

# Is Paying Taxes Habit Forming?

## Theory and Evidence from Uruguay

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## **Abstract**

Citizens can develop persistent, self-reinforcing habits of interaction with tax bureaucracies and other organs of the state. Yet, policy interventions can also foster or disrupt habits, often with unanticipated consequences. We study a policy in Montevideo, Uruguay that randomly assigns tax holidays—that is, year-long interruptions of payments—to punctual taxpayers. The program is designed both to reward and induce tax compliance, a critical facet of state capacity. We find that far from fostering compliance, interrupting the habit of paying taxes results in a substantial and prolonged reduction in payments after the holiday's conclusion. Consistent with our theory, failure to pay has self-sustaining effects. Yet, for taxpayers with a strong reserve of compliance habit, negative effects eventually decay. We use field and survey experiments to isolate the habit mechanism from alternative explanations. Our findings have implications for understanding virtuous or vicious cycles in civic participation.

# 1 Introduction

Interactions between citizens and the state often involve routinized, repeated behaviors—and this repetition may itself breed habits of citizenship, with independent consequences for civic participation. If habits are self-reinforcing, they may also help explain the persistence of broad patterns of political development, for instance, involving citizens’ acquiescence to state dictates or their fulfillment of civic duties. At the same time, interventions that create or break habits can be critical forces for change. The power of habit therefore implies the possibility of virtuous or vicious cycles in civic participation—and raises the question of how habits are formed and how they may be disrupted.

Consider tax compliance, a critical aspect of citizen-state interaction and key facet of state capacity. Scholars often attribute low rates of compliance, especially in developing countries, to weak monitoring capacity and the inability of states to penetrate society and compel tax payment (Mann 1984; Besley and Persson 2009). Yet the force of habit can also sustain high or low tax compliance. In data we gathered for this project, we found persistent non-compliance with municipal tax bills in Montevideo, Uruguay. The average tax account in Montevideo owes six past due tax payments; only 65 percent of tax bills are paid on time; and the municipality classifies just 35 percent of taxpayers as “good taxpayers,” based on having paid every tax bill punctually over the previous year.<sup>1</sup> Weak monitoring capacity cannot explain these outcomes: with such municipal taxes, the state knows with certainty the amount of tax owed yet still fails to induce prompt compliance among substantial numbers of taxpayers.

Habit, by contrast, may play a role in producing such compliance patterns. While some taxpayers are intermittent compliers in our data, many “good taxpayers” pay taxes punctually year after year while similarly situated people are repeatedly non-compliant. The difficult question is whether this reflects any causal effect of habit, or whether other attributes account for all of the difference between compliant and non-compliant taxpayers. Empirical research on the habit of paying taxes is not well developed, perhaps because it is exceedingly difficult to generate as-good-as-random assignment of past tax compliance. Yet, understanding the impact of the act of paying taxes—or failing to do so—is important for both social-scientific and policy purposes.

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<sup>1</sup>See Figure 1, discussed later.

We show in this article that states—and social scientists—ignore the force of habit at their peril. Faced with the reality of low compliance, and the apparent difficulty of using negative incentives such as threats of punishment to elicit payments, many municipalities in Latin America have experimented with rewards programs that offer positive incentives for prompt tax payment. For example, upwards of 25 percent of municipalities in Brazil, Colombia, Ecuador, and Uruguay, and many localities in Argentina, Peru, and Mexico, now offer rewards programs such as prize lotteries for good taxpayers.<sup>2</sup> Montevideo was one of the earliest innovators of such policy: since 2004, and across four types of municipal taxes, the municipality has raffled a year free of tax payments to eligible taxpayers who have been punctual compliers over the previous year. The policy is intended both to reward and incentivize the payment of taxes; it may also boost perceptions that the tax system is equitable and transparent.

However, such holidays also interrupt the habit of tax payment. Indeed, the lotteries provide a rare form of randomization that allows study of the impact of disrupting compliance. In this study, we leverage unusual access to a detailed panel of administrative data on individual tax payments. We compare tax holiday winners to a randomly sampled control group of eligible non-winners. This natural experiment allows us to assess how holidays influence subsequent tax compliance, using unobtrusive outcomes that are not subject to social desirability bias from self-reports and that are measured over more than a decade. Placebo outcome tests with data on ineligible taxpayers as well as balance tests on pre-treatment covariates validate key assumptions of our design. We also draw on qualitative interviews with municipal officials and tax holiday winners, a large field experiment, and a survey experiment to assess mechanisms that explain our effects.

We find that far from promoting compliance, Montevideo's tax holiday inhibits it. Winning the holiday substantially reduces tax payments after the conclusion of the holiday, an effect that lasts on average for up to two years. This consequently also reduces eligibility for the reward program and increases citizens' accumulated tax debt. Several findings indicate the importance of habit disruption. (1) We find no negative effects for the one municipal tax for which winners pay a small amount of tax during the holiday—and for which the habit of payment is thus not in fact interrupted. (2) The holiday does not decrease compliance among taxpayers signed up for automatic debits, whose payments me-

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<sup>2</sup>See Section 2.

chanically restart after the holidays. Only for manual taxpayers does the interruption have a negative impact. (3) The negative effects are also less pronounced for taxpayers with a greater “stock” of prior compliance habit. This pattern of effects is consistent with our theory of habit but at odds with several alternative explanations emphasizing broader shifts in attitudes or other behavioral changes. We also decouple the impact of habit interruption from the effects of information provided by the municipality to lottery winners. Thus, we collaborated with the municipal government on a field experiment in which we mailed to taxpayers informational flyers stamped with the municipal logo. We assigned taxpayers at random to a pure control group that received no flyers; a placebo control group that received a reminder of an impending tax due date; or a treatment group that received the reminder plus additional information about the tax holiday lottery. In contrast to the impact of payment interruptions, the effects of information about the holiday are weak and short-lived. Finally, we use both qualitative interviews and a survey experiment to assess impact on attitudes towards the equity and transparency of the tax system. We find no evidence that informational or attitudinal mechanisms can account for our findings. Our findings thus suggest that interventions that are inattentive to the force of habit can have substantial negative consequences. New policies should be considered in light of their likely effects on habit formation—and disruption.

Our theory and findings also illustrate how habits can contribute more broadly to persistent patterns of citizen-state interaction. In the theoretical framework we develop in the next section, compliance has feedback effects: paying taxes in one period affects the stock of compliance habit and therefore influences the propensity to pay in later periods. Consistent with this theory, we find that the negative effect of tax holidays endures beyond the impact of the initial exogenous interruption—because failure to make a payment after the holiday further reduces the propensity to comply. Yet, also in accord with the theory but at odds with several alternative explanations, the total effect of the interruption eventually decays among good taxpayers eligible to win the holiday, who have a history of consistent previous payment. In other words, the effects of policy interventions are conditioned by compliance histories and practices. For poor taxpayers, behavioral nudges that produce better compliance habits could be critical; yet such policies would have to reckon with the force of accumulated non-compliance habits. Our results thus underscore the importance of reserves of habit and suggest how self-reinforcing practices produce broader patterns of tax compliance. While social scientists have focused on how development

outcomes can be locked-in by strategic equilibria, or by increasing returns and path dependency (Collier and Collier 1991; Pierson 2000; Acemoglu and Robinson 2012), our results suggest that habits can also have persistent influences on citizen-state interactions.

Our study thus provides new insights into the causes of tax compliance and sources of weak state capacity. By shaping patterns of tax payment, habit may also impact other important phenomena. For example, taxation can shape demands for political accountability.<sup>3</sup> Paler (2013) finds that Indonesian citizens experimentally primed to think of direct taxes increased their political monitoring and anti-incumbent political action, while Martin (2014) finds that taxation boosts citizens' willingness to punish leaders in laboratory experiments in Uganda. Yet, such downstream accountability effects depend on the elicitation of tax compliance in the first place. We also contribute to the study of habit as a source of civic participation. Gerber, Green and Shachar (2003) show that voters randomly assigned to receive a get-out-the-vote message in one election were significantly more likely to turn out in the next, while Meredith (2009) finds that eligibility to vote in a past presidential election—as determined by whether a voter was just over or just under 18 years old—increases the probability of participation in the subsequent election. Coppock and Green (2015), combining data on millions of voters from several experiments and natural experiments, similarly find persistent effects of voting. Interruptions of the voting habit due to residential mobility may also account for turnout disparities between young and old voters in the United States (Aldrich, Montgomery and Wood 2011; Ansolabehere, Hersh and Shepsle 2012). Outside of electoral participation, however, the force of habit is much more sparingly studied; and scholars have not convincingly isolated the impact of habit disruption rather than formation. We focus here on how interruption of a behavior—as opposed to a shift in the broader context in which a behavioral choice is made—can significantly disturb habit.

## **2 Why do people comply? Taxes, incentives, and habit**

By “habit” we do not mean a behavior that is necessarily automatic or unthinking. Social psychologists have developed an understanding of habit as involving repetition of a response under similar

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<sup>3</sup>See e.g. Schumpeter (1918 (1954)); Bates and Lien (1985); Ross (2004); or Prichard (2015).

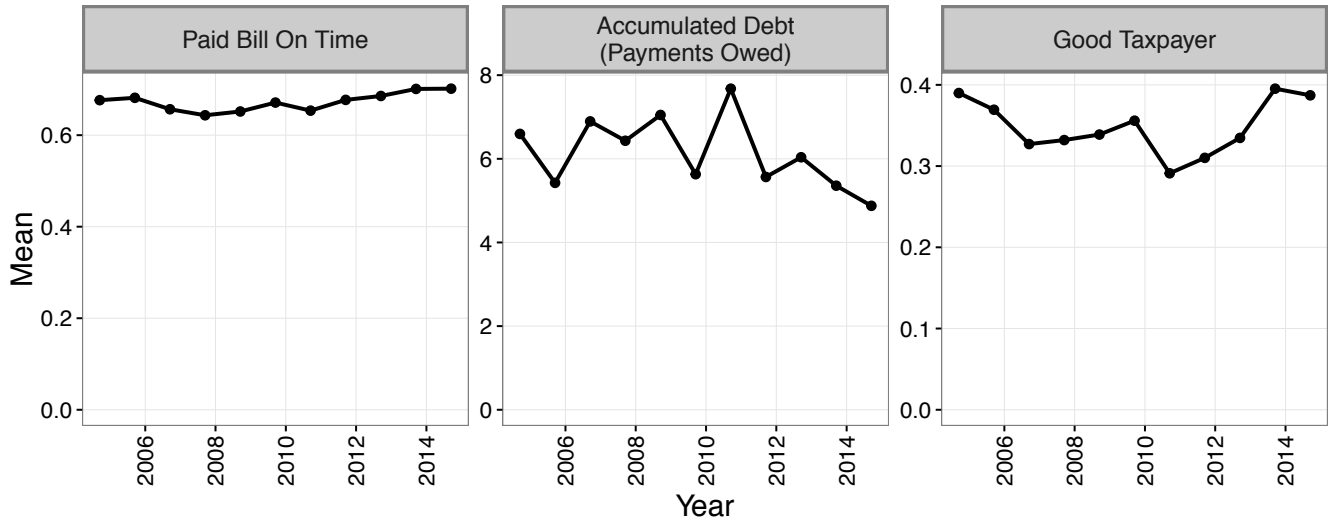
conditions, so that the response tends to recur when those conditions occur (Wood and Neal 2007). This leaves open the specific cognitive process through which the repetition of behavior induces habit. The sociologist Pierre Bourdieu’s related notion of *habitus* as “a system of acquired dispositions” emphasizes that experience breeds practice, and thus a ‘feel for the game’ that guides action (Bourdieu 1990, 13). In Uruguay, the majority of taxpayers pay their taxes in person at kiosks. They also receive tax bills in advance of each payment period. Thus, a compliance habit can form from the repetition of payment under similar conditions, involving the arrival of a tax bill and a trip to the local kiosk. We argue that habit may elucidate several features of tax compliance, in a way that decision-theoretic models emphasizing the costs of evasion or the benefits of tax payment cannot.

Consider data that we gathered working with the city government of Montevideo. Figure 1 shows compliance patterns between 2000 and 2014, based on our random sample of 9,297 property, vehicle, head and sewage tax accounts. The relatively low rate of prompt bill payment (left panel) results in substantial payments owed (middle panel). The municipality also rates a minority of taxpayers as “good taxpayers” based on being current on payments over the previous year (right panel)—a measure that establishes eligibility for the tax holiday we study. These averages mask substantial temporal stability among compliant and non-compliant taxpayers, however. Of those classified as good taxpayers at a given moment in time, over 75 percent were thus classified ten payment periods later.<sup>4</sup> By contrast, only 11 percent of “bad taxpayers” were classified as good taxpayers after ten subsequent periods. Reserves of habit could play a role in separating compliant from non-compliant taxpayers—though absent other data it would be difficult to sustain this claim, since good and bad taxpayers could differ in many ways besides their compliance habit. To distinguish an account focused on habit from alternatives, it is useful first to consider the capacity of standard models to explain these patterns.

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<sup>4</sup>The data are in Table 3.2, discussed later.

Figure 1: Municipal Tax Compliance Over Time (Montevideo, Uruguay)



Why, then, do people comply with taxes? In a standard formalization of the compliance problem, taxpayers compare the utility of evasion to the cost of punishment, discounted by its probability (Allingham and Sandmo 1972). Let  $y$  be an asset value,  $t$  be the annual tax rate, and  $z$  be the unpaid annual amount of taxes due; with full nonpayment,  $z = ty$ . The expected net benefit of evasion is then  $z - pc$ , where  $c$  is the penalty for nonpayment and  $p$  is the probability of punishment. In the context of municipal taxes, the cost of punishment  $c$  could include (1) fines and interest charges for delayed payments, and ultimately (2) losing one’s house or other property. To explain systematic non-compliance, researchers often focus on the low value of  $p$ , due to the difficulty of sanctioning tax evasion (Bates and Lien 1985). Weak states may have limited capacity—what Mann (1984) calls “infrastructural power”—to penetrate society and monitor and discipline non-compliers (see Soifer 2008).

This standard account, however, is unlikely to explain the patterns in Figure 1. The municipality knows taxpayers’ obligations with certainty, for instance on the basis of appraised property values. The government’s problem reduces to the seemingly easier task of compelling punctual payments—somewhat akin to that faced by a credit-card company collecting debt from delinquent cardholders. To be sure, enforcing punishments for non-payment can still pose challenges. Our interviews with officials in several Latin American cities suggest that municipalities only rarely seize and auction properties on which taxes are owed; at most, an embargo is placed on a property so that it cannot be privately sold until debts are cleared. As a municipal tax official in Argentina notes, “In the last 20 years, we have



never auctioned either a commercial or residential property. In general, we end up with an agreement” in which delinquent taxpayers consent to a discounted payment plan.<sup>5</sup> The political unpopularity of sanctions can be constraining in municipalities, where face-to-face negotiations are common and selective enforcement (or “forbearance,” see Holland 2016) may prevail. Thus, “proximity means that a neighbor can approach the administration to justify why he doesn’t pay.”<sup>6</sup> Reprieves for delinquent taxpayers are also prevalent: Montevideo’s city government issued 11 amnesties between 1997 and 2013.<sup>7</sup> Yet, even if such difficulties lower  $p$  or  $c$ , expectations of weak punishments for evasion should operate relatively uniformly across taxpayers—thus failing to explain the substantial variation across good and bad taxpayers. Figure 1 also shows that many taxpayers do pay their taxes. Given weak enforcement, the right question may be not why many people don’t pay taxes—but why anyone does.

Perhaps, then, the material or expressive benefits of paying taxes induce compliance. Latin American municipal governments from Salta, Argentina to Peruíbe, Brazil to Miraflores, Peru now raffle prizes—from televisions to new cars and houses to discounted payments—to those who pay on time. Our 10% sample of municipalities in Latin American countries found that 79% of Uruguayan municipalities offer such a reward for good taxpayers, along with an estimated 24% of Brazilian municipalities; incentive programs are also prevalent in Argentina, Bolivia, Colombia, Ecuador, Mexico, and Peru.<sup>8</sup> Many of our interviewees believe that these policy innovations cause greater compliance. As an Argentine official noted, “We have a compliance rate of 85% with the Municipal Service Tax today, whereas when we started [prize lotteries] in 2009, it was at 68%.”<sup>9</sup> They argue, plausibly, that prizes may not only sustain compliance among good taxpayers but also induce bad taxpayers to bring their accounts up to date. Another Argentine municipal tax official noted that “one of the conditions [to participate] was not to be in a payment plan. What did people say? ‘Make me a payment plan’ to allow

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<sup>5</sup>Interview, Daniel Chillo, municipality of Tigre; all translations ours.

<sup>6</sup>Ibid.

<sup>7</sup>That includes amnesties in 1997, 2000, 2001, 2002, 2003, 2004, 2005, 2008, 2009, 2010, and 2013.

<sup>8</sup>We used Web searches and interviews with municipal bureaucrats and politicians. See Appendix Figure A1.

<sup>9</sup>Chillo, note 5.

entry to the lottery.<sup>10</sup> A former Brazilian mayor noted that after initiation of the prize program, “many indebted people went to look for payment plans.”<sup>11</sup>

In Montevideo, the center-left government of the Frente Amplio hoped precisely that its prize policy would counter the perceived negative incentive effects of amnesties following the economic crisis of 2002—which eased the burden on delinquent taxpayers without offering a compensating benefit for punctual compliers. Certainly, one might expect the strictly material rewards to have a limited impact. Under Montevideo’s lottery, eligible taxpayers win a year free of tax payments with probability  $1/5,000$  in any payment period. The expected monetary gain from paying a year’s taxes is then (without discounting)  $(1/5,000)z - z$ .<sup>12</sup> In other words, a taxpayer has to pay a year’s worth of taxes in order to gain, with probability  $1/5,000$ , a year free of tax payments. Casinos would make no money if gamblers did not take bets with negative expected values—but this does not look like a promising deal for the taxpayer. Yet, reward programs such as Montevideo’s may also influence perceptions of the fairness, equity, or transparency of the tax system, which could also shape compliance behavior. An Argentine interviewee emphasized the public, credible nature of his municipality’s prize lottery, as well as the importance of social recognition: “We take a photo and put the program on the webpage of the municipality, we publish a list of the taxpayers among whom we do the lottery.”<sup>13</sup> A Brazilian mayor noted, “the best weapon [against non-compliance] is transparency.”<sup>14</sup> Another interviewee noted, “every time we award prizes we make a kind of show.... this helps create a taxpaying culture.... It is not worth it to hit unless you also caress those you need to caress.”<sup>15</sup> In sum, such incentive policies may shape the expressive as well as material benefits of tax compliance.

To extend the standard framework, we might therefore allow an expressive benefit  $b$  to influence

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<sup>10</sup>Carlos Maisterrena, Ciudad de Paraná, Entre Ríos, Argentina.

<sup>11</sup>Beto Tricoli, mayor of Atibaia, Brazil (2001-2008).

<sup>12</sup>The average property value is about US\$36,035 (956,000 pesos), and the average annual property tax is about US\$265 (7,044 pesos). The expected value gross of the tax payment is then US\$265/5000, or about five US cents.

<sup>13</sup>Chillo, note 5. See Chetty, Mobarak and Singhal (2014) on social pressure and compliance.

<sup>14</sup>Geraldo Cruz, former mayor of Embu das Artes, São Paulo, Brazil.

<sup>15</sup>Maisterrena, note 10.

the utility of tax payment. Studies of taxation suggest a broad view of what  $b$  might include—for example, the strength of ethnic boundaries (Lieberman 2003), the degree of altruism and fairness (Scheve and Stasavage 2016), or the extent of norms of cooperation that induce “quasi-voluntary” compliance (Levi 1988).<sup>16</sup> We are agnostic about how the new incentive programs in Latin American may boost the expressive benefits of paying taxes, but in our empirical analysis, we investigate the impact of Montevideo’s policy on attitudes towards the equity and transparency of the tax system.

## 2.1 Habit as a cause of compliance

However, this extended framework is also incomplete—and leaves unexplained several key features of tax payment data that we explore empirically.

Suppose instead that compliance with taxes is partly habitual.<sup>17</sup> For example, let  $\gamma_t = 1$  if a taxpayer complies at payment period  $t$ . A framework that accommodates habit formation allows the utility of compliance at  $t$  to depend positively on  $\theta\gamma_{t-1}$ , where  $\theta \in (0, 1)$  captures the sensitivity of current tax payment to the previous period’s compliance behavior. Note moreover that by a recursive argument, the “stock” of compliance habit at time  $t$  is given by  $S_t \equiv \sum_{i=1}^{\infty} \theta^i \gamma_{t-i}$ .<sup>18</sup> Thus, the whole history of payment influences the stock of habit  $\theta\gamma_{t-1} + \theta^2\gamma_{t-2} + \theta^3\gamma_{t-3} + \dots$ , with more recent behavior weighted more heavily. We can now complete our extension of the standard decision-theoretic model. Thus, let  $\gamma_t = 1$  if

$$b + (1/5,000)z + S_t + v_t > z - pc, \tag{1}$$

and otherwise  $\gamma_t = 0$ . The left-hand side of (1) gives the benefit of paying taxes, while the right-hand side gives the expected utility of evasion. Thus, the left-hand side is the sum of the expressive reward  $b$ , an expected material prize  $(1/5,000)z$ , and the stock of habit  $S_t$ ; we also add mean-zero random noise  $v_t$ , so that tax payment is not a deterministic function of the benefits and the stock of habit. On the right-hand side, non-compliance implies keeping the unpaid taxes  $z$  but at the expected cost  $pc$ . Note

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<sup>16</sup>See also Luttmer and Singhal (2014) on “tax morale.”

<sup>17</sup>Our registered pre-analysis plan discusses this possibility (AUTHORS).

<sup>18</sup>Economists use similar approaches to study the equity premium puzzle (Schmitt-Grohe and Uribe 2008).

that the benefits of tax payment are positively related to the history of past compliance.

Importantly, this model of habit generates several implications consistent with our data and findings we present later—but inconsistent with several alternative theories. First, there can be persistent effects of shocks to tax compliance. Thus, exogenous interventions—such as those that switch past compliance ( $\gamma_{t-1} = 1$ ) to non-compliance ( $\gamma_{t-1} = 0$ )—can produce a negative impact on tax compliance not only in the immediately subsequent period but also beyond it. After all, compliance at period  $t$  is a function of compliance at  $t-1$ ; but compliance at period  $t+1$  is then a function of compliance at  $t$ . An intervention that reduces compliance at  $t-1$  and therefore diminishes the stock of compliance habit has “knock-on” effects on compliance at  $t+1$ . Disrupting the habit of tax compliance through an intervention like the tax holiday can have lasting effects on compliance.

Second, however, there is naturally a decay in the effect of such habit disruptions. Consider a taxpayer who has always complied prior to  $t-1$ . Such a taxpayer has a large positive stock of habit  $S_t$  and thus temporary disruptions have a relatively smaller impact on behavior. Also, should the taxpayer comply after the interruption, he will be more likely to continue to do so than those with a smaller reserve of habit. Taxpayers with large  $S_t$  are therefore more likely to endogenously recover the habit of paying taxes. Moreover, such a taxpayer may also be likely to have parameter values ( $p$ ,  $c$ , or  $b$ ) that favor compliance, since the underlying propensity to pay taxes, net of the stock of habit, is also likely to shape compliance behavior—and also therefore feed back into  $S_t$ .<sup>19</sup> Thus, for many future realizations of  $\nu$ , such a taxpayer will again comply, which will then foster continued compliance.

Finally, habit partitions taxpayers into a set that typically complies and a set that does not, and these compliance histories condition the effects of interventions. For taxpayers with large stocks of past compliance habit (high  $S_t$ ), the inequality in (1) is more likely to be satisfied, and paying taxes may usually be the preferred option; those for whom  $S_t$  approaches zero are more likely not to comply. Moreover, such a partition is self-sustaining due to the feedback effects. To be sure, since compliance is a random variable that depends on  $\nu_t$ , some taxpayers with high  $S_t$  might fail to comply on some occasions. Yet, the effect of an intervention that generates non-compliance at  $t-1$  decays more rapidly for taxpayers who possess a strong prior habit of compliance. Behavioral repetition thus contributes to

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<sup>19</sup>We do not subscript as  $b_i$ , yet it is natural that the expressive benefit of paying taxes varies across taxpayers.

the emergence and persistence of “good” and “bad” taxpayers.

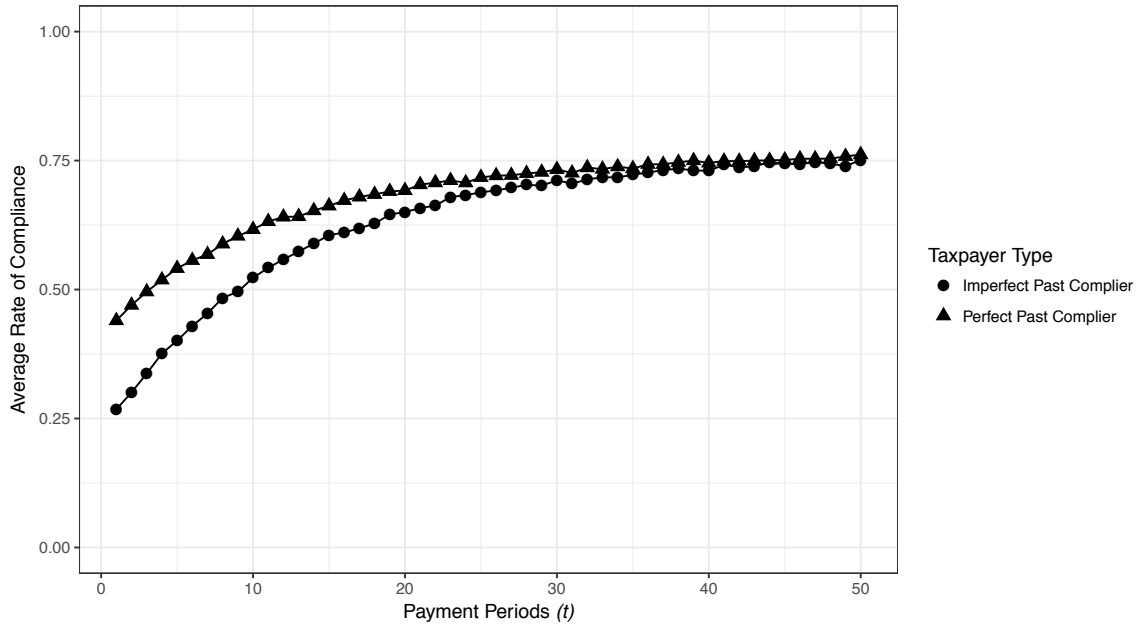
We illustrate these points with a computer simulation that shows the impact of a three-payment-period interruption of tax payments—analogue to the tax holiday we study empirically. We compare two types of taxpayers with identical values of the parameters ( $b$ ,  $z$ ,  $p$ , and  $c$ ) and thus the same underlying propensity to comply, but who differ in the stock of habit. Thus, we manipulate the history of compliance in the 47 payment periods prior to the disruption, so that “Imperfect Past Compliers” paid taxes with probability 0.4 in each period, and “Perfect Past Compliers” paid with probability 1. This approach allows for construction of a different stock of habit among otherwise identical taxpayers. We then exogenously set compliance equal to zero for three payment periods. Finally, we allow tax compliance in every subsequent period to be determined according to (1). Thus, the mean-zero random variable  $v_t$  is realized and the taxpayer makes a compliance decision, given the parameter values and his stock of habit at time  $t$ . We conduct the simulation with 20,000 each of the Imperfect Past Compliers and Perfect Past Compliers. Figure 2 plots the average compliance rate for the two types of taxpayer after the three-period interruption ending at  $t = 0$ .<sup>20</sup>

The simulation reveals several interesting results. First, exogenous changes to tax compliance behavior—such as interventions like a tax holiday that switch past compliance to non-compliance—can have lasting effects. In this simulation, with  $\theta = 0.7$  and thus substantial but not extreme dependence of the stock of habit on preceding payments, it takes many periods for taxpayers to recover to a stable level of average compliance. Second, there is decay in the effect of the disruption over time. Finally, however, the stock of habit matters for the rate of recovery: taxpayers with perfect past compliance and thus a greater stock of compliance habit recover more quickly than those with imperfect past compliance histories.

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<sup>20</sup>Parameters are  $z = 2$ ,  $p = 1$ ,  $c = 1$ ,  $b = 0.05$ ,  $\theta = 0.7$ , and  $v_t \sim N(0, 1)$ . See Appendix Figure A18 for R code.

Figure 2: **Simulation: The Stock of Habit and the Impact of Interruptions**



The figure shows simulated average tax compliance after a three-period tax holiday.

Our framework therefore suggests that exogenous interruptions in the habit of payment can have persistent negative consequences for compliance—but also underscores the importance of the endogenous reserve of habit in shaping compliance behavior. The observable implications of this theory differ from several alternatives we consider below, which thus helps distinguish habit from other explanations for our findings. Note however that testing such a theory of habit is usually very difficult. Choices over tax compliance are likely to be endogenous to attributes and behaviors that covary with habit. Indeed, in our model, taxpayers with greater underlying propensities to pay (net of habitual forces) are likely to pay at greater rates—and therefore build up a greater stock of habit. Thus, habit will be confounded empirically by the underlying propensities. Taxpayers who choose not to comply of their own accord will not provide a valid counterfactual for those who remain compliant.

We therefore require an intervention that exogenously switches past compliance to non-compliance. The tax holiday lottery to which we turn next provides just such a randomized natural experiment.

### 3 The negative effect of tax holidays: a natural experiment

The municipal government uses the results of the otherwise unrelated Uruguayan National Lottery to select taxpayers for holidays. Thus, it selects as provisional winners those tax account numbers, the final four digits of which correspond to the winning number of the relevant National Lottery.<sup>21</sup> In February 2009, for example, the winning National Lottery number ended in 8662. The municipality thus identified all taxpayer account numbers also ending in 8662, for each of the four types of taxes—property, vehicle, head, and sewage—and screened in eligible taxpayers who owed no past taxes and had paid on time over the previous year. The municipality then sends a letter to the addresses associated with each eligible winning account indicating that taxpayers should come to City Hall to claim their year-long tax holiday. As we discuss later, not all winning account holders claim the exoneration. Holidays are granted for the specific tax for which the taxpayer was selected, based on his or her tax-specific account number.<sup>22</sup> Head and sewage taxes are paid six times a year (in February, April, June, August, October, and December) and the municipality grants holidays in connection with each payment period; for vehicle and property taxes, taxes are paid and holidays are issued three times a year (in March, July, and November).

To assess the causal impact of payment interruptions, we first identified all taxpayer accounts that were randomly selected in each lottery held since 2004. The treatment group in our natural experiment consists of winning taxpayers who were eligible to claim the tax holiday: these were all “good taxpayers” in the year prior to the date of the lottery in which their account number was selected. (We do not intend to use the term in a normative sense, but the municipality calls its policy “Lottery for Good Taxpayers”). Constructing the control group requires some care: the right counterfactual for winners of each past lottery consists not of currently eligible non-winners but rather those who were eligible to win (but did not) as of each lottery.<sup>23</sup> We therefore randomly generated a four-digit number, different

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<sup>21</sup>The randomization occurs through the selection of balls from an urn, described in Spanish at [http://www.loteria.gub.uy/Juego\\_Loteria.php](http://www.loteria.gub.uy/Juego_Loteria.php). Winning numbers are at <http://www.montevideo.gub.uy/sorteosBP/pages/sorteosBuenosPagadores.xhtml>. Accessed January 16, 2017; see Appendix Figure A2.

<sup>22</sup>Taxpayers have different account numbers for each type of tax, and these accounts are not readily linked.

<sup>23</sup>Currently eligible non-winners include those who were eligible and ineligible as of the date of each past lottery,

from the winning number, for each lottery since 2004, then screened in all taxpayers whose accounts ended in these numbers and who were eligible as of the corresponding lottery. Our procedure therefore mimicked the random process that created the treatment group. Due to the randomization, the treatment and control groups should be balanced up to chance error on all observable and unobservable attributes—save for the presence or absence of the payment interruption.

Table 3.1 describes this natural experiment. The table depicts the size of treatment and control groups (in bold font), distinguishing between four different types of taxes for which tax holidays are awarded.<sup>24</sup> The table shows the numbers assigned to the two groups by virtue of having a winning or non-winning account number, per the intent-to-treat principle (Dunning 2012, 88). (Later, we discuss how we adjust our analysis to account for the fact that not all taxpayers claimed the exoneration). Our partners in Montevideo’s tax bureaucracy provided a time-series panel of payment data (2000-2014) for all randomly selected account numbers. In addition, we have payment data for taxpayers whose account numbers match those in our treatment or control groups but who were ineligible to win as of the corresponding lottery (plain font in Table 3.1). Although we only use data for eligible taxpayers to estimate treatment effects—since only those taxpayers could claim a tax holiday—we exploit data on ineligible taxpayers for placebo and balance tests. Note that the cells of Table 3.1 are themselves self-weighting random samples of taxpayer accounts in Montevideo. We can thus use them to characterize features of the taxpaying population. For example, we combine eligible and ineligible taxpayers with non-winning numbers for the random sample of 9,297 accounts in Figure 1.

The dependent variable in our analysis is the proportion of taxpayers who paid their bill on time at each tax payment period—an appropriate measure both for evaluating the effect of the tax holiday policy and specifically for interrogating the habit mechanism. The vertical axis of Figure 3 therefore shows the difference in payment rates between taxpayers with winning and non-winning numbers. The horizontal axis shows the number of payment periods elapsed before or after the particular lottery in

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while the treatment group only includes eligible winners at each date. This asymmetry risks bias—since potential tax compliance is very plausibly related to eligibility.

<sup>24</sup>Here we in fact have a series of mini-natural experiments, with random assignment blocked by individual lottery; however, the probability of assignment is the same in every block.



Table 3.1: **Natural Experiment: Sample Sizes**

Tax	Taxpayer Type	Winning Tax Account Number	Non-Winning Account Number	Study Group Totals
<b>Property</b>	<b>Eligible Taxpayers</b>	<b>1354</b>	<b>1339</b>	<b>2693</b>
<b>Vehicle</b>	<b>Eligible Taxpayers</b>	<b>375</b>	<b>391</b>	<b>766</b>
<b>Sewage</b>	<b>Eligible Taxpayers</b>	<b>404</b>	<b>452</b>	<b>856</b>
<b>Head</b>	<b>Eligible Taxpayers</b>	<b>1041</b>	<b>1007</b>	<b>2048</b>
Property	Ineligible Taxpayers	1225	1211	2436
Vehicle	Ineligible Taxpayers	1924	1899	3823
Sewage	Ineligible Taxpayers	939	915	1854
Head	Ineligible Taxpayers	2062	2083	4145
<b>All Taxes</b>	<b>Eligible Taxpayers</b>	<b>3174</b>	<b>3189</b>	<b>6363</b>
All Taxes	Ineligible Taxpayers	6150	6108	12258

The table depicts winning and non-winning account numbers in our sample. Rows used to estimate treatment effects are in bold; non-bolded rows are used for placebo tests.

connection with which a taxpayer was sampled into the study group (centered at  $t = 0$ ).<sup>25</sup> The number of payment periods per year varies by tax (with three annual payments of property and vehicle taxes, and six of sewage and head taxes), so centering allows us to pool analysis across the four types of taxes; later we disaggregate by tax type. The grey vertical strip indicates the period of exoneration. Thus, the number 1 on the horizontal axis indicates the first payment due after the holiday period; 2 is the second payment; and so on. Negative numbers indicate pre-treatment periods.<sup>26</sup> The top panel shows data for taxpayers who were eligible to win the holiday as of the date of the respective lottery, while the bottom panel shows those who were ineligible. Note that there is no variation in tax payment behavior among eligible taxpayers at  $t = -1$ ,  $t = -2$ , and  $t = -3$  (and thus the confidence intervals collapse): taxpayers must have paid on time over at least the three previous payment periods to claim the holiday.

Figure 3 allows for graphical balance and placebo outcome tests that validate key assumptions of our design. We discuss these before turning to treatment effect estimates. First, for the balance tests: randomization implies that prior to  $t = 0$ , tax payment behavior should be identical in expectation

<sup>25</sup>This date varies across taxpayers, since we have lottery data from 2004 to 2014.

<sup>26</sup>The holiday can be delayed by failure to claim the exoneration immediately. To define the end point of the grey strip, we use the maximum time elapsed in the treatment group.

for taxpayers with winning and non-winning numbers. Indeed, Figure 3 shows that differences in pre-treatment compliance are statistically indistinguishable from zero for both eligible and ineligible taxpayers.<sup>27</sup> For higher-powered balance tests, we also pool data on eligible and ineligible taxpayers, giving a total of up to 18,621 taxpayer accounts.<sup>28</sup> We then test for balance on a series of covariates, including tax compliance at several pre-treatment payment periods (Appendix, Table A1). None of the  $p$ -values approach standard significance levels, indicating that the randomization worked as expected.<sup>29</sup> Qualitative detail discussed above—for instance, the public nature of the lottery and its tie to the independent National Lottery—also suggests the credibility of the randomization.

Second, Figure 3 also permits a test of a placebo outcome for which an effect is “known” not to exist (Sekhon 2009; Dafoe and Tuñón 2014). Thus, we assess the effect of assignment to a winning number for ineligible taxpayers. The municipality does not inform such ineligible taxpayers that their number was drawn, and they receive no benefit. Indeed, we find no discernible difference in post-treatment compliance between ineligible taxpayers with winning and losing lottery numbers (bottom panel). Appendix Table A2 reports formal statistical tests which reach the same conclusion. Our test therefore supports an important “exclusion restriction” (Gerber and Green 2012, 39-43; Dunning 2012, 118-121): assignment to a winning account number, absent a tax holiday, does not itself influence compliance behavior. In sum, our data are strongly consistent with random assignment and other identifying assumptions of our design.<sup>30</sup>

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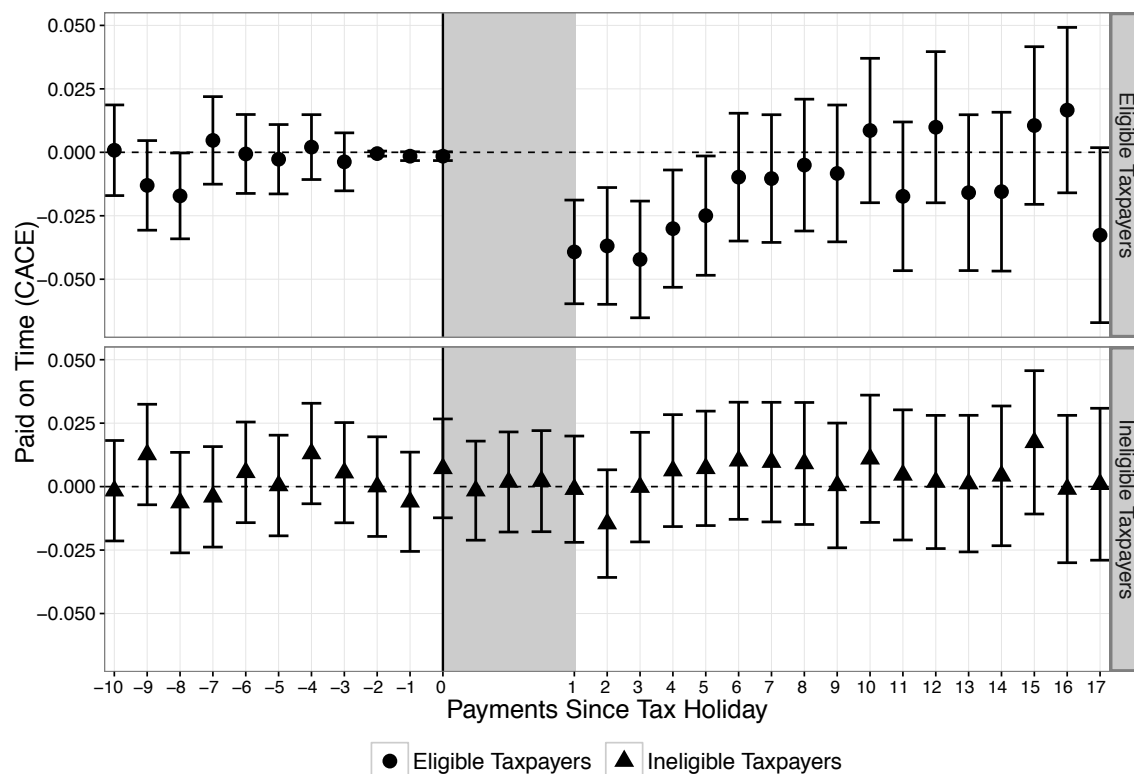
<sup>27</sup>As we discuss later, Figure 3 reports estimated Complier Average Causal Effects ( $\widehat{CACE}$ ). For our balance and placebo tests, however, there is no difference between the  $\widehat{CACE}$  and the simple difference of means.

<sup>28</sup>Having a winning account number is randomly assigned for both types, so balance tests for ineligible taxpayers are useful even though they cannot claim the holiday.

<sup>29</sup>The treatment and control groups are also intermingled evenly throughout the municipality (Appendix Figure A3).

<sup>30</sup>Our evidence in section 4 validates another core assumption: non-interference. In brief, news of the lottery does not substantially travel to non-winners: only 8% of non-winners have heard of the existence of the lottery.

Figure 3: The Negative Impact of Holidays on Compliance



The figure depicts balance tests, placebo outcome tests, and treatment effects in our natural experiment. The horizontal axis measures tax payment periods before or after the tax holiday treatment (grey vertical strip). The vertical axis shows the estimated complier average causal effect (CACE) for the proportion of taxpayers who paid on time at each payment period. Vertical lines show 95% confidence intervals.

Finally, Figure 3 shows estimates of treatment effects.<sup>31</sup> Thus, black circles to the right of the grey strip compare compliance behavior of eligible winners and non-winners after the conclusion of the holiday (top panel). Vertical lines show 95% confidence intervals around these point estimates.<sup>32</sup> The figure shows estimated complier average causal effects (CACEs) to account for the fact that only 72 percent of notified winners actually claimed the exoneration.<sup>33</sup> (Here we use “complier” in the

<sup>31</sup>Here we pool effects across the four types of taxes, per our pre-registered protocol (AUTHORS).

<sup>32</sup>We estimate the mean and standard error for the groups with winning and losing numbers in each time period separately, and use normal approximations for the confidence intervals (since the  $N$ s are large).

<sup>33</sup>Many of the remaining winners are likely corporations, which are not eligible for the holiday. The municipal-

statistical sense of compliance with treatment assignment, rather than compliance with tax obligations). Thus, we divide the estimated average causal effect (ACE) by the proportion of taxpayers with winning numbers who received the tax holiday. Table 3.2 also reports the estimated ACEs, CACEs and standard errors, at post-holiday payment periods 1, 5, and 10, as well as the average for all ten periods.

Tax holidays have a substantial, negative, and persistent effect on subsequent tax compliance. The effect lasts for five payment periods on average, or nearly two years for the property tax. The estimated complier average causal effect is -4% in the first post-holiday payment period, and -3% pooling over the first ten periods (Table 3.2). Viewed against a control group non-payment rate of 7% in the first post-treatment payment period (a 93% payment rate), the  $\widehat{CACE}$  of 4 percentage points represents a treatment effect of 57 percent. We also find larger and more persistent effects for our two related measures, the accumulated number of past payments owed and the proportion of “good taxpayers,” in part because failure to pay on time in one period leads to classification as a “bad taxpayer” for the entire subsequent year (Appendix Figure A4).

In sum, rather than fostering greater tax compliance, winning the tax holiday lottery inhibits it. Note there is a persistent negative effect on compliance—but also attenuation of the effect over time. Thus, the data are consistent with the knock-on effects of habit disruption discussed in Section 2 but also with their eventual decay. This pattern is important for distinguishing habit from other potential mechanisms that might explain our findings, a topic to which we turn next.

## 4 Is habit the mechanism?

Is disruption of habit the mechanism that drives the negative impact of tax holidays? A first piece of evidence comes from variation in effects across types of taxes. Although we were unaware of this when we began our study, with the vehicle tax—unlike property, sewage, and head taxes—winners typically continue to pay a small amount during the putative holiday. The reason is that with the vehicle tax, unlike other taxes, payment is exonerated retroactively, so that the *previous* year’s payments are

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ity does not have a technology for tracking which taxpaying accounts are held by firms, perhaps because many businesses operate out of private residences.

Table 3.2: **Estimated Causal Effects of Tax Holidays**

	Control Group Average	$\widehat{ACE}$	$\widehat{SE(ACE)}$	$p$ -value	$\widehat{CACE}$
Post Tax Holiday Payment 1	0.93	-0.03	0.01	0.00	-0.04
Post Tax Holiday Payment 5	0.91	-0.02	0.01	0.04	-0.02
Post Tax Holiday Payment 10	0.87	0.01	0.01	0.55	0.01
Post Tax Holiday Payments 1-10	0.90	-0.02	0.01	0.00	-0.03
Post Tax Holiday Payments 1-10 (Property)	0.92	-0.03	0.01	0.00	-0.03
Post Tax Holiday Payments 1-10 (Head)	0.91	-0.01	0.01	0.15	-0.02
Post Tax Holiday Payments 1-10 (Sewage)	0.93	-0.02	0.01	0.04	-0.04
Post Tax Holiday Payments 1-10 (Vehicle)	0.76	-0.00	0.02	0.98	-0.00

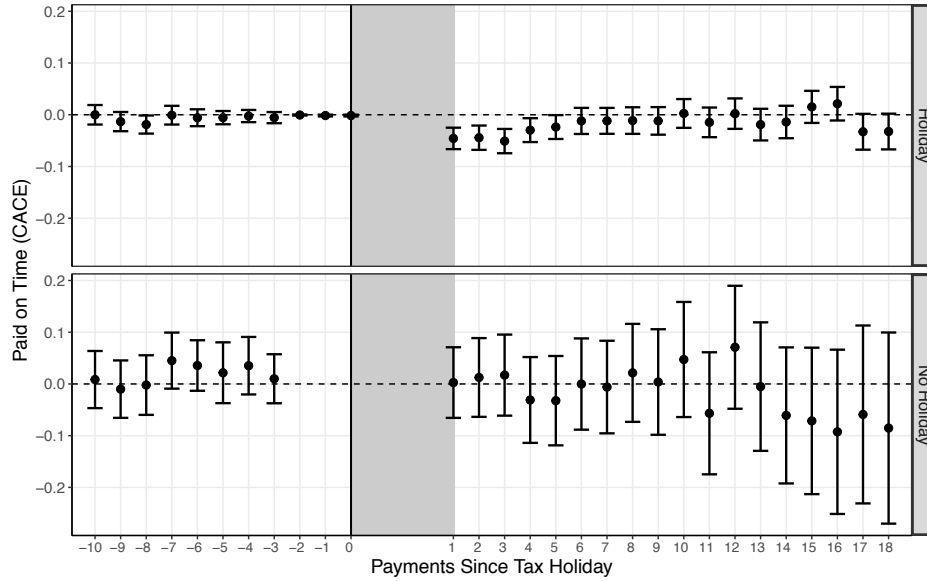
The table shows the estimated average causal effects of treatment assignment ( $\widehat{ACE}$ ), standard errors,  $p$ -values, and complier average causal effect ( $\widehat{CACE}$ ) for the proportion of taxpayers who paid on time. The first four rows show effects for 1st, 5th, and 10th payments due after the end of the tax holiday, as well as their combination. The final four rows disaggregate the effect by type of tax.

forgiven. Some taxpayers take the windfall as a refund, while others take it as a credit against future payments. Yet even those who take credits typically owe minor amounts of vehicle fees in the following year, because the vehicle tax is often increased annually by small amounts. Winning the vehicle tax lottery thus does not typically involve an interruption of the habit of paying taxes.

If our argument about habit is correct, this should imply weaker or null effects for the vehicle tax. Figure 4 presents treatment effect estimates separately for “no holiday” (vehicle) and “holiday” (property, sewage, and head) taxes, including only eligible taxpayers.<sup>34</sup> Winning the lottery has no discernible impact in the no-holiday case (bottom panel). Only when the payment habit is interrupted are the effects negative and significant (top panel). To be sure, these heterogeneous treatment effects are not conclusive: vehicle taxes may differ from the other taxes in ways that are relevant for the effect of a holiday. However, they are strongly suggestive of the force of habit.

<sup>34</sup>Appendix Figure A5 shows the effect for each of the four taxes separately; see also rows 5-8 of Table 3.2.

Figure 4: Treatment Effects By Type of Tax: Holiday vs. No Holiday



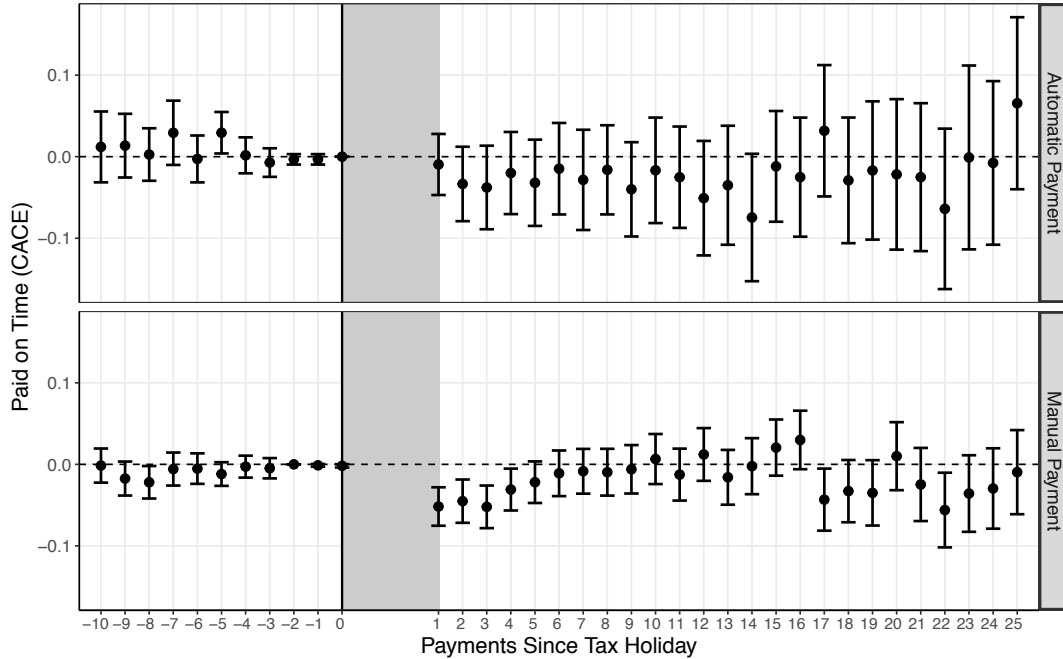
The negative effect only occurs when the payment habit is actually interrupted, in the “Holiday” taxes.

A similar but perhaps more powerful test comes from comparing automatic and manual taxpayers. Around 21% of eligible taxpayers in our study group had enrolled in automatic payment plans at the date of the relevant lottery.<sup>35</sup> For these taxpayers, payments resume automatically after the conclusion of the holiday without any required action. The force of habit therefore could not conceivably operate to generate negative effects for this group of automatic payers. Indeed, the holiday decreases compliance only among manual taxpayers (Figure 5). For the 1,190 automatic payers of property, head and sewage taxes, we find null estimated effects. Thus, when the habit of paying is not interrupted, the holiday does not reduce future tax payment. To be sure, taxpayers who pay automatically could differ from manual payers in various ways that could be related to compliance—though manual taxpayers have higher property values, which might bias against finding negative effects only for them.<sup>36</sup> This is therefore an important further piece of evidence that corroborates the habit hypothesis. Our theory suggests that we should find treatment effects only for manual taxpayers—and that is exactly what we find.

<sup>35</sup>This is 20% for property tax, 15% for sewage, and 26% for head; we do not have these data for the vehicle tax.

<sup>36</sup>The difference in average property values is 2,088,634 vs. 1,142,571 pesos (2004 data).

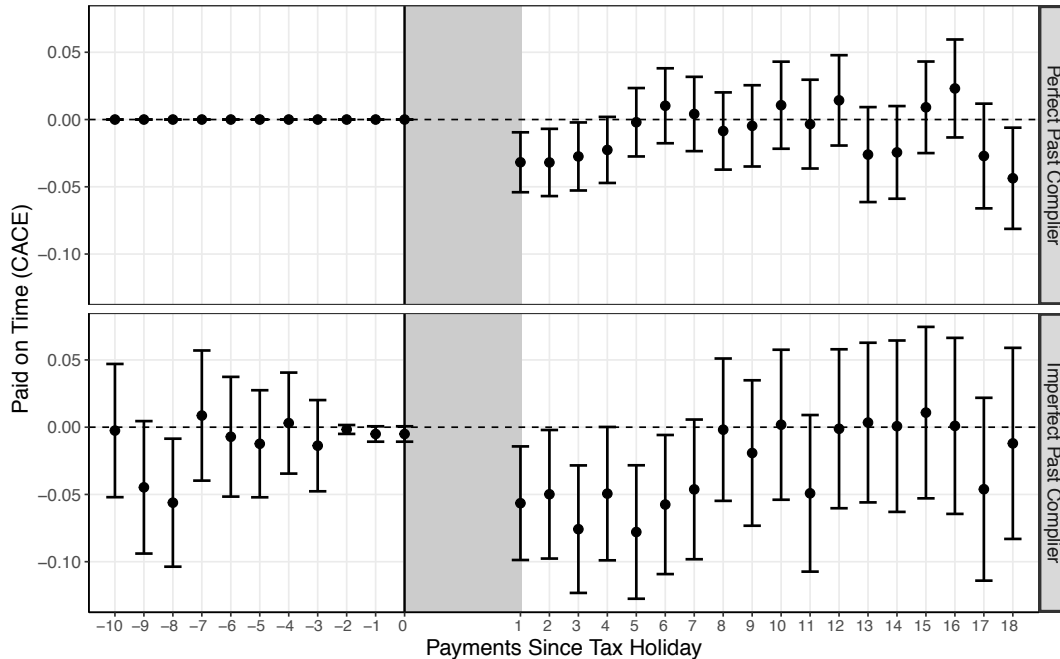
Figure 5: Placebo test: Treatment Effects for Automatic vs. Manual Payers



The negative effect of the holiday only appears for manual taxpayers, not for those in automatic withdrawal programs. The figure depicts effects for the property, head, and sewage taxes.

Our theory in Section 2 has an additional testable implication: the effects of a payment interruption should be less negative, and compliance should bounce back more quickly, for taxpayers with a greater stock of habit (see Figure 2). Thus, Figure 6 compares effects for “perfect past compliers” who had complied punctually over the 15 periods prior to winning the lottery—and who therefore should had a strong habit stock—to “imperfect past compliers” who were eligible to win the lottery at the relevant date but who had missed at least one payment over the previous 15 periods. The figure shows exactly this pattern: the negative effects are more pronounced and last longer for the marginal taxpayers. Indeed, the difference in the estimated average causal effects is statistically significant for the first seven post-holiday payment periods. Our quantitative tests thus suggest that the disruption of a habit drives the negative effect of tax holidays, and the stock of habit conditions these effects.

Figure 6: **The Stock of Habit: Perfect vs. Imperfect Past Compliers**



The negative effect of winning is less pronounced for taxpayers with a greater reserve of payment habit. “Perfect Past Compliers” paid punctually in all 15 payment periods prior to winning the lottery, while “Imperfect Past Compliers” failed to do so in at least one period. Differences in estimated average causal effects are statistically significant at the 0.05 level for the first seven post-treatment payment periods.

Our qualitative evidence also lends insight into the nature of the payment interruption—and how it disrupts the compliance habit. We conducted 20 qualitative, open-ended interviews with taxpayers who won a property tax lottery in 2014-2015. The vast majority of the winning interviewees paid their tax bill at a local kiosk before winning the lottery and continued to do so after the tax holiday; the method of payment was unchanged for 18 of our 20 interviewees.<sup>37</sup> Many winners recalled receiving a zero-balance bill from the tax authorities during the period of exonerated (and one interviewee showed it to us). In sum, the mode of payment and broader payment context did not change; and winners received notices from the municipal government reminding them that they are taxpayers. What changed is simply the fact of payment. Our evidence suggests that the mere failure to repeat the payment behavior

<sup>37</sup>Only one paid continuously by automatic debit (CTA 592794). Another had changed the method of payment but attributed that to being retired and not wanting to leave the house for security reasons (CTA 572594).



created persistent negative effects on compliance.

## 4.1 Alternative explanations

Our results also discount several alternate explanations. Consider one candidate: perhaps winners spend their retained income on, say, consumption goods, in a way that makes it more difficult to resume meeting their tax obligations immediately after the end of the holiday. We could refer to this as a sticky “substitution” or “income” effect. In qualitative interviews, we asked winners of property tax holiday what they did with the extra income gained from the holiday. Many did mention using this to cover other costs, though taxpayers afforded differential importance to the monetary prize.<sup>38</sup>

Two pieces of evidence suggest that such substitution effects cannot fully explain our findings, however. First, differences in the economic importance of the rebate to different taxpayers might suggest heterogeneous effects of the holiday for richer and poorer taxpayers. Yet, we do not find evidence for such disparate impacts, for example, by property values.<sup>39</sup> Second and perhaps more powerfully, the null effects for the vehicle (no holiday) tax are inconsistent with this alternative interpretation. After all, winners of the vehicle tax lottery receive an important temporary income shock that they can likewise divert to consumption goods. If substitution effects explain our findings, we should thus observe a negative effect for winners of this lottery. Instead, consistent with our interpretation, we find a null effect for the vehicle tax—the one tax in which the payment habit is not interrupted (Figure 4).

Another set of alternative explanations focuses on how the holiday might shape attitudes towards the payment of taxes. For instance, perhaps experiencing the exoneration breaks a “taboo” against non-compliance or encourages taxpayers to think of themselves as non-compliers. This explanation is not unrelated to habit—in that failure to pay has a causal impact on future payment propensities—but seems closer to what we could call “identity.” Another possibility is that by stimulating extrinsic incentives to comply, the material rewards offered by holiday might crowd out intrinsic incentives,

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<sup>38</sup>One spoke fondly of using the extra money to eat out in restaurants (Interviewee CTA 512794), while another said “it didn’t change my life at all, it was enough to buy a good pair of shoes” (Interviewee CTA 334095).

<sup>39</sup>Admittedly, the interpretation of these tests is tricky: the wealthy have more valuable properties and therefore receive larger tax breaks during the holiday—but they also tend to have greater income. See Appendix Figure A6.

such as a sense of civic duty (Gneezy and Rustichini 2000). In both cases, however, we would expect the impact of receiving the holiday to be more or less permanent. Once a taxpayer has broken the taboo or learned of the extrinsic incentives, she should tend to comply at consistently lower rates in the future. Instead—consistent with our theory of habit in Section 2 but not with these alternative explanations—we find negative but decaying effects (Figures 3-6). Moreover, if the breaking of taboos or the crowding out of extrinsic incentives account for our findings, we might also expect the negative impact to be greatest for those who have previously always fulfilled their civic duty. Instead, the effect is weaker for those with a greater stock of habit (Figure 6). We return to the impact of the holiday policy on attitudes in our later description of our survey experiment.

#### **4.1.1 Informational mechanisms**

The hypothesis about the crowding out of intrinsic incentives suggests a broader possibility, however: perhaps it is the receipt of information about the tax holiday—rather than the interruption of payments—that explains our negative effects. In a household survey of a probability sample of taxpayers, we found that baseline knowledge of the program is low: only 8% of respondents identified the lottery as a municipal policy that rewards good taxpayers, while only 5% of survey respondents knew someone who had won the lottery.<sup>40</sup> Thus, receiving an award letter from the municipality informs many taxpayers of the existence of the policy. Conceivably, learning about the policy exerts negative effects on future compliance. For example, taxpayers might interpret the new information as a negative signal of municipal capacity or the attractiveness of paying taxes. They might construe the fact that the government holds a lottery to reward good taxpayers as an indicator that it has a hard time eliciting compliance—thus inferring that by complying, they are “suckers” on whom non-compliers are free riding. (A priori, of course, many other informational effects might suggest *positive* effects on compliance. Thus, the lottery could boost perceptions of the transparency or equity of the tax system, thereby increasing willingness to pay). Unfortunately, the holiday treatment is bundled with the information treatment in our natural experiment, making it difficult to evaluate their separate effects.

To separate the impact of information from the effect of habit disruption, we thus draw finally on a

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<sup>40</sup>These percentages are drawn from the placebo control group in our field experiment described below (N=412).

large field experiment in which we provided randomly selected taxpaying households in Montevideo—including those both eligible and ineligible for the lottery at the time of the experiment—with information about the tax holiday. Specifically, we collaborated with the municipality to design and mail flyers printed with experimentally varied messages about the tax holiday lottery. We focused on property taxes both because of the importance of this tax and to eliminate potential sources of heterogeneity that would decrease statistical precision.<sup>41</sup> Our baseline reminder serves as a placebo control:

Dear neighbor: We want to remind you that **the second payment of property taxes is due in July**. If you have not received your bill, you can obtain a duplicate copy on our web site ([www.montevideo.gub.uy](http://www.montevideo.gub.uy)).<sup>42</sup>

Our next condition repeats this reminder but adds information about the tax holiday lottery:<sup>43</sup>

The municipal government of Montevideo wants to reward good taxpayers. **If you pay on time, you will be automatically entered in a lottery to win a year free of property tax payments**. Lotteries occur every other month of the year in conjunction with the National Lottery. The winners will be duly informed and the results of the lottery will be published on the web site of the city government. **You can be the next winner!**

The experimental realism of our treatments is substantial: when folded for mailing, the municipal logo is visible, and in fact the flyers appear identical to municipal tax bills before being opened.<sup>44</sup>

We worked with the municipal bureaucracy to draw a stratified random sample of eligible and ineligible taxpayer accounts, the former being those that could potentially win the tax holiday as of the date of the intervention (Table 4.3).<sup>45</sup> The population from which this sample was drawn should be

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<sup>41</sup>Castro and Scartascini (2015) study the impact of messages about sanctions on property tax payment.

<sup>42</sup>The bold typeface is as in the Spanish-language flyers; see the Appendix, Figures A7-A13.

<sup>43</sup>Flyers vary whether this information emphasized the individual (as here) or social returns of the lottery. Our pre-specified analyses often pool these into a single “reminder + existence of lottery” condition, as we do here.

<sup>44</sup>The flyers were authorized by the municipality, and our study was approved by our institutional review board.

<sup>45</sup>One might imagine that ineligible taxpayers are concentrated in poorer, outlying areas of Montevideo. In fact, per Appendix Figure A14, eligible and ineligible taxpayers are quite evenly spread throughout the city.

conceptualized as “all property tax-paying households with bills due in July 2014.” We also verified that none of our sampled taxpayers had actually won a lottery in the past, since our goal was assess the effect of informing taxpayers about the possibility of exoneration. (Note, however, that having won the lottery in the past—even in the immediately preceding year—does not disqualify a taxpayer from winning again). We then randomized sampled taxpayers to intervention groups. All eligible taxpayers and all ineligible taxpayers had the same probabilities of assignment to each condition, but the probabilities differed across the groups since a larger share of the eligibles were retained as controls. We account for these differing assignment probabilities in our analysis. The treatment groups are statistically balanced on pre-treatment covariates (Appendix Tables A3 and A4). We focus in Table 4.3 on the interventions that are theoretically relevant for alternative explanations, though these are a sub-set of treatments in a larger experiment that also included conditions reminding taxpayers about punishments for non-payment. However, we ensure that results are robust to corrections for multiple comparisons reflecting the full design, per our pre-specified analysis plan.<sup>46</sup> Our flyers were distributed in phases in June 2014, such that they would arrive approximately 8 days before tax due dates.

Table 4.3: **Field Experiment: Treatment Conditions and Sample Sizes**

<b>Treatment condition</b>	<b>Sample of eligibles (Good taxpayers)</b>	<b>Sample of ineligibles (Bad taxpayers)</b>
Control	N=7,243	N=3,412
Reminder of Taxes Due (Placebo Control)	N=1,532	N=2,080
Reminder + Information About Lottery	N=3,037	N=4,150
<b>Study Group Totals</b>	<b>N=14,784</b>	<b>N=13,862</b>

The table depicts assignment to a subset of treatment conditions in our field experiment. Total N=28,646. See Appendix Table A5 for the full design.

For outcome variables, we use two behavioral measures of tax compliance. First, using data from the municipal tax office, we measure whether the account holder accessed his or her Web taxpayer

<sup>46</sup>We present complete results in Appendix Figure A15. Several studies have found that messages increasing the salience of penalties can increase compliance; see Castro and Scartascini (2015). In our study, that is not the case.

account, for example, to print a duplicate bill (“Web Access”); we interpret this as a measure of intended compliance. Second, we measure whether the account holder paid her tax bill on time (“Paid On Time”). We measure both outcomes over the seven payment periods following our intervention (which includes over two years of data), allowing us not only to detect any medium-run as well as immediate effects—and therefore to compare the dynamic effects of information to the persistent but decaying impact of payment interruption.

Does information about the lottery affect tax payment behavior? Figure 7 shows the effect of (1) the reminder about taxes due plus information about the tax holiday lottery; and (2) the effect of the reminder alone (the placebo control), both relative to the pure control group. For the Web Access measure (right panel), in the first period following the intervention we do see a substantial increase of nearly 7 percentage points among those who received the reminder—a 54 percent increase over the control group mean of 13 percent. This is a useful result, as it suggests that recipients paid attention and responded to our flyers.<sup>47</sup> However, the positive effect of the reminder alone is actually substantially larger than the effect of the reminder, plus information about the lottery.<sup>48</sup> Moreover, the positive effect of the placebo control is short-lived and disappears within two payment periods—unlike the sustained effect of the payment interruption studied in the previous section—while the treatment boosts intended compliance for only one period, relative to the control. As for the Paid On Time outcome measure (left panel), we find no effect of information, either in the first period after the intervention or over the longer period following it, and little apparent effect of the placebo reminder.<sup>49</sup>

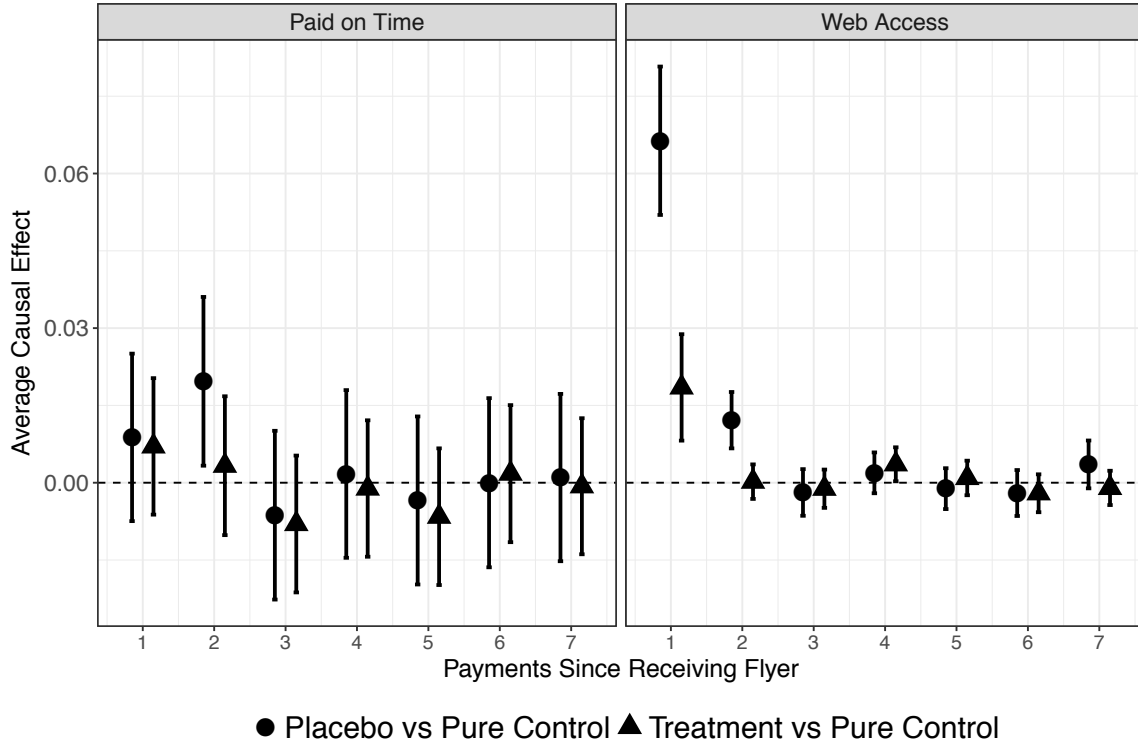
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<sup>47</sup>Note that Figure 7 shows intent-to-treat analysis. Problems in the implementation of our household survey diminish our confidence in estimates of the percentage of households that received our flyer. However, taxpaying households are very likely to receive our flyers, which were distributed through the post office just as tax bills are.

<sup>48</sup>In retrospect, the additional text about the lottery could have simply blunted the impact of the reminder. It may also be that Hawthorne-type effects—which the placebo treatment is designed to allow us to discount—are stronger when recipients receive only a reminder to pay taxes rather than additional general language about the lottery.

<sup>49</sup>In Appendix Figure A16, we show the pooled, tightly-estimated null effect for the whole post-treatment period.

Figure 7: **Field Experiment: Effects of Information About the Tax Holiday on Compliance**



The figure depicts the effects of a reminder of an upcoming property tax due date (Placebo), and this reminder plus information about the tax holiday (Treatment), both relative to a group that received no flyers (Pure Control). Outcomes measure whether taxpayers paid punctually (Paid On Time) or accessed their online accounts (Web Access). Effects are similar for eligible and ineligible taxpayers separately.

Thus, unlike the disruption caused by tax holidays, information about the lottery had no sustained effect on actual tax payment behavior—and while the effect on intended compliance is positive, the impact of information plus a reminder is less than a simple reminder. Note that a positive incentive effect could in principle induce a negative impact of holidays, if winners falsely believe that their probability of winning the lottery a second time is lowered and are induced to comply at lower rates than non-winners by this false presumption. Our household survey data do support the existence of such misperception.<sup>50</sup> However, to explain the negative effect of winning on future compliance, the

<sup>50</sup>Indeed, 42% of respondents thought that the chances of winning the lottery again would be lower for someone who had already one it once—even though the probabilities are in fact independent.

lottery itself would have to exert a powerful positive incentivizing effect; and our field experimental evidence is simply not consistent with this. The informational mechanism thus cannot readily explain the negative impact of tax holidays on compliance. As we show in Appendix Figure A17, information also had little to no impact on compliance among either ineligible and eligible taxpayers considered separately. This is useful for assessing broader policy impact—since we might expect (as did municipal policymakers) that the program would cause ineligible taxpayers to bring their accounts up to date to gain eligibility for the program. Yet, here we see no evidence of such positive impact among ineligibles.

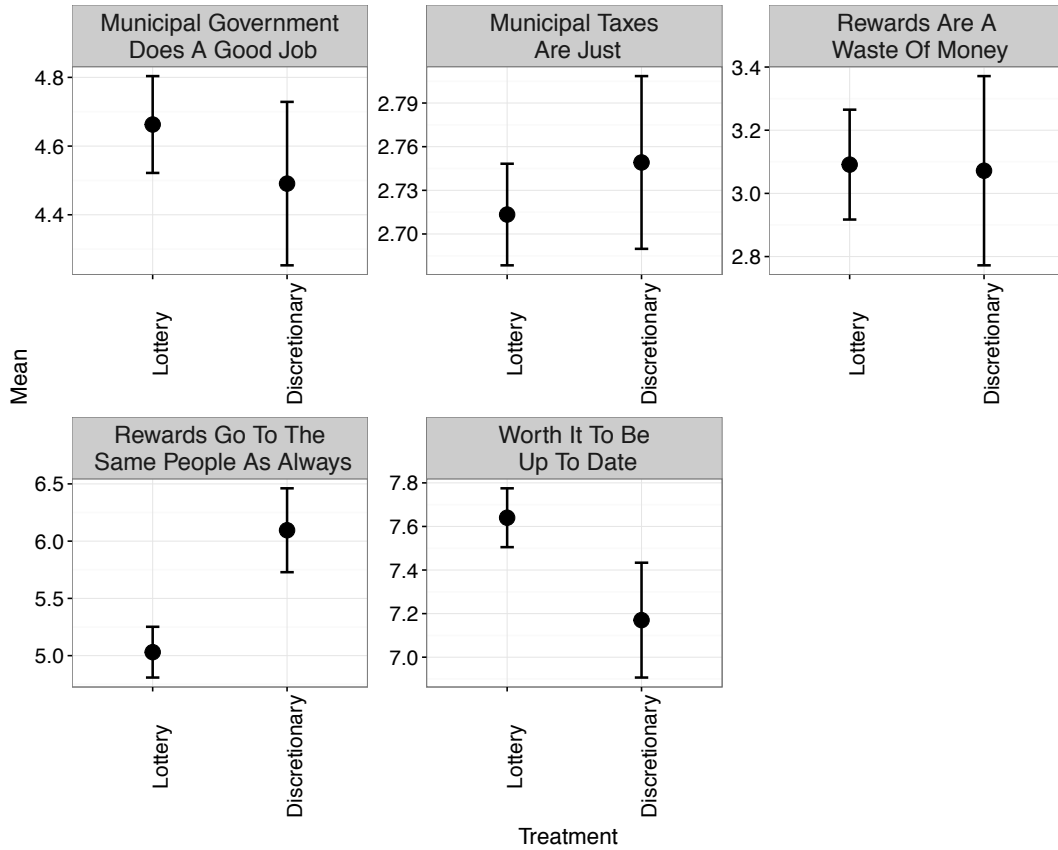
Finally, we also use data from a separate survey experiment conducted with respondents in several thousand households to assess whether the lottery acts as a negative signal about municipal capacity or the equity of the tax system.<sup>51</sup> Thus, we compare respondents who were informed about the lottery—using language very similar to that printed on our flyers—to those who were told that the municipality “from time to time” selects good taxpayers and rewards them with a year free of tax payment. We thereby intend to assess the impact on attitudes of information about a transparent way of allocating prizes for compliance—the lottery—relative to a method with more potential for discretion. We gathered outcome data on five measures of attitudes towards the municipal government and the tax system. As shown in Figure 8, we find no effect of information about the lottery on perceptions that (1) the municipal government does a good job, (2) municipal taxes are just, or (3) rewards for good taxpayers are a waste of money. However, being informed about the lottery (4) boosted perceptions of transparency and equity—in particular, decreased agreement with the statement that rewards “go to the same people as always”—and also (5) boosted agreement that it is worth it to be up to date on ones taxes (even though our behavioral evidence suggests little positive effect on actual behavior).<sup>52</sup> Information about the lottery does not therefore seem to act as a negative signal about municipal capacity. Put in terms of our behavioral model, it is possible that the tax holiday policy shapes parameters such as  $b$ , the expressive benefit of paying taxes. Yet, that change is not sufficient to counteract the negative impact of the holiday on compliance behavior.

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<sup>51</sup>See the online Appendix and pre-analysis plan for further details.

<sup>52</sup>Appendix Table A6 shows full results for the survey experiment, including a column showing that the effects for outcomes (4) and (5) survive multiple comparison adjustments.

Figure 8: Survey Experiment: Effects of Information about the Lottery on Attitudes Towards Taxation



The figure shows effects in our survey experiment on five measures of attitudes towards taxation. The “lottery” group was informed about the tax holiday using language similar to our mailed flyers. The “discretionary” group was told that the municipality “from time to time” rewards good taxpayers with holidays. Differences in the top panel are not statistically significant; in the bottom panel they are.

In sum, alternative explanations cannot explain key features of our data. Neither informational effects nor broader changes in attitudes account for the negative impact of the tax holidays. Our evidence suggests instead that interrupting payments disrupts taxpayers’ compliance habit. This effect can be quite disruptive for the flow of tax payments, since a current shock to a good taxpayer’s compliance today has knock-on effects on future compliance. Indeed, by disrupting the habit of payment, Montevideo’s incentive program made those who won the exoneration worse taxpayers than they would otherwise have been. This effect was quite persistent, lasting for at least five payment periods, or nearly two years for property taxpayers which is paid three times a year.



Yet this negative effect also eventually receded, among the highly compliant taxpayers who were granted the interruption. Plausibly, their stock of habit is so strong that especially once they eventually began to comply again, they set themselves on a self-sustaining course back towards strong compliance. Indeed, our evidence suggests that even though the holiday disrupted habits and altered the rate of payment, it did not fundamentally shift taxpayers' vision of themselves as good taxpayers, nor their sense of the "rules of the game" guiding practice (Bourdieu 1990). We interviewed three past winners of tax holidays who missed payments after the end of their exonerations, to see what we could glean about the processes that led them to tax delinquency. In fact, none of them remembered having missed payments after the holiday.<sup>53</sup> While habit need not be automatic, delays in payment after the exoneration did not result from strategic considerations, attitudinal shifts, or even intentional action, at least for these three taxpayers. Whether aware of it or not, these good taxpayers simply got out of the habit of payment; yet they were able to recover the habit eventually.

Our findings thus underscore that even if disruptions matter, habits can also be difficult to alter permanently. The stock of habit is critical for explaining why some taxpayers persistently comply while others do not. Beyond the impact of the specific program we study, then, our theory and empirical results highlight how habits can contribute to persistent patterns of citizen-state interaction. Reserves of habit and self-reinforcing practices produce broader patterns of tax compliance; and the effects of policy interventions are conditioned by these compliance histories and practices. Similar dynamics very plausibly apply to other kinds of interactions between citizens and their states. Our findings therefore have more general implications for understanding the persistence of modes of civic participation.

## 5 Conclusion

Social scientists have long noted that countries may be locked into high or low development paths, especially with respect to outcomes such as state capacity. Some of these effects may emerge in equilibrium from strategic behavior, while others may be due to increasing returns and path dependency.

Yet, citizens also develop habits of interaction with tax bureaucracies and other organs of the state

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<sup>53</sup>Interviewees CTA3112776, CTA356743, and CTA3408155.

that can be highly consequential for a range of citizen-state interactions—and for broader development outcomes. Habits can have lasting consequences, as both positive and negative habits tend to be self-reinforcing. Still, interventions can shape habits. For citizens who do not always pay their taxes, behavioral nudges may help create stronger habits of compliance. By the same token, programs that break compliance habits can have important, often unrecognized negative consequences.

For policy makers, lack of attention to habit can lead to perverse consequences. Municipalities throughout Latin America have developed positive incentive schemes to boost tax compliance. Montevideo, one of the pioneers of such policies, has offered good taxpayers a chance to forego a year of tax payments, in the hopes of both rewarding and inducing compliance. Yet, our findings suggest the policy is a net revenue loser, not only because of foregone tax payments during the holiday—but because, by disrupting the habit of payment, the holiday makes winners worse taxpayers than they otherwise would have been. Moreover, our field experiment indicates that the policy does not offer an offsetting benefit by incentivizing compliance among ineligible taxpayers. Certainly, there can be other rationale for maintaining such schemes, such as engendering positive attitudes towards the transparency or equity of the tax system. However, other kinds of rewards could realize such legitimacy gains without disrupting compliance habits. Indeed, after we presented the findings from this study to officials in Montevideo, they changed the policy to offer lottery winners cash rebates instead of holidays.

For social scientists, our findings provide new insights into sources of weak state capacity. In many Latin American countries, the extension of citizenship preceded the formation of strong states that could effectively enforce tax compliance. Ensuing habits of non-compliance could have extended across many years, and even across generations, through a combination of parental transmission and the knock-on effects of actual practice. Our research is thus complementary to studies of the parental transmission of attitudes towards corruption or other persistent social phenomena (Simpser 2016). The good news from one perspective is that interventions can build habits as well as destroy them, and the effects of habit disruptions are persistent but also decay. Yet, if left unchecked by countervailing forces—such as that taxpayers who were given holidays were reliable tax taxpayers to begin with—the failure to construct compliance habits, or their active destruction, can have long-lasting consequences.

Our study also provides new insights into the operation of habit itself. While social psychologists have recognized habit's importance, and while scholars of political participation have studied its role

in voting, its influence on many important modes of citizen-state interaction is substantially under-explored. Our study provides evidence of the significance of habit in a novel domain of tax compliance. Our findings also shed light on the consequences of habit disruption, as opposed to habit formation. Many policies and interventions involve interruptions: soldiers are given leaves of absence, students take gap years, professors are granted sabbaticals. These policies may have many offsetting benefits (especially sabbaticals, we would emphasize). Yet, through the channel of habit, they could also have largely unremarked downsides. Even research on the negative effects of summer vacations on academic performance tends to focus on the differences across children in opportunities to learn during the break, rather than the impact of habit disruption itself (Cooper and Greathouse 1996).

States and social scientists alike should therefore consider the impact of habit in generating vicious as well as virtuous cycles in civic participation. Interventions that disrupt habits can be critical forces for change, with sometimes unexpected consequences. Yet, their effects may depend on pre-existing stocks of habit, which contribute to sustaining broader development paths. The role of habit in generating strong and weak civic participation, or reliable vs. unreliable patterns of citizenship, should be considered in future research; and its relative contribution to tax compliance should be considered and measured, alongside alternative sources of state capacity.

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