on the property or to foreclose by sheriff's sale for continued failure to pay taxes. The results suggest that economic motives to pay property taxes are more effective than those that appeal to social norms.

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

1 Introduction

Property taxation plays a central role in the financing of municipal government services in the United States. As a matter of practical local government finance, it is the mainstay of city and school district budgets. In 2013, over 72 percent of all local government tax revenues and nearly 50 percent of all own revenues came from property taxation. The potential economic advantages and disadvantages of a local property tax are well known. With mobile households and local zoning the property tax approximates a benefit for the financing of local services (Hamilton, 1975). In cities with stagnant growth property taxes will have adverse effects on new construction and home improvements. In growing cities property taxes approximates a land tax that is proportional to a wealth tax and attractive from an equity standpoint.¹

The collection of property taxes has one very important administrative advantage over the collection of other taxes: the legal tax obligation is known to the taxpayer and the taxing authorities. Self-reporting of tax bases, as required for income, profits, sales, and VAT taxes, is not needed for the property tax. Each taxpayer has an assigned tax base, the value of their property, against which a common tax rate is assessed. This avoids problems of misreporting tax bases or working outside the formal or taxable economy.²

Yet, local taxing authorities commonly confront challenges in collecting property taxes. Standard enforcement strategies—such as liens and foreclosures—are time intensive and costly to implement. The inherent problems associated with standard enforcement activities raise the question whether there are lower-cost alternatives that can enhance revenue collection. In this paper we conducted a randomized field experiment to assess the efficacy of different property tax notification strategies in City of Philadelphia.

For all these virtues to be realized, it is essential that the property tax be collected, both

¹See, for example, Aaron (1975) and Mieszkowski (1972).

²See Blumenthal, Christian, Slemrod, and Smith (2001), Kleven, Knudsen, Kreiner, Pedersen, and Saez (2011), and Pomeranz (2015).

efficiently and fairly. Among large U.S. cities, this is not assured. Because of the importance of the tax to city budgets, even small differences in collection rates can significantly affect the provision of local public services. While the average yearly rate of tax collection is 95 percent among a sample of large cities in the U.S., many cities collect only 90 percent of taxes due, and several cities do far worse. Among the poorest performers are Cleveland (84%), Detroit (68%), Flint (64%), Milwaukee (86%), and Pittsburgh (85%). While the poorest performers are all high-poverty cities, poverty alone is an inadequate explanation for their performance. There are many high-poverty cities that in fact collect almost all of their property taxes; for example, Baltimore (96%), Birmingham (98%), Dallas (98%), Houston (98%), Minneapolis (98%), and even New Orleans (95%).³ These high-poverty, high-tax-compliance cities suggest that other factors are likely at work. This paper explores one of these factors: tax collection strategies. The administrative issue for the property tax is simple: did the taxpayer pay the tax on time or not? If not, what can the tax administrator do to enforce compliance? Answering these questions is important, as there is considerable disagreement on how to ensure property tax compliance.

The most common strategy to enforce compliance are fines and penalties. Failure to pay property taxes on time leads to interest charges sufficiently large as to preclude any arbitrage advantage to waiting, and perhaps a significant late fine. Fines, however, 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 unviable and as empty threats; or, in the extreme, as a breakdown of cooperative democratic governance.

When a delinquent tax payer does not respond to penalties and fines, the city can take out a tax lien on the property. After a tax lien has been obtained, it can also start the foreclosure process. A tax lien is a lien imposed by law upon a property to secure the payment of taxes. Before the owner can sell the property and give clear title to the buyer, he must pay off the lien. However, a lien does not impose a direct, tangible cost on a delinquent

³For a more detailed analysis see Chirico, Inman, Loeffler, MacDonald, and Sieg (2016).

taxpayer and thus may only provide weak incentives to comply with the tax laws. Moreover, liens are ineffective tools to collect tax debt if the property will not be transacted in the market (i.e., at arms' length), or is believed to be such by the current owner. If, for example, the transaction occurs within a family, it may not require an official transfer of the deed – and even official deed transfers may occur at nominal prices and be exempted from rules governing arms-length sales.

A city can sell tax liens to investors.⁴ Properties often sell for a premium at lien auctions. This means that the lien holder gets zero percent interest and actually pays a premium to acquire the lien with the hope of foreclosing and obtaining clear title to the property. However, selling liens to “vulture investors” can be costly from a political perspective.

Lien holders can start the foreclosure process if they do not recover the taxes in due time. When the owner of a property located in a city fails to make a payment arrangement on municipal debt levied on his/her property, that property may be sold at auction (administered in Philadelphia by the Office of the Sheriff) to allow the city to collect on that unpaid debt. However, the foreclosure process is costly and time-intensive. In Philadelphia, the process of offloading a property at sheriff's sale can take nine months to a year. Given that the median outstanding tax debt in Philadelphia in a single year is typically less than \$1,000, sheriff sales may not be cost effective for a variety of properties with low-to-median market values.

Given the inherent problems associated with standard enforcement strategies, attention has turned to low-cost alternatives. The main option for cities is to develop more effective notification strategies. In this paper we explore the efficacy of seven “nudges” for improved property tax collection Philadelphia.⁵ Our first nudge strategy is a simple reminder letter to the taxpayer that their taxes are due; the letter is identical in content to the initial tax

⁴In July 2015 the City of Philadelphia tried to auction off 865 liens online. The results were disappointing. The city sold only 28 percent of the liens for a total of \$2.1 million, according to data from the city's revenue department. (Philadelphia Magazine, 2015). One potential problem of this sale was that the minimum bid for the liens might have been priced too high.

⁵For a survey on field experiments see Harrison and List (2004).

bill listing the tax due and any penalties for late payments. The reminder letter will be our “control nudge” and is meant to address non-payment due to forgetfulness or oversight.

The second set of strategies are meant to address an economic motive for non-payment. The delinquent taxpayer is assumed to be making an economic calculation that by not paying there is a positive probability that delinquency will go undetected or if detected, ignored for administrative reasons, and that the expected economic gains of not paying exceed the expected economic costs of being caught and fined (Allingham and Sandmo, 1972). In most real world tax settings, the probability of being caught and the size of the likely sanction are both too low to rationally account for most observed levels of taxpayer noncompliance (Alm, McClelland, and Schulze, 1992).⁶ Here, we test for the effect of two nudges addressing potentially large economic consequences – one where delinquent taxes plus a graduated fine growing over time are collected as a “lien” on the property at sale, and a second where the property is seized for auction (at sheriff’s sale), with a portion of the proceeds used to pay delinquent taxes and penalties. The lien imposes a growing real dollar future loss on the delinquent taxpayer as the interest rate for penalties exceeds the taxpayer’s alternative rate of return. The sheriff’s sale imposes an immediate economic loss, and further requires the delinquent taxpayer to find a new residence. Both of these nudges threaten large economic and, in the case of the sheriff’s sale, large psychic costs for continued noncompliance.

Two additional nudges appeal to what Luttmer and Singhal (2014) have called “tax morale.” First, we remind taxpayers that their payments do provide valuable public services. Here we seek to address noncompliance due to a desire by taxpayers to free-ride on the payments of their neighbors or of Philadelphians generally. The first free-rider strategy seeks to motivate payment by reminding the taxpayer that his payments go to providing services for his family and his immediate neighbors and lists specific amenities in their vicinity likely

⁶An alternative specification for taxpayer utility that allows for loss aversion has done a better job in explaining taxpayer compliance among Swedish taxpayers than did the classical expected utility specification with always-declining marginal utilities in income; see Engström, Nordblom, Ohlsson, and Persson (2015).

to be affected; we call this strategy the “neighborhood” nudge. The second free-rider strategy reminds the taxpayer that his taxes support important city-wide services such as education and public safety. We call this strategy the “community” nudge.

A final set of nudges appeals to a possibly deeper motive for tax compliance – fulfilling one’s obligations to a self-identified community of peers (Posner, 2000) or to an abstract community of citizens (Rawls, 1971). The former of these community strategies we call the “peer” nudge; the latter we call the “civic duty” nudge.

The seven nudge strategies for increased taxpayer compliance are first compared to the alternative of doing nothing beyond sending the first tax bill. We then compare the seven nudge strategies among themselves to see which are most effective in encouraging taxpayer compliance.

Our experiment started in the beginning of June 2015. No other enforcement activities were undertaken by the City until the middle of August 2015. It is, therefore, useful to distinguish between the short- and long-term impacts of our intervention. Short term outcomes are those that measure compliance up to three months into the experiment. These outcomes are clean measures of the impact of the intervention since no other enforcement activities took place during that time period. In the short term, we find that most of our nudge strategies significantly outperform the “do nothing” alternative both in the rate of taxpayer compliance and in the level of payments, conditional on compliance. Second, among the seven nudges, the most effective in encouraging tax payment are the two economic strategies that threaten large financial (“lien”) or financial and psychic (sheriff’s sale) penalties.

After one month, approximately 30 percent of all taxpayers in the holdout (“do nothing”) sample had made some contribution towards their tax liabilities. In contrast 40 percent of taxpayers that received the lien letter and 37 percent that received the sheriff’s sale letters had made payments. The results are similar after three months of the intervention. Fifty-one percent of all households in the holdout sample had made some contribution after three months, versus 61 percent for the lien and 60 percent for the sheriff’s sale letters. Reminder

letters also improved the level of tax payments, given that the taxpayer complied. The three-month impact of these two letters was approximately \$75 per letter. Receiving a reminder letter improved taxpayer compliance in the short run, with the lien and sheriff’s sale letters the most effective.

We also consider long-term outcomes measured six months after our experiment. While our experimental design is still valid for these outcomes, it is harder to interpret the findings since other interventions occurred during that time period, such as enforcement activities by collection agencies. In particular, the city contracted with one private collection agency. These collectors primarily use phone calls to contact tardy tax payers and threaten them with penalties and fines to obtain compliance. All taxpayers that have not paid the taxes are subject to this uniform second treatment by the collection agency. Our estimates of the longer term treatment effects thus reflect two treatments: our initial letter treatment plus the phone calls performed by the collection agency. Since we were not able to randomize on the treatment by the collection agency, we can only identify the effect of the joint treatments.

Our findings with respect to longer-run outcomes indicate that there was at least some convergence in the effectiveness of the nudge strategies. After 6 months, 73 percent of households in the holdout sample had made some payments to the City. The only letters that significantly improve the compliance above that rate were the lien and sheriff letters, which increased compliance by 3 to 4 percentage points. The six-month impact of these two letters was approximately \$31 per letter relative to the holdout sample and \$21 relative to the control letter. As such it is clear that there has been a fair amount of convergence in the effectiveness of the different treatments at the six month stage. We do not know whether this convergence in the effectiveness is due to additional treatment by the collection agency or whether it would have also occurred in the absence of the second treatment.

We find that the impact of all of our six letters relative to the holdout or control group is much attenuated after six months. This finding is consistent with the view that the enforcement methodologies of the collection agency are probably more closely aligned with

our deterrence letters than with the other five letters that we explored. As a consequence it is not surprising that we find some strong convergence in the effectiveness of all treatments after six months. Finally, we investigated whether our experiment had any spill-over effects into the following tax year. Looking at compliance rates through July 11, 2016, we find no statistically detectable impact of any of our letters on subsequent-year compliance.

Ignoring the opportunity costs of time, the cost of our experiment was a mere \$23,000. Our back-of-the-envelope calculations suggest that our experiment generated approximately \$690,000 after three months. We estimate that if extended to the whole of our sample of delinquent taxpayers, the two most effective nudges – the lien or sheriff’s sales reminders – have the potential to increase collected revenues during each tax year by as much as 3 to 4 million dollars.

The rest of the paper is organized as follows. Section 2 contains a brief literature review. Section 3 discusses details of our field experiment including a detailed description of the treatments and the randomization procedure. Section 4 discusses our randomization procedure. Section 5 reports the main empirical findings. Section 6 offers conclusions and briefly discusses the policy impact of our experiment and discussions on enforcement activities in the City of Philadelphia.

2 Literature Review

Our study is related to different branches of the empirical literature on tax compliance. Early empirical studies focused the effectiveness of penalties and fines and found little impact of such penalties on aggregate tax compliance (Slemrod, 2007). More recently studies have found an impact of threats of fines on increasing tax payments among individuals for an Austrian TV license fee (Fellner, Sausgruber, and Traxler, 2013) and for rental incomes (Wenzel and Taylor, 2004). Hallsworth, List, Metcalfe, and Vlaev (2014) also find the speed with which taxpayers pay their liabilities can also be improved with increased fines. In

contrast, Ariel (2012) find that threats of fines reduced corporate tax compliance in Israel.

A range of alternative theories have been suggested to explain taxpayer compliance behaviors.⁷ First is incomplete information. Perhaps taxpayers are honest, but simply do not understand what their true obligations are. Tax forms and regulations can be complicated. A recent study of Finnish small business owners showed that explicitly mentioning the rate change in VAT as part of a general questionnaire regarding tax administration significantly increased tax compliance to the higher rate Kosonen and Ropponen (2015).

Second is dishonesty – true obligations may be known to the taxpayer, but they may choose to cheat. They can do so in two ways. When taxes are self-assessed (e.g., income tax, VAT, profits), taxpayers can under-report incomes or sales and over-report costs and purchases, or they can simply not pay by working outside the formal economy. Research on Danish and Chilean taxpayers found that taxpayers’ reported incomes and value-added sales increased as the ability of the tax administration to independently assess those income and sales improved via outside reporting Kleven et al. (2011) and Pomeranz (2015). Reported taxable incomes by Minnesota residents were also found to increase when the probability of an official tax audit was increased (Slemrod, Blumenthal, and Christian, 2001).

When tax obligations are known to both the taxpayer and the tax authorities, citizens may still choose to cheat if the likelihood that they will be detected, prosecuted, and/or fined are low. From the economic model of tax compliance, taxpayers make their decision to comply by balancing the economic savings from non-payment against the uncertain costs they bear from being caught and fined as first specified by Allingham and Sandmo (1972). In most studied instances of tax compliance, however, the probability of being caught and the associated fines are too low to rationally account for the observed high rates of tax compliance. Nor can the answer be found in any plausible estimate of taxpayer risk aversion (Alm et al., 1992). Efforts to understand taxpayer compliance need to consider explanations beyond the narrow framework of individual utility maximization under uncertainty.

⁷For a survey, see, Andreoni, Erard, and Feinstein (1998).

There are two extensions of the usual economic framework to consider. The first re-specifies the taxpayer’s utility from income to allow for non-convex reactions to equal gains and losses. A recent study of Swedish taxpayers finds loss aversion as defined by prospect theory can account for taxpayer compliance in a way that classical utility maximizing behavior with risk aversion cannot (Engström et al., 2015). Taxpayers facing a loss from a \$1000 tax payment were significantly more likely to overstate allowed deductions than taxpayers facing a \$1000 refund for the same deductions.

The second extension retains the classic specification for taxpayer welfare from income, but adds ”tax morale” as one or more additional motives for payment (Luttmer and Singhal, 2014). Tax morale includes reciprocity or payment for public goods received; norm behavior or peer effects; and civic duty. Reciprocity argues that citizens understand that to not pay their taxes will mean less public services. In this case, government services along with after-tax income determine taxpayer welfare. One would expect this motive to be strongest when tax payments are directly linked by the taxpayer to services received like local street repairs. Peer effects may arise when citizens view non-payment as a violation of a community norm of collective compliance and an individual’s non-payment is observed by others in the community. Here, how many other taxpayers are compliant matters to whether the citizen also pays (Posner (2000)). One might expect this motive to be strongest when a citizen’s non-payments are publicized and the citizen is actively linked to a community group that benefits from those payments. Finally, citizens may pay their tax obligation because they view it as the “right thing to do” as a citizen. Here the act of payment has value on its own; there are no direct benefits and no one else need know. The citizen has accepted the social contract and bears a presumptive obligation to fulfill it (Rawls, 1971).

Efforts to empirically identify the possible influence of these non-economic motives have been mixed. Blumenthal et al. (2001) find no evidence that these motives significantly influence truthful reporting of taxable income for Minnesota taxpayers, but Hallsworth et al. (2014) do find a strong beneficial impact on compliance from peer motives. Perez-Truglia

and Troiano (2015) find that shaming penalties have a large effect on repayment of smaller debt amounts, but no effect on larger debt amounts. In a study closest to our work here, Castro and Scartascini (2015) examine motives for property tax payments in a municipality in Argentina. They find that the economic motives from fines and enforcement are most salient, but that the non-economic motives do matter for selected subsamples of the population—in particular, lower-income residents.

We conducted an earlier pilot study of property tax compliance in Philadelphia. The results are reported in Chirico, Inman, Loeffler, MacDonald, and Sieg (2016). We find evidence that motives driven by reciprocity, peer effects, and civic duty can positively impact property tax payment compliance. But our sample size was small and our framing of the alternative motives was not as clear as we would have liked. In this study we specifically examine deterrence, reciprocity, peer influence, and civic duty notifications with a larger sample and with a sharper experimental design.

3 A Tax Reminder Experiment

The research setting for this experiment is the City of Philadelphia. Notices of property tax payments are sent each year on January 1, and the full balance of taxes are due by March 31. If payment has not been received by that date, or the taxpayer has not entered into a tax-paying plan with the City, fines and interest penalties begin to accrue. On April 1, the Department of Revenue (DoR) begins contacting unpaid accounts, informing taxpayers of taxes due and the accumulation of fines and penalties for late payment. Normally, two-thirds of the delinquent accounts are sent to outside collection agencies acting as co-counsel for the City; one-third of the delinquent accounts remain within the Revenue Department for collection. The outside collecting agents are reimbursed at the rate of 6 percent of all delinquent revenues collected by December 31st. All accounts still delinquent after that time are then assigned to new collection agents. Our experiment was implemented using the

universe of taxpayers who owed real estate taxes for the 2015 tax year alone.

Of the 579,828 properties in the city in 2015, approximately 100,000 properties, or 83 percent of all properties, were late as of April 1st. The sample included in our experiment were the 27,264 properties remaining with the Revenue Department still owing at least \$10 in property taxes as of May 15, 2015. Our sample includes only new noncompliant taxpayers – it excludes all chronically delinquent taxpayers who continued to owe taxes from prior years. Our experiment began in mid-June 2015 and continued until December 31, 2015. To make sure that our experiment was not contaminated by other treatments, the DoR agreed to postpone other enforcement activity until August 15. In particular, no other collection agencies contacted the households in the sample until approximately the beginning of September.

Our seven reminder letters were designed in coordination with officials of the Department of Revenue. Each letter was vetted by the Department to ensure that it could be understood by a taxpayer with at least a fourth or fifth grade level of reading comprehension. Each letter also provided contact information for assistance for non-English speaking taxpayers. The full letter templates are included in an Appendix. For brevity we present here the important distinguishing feature of each letter. Our control letter provides a generic reminder to the taxpayer. Specifically:

Treatment Letter 1: Control

Our records indicate that you have a balance due of *balance*. If you have already paid, thank you. If not, please pay now or contact us to arrange a payment plan. The fastest and easiest way to pay is online at www.phila.gov/pay. Paying by E-check only costs 35¢- less than the cost of a stamp!"

Two letters were mailed to test the efficacy of either of our economic penalties. The first imposes an economic penalty only and is called the lien letter. The lien letter notes that the City will impose a lien on the delinquent property which entitles the City to deduct the amount of the lien from any future arms-length market sale of the property.

Treatment Letter 2: Lien

Failure to pay your Real Estate Taxes may result in the sale of your property by the City in order to collect back taxes. In the past year, we have sold N properties in your neighborhood at sheriff's sale. Included in these N are the following properties near you: <three properties and their sale dates>

Pay your taxes now to prevent the sale of your property. Our records indicate that you have a balance due of *balance*.

N is the number of properties sold in the recipient's neighborhood between June 2014 and May 2015. The three listed properties in the taxpayer's neighborhood were randomly selected from a list of properties that had been recently sold and included tax liens on the sale. All delinquent taxpayers receiving the lien letter in the same neighborhood saw the same list of three properties.⁸

The second letter including an explicit mention of an economic penalty was the sheriff's sale letter. We view this treatment letter as the most onerous economically. It not only imposes the full economic penalty of taxes plus fines plus interest at the time of sale, but it forces the sale of the taxpayer's property. The inconvenience and, perhaps more importantly, the psychic costs of moving may be significant.

Treatment Letter 3: Sheriff's Sale

Failure to pay your Real Estate Taxes will result in a tax lien on your property in an amount equal to your back taxes plus all penalties and interest. When your property is sold, those delinquent tax payments will be deducted from the sale price. By paying your taxes now, you can avoid these penalties and interest. Properties near you in *neighborhood* that have had liens placed on them include: <three properties and their sale dates>

Pay your taxes now to avoid a lien being placed on your property. Our records

⁸An initial plan to select the three lien sale properties nearest each delinquent property met with privacy concerns and was therefore not pursued.

indicate that you have a balance due of *balance*.

N is the number of properties sold by sheriff's sale in the recipient's neighborhood between June 2014 and May 2015. The three listed properties in the taxpayer's neighborhood were randomly selected from a list of properties that had been recently sold through a sheriff's sale. Again, all delinquent taxpayers receiving the sheriff's sale letter and in the same neighborhood saw the same list of three properties.

The next two reminder letters address the free rider motive for non-payment. The first letter appeals for payment from those who might see their gain from non-payment largely in terms of their private benefits from neighborhood services, what we call the neighborhood letter.

Treatment Letter 4: Neighborhood

We want to remind you that your taxes pay for essential public services in *neighborhood*, such as <two local amenities>, your local police officer, snow removal, street repairs, and trash collection. Please pay your taxes to help the city provide these services in your neighborhood.

The neighborhood amenities were chosen at random for each property from a list of City provided parks, recreation centers, and libraries in the neighborhood of the delinquent property. The second free rider letter appeals for payment from those who see their gain from non-payment in terms of their public benefits from Philadelphia-wide services, what we call the community letter. This letter reads:

Treatment Letter 5: Community

Your taxes pay for important services that make a city great. Your tax dollars are essential for ensuring all Philadelphia children receive a quality education and all Philadelphians feel safe in their neighborhoods. Please pay your taxes as soon as you can to help us pay for these important services.

The final two reminder letters appeal to a taxpayer's sense of community more generally. The first asks the delinquent taxpayer to recognize that he is not a contributing member of

his (personally defined) community of peer taxpayers, a letter we call the peer letter.

Treatment Letter 6: Peer

You have not paid your Real Estate Taxes. Almost all of your neighbors pay their fair share: 9 out of 10 Philadelphians do so. By failing to pay, you are abusing the good will of your Philadelphia neighbors.

The second letter stresses that non-payment will violate a wider community norm of honest and responsible tax compliance needed for a functioning democracy, a letter we call the civic duty letter.

Treatment Letter 7: Duty

For democracy to work, all citizens need to pay their fair share of taxes for community services. You have not yet paid your taxes. By failing to do so, you are not meeting your duty as a citizen of Philadelphia.

As a baseline control, we randomly removed 3,000 delinquent properties from the possibility of receiving any reminder letter at all. These taxpayers became our holdout sample and allowed us to estimate the efficacy of simply communicating with the taxpayer after the date that taxes are due.⁹

4 Randomization Procedure

Randomization took place in two stages. First, a number of eligible properties were randomly assigned to the Holdout Sample. Our main interest in this study is on unary owners, i.e. households that only own one property in the city. Once we restrict attention to this

⁹We also tested one more intervention that has been successfully used by private firms in collecting overdue credit card payments. This is to send the payment reminder in an envelope larger than the usually-sized envelopes used for the first mailing of tax bills. Credit card firms have found that reminders mailed in usual envelopes (4 1/8" × 9") were often ignored, while reminders mailed in larger envelopes (9" × 12") resulted in greater payments. The total number of properties in this additional treatment was 12,193 randomized over the seven treatment letters. We found no statistically significant effect of letter size on compliance behavior or size of payment. These results are available upon request.

sample, we have 16,940 observations in the treatment group and 2,088 observations in the holdout sample. The total sample size is 19,028.¹⁰ Table 1 checks whether the treatment and control group are balanced based on the two most important variables, amount due and assessed property value.

Table 1: Balance between Holdout and Treated Samples

Variable	Treated	Holdout	<i>p</i> -value
Amount Due (June)	\$1,287	\$1,233	0.24
Assessed Property Value	\$144,145	\$142,630	0.93
# Owners	16,940	2,088	

Table 1 shows that randomization was successful in the unary owner sample. The average debt owed by each owner was \$1,287 in the treatment group and \$1,233 in the holdout sample. The average assessed property value is \$144,145 in the treatment group and \$142,630 in the control group.

Next we test whether randomization was successful among the seven treatment groups. Table 2 shows the results for the unary owner sample in the top panel of the table. Overall, we find no evidence that would suggest any problems with randomization.

While the vast majority of properties in the city of Philadelphia are owned by unary owners, approximately 10 percent of the properties are owned by individuals or firms that own multiple properties. There is some interest in including these multiple owners in the analysis as well. Since we are interested in taxpayer compliance and not property compliance, we identified owners of multiple delinquent properties by their legal name and randomly assigned each owner to a treatment group.¹¹ Any delinquent taxpayer holding multiple properties within each treatment group received the same letter for each of those properties. Given the

¹⁰We also trimmed the sample and excluded the 28 owners with highest total assessed property value. None of the findings reported in the paper depend on this trimming.

¹¹We lacked an objective identifier such as a social security. There is some possibility that two or more different owners have the same name, but inspection by the authors found this to be very rare. To the extent that it occurs, we consider this random noise to the experiment.

high correlation between the propensity to pay taxes and total debt owed, randomization blocks were defined according to owner-level total debt to assure uniformity of samples along the dimension of debt owed. Each property assigned to receive a reminder letter was equally likely to receive each of the seven treatments.

Excluding the holdout sample but including multiple owners gives us a sample size of 19,362 observations.¹² Table 2 displays the balance tests for pre-randomization characteristics 2. Results confirm that randomization was also successful in this larger sample that included multiple property owners. There are no statistically significant differences across reminder letters.

5 Empirical Results

5.1 Short Term Impact

In this section we focus on the short-term impact of our intervention, which we define as the first three months after our intervention letters were posted. During this time period, tardy taxpayers were only exposed to our intervention. As a consequence, our estimates of the treatment effects are not contaminated by other interventions by the tax authority.

To gain a more complete insight into the nature of tax compliance in Philadelphia, we consider two distinct measures of tax compliance. We define partial compliance as a tardy taxpayer making any real estate tax payment at all. Partial Compliance is of interest because even small additional payments help, but perhaps more importantly, a tax contribution represents a willingness by the taxpayer to be engaged with city governance. Further, it is common for late taxpayers to pay down their debt gradually instead of in lump sum. The ever-paid outcome in particular does not differentiate between taxpayers that made full repayment and those who made only a partial contribution. Full compliance is defined as

¹²Unfortunately, we were not able to include the holdout sample in the block-randomization procedure. As a consequence, we can only include the holdout sample into our analysis if we condition on unary ownership.

Table 2: Balance on Observables

Unary Owners							
Variable	Control	Neighborhood	Community	Duty	Peer	Lien	Sheriff <i>p</i> -value
Amount Due (June)	\$1,256	\$1,289	\$1,290	\$1,299	\$1,280	\$1,280	\$1,315 0.98
Assessed Property Value	\$158,370	\$159,079	\$130,265	\$165,617	\$130,936	\$130,642	\$134,334 0.46
# Owners	2,419	2,387	2,441	2,432	2,416	2,429	2,416 0.99
Unary and Multiple Owners							
Variable	Control	Neighborhood	Community	Duty	Peer	Lien	Sheriff <i>p</i> -value
Amount Due (June)	\$1,593	\$1,589	\$1,583	\$1,583	\$1,572	\$1,593	\$1,590 1
Assessed Property Value	\$180,664	\$180,172	\$153,528	\$183,991	\$155,438	\$155,499	\$157,398 0.48
% with Unary Owner	87.6	86.4	88.4	88.1	87.5	88.0	87.5 0.42
% Overlap with Holdout	3.69	3.73	3.40	3.40	3.55	3.44	3.29 0.97
# Properties per Owner	1.27	1.32	1.26	1.26	1.26	1.26	1.26 0.67
# Owners	2,762	2,762	2,762	2,762	2,762	2,761	2,762 1

p-values in rows 1-5 are *F*-test *p*-values from regressing each variable on treatment dummies. A χ^2 test was used for the count of owners.

eliminating real estate tax debt.

Table 3: Short-Term Linear Probability Model Estimates

	Ever Paid		Paid in Full	
	One Month	Three Months	One Month	Three Months
Holdout	30.5	51.4	23.5	40.8
Control	3.8*** (1.4)	3.9*** (1.5)	2.2* (1.3)	3.0** (1.5)
Neighborhood	1.7 (1.4)	2.7* (1.5)	-0.2 (1.3)	1.5 (1.5)
Community	3.8*** (1.4)	2.8* (1.5)	1.3 (1.3)	2.5* (1.5)
Duty	2.4* (1.4)	3.6** (1.5)	0.7 (1.3)	2.3 (1.5)
Peer	3.9*** (1.4)	3.5** (1.5)	1.8 (1.3)	3.4** (1.5)
Lien	9.0*** (1.4)	9.2*** (1.5)	5.6*** (1.3)	7.2*** (1.5)
Sheriff	7.4*** (1.4)	8.8*** (1.5)	4.5*** (1.3)	6.8*** (1.5)
Num. obs.	19028	19028	19028	19028

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Holdout values in levels; remaining figures relative to this

We start by considering the partial compliance results that pertain to the sample in which we exclude owners of multiple properties. Table 3 reports the estimated participation rates in the holdout sample as well as the differences in participation among the seven treatment samples. Standard errors are reported in parentheses. We find that all seven treatments increased partial compliance at the one- and three-month snapshots. Almost all of these increases in compliance behavior are statistically significant at standard levels of significance.

After one month, approximately 30 percent of all taxpayers in the holdout sample had made some contribution towards their tax liabilities. In contrast, 40 percent of those that received the lien letter and 37 percent of those that received the sheriff's sale letters had made payments. The results are similar after three months of the intervention. The overall

participation rate rose, with 51 percent of all owners in the holdout sample having made some contribution after three months. This is in turn dwarfed by the 61 percent of households that received the lien letter and 60 percent of households that received the sheriff’s sale letter that made some payments in the same interval.

As shown in Table 3 the results are qualitatively and quantitatively the same if we use “paid in full” as our compliance outcome. The main difference is that the neighborhood, community and duty letters lead to a significant increase in compliance relative to the holdout group only for partial compliance, though the sign of the estimate is mostly the same. All other findings are similar. As a robustness check we also estimated Logit models. Not surprisingly, the main findings are qualitatively and quantitatively the same.

Next we conduct some simple back-of-the-envelope calculations to assess the impact of these estimates on revenues. Here we focus on the results after three months. We take the median nonzero eventual payment (i.e., the median positive remission by year’s end) in each subsample and multiply the median payment with the increase in the compliance probability reported in Table 3. This product can be interpreted as the impact of each treatment on revenue per letter. To obtain the total estimated impact we then multiply the impact per letter with the total number of individuals in each treatment. These results are reported in Table 4. Overall, we find that all seven treatments generated positive revenues for the City. The three-month impact of these letters ranged between \$21 for the neighborhood letter and approximately \$76 per the lien letter. We thus conclude that receiving a reminder letter improved taxpayer compliance in the short run, and further that the lien and sheriff’s sale letters were the most effective in inducing repayment.

Another way to determine the revenue implications of our different treatments is to regress the total amount of revenue raised on indicator variables for each treatment. These regressions confirm our estimates reported in Table 4. We find that the average payments in the holdout sample were \$323 after one month and \$636 after three months. All of our letters, including the control treatment, increased payments at the one- and three-month

Table 4: Estimated Three-Month Impact on Revenue

Treatment	Impact Per Letter	Total Impact
Control	\$32.51	\$78,634
Neighborhood	\$22.32	\$53,287
Community	\$23.61	\$57,623
Duty	\$30.05	\$73,084
Peer	\$28.95	\$69,955
Lien	\$76.4	\$185,580
Sheriff	\$73.27	\$177,020

cross-sections. The two threat letters were the only two letters that significantly increased revenue collection. After one month the lien (sheriff) treatment increased payments by \$90 (\$69). After three months, the increases are approximately \$97 per letter for both of these treatments. This supports our assertion that the estimates reported in Table 4 are conservative estimates of the effectiveness of our treatments.

Finally, we conducted a number of robustness checks. Recall that we randomized the seven treatments at the ownership level. In Table 5 we replicate the analysis done above, excluding the holdout sample and expressing estimates relative to the control treatment. We then estimate the model using the larger sample that also includes owners of multiple properties. Overall, we find the results are similar to the ones reported in Table 3. If anything, the treatment effects are stronger in the unary owner sample. This evidence leads us to conclude that owners of multiple properties are less likely to respond the kind of nudge strategies explored in this paper.

5.2 Long-Term Impact

Recall that all tardy tax payers were assigned to a collection agency in the middle of August 2015 and were thereby subjected to another enforcement activity which largely consisted of another “threat” treatment – phone calls that threatened them with penalties and fines to

Table 5: Robustness Analysis: Multiple Owners

	All Owners		Single-Property Owners	
	One Month	Three Months	One Month	Three Months
Neighborhood	−0.01 (0.01)	−0.01 (0.01)	−0.02 (0.01)	−0.01 (0.01)
Community	−0.00 (0.01)	−0.01 (0.01)	0.00 (0.01)	−0.01 (0.01)
Duty	−0.01 (0.01)	−0.00 (0.01)	−0.01 (0.01)	−0.00 (0.01)
Peer	0.00 (0.01)	−0.01 (0.01)	0.00 (0.01)	−0.00 (0.01)
Lien	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)	0.05*** (0.01)
Sheriff	0.03** (0.01)	0.05*** (0.01)	0.04** (0.01)	0.05*** (0.01)
Num. obs.	19333	19333	16940	16940

*** $p < 0.001$, ** $p < 0.05$, * $p < 0.1$

coax compliance. While our experimental design is still valid for these outcomes, it is harder to cleanly interpret the findings due to this mixed bag of interventions. All taxpayers that had not paid by mid-August were subject to this uniform second treatment by the collection agency. Our estimates of the longer-term treatment effects thus reflect two treatments: our initial letter treatment plus the phone calls performed by the collection agency. Since we were not able to randomize on the treatment by the collection agency, we can only identify the effect of the joint treatments.

Given the similarity of results, we focus on the unary owner sample. Table 6 reports the estimated participation rates in the holdout sample as well as the differences in participation in the seven treatment samples after six months of the intervention. We find that only two of the treatments increased partial compliance at the six-month juncture. We find that 73 percent of households in the holdout sample made some payments to the City. The only letters that significantly improve the compliance above or below that rate were the lien and

Table 6: Long-Term Linear Probability Model Estimates

	Ever Paid		Paid in Full	
	Six Months	Tax Year 2016	Six Months	Tax Year 2016
Holdout	73.3	65.5	63.2	52.5
Control	1.3 (1.3)	-1.4 (1.4)	1.5 (1.4)	-0.7 (1.5)
Neighborhood	-0.2 (1.3)	-3.1** (1.4)	-0.0 (1.4)	-2.2 (1.5)
Community	0.9 (1.3)	-1.8 (1.4)	1.1 (1.4)	-2.0 (1.5)
Duty	2.1 (1.3)	-1.6 (1.4)	1.0 (1.4)	-1.9 (1.5)
Peer	1.3 (1.3)	-1.9 (1.4)	2.3 (1.4)	-1.1 (1.5)
Lien	3.8*** (1.3)	-0.9 (1.4)	4.8*** (1.4)	-0.7 (1.5)
Sheriff	3.8*** (1.3)	-0.6 (1.4)	3.0** (1.4)	-1.1 (1.5)
Num. obs.	19028	19025	19028	19025

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Holdout values in levels; remaining figures relative to this

sheriff letters, which increased compliance by 3 to 4 percentage points. The findings are similar using full repayment as the outcome measure.

To translate these participation rates into revenue, we again take the median nonzero payment in each subsample and multiply it with the increase in compliance probability reported in Table 6. The results are reported in Table 7. We find that the six-month impact of these two letters was approximately \$31 per letter relative to the holdout sample and \$21 relative to the control letter.¹³

Table 7: Estimated Six Month Impact on Revenue

Treatment	Impact Per Letter	Total Impact
Control	\$10.74	\$25,976
Neighborhood	-\$1.47	-\$3,517
Community	\$7.2	\$17,568
Duty	\$17.32	\$42,134
Peer	\$11.16	\$26,972
Lien	\$31.42	\$76,328
Sheriff	\$31.43	\$75,940

We find that the impact of our six letters relative to the holdout or control group is much attenuated after six months. This finding is consistent with the view that the enforcement activities of the collection agency are probably more closely aligned with our deterrence letters than with the other five letters that we explored. As a consequence, it is not surprising that we find some strong convergence in the effectiveness of all treatments after six months – as the threat-like approach of the agency comes to the fore, the much earlier receipt of our treatment has a dwindling impact. However, it is also possible that some convergence of the effectiveness of treatment would have resulted even in the absence of the introduction of the collection agency. Since we were not allowed to randomize on that treatment, we cannot offer a definitive conclusion.

¹³Again, we also ran a revenue regression as a robustness check, but it was inconclusive. Only the duty treatment was marginally significant, which was due to the influence of a few outliers.

For revenue collecting agencies, particularly those with revenue collection problems, acceleration of payment can be understood to be a useful result in and of itself. Bills must be paid and debts must be serviced on regular schedules. Relatedly, the longer that tax bills remain unpaid, the more expensive it becomes to collect. Whether handled internally or externally through debt collection firms, downstream collection practices leave diminished revenues. For both of these reasons, early collection is, *ceteris paribus*, better collection. This is not to say, however, that early collection is social-welfare-improving. If tardy-but-eventually-compliant taxpayers forestall early payment to cover other expenses or invest in other assets which they eventually use to repay their tax bill with interest, late repayment may have been individually optimal, in which case the welfare of the tax agency may not be synonymous with the welfare of society. This is especially true if tax payments are made weeks rather than months late, such that monthly payments can still be made based on expected monthly receipts. In the case of chronically-delayed but consistently-paid payments, it is less obvious that accelerating eventual or inevitable payment constitutes something of value.

We also obtained data characterizing tax compliance of our sample of taxpayers in the tax year 2016 which followed our 2015 intervention. The goal was to investigate the existence of any spill-over effects of our treatments into the next tax year. Again, our analysis is subject to the same mulled-treatment constraint discussed above. Focusing again on the unary owner sample, the second and fourth columns of Table 6 summarize our main findings. Overall, we find that none of our treatments had any continued differential impact on tax compliance in 2016. However, it is worth noting that the overall compliance rate in 2016 was significantly higher than that in 2015, which may be a direct consequence of our increased enforcement activities.

6 Conclusions

We have designed and implemented a new, multi-arm field experiment designed to test which low-cost notification strategies increase property tax payment rates. Our results suggest that notification strategies are effective at reducing tax delinquency and increasing tax revenue collection. Our different treatments are motivated by a wide swath of theorized “nudges” including social norming, moral suasion, tax morale, and deterrence. Our results suggest that all treatments are successful in increasing tax compliance and raising revenue for the City in the short run. Hence, a revenue director can choose from a menu of effective messages to increase tax compliance and revenue collection.

There are, however, some important quantitative differences in the effectiveness of the different messages, which imply some trade-offs faced by the revenue director. Credible threats regarding the foreseeable consequences of nonpayment are much more effective than other treatments that rely on moral persuasions or appeals to civic duty. If a revenue director wants to generate more property tax collection in Philadelphia, it appears that he or she should choose a tougher and politically more costly message.

The long-run effects of our intervention are harder to assess. We still find that credible threat notifications increase repayment rates and revenues after six months, although the effects are smaller than the ones observed in the short run. All tax payers that were still tardy three months after our experiment were contacted by a collection agency that engaged in serious enforcement activities. We think it is likely that this additional treatment may explain the convergence in the effectiveness of our treatments that we observe in the data.

Overall, our findings suggests that increasing tax compliance at low cost is possible. More research is needed on the reasons for different behavioral responses to consequentialist and non-consequentialist messages. Perhaps the differences in the effectiveness of the various treatments lie in alternative theories of why tax delinquents exist in the first place. Non-consequentialist theories of non-payment implicitly rest on the assumption that non-

compliers are not liquidity-constrained and are merely unaware of the collective consequences of non-payment. Under this analysis, tax delinquency is due to discouragement, indifference, lack of appreciation, or unawareness. Delinquents merely need to be encouraged or reminded to participate. If tax delinquents are discouraged, providing them with information about peer behavior, neighborhood or civic duty increases the overall rate of tax compliance. This may reflect the fact that delinquents are not indifferent to their peers' positive and negative behavior. Likewise, the provision of information on public goods assumes that recipients have not incorporated consideration of public goods funded through tax dollars into their payment behavior. Our results, however, suggest that this is an incomplete explanation for tax delinquency in Philadelphia.¹⁴

Our results do clearly suggest that many tax delinquents are seemingly unaware of the consequences of nonpayment. Our provision of detailed information about the collection process had a clear impact on the likelihood of repayment. This result echoes other recent findings that clear, consistent, and timely provision of information on consequences, particularly in the context of compliance monitoring, can lead to notable improvements in behavioral compliance – see also Hawken and Kleiman (2009). Perhaps, then, the puzzle of high non-payment rates can be understood as a case of under-enforcement. This possibility is bolstered by the fact that, conditional on any payment, converted defiers became near perfect compliers, making full payments in almost all cases. This suggests that, at least for the margin affected, liquidity constraints are not the primary reason for initial non-payment.

Notification strategies that convey information about enforcement activities are best viewed as complements and not substitutes to traditional enforcement activities. Notifications provide information about enforcement, thus resolve some problems that arise because some tax payers are not well informed about the consequences of non-compliance. Providing credible and tangible information can then help to overcome this incomplete information

¹⁴We explored differences in envelope size as a potential avenue to increase revenues. We observe no effect of increased envelope size. Apparently, taxpayers open tax bills even if they do not pay them.

problem. However, any threat to take a lien on a house or to start a foreclosure process can only be credible if it is backed up by real actions. It is hard to believe that notifications strategies that convey empty threats on enforcement activities can be effective.

Our research had some direct impact on the tax enforcement activities of the City of Philadelphia. After we finished our initial pilot study, the City decided to mailed letters to delinquent owners of more than 4,000 selective properties, warning them of the impending lien sale. the Philadelphia Magazine reported in July 2015 that “the threat was clear: If they didn’t pay their delinquent taxes, the city would try to sell their debts to a third party. Out of the 4,000-plus properties, 1,419 of the owners paid their delinquent taxes in full, while 645 paid their 2015 taxes. The city reaped \$5.5 million in cash, as well as an additional \$2.2 million in expected payment agreements. All together, that’s about \$10 million in proceeds. In other words, it appears that a lien sale is an incredibly effective tool with which to threaten property owners who have not paid their taxes.” After we concluded this experiment, we debriefed the city about our results. The city then decided to send a version of our sheriff’s sale letter to all late tax payers in the summer of 2016. While we do not have the data to assess the effectiveness of this full scale implementation of our notification strategy, early results seem to indicate that these letters improved tax compliance within the City of Philadelphia.

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