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EVIDENCE FROM A FIELD EXPERIMENT

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Procrastination and Property Tax Compliance: Evidence from a Field Experiment
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ABSTRACT

Municipal governments commonly confront problems with property tax collection. We model tardy taxpayers as procrastinators that have a present bias. Late payments arise due to lack of salience, lack of deterrence or lack of tax morale. To test the importance of the different theoretical explanations, we developed and implemented a randomized controlled experiment conducted with the City of Philadelphia. The structure of the experiment allows us to identify the relative importance of the three key sets of parameters of our model. We find that lack of salience and lack of deterrence are key components of non-compliance behavior.

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1 Introduction

Property taxation is the primary tax for most U.S. cities. In fiscal year 2013, 30 percent of all local government revenues and over 73 percent of local taxes came from the property tax (Census of Governments, 2013). Yet collection of the tax has, in many cities, been problematic. While some U.S. cities do an excellent job in collecting the tax, receiving over 95 percent of assessed revenues in the year the tax is due, other cities have over the last ten years done significantly worse – notably Flint (78%), Cleveland (84%), Pittsburgh (86%), Milwaukee (87%), Philadelphia (88%), Detroit (89%), and St. Louis (89%).¹ While Flint, Detroit, Cleveland and Milwaukee are relatively poor cities, Philadelphia and Pittsburgh are not. Among the list of cities with outstanding tax collection records are Buffalo, Birmingham, Houston, and New Orleans. While city poverty is important, it cannot be the whole explanation for low rates of collection. Poor tax administration is likely to be an important contributing factor as well.

This failure to collect the property tax on time creates budget uncertainty at best and budget deficits at worst. Yet collecting the property tax should be straightforward. In contrast to collecting self-reported taxes such as those on income, profits, and sales, property tax obligations equal to the city’s assigned assessed value of the taxed property times the city chosen tax rate are known by both the city and the taxpayer. There is no uncertainty as to what is due, or when.² Payment is primarily a matter of enforcement. The most common enforcement strategy is the economic stick: fines and penalties. Failure to pay property taxes 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.

When a delinquent taxpayer does not respond to penalties and fines, the city can take out

¹For more details, see Chirico, Inman, Loeffler, MacDonald, and Sieg (2016).

²Much of the current literature on tax compliance has focused on taxpayers truthful reporting of income or sales under the threat of a tax audit; see Slemrod (2007) for a review and more recently the research of Kleven, Knudsen, Kreiner, Pedersen, and Saez (2011) and Pomeranz (2015).

a tax lien on the property. A lien does not impose any immediate direct, tangible costs on a taxpayer since payments are typically only realized at the time of a transaction.³ However, obtaining a tax lien enables the owner of the lien to eventually start a foreclosure process. When the owner of a property located in a city fails to make a payment arrangement on municipal tax levied on his or her property, that property may be sold at auction to allow the city to collect on that unpaid debt. However, the foreclosure process is costly and time intensive.⁴ While there are some problems with the effectiveness of the existing enforcement mechanisms, it is only possible to avoid payment by abandoning the property in the long run. Needless to say, this is a very costly option for most owners.

Despite the fact that there are no obvious financial gains to not paying property taxes, we observe that a significant fraction of tax payers do not pay on time. To explain the behavior of these procrastinators, researchers have started to explore the effectiveness of softer, nudge approaches or notification strategies to reinforce the different motivations of tax compliance. This paper uses a field experiment involving over 19,000 delinquent Philadelphia taxpayers to examine the effectiveness of seven alternative strategies for improving city property tax collection. Each involves a randomly assigned tax “nudge” of a tardy taxpayer. The first is a simple reminder that the payment is late. The next two involve the reminder plus a threat of a significant sanction if payment is not received by the end of the calendar year: a lien on the home when sold equal to taxes due plus accrued interest and penalties *or* the lien coupled with an immediate sheriff’s sale of the home to collect the lien. The final four nudges include the reminder coupled with an appeal to what the tax compliance literature has called a “tax morale” motive for paying one’s taxes.⁵ The four morale motives included

³A city can also sell tax liens to investors to speed up the revenue collection process. Liens often sell at above par prices because of the foreclosure option. But selling liens to “vulture investors” can be politically costly for a city administration.

⁴Auctions are administered in Philadelphia by the Office of the Sheriff. This process of offloading a property at Sheriff’s Sale can take nine months to a year.

⁵See Luttmer and Singhal (2014) for a review of the tax morale strategies for tax compliance. They identify three tax morale motivations in the literature, each grounded in a positive gain in utility from the act of paying one’s taxes. These include: 1) a motive from reciprocity where the taxpayer recognizes they

here are: first, a reminder that taxes pay for neighborhood services such as street repairs, trash pick-up and the local park; second, a reminder that taxes pay for important city-wide services such as police protection and public schools; third, a reminder that 9 out of 10 Philadelphians have paid their taxes and you have not; and fourth, a reminder that paying one's taxes is an important obligation of citizenship in a democracy. Tax compliance after receiving one of the seven "nudges" is then compared to compliance for those who have not received a "nudge" due to random assignment to a holdout sample.

To understand the potential influence of each nudge, we model tax delinquency as a problem of taxpayer procrastination following Akerlof (1991) and O'Donoghue and Rabin (1999). Procrastination occurs because of present bias as in O'Donoghue and Rabin (1999) and declining saliency as in Akerlof (1991). Present bias is always present. Saliency can be nudged by a reminder letter. The reminder letters stressing liens or liens plus the sale of one's home add a future expected cost to non-payment as in the tax compliance model of Allingham and Sandmo (1972). The reminder letters stressing the tax morale are modeled as utility gains to the procrastinator from paying ones taxes. Economic theory, therefore, plays a central role in the design and implementation of our field experiment. Late payments arise in our model due to lack of salience, lack of deterrence or lack of tax morale. We have designed the field experiment to test the importance of these three competing theories. We show that the treatment effects that are identified by our experiment have a clear interpretation in the context of the parameters of our model. Our experiment is, therefore, designed to explicitly test competing models of behavior as recommended by Levitt and List (2007) and Card, DellaVigna, and Malmendier (2011).

Our work here is closely related to the recent work of Hallsworth, List, Metcalfe, and Vlaev

are part of a larger group playing a non-cooperative game with other taxpayers for the provision of public goods; 2) a motive from peer behavior where the taxpayer gains utility from knowledge that they are part of larger group of contributors; and 3) an intrinsic motivation that provides a direct utility benefit from the act of paying one's taxes. Luttmer and Singhal (2014) also mention taxpayer culture and taxpayer behavior other than utility maximization as additional explanations for the rate of taxpayer compliance.

(2014) studying the effect of taxpayer nudges on the timeliness of income tax payments in the UK and to Castro & Scartascini’s (2015) study of local property tax payments in Argentina. Like our study, the amount owed to the tax authorities in these two studies is known by the authority and the taxpayer with certainty; the only issue is payment. As here, the empirical analysis of Hallsworth et al. (2014) follows from a model of taxpayer procrastination. The primary focus of their field experiments is the *framing* of the morale nudge, comparing the effectiveness of what they call a *descriptive* message (“a majority of citizens pay their taxes”) to that of an *injunctive* message (“you *should* pay your taxes because”). Our analysis also includes a descriptive message (“9 out of 10 taxpayers have paid their tax”) and an injunctive message (paying one’s taxes is a duty of citizenship”). We differ from the Hallsworth et al. (2014), by including a more strongly worded message on the penalties for non-compliance and by allowing a longer period of study for compliance behavior (3 weeks vs. 6 months in our study). The longer period allows a sharper identification of the saliency of each nudge. Finally, they study compliance for the payment of an important national tax; we study compliance for an important local tax. Like the work here, Castro and Scartascini (2015) study citizen payment of their local property taxes. They also examine effectiveness of separate nudges that stress legal and financial consequences of non-payment, the advantage of payment for the provision of neighborhood services (street lighting), and the fact that seven of ten taxpayers do pay their bills on time. However, they do not consider the effects of saliency nudges independent of the content of the nudges, which is one of the key objectives of our analysis.⁶

Our experiment supports three central conclusions. First, saliency of the tax obligation matters. A simple reminder letter has both a statistically significant and policy relevant impact on the rate of taxpayer compliance, though the effect wears off over time. Second,

⁶We conducted an earlier pilot study of property tax compliance in Philadelphia. The results are reported in Chirico, Inman, Loeffler, MacDonald, and Sieg (2016). In contrast to our results here, we find evidence that tax morale motives driven by public good provision, peer effects, and civic duty can positively impact property tax payment compliance; see footnote 19 below.

beyond the simple reminder, the content of the “nudge” matters as well with those stressing rising financial penalties having the greatest impact on compliance. Those appealing to a tax morale – neighborhood, community, peer behavior, and civic duty – were no more successful than the simple reminder letter in inducing additional tax compliance. Third, the marginal revenue benefit of our most effective message is significant, raising over \$65 in new revenue for each \$1 of administrative costs. That said, however, the aggregate effect of nudges on uncollected revenue is modest, bringing in only 5% of all revenue still owed, at least in Philadelphia.

The rest of the paper is organized as follows. Section 2 provides a behavioral model of tax compliance that allows for delay and non-compliance in equilibrium and shows how different nudge strategies affect the decision to delay compliance. 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 discusses the urban fiscal policy implications of our experiment. Section 7 offers conclusions.

2 Taxpayers As Procrastinators

Most city residents are law abiding citizens. If late in their city tax payments it is unlikely it is part of a strategic plan to avoid ever paying. Property tax payments are computed by the city as assessed home value times the city’s property tax rate and are known both to the city and the taxpayer. While it is possible to avoid payment by abandoning the property, this is very costly. For the vast majority of taxpayers the only issue is timely payment. Taxpayers receive their tax bill in January of the fiscal year with full payment or an agreed to payment schedule required by the end of March. Most families have the payment withheld in an escrow account as part of their monthly mortgage payments. If payment, or enrollment in a payment plan, has not been made by the end of April, the city starts enforcement

proceedings against the taxpayer. Enforcement begins with a reminder letter that all taxes and additional accrued interest and penalties are now due. In Philadelphia, those reminder letters are mailed in early May. We are studying the payment decisions of these tardy, or late, taxpayers. Following the analysis of O’Donoghue and Rabin (1999), our late taxpayer are seen as procrastinators who struggle with the problem of when, not if, to pay their property taxes.⁷

Our taxpayer makes a decision every two weeks or perhaps every month as they pay their family bills. They can pay their taxes today, or postpone the decision until “tomorrow.” If they pay their taxes today, they bear the immediate cost equal to the payment made. Taxpayers enjoy a benefit from having paid their taxes, but those benefits are not realized until “tomorrow,” either as the simple relief of knowing their taxes are paid or perhaps from the good feelings – that is, tax “morales” – of knowing they have met their obligations to their fellow residents.⁸ This is O’Donoghue and Rabin’s problem of the procrastinator facing immediate costs and delayed benefits. The decision period is today at time t , where t represents the number of periods since first receiving a notice that taxes are due. In deciding today as to whether to pay or not pay taxes, the taxpayer’s inter-temporal utility function is specified over possible dates for payment. If the taxpayer makes a payment at time t , lifetime utility at time t is given by:

$$U_t^t = (\varphi^{t+1}\beta\delta) V - c_t \tag{1}$$

⁷We are not the first to model taxpayer compliance as a problem of procrastination; see Hallsworth, et. al. (2014). We differ from their analysis in two ways. First, their focus is on late taxpayers as possibly credit-constrained households. That is less of an issue for our work as all our taxpayers are homeowners with assets that can be used as collateral for a loan to pay taxes. It is true that homeowners, particularly the elderly, may not utilize such loans, but that is a problem of financial literacy not tax compliance. Second, while we both rely upon the fundamental work of O’Donoghue and Rabin (1999), we amend that analysis to include the insight of Akerlof (1991) on the importance of “saliency” to the problem for procrastinators. We also extend the model to allow for active tax enforcement by the city.

⁸We make the realistic assumption that our taxpayers will receive their public services whether they pay their taxes or not. If they do not pay their taxes, then they will be free-riding on the good will of their more responsible neighbors.

where c_t is the cost of tax payment at time t , and V is the benefit of knowing one's taxes are paid but not enjoyed until the period after payment. We assume V is constant for whenever taxes are paid.

Benefits are evaluated in today (period t) dollars allowing for declining saliency to future benefits and costs at rate φ ($0 \leq \varphi \leq 1$), possible present bias to all discounting at rate β ($0 \leq \beta \leq 1$), and the usual discounting of money values at rate δ ($0 \leq \delta \leq 1$). If the taxpayer plans to make a payment at time $t + s$, then the anticipated lifetime utility at time t of that payment is given by:

$$U_t^{t+s} = (\varphi^{t+s+1} \beta \delta^{s+1}) V - (\varphi^{t+s} \beta \delta^s) c_{t+s} \quad s = 1, 2, \dots \quad (2)$$

where c_{t+s} are the costs of tax payments at time $t + s$. The costs of tax payment may rise over time with accruing interest and penalties.

While tax payments made today are realized as a cost (c_t) today, tomorrow's tax payments and tomorrow's benefits are both realized in the next period, and are, therefore, discounted for today's decisions. For example, outcomes realized one period from today are discounted at the rate $\varphi^{t+1} \beta \delta$ and if realized two periods from today at the rate $\varphi^{t+2} \beta \delta^2$.

In our analysis the length of each individual period is relatively short, perhaps two weeks to a month between paying one's bills, and the overall decision horizon of our delinquent taxpayer's is no longer than several months. We will, therefore, assume that $\delta = 1$. The taxpayer may display a present bias, however, represented by a further discounting of future costs and benefits at a rate $\beta < 1$; time consistent taxpayers do not display a present bias so $\beta = 1$. Finally, our delinquent taxpayer may be forgetful which we represent as a declining rate of awareness or saliency, φ^{t+s} . Constrained by bounded rationality, taxpayers may only be able to pay attention to limited set of facts or tasks (Akerlof, 1991). For the forgetful taxpayer, $\varphi < 1$; for the fully aware taxpayer, $\varphi = 1$. In the extreme future or for the very forgetful taxpayer, $\varphi \simeq 0$ - that is, "out of sight, out of mind." Introducing the

concept of saliency is a relatively simple way to give “reminders” an explicit role in taxpayer compliance.⁹ As we discuss in detail below, saliency can explain differences in the response rates of taxpayers in the holdout sample and taxpayers that just received a neutral reminder letter.

Our analysis focuses on the type of taxpayer who O’Donoghue and Rabin identify as the naive procrastinator. Here payment behavior stands in contrast to that of the fully aware ($\varphi = 1$) and time consistent ($\beta = 1$) taxpayer who will always pay her taxes on time (see below) and the sophisticated procrastinator who recognizes she is forgetful and/or present biased but is able to commit to an optimal payment schedule in advance. Here, that commitment device could be an escrow account with the mortgage bank or a city arranged tax payment plan. In contrast, the naive procrastinator assumes that she will remember to pay her taxes next period and do so in an optimal, time consistent way – but she does not. As a result, she may keep postponing payment until the end of the tax year when some drastic action – for example, court seizure of the home or garnishment of wages – is taken to collect all taxes, interest, and penalties due. Since both time consistent and sophisticated procrastinators will have paid, or have arranged to have paid, their property tax, they will not be in our sample of late taxpayers. Only naive procrastinators will be in our sample.

How does the naive procrastinator decide to pay her taxes? She will pay her taxes if the benefits from paying today are greater than benefits of paying at some later date. Following O’Donoghue and Rabin, we assume the naive taxpayer adopts what they call a *perception-perfect strategy* and pays her taxes today only if doing so gives them more perceived utility today than by paying at some future date. In our problem with constant V and rising costs c_{t+s} because of accumulating interests and penalties, the best alternative date for paying taxes will always be in the immediate next period $t + 1$. If so and assuming $\delta = 1$, the naive procrastinator pays today, if the lifetime utility of paying today is greater or equal to the

⁹Saliency and reminders play a similar role in the behavioral economics of health policies; see Kessler and Zhang (2014) for a review.

lifetime utility if she delays:

$$(\varphi^{t+1}\beta) V - c_t \geq (\varphi^{t+2}\beta) V - (\varphi^{t+1}\beta) c_{t+1} \quad (3)$$

or if:

$$(\varphi^{t+1}\beta) (V(1 - \varphi) + c_{t+1}) \geq c_t \quad (4)$$

The RHS of equation (4) is the perceived cost of paying one’s taxes today. The LHS of equation (4) is the perceived cost of paying taxes one period later and is equal to the actual payment of those taxes one period later (c_{t+1}) plus the benefits “forgotten” ($V(1 - \varphi)$) because of declining saliency. With time invariant benefits (V), if the perceived costs of paying one’s taxes one period later are greater than or equal to the perceived costs of paying one’s taxes today, the taxpayer will pay today.

Current period costs of compliance will equal taxes owed (T) plus accumulated interest and penalties at rate ρ now due from not paying taxes in prior periods:¹⁰

$$c_{t+s} = T (1 + \rho)^{t+s} \quad s = 0, 1, 2, \dots, S, \quad (5)$$

Where S is the terminal date at which point a very large penalty is imposed upon the taxpayer for non-compliance, for example aggressive (harassing) enforcement or seizure of one’s home. In the case of Philadelphia, after date S (December 31, 2015) the tax bill of the non-complying taxpayer, now called a “delinquent” taxpayer, can be given to a collection

¹⁰Strictly speaking interest and penalties do not begin to accumulate until some number of periods after the tax bill was first received. Rather than interest and penalties accumulating from the first date of the receipt of the tax bill for t periods as specified here, penalties only begin to accrue after a grace period. In the case of Philadelphia, the grace period between when the bill is received and taxes are due is three months. We adopt this simpler specification for the timing of payments to minimize the use of superscripts for dating all the periods. All that is required to ensure the same level of accumulated penalties is to lower the rate of interest and penalties, ρ , in our specification to reflect the grace period. All comparative statics from the model will be the same.

agency and the agency becomes the enforcer of payment. That agency can obtain a court-order to garnish wages of the violating taxpayer. As date S approaches the likelihood of compliance increases because of this very large, expected penalty.

Substituting this definition into equation (4) gives:

$$\varphi^{t+1}\beta (V(1 - \varphi) + T (1 + \rho)^{t+1}) \geq T (1 + \rho)^t \quad (6)$$

as the requirement for current period tax compliance. More simply, rearrange and divide both sides by $T(1 + \rho)^t$ and the condition for immediate tax payment becomes:

$$\varphi^{t+1}\beta (v(1 - \varphi) + (1 + \rho)) \geq 1 \quad (7)$$

where $v = V/[T(1 + \rho)^t]$ are the benefits of paying one's taxes per dollar of taxes (and penalties) paid. The RHS of equation (7) is the cost of paying one dollar of taxes today; the LHS of equation (7) is the perceived costs of delaying and paying one's taxes in the next period. The perceived costs of delay are equal to the future benefits "forgotten" per dollar of taxes paid *plus* the added tax penalties from waiting. The taxpayer will pay her taxes today if the cost of paying a tax dollar today is less than or equal to the costs of waiting and paying that tax dollar in the next period.

In contrast to the naive procrastinator who is forgetful ($\varphi < 1$) and/or present biased ($\beta < 1$) and may therefore delay payment, the fully aware ($\varphi = 1$) and time consistent ($\beta = 1$) taxpayer always pays her taxes on time – that is, with penalties and interest, $1 + \rho > 1$.

In addition to the usual *passive* enforcement of late payments that occurs through the payment of interest and penalties when taxes are paid, the city may also use an *activist* enforcement strategy that audits some delinquent taxpayers at the beginning of the current period. If audited and determined to be a delinquent taxpayer, with probability π , the

taxpayer must then pay an additional fine F in the next period. F might include “booting” the taxpayer’s car, removing the taxpayer’s children from school until payment is received, or additional fines equal to added administrative costs plus penalties. A city might target its activist strategy at those taxpayers with very large tax bills or with a year after year history of being a late taxpayer.

We assume, for simplicity, that activist enforcement is only in period t and not later.¹¹ If the taxpayer does not pay in period t , then under the activist enforcement strategy, the expected lifetime utility in the next period if there is delay must allow for the possible imposition of the penalty, F . In this case, the expected lifetime utility from a one period delay becomes:

$$\begin{aligned} U_t^{t+1} &= \pi [\varphi^{t+2}\beta V - \varphi^{t+1}\beta c_{t+1} - \varphi^{t+1}\beta F] + (1 - \pi) [\varphi^{t+2}\beta V - \varphi^{t+1}\beta c_{t+1}], \quad \text{or,} \\ &= \varphi^{t+1}\beta [\varphi V - c_{t+1} - \pi F] \end{aligned} \tag{8}$$

Now the taxpayer’s decision rule is to pay if the expected utility of delay is less than the expected utility of paying today, or with the normalization that $f = F/(T(1 + \rho)^t)$, if:

$$\varphi^{t+1}\beta (v(1 - \varphi) + (1 + \rho) + \pi f) \geq 1 \tag{9}$$

Note that the likelihood of making tax payments increases in the activist enforcement parameters π and f .¹²

The following proposition summarizes the analysis above.

Proposition 1 *Naive procrastinating taxpayers will pay their taxes today if their perceived expected lifetime utility of delaying payment is less than or equal to the lifetime utility of*

¹¹The extension to a model in which enforcement occurs in each period with probability π is not difficult and all results summarized in Proposition 1 also apply in that model.

¹²Equivalently, Equation 9 can be re-written as $\varphi^{t+1}\beta(v(1 - \varphi) + (1 + \rho)) \geq 1 - \varphi^{t+1}\beta\pi f$, where $\varphi^{t+1}\beta\pi f$ can be interpreted as a “benefit” of early tax payment or “forgiveness” of tax penalties. Penalty forgiveness is a common strategy to encourage tax payment.

paying their taxes today, or as long as the costs from delay are greater than the costs of payment today. The likelihood of payment will increase as:

- 1. taxpayer present bias is reduced (β rises);*
- 2. taxpayer saliency of future benefits and costs increases (φ rises);*
- 3. the benefits or the tax morale from the act of tax payment increases (v rises);*
- 4. the penalties upon late payment or the subjective perception of these penalties increase (ρ rises); and*
- 5. activist enforcement probability (π) and the fines (f) increase.*

Proposition 1 provides the conceptual framework for the design of our field experiment and the interpretation of our empirical findings. We designed an experiment to evaluate the importance of three competing theoretical explanations of non-compliance: lack of salience (Proposition 1.2), or lack of benefits or tax morale (Proposition 1.3), or lack of deterrence (Proposition 1.4). We do not test Proposition 1.1, and therefore implicitly assume that all tardy taxpayers suffer from a common rate of present bias. Finally, our experimental design for Philadelphia does not allow us to evaluate the importance of activist enforcement strategies (Proposition 1.5).

3 A Field Experiment

The research setting for the experiment is the City of Philadelphia for calendar year, 2015. Notices of property tax payments are sent 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 payment plan with the City, then taxes are considered tardy and interest and penalties begin to accrue. On April 1, the City's Department of Revenue (DoR) begins

contacting all taxpayers with unpaid accounts, informing them of taxes due and accumulated interest and penalties for late payment. At this time, the City will normally send two-thirds of the tardy accounts to outside collection agencies acting as co-counsel for the City. The outside collection agencies are reimbursed at the rate of six percent of all their tardy revenues collected by December 31. The remaining one-third of the tardy accounts remain with the DoR for collection. All accounts still tardy on December 31 are designated as “delinquent” and then assigned to new outside collection agencies. For the purposes of our experiment the City of Philadelphia agreed to delay sending any of the tardy accounts to the collection agencies until August 15, 2015.

Our experiment was implemented with those taxpayers newly tardy on March 31, 2015. Of the 579,828 properties in the city receiving 2015 tax bills, approximately 100,000 or 17 percent were late in payment as of April 1. Of these 100,000 properties, 27,264 still owed more than \$10 as of May 15 and had not owed property taxes from prior years. Our experiment excludes all chronically delinquent taxpayers who owed taxes from prior years. Of the 21,468 tardy taxpayers, 2,429 taxpayers owned more than one property. While all 21,468 taxpayers were included in our experiment, we focus our empirical work on the 19,333 taxpayers who owned only one property.¹³

Our experiment began with the mailing of reminder letters in mid-June, 2015 and continued to December 31, 2015. Of the tardy taxpayers with a single property, 16,940 received a standard or experimental reminder letter and 2,088 taxpayers did not receive a reminder. This sample of 2,088 taxpayers became our “holdout” sample and the basis for identifying the importance of saliency in taxpaying behavior. To ensure that our experiment was not contaminated by other treatments not under our control, the DoR agreed to postpone all other enforcement activities until August 15. In particular, the outside collection agencies were not allowed to begin their collection efforts until after that date. The likely earliest

¹³As a robustness check we repeated our empirical analysis for the full sample of and the results are identical those we report in Sections IV and V below.

date that those efforts led to any contact with a taxpayer is September 1.

Each reminder letter was approved by City’s DoR to ensure that it could be understood by a taxpayer with at least a fourth or fifth grade level of English reading comprehension. Each letter also provided contact information for assistance for non-English speaking taxpayers. Translation were available for a number of different languages.¹⁴

Each reminder letter in our experiment was drafted to identify the possible impact on taxpayer compliance of the key variables in equation from Proposition 1. We could not, however, measure the effect of either taxpayer present bias (β) because our sample was limited to tardy taxpayers only. We also cannot evaluate the direct impact of a more activist enforcement strategy (π, f) as the city had not adopted such a strategy in our sample year, 2015. We can identify the potential importance of taxpayer saliency (φ), tax morales as they impact the benefits of tax payment (v), and interest and penalties (ρ). For brevity we present here the important distinguishing feature of each letter.

*Reminder-only: 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 cent – less than the cost of a stamp!

The reminder-only letter allows us to identify the potential importance of tax saliency to taxpayer compliance. From Proposition 1 our holdout sample has a rate of saliency of φ^{t+1} when evaluating future benefits and costs. But those receiving our reminder letter today have a rate of saliency when evaluating future benefits and costs of φ only. When saliency is important, future taxes and benefits will be more salient after the receipt of the reminder, thus increasing the likelihood of taxpayer compliance; that is $\varphi > \varphi^{t+1}$, for $\varphi < 1$. A higher rate of compliance among taxpayers receiving the reminder-only letter compared to those in

¹⁴Templates of the “reminder only” and “lien” letters are attached in the appendix. The full template for the other letters are available as an online appendix.

the hold-out cohort identifies a separate role for saliency in taxpayer compliance.¹⁵

Reminder plus Tax Lien: Failure to pay your Real Estate Taxes may 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 your neighborhood that have liens placed on them include: < List Three Properties and Sale Dates > **Pay your taxes now to avoid a lien being placed on your property. Our records indicate that you have a balance due of *balance*.**

Reminder plus Lien and Sheriff's Sale: 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 a Sheriff's Sale. Included in these N properties are the following properties near you: <List Three Properties and Sale Dates> **Pay your taxes now to prevent the sale of your property. Our records indicate that you have a balance due of *balance*.**

The reminder letter coupled with the threat of a lien, or a lien plus a sheriff's sale of the taxpayer's home, increase the expected interest and penalties to the costs of delay – that is, an increase in penalties (ρ). Both letters make clear that interest and penalties will be collected by listing neighborhood properties where these added enforcement measures have been implemented. A taxpayer lien for all interest and penalties will be collected at the future date of home sale, which may be a very large obligation if the home is sold significantly in the future. A lien coupled with a sheriff's sale may occur sooner and thus have lower accumulated interest and penalties, but the forced sale of one's home is likely to have very high psychic costs. Which of the two added penalties is larger, and therefore likely to have a stronger

¹⁵Our experimental design can identify the presence of saliency by an increase in compliance for those receiving a reminder letter, but time staggered reminder letters at a two-week or monthly interval would be needed to identify the actual rate of saliency – that is, the value of φ . This was not possible within the time constraints imposed by DoR on our experiment.

impact on compliance, will depend upon the circumstances of the individual tardy taxpayer. However, both letters should increase compliance over the holdout cohort from the reminder effect on saliency and from the added expected penalty, and both letters should increase compliance over the reminder-only letter from the added expected penalty.

Our final four reminder letters test for the potential role of “tax morale” motives for compliance. An appeal to a tax morale is meant to cue a possible benefit from having paid one’s taxes, apart from the actual receipt of services those payments may make possible. In contrast to user fees, property tax payments are not tied to the citizen’s receipt of particular services during our experimental period. In effect, each delinquent taxpayer is a free rider, and the appeal to a tax morale for payment is meant to overcome such self-interest. In our model of taxpayer compliance these higher motives are captured by v in Proposition 1, the morale benefits from paying per dollar of taxes, interest and penalties paid.

We test for the importance of four such motives: 1) the value of knowing one is a contributor to the immediate services of one’s neighborhood, v_N ; 2) the value of knowing one is a contributor to the wider services that benefit the city as a whole, v_C ; 3) the value of knowing one is part of a collective effort with other taxpayers or “peers” in paying for city services, v_P ; and 4) the value of knowing one has meet one’s obligations as a citizen in a democracy, v_D . Each of these benefits may motivate taxpayer compliance, and our reminder letters are meant to trigger a possible recognition of the importance of each motive. Some tardy taxpayers may respond to one motive, some to another, and perhaps others to none at all if the free-rider motive is decisive. The four tax morale reminder letters are:

Reminder Plus Appeal to Neighborhood Services: We want to remind you that your taxes pay for essential public services in *neighborhood name*, such as <List 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. Our records indicate that you have a balance due of *balance*.**

Reminder Plus Appeal to City-Wide Services: Your taxes pay for important services that make a city great. Your tax dollars are essential for ensuring all Philadelphia's 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. Our records indicate that you have a balance due of *balance*.**

Reminder Plus Appeal to Peer Behavior: 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. Our records indicate that you have a balance due of *balance*.**

Reminder Plus Appeal to Civic Duty: For democracy to work, all citizens need to pay their fair share of taxes for community services. **By failing to do so, you are not meeting your duty as a citizen of Philadelphia. Our records indicate that you have a balance due of *balance*.**

The morale benefits from knowing one has paid one's taxes equals a weighted average of these motivations (v) plus a possible additional weight (v_i) when one of the reminder letters reinforces or enhances the affected benefit from tax payment: $v + \sum_i \omega_i v_i$, where $i = N, C, P, \text{ or } D$, and where $\omega_i = 1$ if a reminder letter is received targeting benefit i , and v_i is the additional weight given to that motivation. We take as evidence that an increase in tax morale increases the likelihood of tax compliance when a tax morale reminder letter increases the rate of compliance above that of those receiving a reminder-only letter. If none of the tax morale letters impact compliance above a reminder-only letter then, at least on the margin for paying the property tax, the free-rider motivation is decisive for tardy Philadelphia taxpayers. In this case, increased enforcement will need to appeal to reminders and penalties.

4 Randomization Procedure

Randomization took place in two stages. As a baseline control, we randomly removed 3,000 tardy properties from the possibility of receiving any reminder letter at all, representing 2,088 property owners. These taxpayers ($N=2,088$) became our holdout sample and allowed us to estimate the efficacy of simply communicating with the taxpayer after the date that taxes are due. We next grouped all remaining properties by owner and randomized all owners to treatments based on the total amount of property taxes owed on all of their properties.

While the vast majority of properties in the city of Philadelphia are owned by those with just one property, approximately 10 percent of the properties are owned by individuals or firms that own multiple properties. Since we are interested in taxpayer compliance and not property compliance, we identified owners of multiple properties by their legal name and randomly assigned each owner to a treatment group.¹⁶ Any tardy taxpayer holding multiple properties within each treatment group received the same letter for each of those properties. Given the 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. Since most tardy property owners own only one property, our main interest in this study will be households that only own one property in the city. Once we restrict attention to this sample, we have 16,940 taxpayers in the treatment group and 2,088 taxpayers in the holdout sample. The total sample size is 19,028.¹⁷ Table 1 checks whether the treatment and holdout groups are balanced based on the two most important variables, taxes due and assessed property value.

¹⁶We 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.

¹⁷We also trimmed the sample and excluded the 28 owners with highest total assessed property value due to large variance in debt owed among the largest delinquents. None of the findings reported in the paper depend on this trimming.

Table 1 shows that randomization was successful in the single property 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 holdout group. As a further test of our randomization procedure, we also checked to see whether randomization achieved spatial uniformity throughout the geographic expanse of the city. As reported in Table 1 geographic balance was achieved.

Next we test whether randomization was successful among the seven experimental treatment groups. Table 1 shows the results for the single property owner sample. Overall, we find no evidence that would suggest any problems with randomization. Results for multiple property owners, which do not differ from results for single property owners, are reported in Table A2 in the appendix.

5 Empirical Results

Table 2 presents our core results for the three month period of our experiment largely unaffected by the intervention of the two outside collection agencies hired by the City to begin their own enforcement efforts in September, 2015. We consider two distinct measures of tax compliance behavior. First, did the taxpayer make any contribution at all towards their tax bill; this is the *ever-paid* response. Second, did the taxpayer make a full payment of their tax bill; this is the *paid-in-full* response. The sample includes only the 19,028 taxpayers who own a single property.¹⁸ For ease of interpretation, Table 2 presents OLS estimates for the linear probability model; logit estimates are available in Tables A3 and A4 in the appendix and are identical in significance and interpretation to the OLS results reported here.

The top line of Table 2 reports the mean rate of compliance of our holdout sample for

¹⁸We have repeated our analysis for the sample of taxpayers, including multi-property owning taxpayers. Results for the full sample are identical to those reported here for single property owners. We limited our reported results and discussion to the single property owner sample. For comparison, results for the sample with multiple property owners are reported in Appendix Tables A1 and A4.

Table 1: Balance on Observables (Single Property Owners)

Variable	Holdout	Reminder	Lien	Sheriff	Neighborhood	Community	Peer	Duty	<i>p</i> -value
Amount Due (June)	\$1,233	\$1,256	\$1,280	\$1,315	\$1,289	\$1,290	\$1,280	\$1,299	0.92
Assessed Property Value	\$142,630	\$158,370	\$130,642	\$134,334	\$159,079	\$130,265	\$130,936	\$165,617	0.53
Region									0.67
Center City	109	111	109	115	118	105	114	129	
Northeast Philadelphia	352	427	383	370	397	399	427	394	
North Philadelphia	449	520	525	526	491	498	533	527	
Northwest Philadelphia	537	601	645	666	620	654	615	611	
South Philadelphia	210	211	253	239	242	234	241	248	
West Philadelphia	431	549	514	500	519	551	486	523	
# Owners	2,088	2,419	2,429	2,416	2,387	2,441	2,416	2,432	

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

ever-paid or *paid-in-full* one month from the starting date of the experiment (July 15) and for the three months to the ending date of the experiment (September 15). The rate of *ever-paid* compliance for taxpayers in the holdout sample rises from 30.5 percent after one month to 51.4 percent after three months; the rate of *paid-in-full* compliance for the holdout sample raises from 23.5 percent after one month to 40.8 percent after three months. The rising rate of compliance for the holdout sample without receipt of a reminder letter is explained within the O’Donoghue and Rabin (1999) procrastination model by the presence of a terminal date to payment (S=December 31) at which time large costs to non-compliance can be imposed (e.g., garnishing of wages, sale of the home, publishing of names in the Philadelphia Inquirer).

Table 2: 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
Reminder	3.8*** (1.4)	3.9*** (1.5)	2.2* (1.3)	3.0** (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)
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)
Peer	3.9*** (1.4)	3.5** (1.5)	1.8 (1.3)	3.4** (1.5)
Duty	2.4* (1.4)	3.6** (1.5)	0.7 (1.3)	2.3 (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 the holdout benchmark.

The next seven rows report the additional impact on compliance from our seven treatment letters: Reminder-only, Reminder/Lien, Reminder/Sheriff, Reminder/Neighborhood,

Reminder/Community, Reminder/Peer, and Reminder/Duty. Receiving the reminder-only letter increases the rate of compliance after one month for an *ever-paid* tax payment by 3.8 percent above the holdout's rate of compliance and by 3.9 percent after three months. Both effects are statistically significant at the 99 percent level of confidence. These estimates for the reminder-only letter indicate the relative importance of saliency to taxpayer compliance behavior. Our letter is particularly effective early in our experiment, where the pure effect of a reminder increases the rate of compliance after one month by approximately 12 percent ($= 3.8/30.5$). While receipt of the reminder letter is still effective after three months, its relative impact on compliance behavior is less, adding an additional 8 percent ($= 3.9/51.4$) to the rate of *ever-paid*. The same statistical significance and declining rate of impact on compliance is observed for the outcome, *paid-in-full*. Here the reminder-only letter increases the one month rate of compliance over the holdout sample by 2.2 percent on a mean rate of holdout compliance of 23.5 percent (9.4 percent improvement) and the three month rate of compliance over the holdout sample by 3.0 percent on a mean rate of 40.8 percent (7.4 percent improvement).

Adding a message to the reminder letter has a mixed impact on taxpayer compliance. Table 2 reports the joint effects of receiving a reminder and a message. Of the six messages, only the reminder/lien and reminder/sheriff letters had a statistically robust *added* impact on compliance. After one month, the sample receiving the reminder/lien letter had an additional 9.0 percent rate of *ever-paid* compliance over the holdout sample's compliance rate of 30.5 percent rate (30 percent improvement) and after three months, an additional 9.2 percent rate of *ever-paid* compliance over the holdout sample's compliance rate of 51.4 percent (18 percent improvement). The impact is statistically significant at the 99 percent level of confidence. The results for paid-in-full compliance for the reminder/lien letter are also quantitatively important and statistically significant, adding 5.6 additional compliance over the holdout sample's one month mean rate of 23.5 percent (24 percent improvement) and an additional 7.2 percent compliance to holdout sample's three month mean compliance rate of 40.8 percent

(18 percent improvement). Comparable impacts are observed for the sample receiving the reminder/sheriff letter, where we observe a 24 percent (=7.4/30.5) improvement in the rate of ever-paid compliance after one month, a 17 percent (= 8.8/51.4) improvement in *ever-paid* compliance after three months, a 19 percent (= 4.5/23.5) improvement in *paid-in-full* compliance after one month, and an 17 percent (= 6.8/40.8) improvement in *paid-in-full* compliance after three months.

Table 3: Short-term Results: Relative to Reminder-Only

	Ever Paid		Paid in Full	
	One Month	Three Months	One Month	Three Months
Reminder	34.3	55.4	25.8	43.8
Lien	5.3*** (1.4)	5.3*** (1.4)	3.4*** (1.3)	4.2*** (1.4)
Sheriff	3.6*** (1.4)	4.9*** (1.4)	2.3* (1.3)	3.7*** (1.4)
Neighborhood	-2.1 (1.4)	-1.2 (1.4)	-2.5* (1.3)	-1.5 (1.4)
Community	0.1 (1.4)	-1.1 (1.4)	-0.9 (1.3)	-0.5 (1.4)
Peer	0.1 (1.4)	-0.4 (1.4)	-0.4 (1.3)	0.3 (1.4)
Duty	-1.3 (1.4)	-0.3 (1.4)	-1.6 (1.3)	-0.7 (1.4)
Num. obs.	16940	16940	16940	16940

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

No such consistent improvements in compliance above the reminder-only letter are observed for those receiving a reminder letter with a “tax morale” message. This is seen most clearly in Table 3 where we compare compliance in the reminder-only sample to that of the samples receiving one of the six message letters. In this comparison, both the reminder/lien and the reminder/sheriff letters stressing the penalties of noncompliance have statistically significant and policy relevant additional impacts on compliance above reminder-only, both

for the *ever-paid* and *paid-in-full* outcomes and at the one month and three month intervals. The lien letter adds more than a 5 percent increase in the rate of compliance above the reminder-only letter for *ever-paid* and about 4 percent to the rate of compliance for *paid-in-full*. These effects represent a 10 to 15 percent improvement in the rates of compliance over those obtained with the reminder-only letter. The sheriff letter also offers a significant improvement over the reminder-only letter, though the effects are slightly lower than those obtained with the lien letter. Compliance rates for *ever-paid* increase by 3 to 5 percent and for *paid-in-full* by to 2 to 4 percent above those achieved with the simple reminder. These effects represent a 9 to 11 percent improvement in compliance performance over what had been obtained with a reminder only. Table 3 also shows most clearly the inability of the tax morale reminders to induce greater compliance from Philadelphia’s tardy taxpayers. Among those reminders, only the neighborhood letter is ever statistically significant and its effect is negative (!) for those paying in full.¹⁹ Our results are similar in statistical significance and

¹⁹Our results for both the positive impact of penalties and mixed effectiveness of tax morale messages are consistent with most of the current literature on “nudges” and tax compliance; see (Hallsworth, 2014) for a thorough review. In the interest of full disclosure, however, our pilot study (Chirico et al., 2016) for this project did find a role for a community or duty letter in increasing compliance. The control group in the pilot study received a reminder-only letter. Three other groups received either a penalty letter, a community letter – your taxes pay for city schools, police services, and fire fighters – or a combined peer/duty letter – 9 out of 10 Philadelphians pay their taxes; paying your taxes is your duty. In our pilot the penalty letter had no additional effect on compliance over that of the reminder-only letter. The community letter increased the rate of compliance above the reminder letter by 4 percent, but the effect was not quite statistically significant. The combined peer/duty letter increased rate of compliance above the simple reminder letter by 2 percent and the effect was statistically significant at a 95 percent level of confidence.

It is worth speculating as to why our results here differ from those in our pilot study. First, the pilot was run on a much smaller sample (3,900 single property taxpayers) and thus the results were less precisely estimated. Second, and more importantly, the sample for the study included only taxpayers who had not yet paid by the middle of November, 2014 (the time of our pilot), and thus are very close to being what the City will classify as a “delinquent” taxpayer as those who have not paid by December 31 of the tax year. The sample therefore consisted of the “most-tardy” of tardy taxpayers. Of these “delinquent” taxpayers who did make a contribution in our pilot study, the contributions were typically only partial payments of \$50 to \$150, suggesting these households may be seriously cash constrained. One might then imagine that for this sample of tax payers penalties are irrelevant; they cannot pay in full in any case. But a morale nudge might induce some payment in the spirit of a “charitable contribution.” Consistent with this possible explanation is the fact that the average rate of compliance of this sample over the six weeks of our pilot was only 15 percent and the moral nudges boosted the rate of those making even some contribution to no more than 20 percent. It would be very valuable to design a larger experiment that seeks a compliance strategy for these

impact to those in Castro and Scartascini’s (2015) study of property tax payments in Junin Argentina, the other major field experiment seeking to improve property tax collection. For Philadelphians at least, and for the residents of Junin, it is reminders and penalties that improve compliance among tardy taxpayers.

Table 4: Long-Term Linear Probability Model Estimates

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

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

Table 4 estimates the longer run impacts of our seven nudge interventions on compliance. The letters were sent on June 15th and received soon thereafter. The first two columns of Table 4 show the estimated effects on compliance of having received a letter six months later, again compared to compliance behavior in our holdout sample. Now the reminder-only letter no longer has an impact on compliance behavior, suggests declining saliency over very tardy or delinquent taxpayers. For this sample, one could add a “cost” to early payment in Equation 9 to reflect a cashflow constraint. Here the literature on financial behavior under liquidity constraints is relevant; see Zeldes (1989).

time. Reminder letters that stress penalties from a lien or a lien plus sheriff’s sale still have influence, however. The implied increase in expected penalty from non-compliance appears sufficient to overcome the loss of saliency. But again consistent with declining saliency, the estimated impact of the lien and sheriff letters, while still statistically significant, are roughly half as large as their impact at the one and three month intervals; compare Tables 2 and 4. Again, none of the tax morale nudges show a statistically significant impact on compliance behaviors.²⁰

The last two columns of Table 4 carry our sample into the next tax year, beginning with the receipt of a new property tax bill in early January, 2016, and asks if having received a reminder letter in June, 2015 improves compliance behavior for the payment of the 2016 taxes by June of 2016. Consistent with the importance of saliency, none of the 2015 reminder letters appear to have “staying power” into the next tax year. Tardy Philadelphians need constant reminders.

6 Discussion

While of interest as a specification and test of a behavioral theory of tax compliance, our results are also relevant for city tax collection policies. As a strategy for improving collection from tardy taxpayers, our analysis informs two important policy issues. First, cities need revenues: Do reminders improve collection, and then do reminders with a message raise more money than a simple reminder? Second, in light of the recent municipal fiscal crises and the potential for an unraveling of citizen commitment to local governance: Do reminders

²⁰The six month results need to be interpreted with care, however, as they are no longer part of our experimental design. Beginning between mid-August and mid-September the City allowed two private collection agencies to begin their efforts at collecting taxes from those in our original sample of 19,333 tardy taxpayers who had not yet paid their taxes, including those in our holdout sample. The treatments therefore, become a joint intervention of our letters and the unspecified, proprietary strategies of the collection agencies, which we then compare to the collection agencies’ strategies alone as they impact those in the holdout sample. Whatever impact those proprietary strategies may have on compliance, our lien and sheriff sale letters still appear to have a lingering, value-added impact.

with a message, and then which message, improve tax collection as a “nudge” to citizen engagement? Table 5 provides answers to these two questions.

Table 5: Three Month Impact of Collection “Nudges”*

Treatment	Sample Size	Total Taxes Owed	New Payers	Revenue/ Letters	New Revenues	New % of Taxes Paid
Reminder	2,419	\$3.038 M	95	\$28.79	\$69,643	.023
Lien	2,429	\$3.109 M	224	\$67.67	\$164,370	.023
Sheriff	2,416	\$3.177 M	213	\$64.90	\$156,798	.049
Neighborhood	2,387	\$3.077 M	65	\$19.77	\$47,191	.015
Community	2,441	\$3.149 M	68	\$20.91	\$51,041	.016
Peer	2,416	\$3.092 M	85	\$25.65	\$61,970	.020
Duty	2,432	\$3.159 M	88	\$26.62	\$64,739	.020
Totals	16,490	\$22.143 M	838	-	\$615,752	.028

* Sample Size are the number of single property taxpayers in the treatment group. Total Taxes Owed is the total taxes owed by single property taxpayers in the treatment group. New Payers equals the new payers after three months computed as the estimated increase in rate of compliance of those receiving the letter over those in the holdout sample as reported in Table 2; for example, for the reminder letter the number of new payers equals $95 = .039 \times 2,419$. Revenue per letter for each treatment equals the median new revenue collected from those who received a treatment letter and made some payment ($= \$738/\text{letter}$) times the three month increase in compliance from each treatment letter; for example for the reminder letter the median estimated revenue per letter equals $\$28.79 = .039 \times \738 . New revenues for each treatment equals the revenue/letter times the number of single owner properties receiving a treatment letter: for example, for the reminder letter the estimated total new revenues equals $\$69,643 = \$28.79 \times 2,419$. New % of Taxes Paid equals New Revenues Divided by Total Taxes Owed; for example, for the reminder letter $.023 = \$69,643 / \$3,038,000$.

Listed in Table 5 are our seven treatments, the sample size to which each treatment applied and total taxes owed, and then estimates of the impact of each treatment on the number new payers three months after receipt of the treatment letter, the average new revenue received per letter sent, total new revenues collected from each treatment letter above that paid by the holdout sample, and finally, the percent of owed taxes paid because of each treatment.

For single property owners, the total number of new taxpayers above the holdout sample from all reminder letters is 838, an average increase in the overall rate of compliance from receiving one our treatment letters of 4.9 percent ($838/16,940$). Table 5 also provides an estimate of additional revenues raised by each of our treatment letters and then the total revenue raised from each treatment group. From the perspective of the City’s Department of Revenue, our experiment was a good investment of Department resources. Each letter cost

about \$1 to process and send. Thus estimated benefit to cost ratios for the seven treatments ranged from a low of \$19.77 (the Neighborhood letter) to a high of \$67.67 (the Lien letter). The approximately \$17,000 spent on our experiment to mail the 16,940 treatment letters raised \$615,752 in additional city revenues: an average benefit to cost ratio of 36.3.

Among our seven treatments, our experimental results clearly show the power of the lien and sheriff letters compared to a simple reminder or the tax morale nudges. The number of new taxpayers above the holdout sample is three to four times larger and the revenue/letter is two to three times larger with the letters stressing penalties. As a consequence, total new revenues (above the holdout sample) from the penalty letters and new revenues as a share of all taxes owed are three to four times larger as well. If we had sent only the lien or sheriff's letter to the 16,940 taxpayers in our treatment groups we would have raised \$1.15 million in new revenues rather than \$616,752 – nearly twice as much. The paid share of taxes owed would have risen from our experiment's average of .028 to lien letter only of .053.

While the seven treatments are effective on the margin and the penalty letters particularly so, the final column makes clear that at least in Philadelphia, our treatments will not completely solve the larger problem of unpaid City property taxes. The treatments encourage a 3 to 9 percent higher rate of compliance above the holdout sample, and the typical new taxpayer pays on average about 60 percent of what they owe.²¹ Thus the contribution towards total taxes owed will range from a low of 1.5 percent for the neighborhood letter to a maximum of 5.3 percent for the lien letter. Nudges help, and money is money, but at least in Philadelphia, they alone will only partially solve the large problem of tardy and then delinquent tax payments.

Money may not be all that matters with tax collection, however. Voluntarily paying one's taxes on time is a signal that one believes in what government is trying to do; see Posner (2000). From the U.S. Colonies' resistance to British taxation in the 1760's to the

²¹The median taxpayer in our sample who pays taxes, pays \$738 towards the (average) tax bill of about \$1200, or 60 percent.

boycotts of the apartheid government's imposition of utility taxes on the residents of Soweto in the 1980's, refusing to pay one's taxes is a rejection of government's performance. In signaling games where there is a cost to non-compliance, the more who indicate they favor your contrarian position, the more likely you are to publicly express that position too; see Lohmann (1994) and Benabou and Tirole (2011). In our case, what may have once been a strong tax compliance outcome can unravel to a new, non-compliance equilibrium when government no longer performs as needed for a majority of citizens; see Besley, Jensen, and Persson (2015). Recently, such an unraveling towards a low compliance equilibrium can be observed in Detroit. The city's rate taxpayer compliance for property tax collections fell from a ten year average of .90 from 2000-2010 to a compliance rate of .68 by 2014 (Chirico, et al., 2015). In 2013, 47 percent of Detroit's properties were classified as delinquent.²² While nudges help, a high initial value of V reflecting government benefits significantly greater than tax costs may be the most important determinant of the aggregate rate of taxpayer compliance and commitment to city government; see Haughwout, Inman, Craig and Luce (2004).

7 Summary and Conclusions

U.S. cities have a mixed record in their ability to collect taxes from their residents. Some (Boston, Charlotte, San Francisco, San Antonio) do a good job, collecting over 98 percent of property taxes due, others (New York, Philadelphia, St. Louis) are less successful collect-

²²See Reese and Sands (2013) who conclude from their review of the economic and political events leading to the Detroit fiscal crisis that "it is not surprising that many view the social contract between property taxpayers and city government as broken." (p. 9) Another example of this can be seen in the 1990 taxpayer revolt to Prime Minister Thatcher's introduction of a local poll (head) tax; see Besley, Jensen and Persson (2015). The regressive poll tax replaced a proportional property tax. In response to widespread citizen resistance the poll tax was removed two years later and the property tax restored. But compliance rates for the restored property tax were 14 percent lower than before: .83 vs. .97. Efforts to restore compliance since then have stressed high penalties but it has taken nearly eighteen years to return to the original rates of payment. Expected penalties perhaps are no substitute for good governance for ensuring voluntary taxpayer compliance.

ing 90 percent, and finally some, such as Detroit and Flint, collect less than 70 percent of property taxes owed (Chirico, et. al., 2015). Collecting property taxes should be straightforward; both the city and the property owner know exactly what is due. While scofflaws, those permanently in arrears, are a problem, most tardy tax payments are because residents forget or are hoping to “let it ride” and not be noticed. We provide an extension of the O’Donoghue-Rabin’s (1999) theory of procrastination to explain this behavior. We then test three competing explanations incorporated in our model using a field experiment on property tax compliance in Philadelphia.

Our empirical analysis reached three conclusions. First, there is strong evidence that salience is important. A simple reminder will improve compliance. The rate of compliance rose by 4 percent with a simple reminder above that of our holdout sample that received no reminder. But the effects of the reminder decline over time. There is no evidence that having received a reminder in 2015, and having even paid your taxes, improves your chance of compliance when paying your 2016 taxes. These results strongly suggest tardy taxpayers lack salience which is consistent with Akerlof’s (1991) work on procrastination. Taxpayers may have a limited capacity to remember and process tax (and benefit) information when making their spending and financial decisions. An explicit reminder that brings that information to the fore can encourage payment. In this regard our results are consistent with those in Chetty, Looney, and Kroft (2009) on the role of saliency in the payment of sales taxation and the results in Bhargava and Manoli (2015) on the take-up rate for welfare benefits.

Second, a reminder letter with a “message” can improve compliance above a simple reminder, but the content of the message matters. Two of our reminder letters stressed increased penalties for non-compliance; one threatened to place a lien on the property if taxes are not paid and the second threatened a lien and the risk of an immediate sheriff’s sale if taxes are not paid. Both had a significant impact on compliance, raising the rate of compliance by 9 percent over that of taxpayers who received no reminder at all. This finding strongly supports the theory that tardy taxpayers lack sufficient deterrence. The messages

that did not improve compliance above that of a simple reminder letter were our four “tax morale” messages: one stressing your taxes are needed for neighborhood services such as trash collection and the local park, a second that your taxes pay for important city-wide services such as education and protection, a third that 9 of 10 other Philadelphians pay their taxes on time, and a fourth that paying one’s taxes is an important component of the democratic contract. It is important to stress, however, that the impact of any nudge on behavior is conditional on the content of the message, its fiscal context, and affected taxpayers. Our results are for Philadelphia, *given* its current levels of penalties, the current level of services provided by the City, and the preferences of its tardy taxpayers. Tax nudges in cities with lower penalties, better services, or more civically minded taxpayers might induce different behavioral responses. That said, the similarity of our results, both qualitatively and quantitatively, to those of Castro and Scartascini (2015) for the property tax payments in Junin, Argentina is reassuring.

Third, the marginal impacts on city revenues of our strategies were quantitatively significant. A simple reminder letter earned the City \$28 more in additional revenues for each additional dollar of administrative cost. A reminder coupled with our most effective messages - the tax lien and sheriff letters - earned the City \$65 more in extra revenues for each dollar expended. This marginal revenue to cost ratio for well targeted nudges is what is required for understanding the potential role of nudges as part of any City’s revenue collection strategy; see Keen and Slemrod (2016). Still, other administrative strategies may be needed. Reminders and nudges are passive strategies with the compliance decision in the hands of the taxpayer alone. In Philadelphia, our reminders and nudges had only a modest effect on aggregate taxpayer compliance and revenues collected. The most effective nudges we tested improved the rate of compliance by 9 percent over no reminder at all and the level of owed revenues by only 5 percent. Though clearly more costly (both in dollars and perhaps political capital), an activist collection strategy involving direct city audits of tardy taxpayers and large monetary or non-monetary penalties for violators may be needed for more significant

revenue effects.

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A Appendix: Additional Figures and Tables

The appendix contains Tables A2 and A1 which summarizes additional balance tests and robustness analyses using all owners (including multiple property owners). Tables A3 and A4 report estimates based on Logit models for single property owners and single plus multiple property owners.

Table A1: Robustness Analysis: Relative to Reminder (All Owners)

	Ever Paid		Paid in Full	
	One Month	Three Months	One Month	Three Months
Reminder	34.9	56.5	23.9	41.8
Lien	4.8*** (1.3)	4.7*** (1.3)	3.3*** (1.2)	4.0*** (1.3)
Sheriff	3.4*** (1.3)	4.6*** (1.3)	2.3** (1.2)	3.6*** (1.3)
Neighborhood	-1.0 (1.3)	-0.8 (1.3)	-1.2 (1.2)	-0.4 (1.3)
Community	-0.4 (1.3)	-1.4 (1.3)	-0.6 (1.2)	-0.2 (1.3)
Peer	0.3 (1.3)	-0.8 (1.3)	0.4 (1.2)	0.8 (1.3)
Duty	-1.3 (1.3)	-0.2 (1.3)	-1.0 (1.2)	-0.8 (1.3)
Num. obs.	19333	19333	19333	19333

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

Table A2: Balance on Observables
Single Property Owners

Variable	Reminder	Lien	Sheriff	Neighborhood	Community	Peer	Duty	<i>p</i> -value
Amount Due (June)	\$1,256	\$1,280	\$1,315	\$1,289	\$1,290	\$1,280	\$1,299	0.98
Assessed Property Value	\$158,370	\$130,642	\$134,334	\$159,079	\$130,265	\$130,936	\$165,617	0.46
# Owners	2,419	2,429	2,416	2,387	2,441	2,416	2,432	0.99

Single and Multiple Property Owners

Variable	Reminder	Lien	Sheriff	Neighborhood	Community	Peer	Duty	<i>p</i> -value
Amount Due (June)	\$1,593	\$1,593	\$1,590	\$1,589	\$1,583	\$1,572	\$1,583	1
Assessed Property Value	\$180,664	\$155,499	\$157,398	\$180,172	\$153,528	\$155,438	\$183,991	0.48
% with Single Property Owner	87.6	88.0	87.5	86.4	88.4	87.5	88.1	0.42
% Overlap with Holdout	3.69	3.44	3.29	3.73	3.40	3.55	3.40	0.97
# Properties per Owner	1.27	1.26	1.26	1.32	1.26	1.26	1.26	0.67
# Owners	2,762	2,761	2,762	2,762	2,762	2,762	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.

Table A3: Short-Term Logistic Model Estimates (Single Property Owners)

	Ever Paid		Paid in Full	
	One Month	Three Months	One Month	Three Months
Holdout	-0.8	0.1	-1.2	-0.4
Reminder	0.2*** (0.1)	0.2*** (0.1)	0.1* (0.1)	0.1** (0.1)
Lien	0.4*** (0.1)	0.4*** (0.1)	0.3*** (0.1)	0.3*** (0.1)
Sheriff	0.3*** (0.1)	0.4*** (0.1)	0.2*** (0.1)	0.3*** (0.1)
Neighborhood	0.1 (0.1)	0.1* (0.1)	-0.0 (0.1)	0.1 (0.1)
Community	0.2*** (0.1)	0.1* (0.1)	0.1 (0.1)	0.1* (0.1)
Peer	0.2*** (0.1)	0.1** (0.1)	0.1 (0.1)	0.1** (0.1)
Duty	0.1* (0.1)	0.1** (0.1)	0.0 (0.1)	0.1 (0.1)
AIC	24493.1	26068.9	21605.6	26093.5
BIC	24556.0	26131.7	21668.4	26156.3
Log Likelihood	-12238.6	-13026.4	-10794.8	-13038.7
Deviance	24477.1	26052.9	21589.6	26077.5
Num. obs.	19028	19028	19028	19028

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

Table A4: Logit Estimates Including Multiple Owners

	All Owners		Single Property Owners	
	One Month	Three Months	One Month	Three Months
Lien	0.21*** (0.06)	0.20*** (0.05)	0.23*** (0.06)	0.22*** (0.06)
Sheriff	0.15** (0.06)	0.19*** (0.05)	0.16** (0.06)	0.20*** (0.06)
Neighborhood	-0.05 (0.06)	-0.03 (0.05)	-0.09 (0.06)	-0.05 (0.06)
Community	-0.02 (0.06)	-0.06 (0.05)	0.00 (0.06)	-0.04 (0.06)
Peer	0.01 (0.06)	-0.03 (0.05)	0.01 (0.06)	-0.02 (0.06)
Duty	-0.06 (0.06)	-0.01 (0.05)	-0.06 (0.06)	-0.01 (0.06)
AIC	25179.24	26349.91	21922.44	23174.00
BIC	25234.33	26405.00	21976.61	23228.16
Log Likelihood	-12582.62	-13167.95	-10954.22	-11580.00
Deviance	25165.24	26335.91	21908.44	23160.00
Num. obs.	19333	19333	16940	16940

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



**CITY OF PHILADELPHIA
DEPARTMENT OF REVENUE
TAX | WATER | LAW**

Real Estate Tax Delinquency Notice

January 27, 2017

**RICHARD ROE
706 CRESHEIM RD
PHILADELPHIA, PA 19119**

Owner(s): RICHARD ROE
Property Address: 706 CRESHEIM RD
Account Number: 124578340
Balance Due: \$2,087.37

<p>Se brindan servicios de interpretación. خدمات الترجمة الشفهية متوفرة لدينا 提供口译服务。 Services d'interprétation disponibles. 통역이 제공됩니다. Предоставляются услуги устного переводчика. ການ ຈຳລອງ ທາງ ທີ່ ມີ ຄົນ ຈາກ ພື້ນ ທີ່ ຈາກ ພື້ນ ທີ່ ຈາກ ພື້ນ ທີ່</p>

Dear Richard Roe,

Our records indicate that you have a balance due of \$2,187.27.

If you have already paid, thank you. If not, please pay now or contact us for 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!

Sincerely,

Deputy Commissioner Marisa Waxman
Department of Revenue
City of Philadelphia

Revenues for Schools & Services
Have questions or need help? Visit www.phila.gov/revenue or call 215-686-6442



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통역이 제공됩니다.

Предоставляются услуги устного переводчика.

ଆମ ସେବାଗୁଡ଼ିକ ଆପଣଙ୍କ ପାଇଁ ଉପଲବ୍ଧ ଅଟେ ।

Dear Richard Roe,

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 Upper Kensington that have had liens placed on them include:

- 117 EAST WISHART STREET Sold November 19, 2014
- 401-11 E ALLEGHENY AVE Sold April 15, 2015
- 3419 F ST Sold April 15, 2015

Pay your taxes now to avoid a lien being placed on your property. Our records indicate that you have a balance due of \$2,187.27.

If you have already paid, thank you. If not, please pay now or contact us for 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!

Sincerely,

Deputy Commissioner Marisa Waxman
 Department of Revenue
 City of Philadelphia

Revenues for Schools & Services

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