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ABSTRACT

In modern economies, when debt and trust issues arise, a partial forgiveness policy is often the solution to induce payment and increase disclosure. For their part, governments around the globe continue to use tax amnesties as a strategy to allow debtors to make amends for past misdeeds in exchange for partial debt forgiveness. While ubiquitous, much remains unknown about the basic facts of how well amnesties work, for whom, and why. We present a simple theoretical construct that provides both economic clarity into tax amnesties as well as insights into the necessary behavioral parameters that one must estimate to understand the consequences of tax amnesties. We partner with the Dominican Republic Tax Authorities to design a natural field experiment that is linked to the theory to estimate key causal mechanisms. Empirical results from our field experiment, which covers 125,452 taxpayers who collectively owe $5.2 billion (5.5% of GDP) in known debt, highlight the import of deterrence laws, beliefs about future amnesties, and tax morale for debt payment and increased disclosure. Importantly, we find large short run effects: our most effective treatment (deterrence) increased payments of known debt by 25% and hidden debt by 48%. Further, we find no evidence of our intervention backfiring on subsequent tax payments.

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"Lunar exploration was not the equivalent of an American pyramid, some idle monument to technology, but more of a Rosetta stone, a key to unlocking dreams as yet undreamed." American Astronaut, Gene Cernan

1. Introduction

To most historians, the Rosetta Stone represents the key to unlocking ancient secrets, if not to realize "dreams as yet undreamed." As the story goes, in 196 BC, the boy-king, Ptolemy V issued a "Proclamation of Peace" to end the Egyptian civil war, which had been going on for over a decade. The decree was inscribed in three versions on the Rosetta Stone. The top and middle texts were chiseled in Ancient Egyptian using hieroglyphic and Demotic scripts, while the bottom was scribed in Ancient Greek. The decree has only minor differences between the three versions, making the Rosetta Stone the missing link to deciphering the secrets hidden in ancient hieroglyphs.

While the Rosetta Stone unlocked deep ancient wisdom, the central conciliatory message in the Stone contains the roots of a popular instrument used by tax authorities today: tax amnesties. Indeed, historians cite the Stone's general amnesty for the rebels' tax debts—all tax debts were forgiven and imprisoned tax debtors were immediately released—as central to restoring peace in Egypt (Adams, 1993). Today, such measures are used for a different conciliatory purpose. As federal, state, and local budgets continue to tighten, governments have turned to this age-old approach to increase tax revenues for the provision of necessary public goods and services.

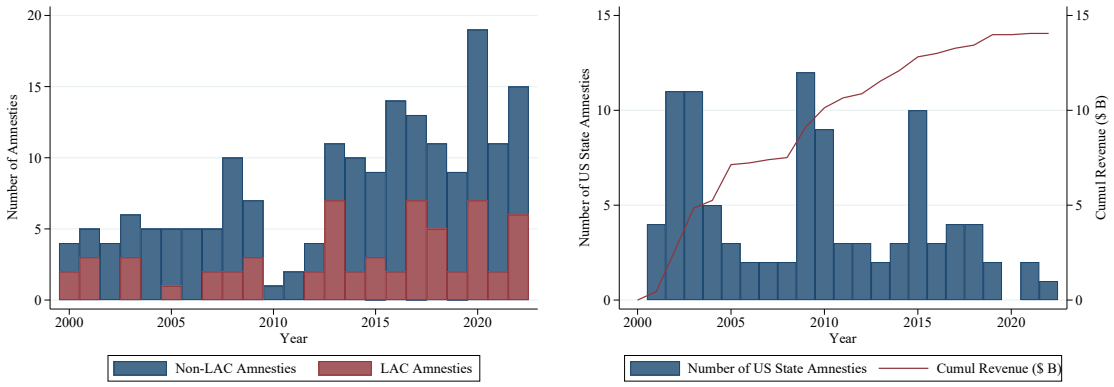
In this manner, it is difficult to overstate the role and import of tax amnesties.[1] Indeed, governments around the globe repeatedly use tax amnesties: since 2000, eighty-four countries have offered one hundred and eighty-four amnesties. And, since 2012, governments have offered at least forty-five amnesties in Latin America and the Caribbean, with eight occurring in the past two years, as shown in Panel (a) of Figure 1.[2] Amnesties have become more

[1] Luitel and Sobel (2007) describe the three characteristics of tax amnesties as (1) short-lived in nature, (2) voluntary participation, and (3) waiving financial and criminal penalties for evasion upon participation.

[2] The count of amnesties only includes temporary debt forgiveness and does not include other permanent voluntary disclosure programs.

common in recent years, in part due to the COVID-19 pandemic. State governments in the United States also implemented tax amnesties forty-six times since 2010 (Panel (b) of Figure 1, Alt (2022)). Yet, a narrow focus on tax amnesties does not do their general structure justice, as just in the past several decades, state governments in the U.S. have given amnesties for not only tax evasion, but also human rights abuses, illegal alien status, freedom violations, war crimes, draft evasion, parking tickets, and even library books that are past due.

Figure 1: International Amnesty Programs Over Time



Note: Panel (a) presents a histogram of the number of countries who implement a tax amnesty in each year from 2000 to 2022. Panel (b) presents the number of state amnesties in the United States in each year from 2000 to 2022 as well as the cumulative revenue raised over this time period in 2021 USD.

Despite the common use of amnesties, the theoretical literature suggests ambiguous effects in the short- and long-run, and there remains a dearth of credible evidence providing such insights (Andreoni, 1991; Malik and Schwab, 1991; Stella, 1991; Graetz and Wilde, 1993). Because many open empirical questions remain, some have questioned the wisdom of tax amnesties. For example, certain detractors argue that few debtors may choose to take up the amnesty, even when offered. Further, taxpayers may believe that the costs of holding onto known and hidden debt is low because the government has signaled low enforcement capacity through amnesties. Amnesties could additionally worsen taxpayers' perceptions of state capacity, further decreasing the incentive to join.

With low take-up, amnesty opponents argue that there are minimal short-run benefits

and that offering evaders amnesty discourages future compliance, reducing long-run revenue (Malik and Schwab, 1991). In effect, amnesties potentially generate moral hazard in future tax periods, as even those scrupulous taxpayers might recognize that penalties for non-payment will be ultimately forgiven or reduced, changing their attitude, moral compass, or overall tax morale from voluntary tax compliance (Leonard and Zeckhauser, 1987; Luttmer and Singhal, 2014; Yücedoğru and Sarisoy, 2020). The cumulative impact becomes an empirical question that requires exogenous variation of key factors to identify the overall welfare implications of amnesties.

Our paper begins by setting out a simple theoretical framework that clarifies the short- and long-run trade-offs associated with tax amnesties. In doing so, we highlight four mediation channels (information, tax morale, expectations, and deterrence) that might be at work when considering the efficacy of tax amnesties. The framework is useful in that it provides insights into the necessary behavioral parameters that one must estimate to understand the consequences of tax amnesties. Furthermore, the framework shows how tests for potential unintended consequences on longer-term income tax reporting and compliance are invaluable in determining whether, and to what extent, governments should leverage amnesty programs.

Our main empirical contribution is measuring the key causal mechanisms via a natural field experiment that is closely linked to the theory. We do so by partnering with the Dominican Republic Tax Authorities (IRSDR), which implemented a field experimental design via randomizing correspondences to taxpayers. In total, the IRSDR delivered messages to 125,452 debtors, who collectively owed 5.2 billion USD in known tax debt, to explore the drivers of amnesty take-up.[3] We randomly allocated debtors to our various treatments in an effort to explore mechanisms: our control condition is the status quo of no direct message from the IRSDR about the amnesty. We compare this control to a simple reminder message that informs taxpayers of the amnesty and how to join it (our information treatment). We augmented the information message with three separate treatments exploring tax morale,

[3]We report all monetary figures in USD. We use the exchange rate on the randomization date.

expectations about subsequent amnesties, or highlighting that the failure to pay taxes can be penalized with a prison sentence.

Our natural field experiment provides four main empirical insights. First, status quo take-up of the amnesty is relatively low. Only 18% of the eligible debtors join the tax amnesty in the control group. Overall, the government raises $263 million from the amnesty, representing only 5% of the total known debts owed. Second, each of our four messages increases the likelihood of paying both known and hidden debts relative to the control group. However, only the deterrence message highlighting the potential prison sentence increases the average debt paid. Third, firms respond more strongly to our treatments than individuals, and larger taxpayers, based on the number of employees, respond more strongly than smaller ones. Finally, we find no evidence that subjects change their tax compliance in the subsequent year. In total, our messages induced treated debtors to collectively pay back $22 million more debt than control debtors and we find no effect on subsequent income taxes paid; however, the average effects of the messages on subsequent taxes are imprecisely estimated.

Beyond considerably raising the tax base for a developing country, one important contribution of our paper is providing causal evidence that tax amnesties are most effective for raising revenue when combined with strong deterrence measures. Previous work on voluntary debt repayments has mainly relied on descriptive,[4] time series,[5] or panel data analyses.[6] The findings in this literature are mixed, with most showing little to no effect of tax amnesties on tax revenue. One notable exception is Londoño-Vélez et al. (2022) who find that an Argentinian tax amnesty revealed assets worth 21% of GDP. Our findings showing higher efficacy of the deterrence message reinforce the claims in the theoretical literature indicating that beliefs about low enforcement are a significant barrier to amnesty efficacy (Malik and Schwab, 1991). Moreover, this finding builds on Fisher et al. (1989) who argue that amnesties may be

[4]See Mikesell (1986); Parle and Hirlinger (1986); Christian et al. (2002); Le Borgne and Baer (2008); Mikesell and Ross (2012); Alstadsæter et al. (2018).

[5]See Alm and Beck (1993); López-Laborda and Rodrigo (2003); Luitel (2014).

[6]See Luitel and Sobel (2007); Ross and Buckwalter (2013); Langenmayr (2017); Shevlin et al. (2017); Johannesen et al. (2020); Londoño-Vélez et al. (2022) Garz and Pagels (2018) similarly show that increased salience from media coverage of celebrity tax evasion leads more taxpayers to join an amnesty.

most politically feasible when transitioning to a stricter enforcement regime. We also provide suggestive evidence that tax morale does not drive the decision to join amnesties. However, we caveat this evidence because our experimental design does not allow us to observe how taxpayers update their tax morale considerations in response to our messages (Luttmer and Singhal, 2014; Giaccobasso et al., 2022).

More broadly, our paper contributes to the literatures on tax evasion and enforcement (Hallsworth, 2014; Bérgolo et al., 2017; Hallsworth et al., 2017; Slemrod, 2019; Antinyan and Asatryan, 2019). Similar to this work, we show that deterrence messages are more effective at raising revenue than messages attempting to change tax morale. Additionally, in contrast with the vast majority of tax experiments, our subjects span the full distribution of tax debt and the span of firm size. This subject pool allows us to show that larger taxpayers, with respect to firm size, are more likely to join the amnesty and more responsive to nudges. From a policy perspective, understanding how the largest taxpayers respond is invaluable due to the increasing concentration of tax liabilities within such taxpayers. Indeed, in our setting, the top 1% of taxpayer based on the number of employees owe 87% of all known debt. Additionally, we show that large taxpayers responded significantly to our deterrence message and our message tempering expectations about future amnesties. Governments where harsh punishments are infeasible can therefore instead change taxpayers' perceptions about future forgiveness opportunities to increase take-up.

Our paper also contributes to the literature on the long-run effects of tax amnesties. In our setting, we find no evidence of overall reductions in subsequent corporate income tax payments. Closest to our paper, Castro and Scartascini (2019) conduct a natural field experiment in Argentina to understand how inattention and costly information acquisition affect taxpayer decisions to join an amnesty and find that their treatments decreased compliance with subsequent tax bills, undermining the goals of the amnesty.[7] Additionally, Lauletta

[7]In both this paper and Castro and Scartascini (2019), the researchers conducting a natural field experiment with the government are unable to exclude some taxpayers from joining the amnesty and instead focus on increased salience and enforcement. Our results therefore speak to the short and long run effects on inducing additional taxpayers to join the amnesty rather than the amnesty itself. Laboratory experiments,

and Campos (2022) find that a tax amnesty in Argentina for property tax increases future compliance.

The remainder of our paper proceeds as follows. Section 2 presents a conceptual framework to improve our understanding of tax amnesties and the channels they might operate. Section 3 describes the institutional context, subject pool, and field experimental design. Section 4 describes the empirical model and results and Section 5 presents pre-registered heterogeneity analysis by the number of employees and additional analysis by the amount of tax debt. Section 6 discusses the results on subsequent tax payments. Section 7 concludes.

2. Conceptual Framework

We now consider a model of tax amnesties. We first focus on a taxpayer's decision to resolve tax debt by joining the amnesty. The model motivates the experimental design and provides intuition for potential behavioral responses to different treatment messages that we consider in our empirical analysis and how the responses may vary across taxpayers. We then briefly discuss how the taxpayer's behavioral responses to the amnesty in the short and long run affect the government's problem of whether and how to offer a tax amnesty to maximize net revenues. Since our experimental design sheds light on the importance of different behavioral parameters and responses, it informs how governments should offer and design tax amnesties. Our framework builds on previous models of tax evasion (Becker, 1968; Allingham and Sandmo, 1972) and amnesties (Andreoni, 1991; Castro and Scartascini, 2019).[8]

We consider a representative taxpayer with income I_t and initial known debt, $D_{k,t}$, owed to the government at the time the amnesty is announced, t. She has additional hidden debt,

which instead allow for greater control over the environment (Al-Ubaydli and List, 2015), have allowed researchers to study the optimal design of amnesty programs in addition to the impacts of past amnesties on compliance (Alm et al., 1990; Alm and McKee, 1998; Torgler and Schaltegger, 2005; Alm and Malézieux, 2021).

[8]Our framework is similar to Castro and Scartascini (2019), but separately considers the role of known and unknown tax debt as well as how previous debts interact with the likelihood of government audits and harshness of the fines, in line with our setting and treatments.

$D_{h,t}$, that we assume is fully revealed if the government conducts an audit in period t. The IRSDR offers an amnesty where taxpayers can pay $\alpha_k D_{k,t}$ to have her known debts forgiven, and $\alpha_h I_t$ to additionally resolve hidden debts ($\alpha_k, \alpha_h \leq 1$). The offer to resolve hidden debt is proportional to I_t since $D_{h,t}$ is only observable after an audit.[9]

We denote a taxpayer who joins the amnesty to resolve known debts at the beginning of period t as $j_k = 1$, and to resolve hidden debts as $j_h = 1$. Each taxpayer has four options as part of the amnesty: (a) do not join the amnesty; (b) join and only pay known debts; (c) join and only pay hidden debt; and (d) join and pay both known and hidden debts. For simplicity, we assume that taxpayers pay the "full" reduced balance when joining at the beginning of period t: $\alpha_k D_{k,t}$, $\alpha_h I_t$, or $\alpha_k D_{k,t} + \alpha_h I_t$.[10] When making this decision, she trades off the value of resolving existing debt with the costs of joining.

Figure 2 depicts the evolution of taxpayer debt based on her own actions and the actions of the government in period t, and therefore the amount of outstanding debt in period $t+1$. At the start of period t, the government offers an amnesty and the taxpayer chooses whether to join to resolve either known or hidden debt. After observing the taxpayer decision to join or not, the IRSDR may conduct an audit, $z \in \{0, 1\}$. The probability that a taxpayer is audited is a function of her known debt in period t, $D_{k,t}$, and income, I_t: $p_z(D_{k,t}, I_t)$. The probability is zero if the taxpayer joins the amnesty to pay hidden debt as there is no longer any hidden debt that can be recovered.[11] If there is an audit, we assume the IRSDR learns the true debt liability and the taxpayer must pay a monetary fine, f, in period t, proportional to the amount uncovered through the audit, $D_{h,t}$. Thus, in this event, the taxpayer pays $fD_{h,t}$, $f > 1$. A taxpayer who does not join the amnesty to resolve both known and hidden debts also faces an expected cost of going to prison $s(D_{k,t}, D_{h,t}; z)$ that is a function of the

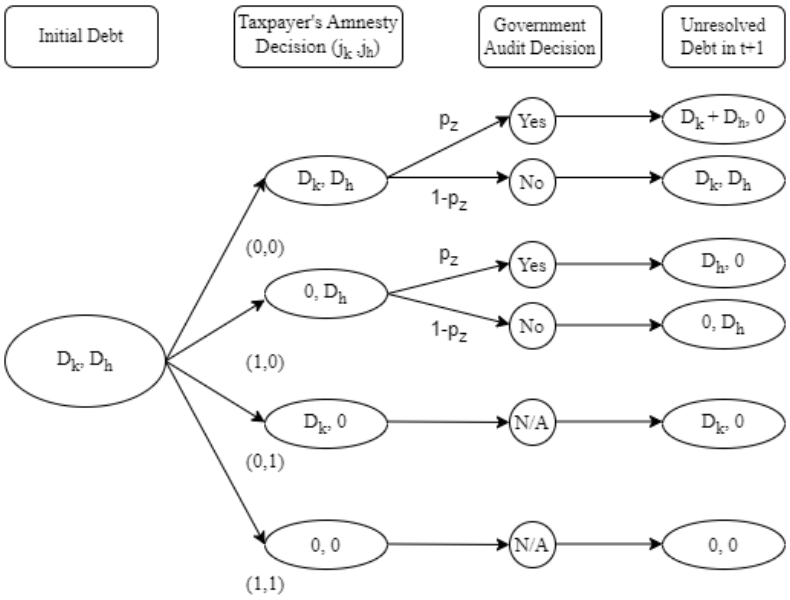
[9] In the Dominican Republic's 2020 amnesty, similar to other amnesties, taxpayers could additionally declare unknown assets by paying some percent of the assets' value. These assets are a second type of hidden debt we do not explicitly model for tractability.

[10] However, in reality, taxpayers who join the amnesty to resolve hidden debts, may also have to decide how much to declare or they could join the amnesty and eventually not pay the whole debt.

[11] Since conducting an audit is costly to the government, it is optimal for the government to not audit those who have resolved all of their hidden debts through the amnesty.

amount of debt, as specified in Law 155-17 in the Dominican Republic.[12]

Figure 2: Taxpayer's Evolution of Debt



Note: This figure presents how a taxpayer's known debt D_k and hidden debt D_h change from her own decisions of whether to join the amnesty as well as based on whether the government conducts an audit to determine her debt at the start of period $t+1$.

If the taxpayer does not resolve her debt in period t, then she additionally faces an expected cost of holding onto the debt for period t+1: $c(D_{k,t+1}(j_k, j_h, z), D_{h,t+1}(j_k, j_h, z); s; a; m)$. The function c is increasing in both known and hidden debts, and directly depends on her amnesty decisions, (j_k, j_h), and the government's audit decisions in period t, z. This evolution of debt from t to $t+1$ is depicted in Figure 2, which allows us to express future debt in terms of initial debt, $D_{k,t}$ and $D_{h,t}$. The expected costs also depend on the taxpayer's beliefs of her likelihood that there will be amnesty in the future, a, its terms (or α's) that allows the taxpayer to resolve the debt at a lower cost in the future, the potential benefits through tax morale, m, from voluntarily paying down her debt, her beliefs about the likelihood she will be audited in the future, and the government's enforcement and other policies (e.g. s,

[12] s is also a function of z since an audit uncovers previously hidden $D_{h,t}$ and therefore changes the information the government has about the taxpayer's past evasion.

financial fines, and interest payments).[13] We assume that all these costs can be measured in a monetary value, to reflect, for example, a taxpayer's willingness to pay to avoid prison.

While taxpayers dislike forgoing consumption to pay down their debts, they may join the amnesty because of the fine in period t, to avoid the expected cost of going to prison in period t, s, and the expected cost of holding on to debt, c, in period $t+1$, as well as "tax morale" benefits from paying their fair share, m, which increases utility from voluntary compliance (Luttmer and Singhal, 2014).[14] These factors enter the individual's maximization problem, which measures expected utility $\mathbb{E}U(j_k, j_h)$ over: their beliefs about the likelihood of a government audit if they do not join the amnesty to pay hidden debts, p_z, the likelihood of future amnesties, a, the beliefs about whether the government will enforce the law, s, and tax morale, m:

$$\arg\max \mathbb{E}U(j_k, j_h) \quad \text{where:} \tag{1}$$

$$\begin{aligned}\mathbb{E}U(0,0) = {} & p_z(D_{k,t}, I_t)\big(I_t - fD_{h,t} - s(D_{k,t}, D_{h,t}; 1) - \beta c(D_{k,t} + D_{h,t}, 0; s; a; m)\big) \\ & + [1 - p_z(D_{k,t}, I_t)]\big(I_t - s(D_{k,t}, D_{h,t}; 0) - \beta c(D_{k,t}, D_{h,t}; s; a; m)\big) + m(0),\end{aligned} \tag{1a}$$

$$\begin{aligned}\mathbb{E}U(1,0) = {} & p_z(0, I_t)\big(I_t - \alpha_k D_{k,t} - fD_{h,t} - s(0, D_{h,t}; 1) - \beta c(D_{k,t}, 0; s; a; m)\big) \\ & + [1 - p_z(0, I_t)]\big(I_t - \alpha_k D_{k,t} - s(0, D_{h,t}; 0) - \beta c(0, D_{h,t}; s; a; m)\big) + m(\alpha_k D_{k,t}),\end{aligned} \tag{1b}$$

$$\mathbb{E}U(0,1) = I_t - \alpha_h I_t - s(D_k, 0; 0) - \beta c(D_{k,t}, 0; s; a; m) + m(\alpha_h I_t), \tag{1c}$$

$$\mathbb{E}U(1,1) = I_t - \alpha_h I_t - \alpha_k D_{k,t} + m(\alpha_k D_{k,t} + \alpha_h I_t) \tag{1d}$$

In each lettered equation above, we express the amount of debt based on the taxpayer's and government's decisions as shown in Figure 2.

In (1a) and (1b), the tax authority may conduct an audit with positive probability

[13] The cost in the future will also depend on features of the economic environment, like inflation (Fishlow and Friedman, 1994).

[14] The benefits to a taxpayer from tax morale can also include other factors, such as reducing shame from not paying her fair share (Perez-Truglia and Troiano, 2018).

because the taxpayer did not join the amnesty to resolve the hidden debt. In this case, the expected utility depends on the likelihood of being audited interacted with the payoffs if audited or not, as well as tax morale. The amounts of known and hidden debt in period $t+1$ depend on whether in period t there is an audit and on taxpayer choices regarding the amnesty (j_k, j_h), as shown in Figure 2. In (1c) and (1d), the probability of an audit is zero since there is no hidden debt. Overall, based on Equation 1, the main behavioral parameters that determine the consequences of the amnesty are the taxpayer's beliefs about prison sentences, s, her beliefs about future amnesties, (a), the importance of tax morale (m), and her beliefs about other enforcement as a function of joining and the amount of debt $(p_z, s,$ and $c)$. We designed our experiment discussed in the next section to understand the importance of these behavioral parameters.

To provide intuition into the individual's problem, we first consider a taxpayer's decision to resolve only her known debt comparing (1a) and (1b). She will join and pay $\alpha_k D_{k,t}$ if $\mathbb{E}U(1,0) \geq \mathbb{E}U(0,0)$. There are four benefits from joining. First, the amnesty offers a discount so that she only owes $\alpha_k D_{k,t}$ instead of $D_{k,t}$, which affects future consumption. Second, joining the amnesty to resolve known debt may affect her beliefs about the likelihood that the IRSDR conducts an audit in period t. The IRSDR may not use its resources on taxpayers who are largely compliant and have recently resolved their known debts, suggesting $p_z(0, I_t) < p_z(D_{k,t}, I_t)$.[15]

Third, taxpayers may believe that resolving known debt reduces the harshness of the punishment from holding other hidden debt. This comes in two forms. First, she may believe that $s(0, D_{h,t}; z) < s(D_{k,t}, D_{h,t}; z)$. That is, the government may reserve prison sentencing only for the most serious offenders with large amounts of combined known and hidden debt. Second, future expected costs of holding debt are lower since c is increasing in debt. The magnitude of these benefits depend on the taxpayer's perceived likelihood of being audited, p_z.

[15]Some amnesties, including an earlier one in the Dominican Republican, guarantee to the taxpayer that her past returns will not be audited as long as her most recent ones are correct (Le Borgne and Baer, 2008).

Finally, a fourth potential benefit of joining is tax morale, m. Especially during the COVID-19 pandemic, some taxpayers may feel obligated to pay their debts so the government has sufficient revenue. However, there is some concern that the amnesty may actually anger taxpayers and lower morale (e.g. Leonard and Zeckhauser, 1987).

We next consider a taxpayer's decision to resolve hidden debts by paying $\alpha_h I_t$. A benefit of declaring hidden debt, $j_h = 1$ in (1c) and (1d), is the taxpayer will not be audited. If she pays off both known and hidden debt in (1d), then the tax debt is zero and belief about future amnesties (a) are also inconsequential. The added taxes paid by joining can also boost the taxpayer's tax morale.

The behavioral parameters in the model suggest that taxpayers may respond differently to an amnesty based on their debt amounts or other characteristics, such as taxpayer size (e.g., the number of employees). Taxpayers with large amounts of known debt benefit more from joining because they save $(1 - \alpha_k)D_{k,t}$ on tax payments, not including future interest. Taxpayers with large amounts of hidden debt also have relatively large benefits from decreasing the likelihood they are audited, p_z, and from a potential decrease in the cost of facing harsh penalties, from c and s. However, if taxpayers with large amounts of debt are unlikely to survive into the near future and therefore have a low β, then they are unlikely to face these consequences and do not have an incentive to join. This implies that the relationship between debt amount and the benefits from joining the amnesty may be non-monotone.

Our focus on the taxpayer's problem revolves around the decision of whether to join the amnesty to resolve known or hidden debts, based on our setting and data. We now briefly discuss three important simplifications and extensions. First, in the model, taxpayers know the amount they need to pay to join the amnesty. However, in practice, the government has imperfect information because they do not perfectly observe current or past I_t. Taxpayers can therefore evade some of their hidden debts through the amnesty at the risk of being caught in an audit.

Second, while our framework focuses on a taxpayer' decision of whether to join the

amnesty, the ability to resolve debt may affect future income tax payments as well. In addition, as we highlight in the model, a taxpayer who joins the amnesty may face a lower or zero likelihood of being audited, and a smaller punishment from being caught because they no longer have known debt. If this leads to more income tax evasion in the future, the amnesty program by itself may backfire, which the government must take into account when deciding whether to offer the amnesty. However, if the IRSDR uses the amnesty as a politically feasible approach to transition to a higher fine and higher enforcement environment, as signaled in our deterrence treatment, the government can increase debt collection while avoiding future revenue losses. Further, taxpayers may be reluctant to join the amnesty as it may reveal information about the taxpayer that decreases the ability to evade taxes in the future (Lauletta and Campos, 2022).

Finally, in our setting, taxpayers in the Dominican Republic could resolve both known and hidden debt. However, the government must decide which, if any, debts taxpayers can resolve through the amnesty. The type of amnesty the government offers could shift the taxpayer's beliefs about future amnesties, a, or her beliefs about the costs of holding debt, c, and therefore affect whether she joins. A government that offers the option to resolve hidden debt may signal that the audit probability is low and that it has low tax capacity since it is willing to give up fines, f, that are only received if it conducts an audit.

Based on these considerations for the government, should it offer a tax amnesty and under what terms? The government would optimally offer an amnesty, with specific α_k and α_h, if the value of debt payments today is larger than the discounted future debt and other tax payments, net of administrative costs. With imperfect information of the taxpayer's beliefs and hidden debt, the IRSDR makes this decision under uncertainty both about how much revenue the amnesty will raise, as highlighted by Equation 1, and how it will affect future tax compliance.

Taxpayers who join the amnesty may change their future tax payments for several reasons. First, there is a mechanical effect from the discounts, α's. However, the discounts do not

necessarily imply that the government collects less in total revenue if it induces taxpayers who would have never paid their debts, because of trust or beliefs about enforcement, to resolve earlier. Second, paying down debt can affect beliefs about the likelihood of future audits, p_z, and the punishments from evasion, f, c, and s. Finally, taxpayers may also evade future taxes if they believe they will benefit from a future amnesty, a; offering an amnesty today could also affect the beliefs about future amnesty and enforcement policies more generally. The government must also choose the discounts trading-off the value of attracting more taxpayers to join to receive revenue today, based on Equation 1, with their effects on taxpayer's beliefs and therefore future taxes paid.

An amnesty could also decrease the total administrative costs the tax administration faces if the amnesty itself is inexpensive, and it reduces the number of costly audits on future income taxes. Additionally, by revealing taxpayer information, the amnesty could improve future tax collection (Lauletta and Campos, 2022), further reducing costs. Especially for developing countries with low state capacity, governments often lack sufficient information about taxpayers, which hinders enforcement (Pomeranz and Vila-Belda, 2019).

Our natural field experiment focuses on the behavioral parameters that govern the individual's decision to join the amnesty. A better understanding of these parameters also helps shed light on the government's optimal policies.

3. Background and Experimental Design

3.1 Institutional Context

The Dominican Republic is an upper-middle-income developing country with a GDP per capita of $8,600 and a population of 10.9 million in 2021 (Bank, 2021). Tax revenue amounts to 13% of GDP, much less than the average of other Latin American and Caribbean countries (22.8%) and OECD countries (33.5%) (Revenue Statistics, 2021). The most important taxes in the Dominican Republic by revenue share are the value-added tax (35.3%), excise taxes (22.7%), corporate income taxes (16%), and individual income taxes (9%).

The Dominican Republic has traditionally had a higher tax evasion rate than other Latin American and Caribbean countries. The IRSDR estimated a tax evasion rate of 62% for the corporate income tax and 57% for the individual income tax in 2017. For reference, the evasion rate for the corporate income tax and individual income tax was 31% and 26% in Mexico, 27% and 34% in Brazil, or 27% and 20% in Chile, respectively (Gobierno de la República Dominicana: Equipo Interinstitucional, 2018). In the recent past, the Dominican Republic offered tax amnesties in 2001, 2007, and 2012 in an attempt to recover some of this evaded tax revenue.

In 2020 the Dominican Republic passed Law 46-20 on Transparency and Asset Revaluation under a new President. Law 46-20 offered tax amnesty to those who owed known and unknown tax debt. The law was passed in February 2020, before the declaration of the COVID-19 pandemic, and the amnesty was implemented in June 2020. Originally, the deadline to join the amnesty was January 1, 2021, but it was changed to December 1, 2021.

Law 46-20 of Transparency and Asset Revaluation allowed regularizing outstanding tax debt known to the IRSDR by paying 70% of the liability amount. Tax debt from any of the taxes in the Dominican Republic and all tax debt, including debt subject to an administrative or judicial recovery process, qualified for the amnesty. Additionally, the amnesty allowed the voluntary declaration of tax debt unknown to the IRSDR by paying 3.5% of the average net revenue declared for the income tax in years 2017 through 2019 (individual income tax for individuals or corporate income tax for firms), and allowed disclosure of assets unknown to the IRSDR by paying 2% of the value of the disclosed assets or reevaluating assets by paying 2% of the change in value.

3.2 Experimental Design

We rolled out a natural field experiment (Harrison and List, 2004) soon after the announcement of the amnesty. Preliminary data analysis revealed that 125,450 subjects, including firms and individuals, in the Dominican Republic owed tax debt. The average debt owed

by each taxpayer in our sample was $40,983, and about 20% of the debt owed was from interest charges. The average age of the debt was a little more than four years. Taxpayers in the Dominican Republic use an online platform, called "virtual office," to declare taxes and interact with the tax authority. Taxpayers joined the amnesty using the "virtual office" or in person at any of the regional IRSDR offices. This would serve as a key piece of our outcome measurement.

Figure A1 presents the timeline of the amnesty. In October 2020, we sent messages to the representatives of 56,766 firms and 68,684 individuals who owed known tax debt. The IRSDR posted the messages in the virtual office and also sent the messages by email. To ensure that each taxpayer received a single message, randomization was performed at the level of the representative listed for each account in the virtual office. These representatives can be the debtor herself or a representative such as an accountant or firm representative. The same representative can be listed in more than one account. We evenly split representatives into five conditions summarized in Table 1 at random.

The first row of Table 1 shows the control group, these are individuals who received the status quo, which is no direct message from the IRSDR. This group included 25,070 taxpayers. Taxpayers randomized into the other four conditions received messages that provided details about benefits and discounts from joining along with instructions on how to join, or a "notification" message. The notification treatment provides information to taxpayers about the value of joining the amnesty, as taxpayers may be unaware of the programs, or may not understand the costs or benefits of joining. The notification may also signal to taxpayers that the IRSDR is taking tax debt more seriously, which would correspond to increases in p_z, f, s or c, or instead that enforcement is low and so the IRSDR is using the amnesty in place of collecting outstanding hidden debt through audits. The message could additionally make the taxpayer believe that future amnesties, a, are more likely, leading to increases in evasion.

The final three treatments add short phrases in bold text, each highlighting one aspect

Table 1: Treatment Messages

Treatment	**Message Text**	**# Agents**	**# Taxpayers**
Control	No message	22,168	25,070
Notification	Reminder about the amnesty program, Law 46-20, and the rules for joining.	22,290	25,489
Tax Morale	"This Law seeks to generate the necessary income for the country in the global context of the health crisis. The economic consequences of the COVID-19 pandemic require a joint effort and government revenues are a very important tool to help those most affected at a critical time such as the current one. We ask you to collaborate by joining Law 46-20 and its amendments."	21,958	24,871
Expectations about Future Amnesties	"This is your last chance to pay off your debt with the significant discounts granted by Law 46-20 and its amendments. There will be no new discounts like those of Law 46-20 and its amendments in the future."	22,085	24,847
Deterrence	"It is important to inform you that failure to pay your tax debts is considered a voluntary action and not an involuntary error, which constitutes a violation of the taxpayer's duties, as established in articles 253 and 254 of the Tax Code. In addition to being subject to the pecuniary penalty, according to the new Law 155-17 against Money Laundering and Terrorism Financing, failure to pay taxes can be penalized with a prison sentence."	22,081	25,173
Total		110,580	125,450

Note: The messages used in the experiment were written in Spanish. Translated messages appear in the table. See Appendix B for more details.

that might persuade taxpayers to join, consonant with our theory. These included a tax morale message, a deterrence message, and a statement suggesting that future amnesties were unlikely. We describe each treatment below and link the content to the behavioral parameters of our theory. Table 1 provides an English translation of the added phrases.[16]

The tax morale message highlighted the need for critical tax revenue for the country in the context of the COVID-19 crisis and reminds taxpayers of the social value of taxes to potentially increase the weight taxpayers put on m. This message is related to a growing number of studies on how morale suasion messages affect tax compliance (Blumenthal et al., 2001; Luttmer and Singhal, 2014; Slemrod, 2019; Giaccobasso et al., 2022). The evidence on the effectiveness of this type of message in the literature is mixed, although, in general, it has been less effective than deterrence messages. We build on past work by testing the effectiveness of tax morale messages in a different setting since we do it in the context of a tax amnesty and by appealing to the extraordinary circumstances of the COVID-19 health crisis.

Our next message attempts to affect the expectations about future amnesties by indicating that Law 46-20 of Transparency and Asset Revaluation is the last chance to cancel the tax debt and that there will not be future amnesties. This message seeks to change taxpayers' beliefs about the cost of holding onto debt from $c(D_{k,t+1}, D_{h,t+1}; s; a; m)$ to $c(D_{k,t+1}, D_{h,t+1}; s; 0; m)$ as their beliefs about the likelihood a future amnesty, a, fall to 0. Without the option of forgiving debt in the future, they are more likely to eventually face an audit and the resulting harsh penalties. Moreover, Kapon (2022) shows that optimal amnesties are increasingly generous over time, which may lead taxpayers to wait for better terms to resolve their debt. This treatment reduces the incentive to wait. Perceptions of future amnesties may therefore affect taxpayer incentives to join the current amnesty. We showed before that amnesties are not rare events in developed and developing countries, and that indeed the Dominican Republic offered previous tax amnesties in 2001, 2007, and 2012.

[16]We show in Table C1 that there are no significant baseline differences between the five groups based on their past debt, financial savings from joining the amnesty, previous taxes paid, or other characteristics.

However, at the time of our experiment the government did not intend to offer additional forgiveness for this debt.

Finally, the deterrence message is based on Holz et al. (2021), who found that a similar message was highly effective in reducing tax evasion in the Dominican Republic in 2019. Our deterrence message highlights the Law 155-17 by reminding taxpayers that the failure to pay a tax debt can be penalized with a prison sentence and therefore affects taxpayer's beliefs about s,and c.[17] The message also adds a "commission" frame, highlighting that the IRSDR considers the failure to pay tax debts as a voluntary action rather than an involuntary error (Hallsworth et al., 2015).

After treatment, we observe whether taxpayers joined the amnesty, payments made into the amnesty, and subsequent tax payments. These payments allow us to measure repayments of both known and hidden debts to the IRSDR as well as the long-run effects of the tax amnesty on subsequent tax payments.

4. Field Experimental Results

Table 2 provides summary results for the control group. Empirically, amnesty take-up was low. Only 18.2 percent of taxpayers in our control group choose to join the amnesty to resolve known debts ($j_k = 1$), and only 8.6 percent pay more into the amnesty than their known liability, our measure of a taxpayer's decision to resolve her hidden debts ($j_h = 1$). Examining the heterogeneity in take up by the number of employees and amount of the known debt, taxpayers with more employees and with more known debt are more likely to join to resolve both known and hidden debt (Panels A and B of Table 2 respectively). It is interesting to note that Panel A shows that the largest quintile of employers in our data set join the amnesty program at a rate of 44.7%.

We estimate the effects of sending each message $g \in G = \{$notification, tax morale,

[17] In 2018, The Dominican Republic attempted to increase tax compliance using a new law that severely increased the punishment for evasion. Law 155-17 against Money Laundering and Terrorist Financing included tax evasion and other tax-related infractions within a list of offenses penalized with severe criminal punishment, including prison and stiff monetary fines. See Holz et al. (2021) for more details.

Table 2: Amnesty Behavior For Uncontacted Taxpayers in the Control Group

Panel A:	Number of Employees					
	All	1 Employee	1st Quintile	2nd/3rd Quintiles	4th Quintile	5th Quintile
	(1)	(2)	(3)	(4)	(5)	(6)
Paid into Amnesty (%)	18.29	14.61	25.86	31.24	35.32	44.72
	(0.24)	(0.25)	(1.09)	(1.19)	(1.49)	(1.64)
Amnesty Payments ($1K)	1.93	0.88	1.52	2.15	3.62	23.20
	(0.11)	(0.05)	(0.17)	(0.23)	(0.49)	(2.64)
Paid more than the Known Liability (%)	8.69	7.18	10.37	13.50	16.10	22.52
	(0.18)	(0.18)	(0.76)	(0.88)	(1.15)	(1.38)
Payments Above Known Liability ($1K)	0.66	0.23	0.25	0.46	1.36	10.20
	(0.08)	(0.03)	(0.04)	(0.07)	(0.38)	(1.97)
Taxes Declared After the Amnesty ($1K)	4.88	0.76	1.82	3.44	10.68	95.64
	(0.76)	(0.05)	(0.34)	(0.38)	(4.03)	(20.02)
N	25,070	19,995	1,620	1,511	1,025	919
Maximum Employees		1	3	7	16	20602

Panel B:	Known Liability Amount					
	All	1st Quintile	2nd Quintile	3rd Quintile	4th Quintile	5th Quintile
	(1)	(2)	(3)	(4)	(5)	(6)
Paid into Amnesty (%)	18.29	5.55	12.17	20.58	25.71	27.51
	(0.24)	(0.32)	(0.46)	(0.57)	(0.62)	(0.63)
Amnesty Payments ($1K)	1.93	0.22	0.32	0.63	1.35	7.07
	(0.11)	(0.07)	(0.07)	(0.10)	(0.24)	(0.48)
Paid more than the Known Liability Debt (%)	8.69	4.76	8.49	11.33	10.90	8.03
	(0.18)	(0.30)	(0.39)	(0.45)	(0.44)	(0.38)
Payments Above Known Liability ($1K)	0.66	0.22	0.30	0.50	0.81	1.47
	(0.08)	(0.07)	(0.07)	(0.10)	(0.24)	(0.28)
Taxes Declared After the Amnesty ($1K)	4.88	3.05	1.00	2.39	2.53	15.33
	(0.76)	(2.24)	(0.17)	(0.41)	(0.37)	(2.99)
N	25,071	5,043	5,005	5,014	4,963	5,045
Maximum Liability (1K$)		0.07	0.38	1.29	5.26	3474.91

Note: Panel A presents the means of our key outcome variables for taxpayers who were not contacted as part of the experiment, that is, those in the control group. Column (1) presents the overall means and columns (2)-(6) divide taxpayers by the number of employees. Individuals without employees are included in column (2) of Panel A. Self-employed workers can have employees and are assigned to columns (2) through (6) of Panel A based on the number of employees. Since only 2.0% of taxpayers in our sample are in the second quintile of the taxpayer size distribution, we pooled the second and third quintiles in our analysis. The quintiles have an uneven number of taxpayers in Panel A due to the discreetness of the data and also because the bins are defined based on the entire taxpayer size distribution for the country as measured by number of employees and not in the sample of taxpayers who have debts and are thus part of the experiment. Panel B similarly presents the means by the quintile of the taxpayers' known liability amount before the amnesty.

expectations, deterrence} by regressing our outcomes, Y_i, on treatment indicators:

$$Y_i = \gamma + \sum_{g \in G} \tau_g \mathbb{1}[G = g]_i + \epsilon_i \tag{2}$$

Given the random assignment of messages, τ_g captures the intent-to-treat effect of message g relative to the status quo of no message. We cluster the standard errors by the taxpayer's representative, since this was the level of treatment assignment. We first estimate

Equation 2 where Y_i is an indicator that is 100 if the taxpayer joined the amnesty to understand which messages induce taxpayers to resolve their known debts, or j_k as in Section 2. Panel A of Table 3 presents these estimated treatment effects, relative to the control group, for the full sample in Column (1), for firms only in Column (2), and for individuals in Column (3). While our main focus is on understanding the effect of nudges relative to the control of receiving no message, the table additionally contains hypothesis tests for the difference between the notification nudge and our other three messages: tax morale, expectations, and deterrence. Comparing each additional message to the notification informs which types of nudges are most effective as well as the drivers of take-up highlighted in our theory.

Table 3 shows that overall the various messages improved performance of the amnesty program. In terms pf participation, all messages increased amnesty take-up among debtors. The effect sizes range from 3.5 to 8% on average (Column 1 of Panel A of Table 3), relative to control group taxpayers. The behavioral change is largely driven by firms, and only the deterrence message induces individuals to join. Although the point estimates suggest that the deterrence message is most effective, we cannot statistically reject that it is equally as effective as the notification alone (p-value = 0.248 in Column 1).

The "Tax Morale" message, which was designed to increase payments by strengthening tax morale, was less effective. The difference between tax morale and the deterrence treatments is statistically different (p-value < 0.04) for both the entire sample and among firms. As discussed by Luttmer and Singhal (2014) and Giaccobasso et al. (2022), this may be because tax morale does not affect amnesty take-up or because we do not observe the direction of the change in tax morale induced by our message since we do not observe priors. Alternatively, taxpayers may have viewed this message as a signal that the government has little resources to uncover evasion during the COVID-19 pandemic, which reduces the cost of evasion.

In Panel B of Table 3, we estimate Equation 2 on the amount paid into the amnesty in USD. Again, estimates for the full sample are in Column (1), for firms only in Column

Table 3: Treatment Effects of Messaging on Amnesty Take-Up and Payments

Panel A: Amnesty Take-Up	(1) Joined Amnesty Full Sample	(2) Joined Amnesty Firms	(3) Joined Amnesty Individuals	(4) Paid More than Liability Full Sample	(5) Paid More than Liability Firms	(6) Paid More than Liability Individuals
Notification	0.99***	1.33**	0.61	0.49*	0.93**	0.089
	(0.36)	(0.59)	(0.44)	(0.26)	(0.42)	(0.32)
Tax Morale	0.68*	0.87	0.52	0.46*	0.56	0.37
	(0.36)	(0.58)	(0.44)	(0.26)	(0.43)	(0.33)
Expectations	1.07***	1.44**	0.65	0.83***	1.27***	0.42
	(0.36)	(0.59)	(0.44)	(0.26)	(0.42)	(0.33)
Deterrence	1.42***	2.11***	0.84*	0.80***	1.53***	0.19
	(0.36)	(0.58)	(0.44)	(0.26)	(0.42)	(0.32)
Constant	18.3***	22.0***	15.2***	8.70***	9.89***	7.73***
	(0.25)	(0.40)	(0.31)	(0.18)	(0.29)	(0.23)
Notify = Morale	0.394	0.453	0.841	0.891	0.402	0.391
Notify = Expect	0.847	0.869	0.927	0.213	0.445	0.313
Notify = Deterrence	0.248	0.206	0.601	0.255	0.178	0.751
Observations	125,450	56,766	68,684	125,450	56,766	68,684
Panel B: Amnesty Payments	(1) Payments Full Sample	(2) Payments Firms	(3) Payments Individuals	(4) Amt More than Liability Full Sample	(5) Amt More than Liability Firms	(6) Amt More than Liability Individuals
Notification	19.2	32.6	-30.3	-87.7	-149.4	-49.4
	(164.0)	(338.8)	(82.2)	(102.5)	(214.3)	(56.9)
Tax Morale	200.7	513.3	-54.1	42.1	174.1	-65.3
	(232.9)	(507.2)	(74.6)	(129.4)	(281.3)	(49.2)
Expectations	161.3	212.6	78.4	-24.9	4.26	-63.6
	(162.9)	(337.0)	(104.3)	(93.4)	(198.7)	(47.9)
Deterrence	490.7**	909.0**	138.5	275.0*	469.7*	112.0
	(215.0)	(434.8)	(154.3)	(146.9)	(275.6)	(142.5)
Constant	1925.0***	3311.6***	796.5***	658.5***	1152.9***	256.1***
	(114.4)	(240.2)	(60.7)	(78.5)	(167.0)	(41.3)
Notify = Morale	0.439	0.343	0.735	0.288	0.219	0.737
Notify = Expect	0.389	0.592	0.284	.45	0.372	0.758
Notify = Deterrence	.03	0.044	0.268	.01	0.016	0.255
Observations	125,450	56,766	68,684	125,450	56,766	68,684

Note: Panel A presents estimates from a linear regression of treatment effect indicators on an indicator (0 or 100) for whether a taxpayer joined the amnesty in Columns (1)-(3) and whether the taxpayer paid more than their known liabilities in (4)-(6). Panel B similarly estimates the treatment effects from a linear regression on the amount paid into the amnesty in USD in (1)-(3) and the amount in excess of the known liabilities in (4)-(6). The table also displays p-values from tests of receiving a notification against other treatments. Column (1) and (4) present estimates for the full sample, columns (2) and (5) for firms, and Columns (3) and (6) for individuals. Standard errors are clustered by representative. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

(2), and for individuals only in Column (3). Although all treatments increased amnesty take-up, only the deterrence message increased revenue relative to those who did not receive a message. The deterrence message also significantly increased amnesty payments above the notification alone, which indicates that beliefs about enforcement are important drivers of take-up and payments. Taxpayers informed about the legal consequences of evasion paid on average \$490.7, or about 25%, more into the amnesty than those who did not receive a message (p-value < 0.022) and \$471 more than those who received only a notification (p-value < 0.030). Overall, our results suggest that amnesties are most effective for increasing revenue when combined with strict enforcement. While we can only detect a statistically significant increase in amnesty payments for firms and not individuals, the size of the effect of the deterrence message for individuals is roughly the same percent increase as with the firm sample.

Next, we investigate whether the messages resolve outstanding hidden liabilities to the government, or j_h in our model. Specifically, the recorded tax debt represents how much each taxpayer owes according to the IRSDR. Taxpayers can also have additional tax liabilities that the IRSDR would not be able to observe without an audit. Taxpayers who pay more than their known liabilities in the amnesty reveal additional past evasion.

We consider whether the treatment messages induce taxpayer to reveal and resolve hidden debt in two ways. First, we estimate Equation 2 where the outcome is an indicator representing whether the amount paid into the amnesty by the taxpayer exceeds the known liability by the government. We present those treatment effect estimates in Columns (4)-(6) in Panel A of Table 3.[18] Second, we estimate the effects of our messages on the amount the taxpayer paid in excess of the known liability and present those empirical estimates in Columns (4)-(6) of Panel B.[19]

[18]Our outcomes here most directly correspond to taxpayers who resolve both known and hidden debt, or $j_k = 1$ and $j_h = 1$. In practice and in our theory, taxpayers can decide to resolve only hidden debt. However, we cannot separately observe resolutions for known and hidden debt in our data, only the total amount paid into the amnesty.

[19]This variable is 0 if the taxpayer paid equal to or less than her known liability.

The pattern is similar to our results on amnesty take-up and payments of known debt. On average, taxpayers who receive the deterrence message are approximately 0.8 percentage points more likely to pay hidden liabilities and pay $275, or 42%, more above their known liabilities than taxpayers who do not receive a message. We also find that the deterrence message significantly increases payments above the known liability compared to the notification alone (p-value = 0.01 in Column 4 of Panel B). This again stresses that amnesties are most effective when combined with strict enforcement. Treatments are especially effective in inducing taxpayers with relatively new debt to pay more than their known liabilities (Appendix Table E1).

Overall, the amnesty recovered $263 million of the $5.2 billion owed to the IRSDR. The amnesty raised $48 million in the control group. Sending a message to taxpayers notifying them about the amnesty increased these payments by an extra million dollars while the tax morale and expectations messages increased payments by $4.6 and $4.3 million, respectively. The deterrence message was most effective, raising an additional $11.8 million dollars over the control group. In total, the experiment raised just under $22 million dollars, representing 0.023% of the Dominican Republic's gross domestic product in 2021.

5. Moderation Analysis: Size Matters

Based on our model and pre-analysis plan, we now investigate treatment effect heterogeneity by both the taxpayers' number of employees and known debt. Heterogeneity by taxpayer size, measured by the number of employees, is particularly important for tax collection. For instance, the largest 1% of firms, based on number of employees, account for over 60% of the tax revenue from the corporate income in the Dominican Republic (Holz et al., 2021) and the largest 1% of taxpayers owes 87% of all known debt in our data. Despite the policy importance of the largest taxpayers, there is relatively little experimental research that measures how large firms or high income taxpayers respond to tax amnesties or more generally to behavioral interventions (e.g., Pomeranz (2015); Bergolo et al. (2022); Holz et al.

(2021)).

The treatment effects by taxpayer size, relative to the control group who are not contacted, on take-up and whether the taxpayer paid more than their know liability by taxpayer size are presented in Panels (Ia) and (Ib) of Figure 3 respectively.[20] We additionally present the results as regression tables in Appendix D. These two extensive margin measures, used in Pomeranz (2015) and Holz et al. (2021), are scale insensitive and thus allow a useful exploration of heterogeneity across the taxpayer size distribution.[21]

We separately estimate Equation 2 for taxpayers with one employee and then divide the remaining subjects by the quintile of the number of employees in 2019 among all taxpayers in the country. The quintiles have an uneven number of taxpayers, mostly because of the discreetness of the data, but also partially because the bins are defined based on the entire taxpayer size distribution for the country and not only using the sample of taxpayers that qualifies for the amnesty. Therefore, each coefficient gives the causal effect of receiving a particular treatment message compared to the control group for taxpayers of a given size. As explained in Section 3.1 , since only 2.0% of taxpayers in our sample are in the second quintile of the taxpayer size distribution, we pooled the second and third quintiles in our analysis.

Panels (Ia) and (Ib) of Figure 3 show that the deterrence message has the largest effect on amnesty take-up and payments above their known liability for the largest taxpayers, or those in the fourth and fifth quintiles of the country's taxpayer size distribution. Our estimates additionally indicate that the expectations message, which was intended to affect beliefs about the likelihood of future amnesties, was also effective at increasing take-up for large taxpayers. In sum, our estimates suggest that for the 5th quintile firms, the deterrence message increases the participation rate in the amnesty program from 44.7% to over 50%. Likewise, the deterrence treatment has a considerable effect on 4th quintile firms as well:

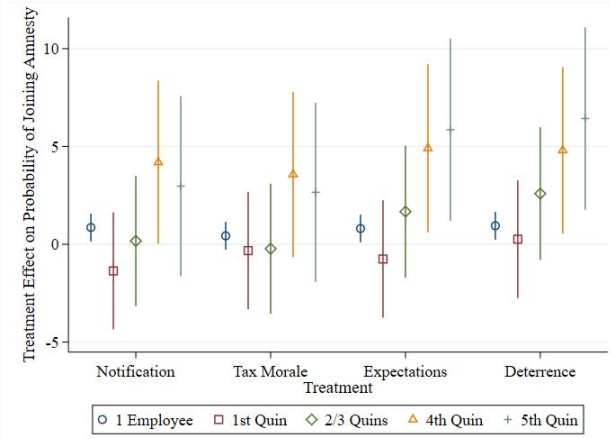
[20] In addition to firms, our sample also includes individuals who may also have employees.

[21] These results are therefore similar to the analysis in Pomeranz (2015) and Holz et al. (2021) who consider the effect on paying more in taxes in the treatment year than in the previous year. Appendix E shows additional results on taxpayer's payment amounts, in dollars, and payments above their known liability.

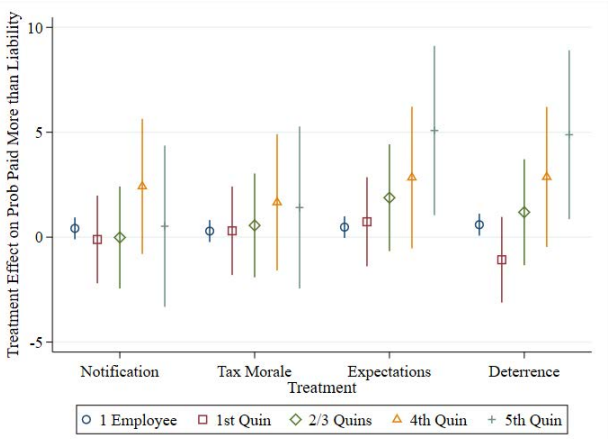
Figure 3: Treatment Effects on Joining Amnesty to Resolve Known and Hidden Debts

Panel I: Treatment Effects by Message and Number of Employees

(a) Joined by Taxpayer Size

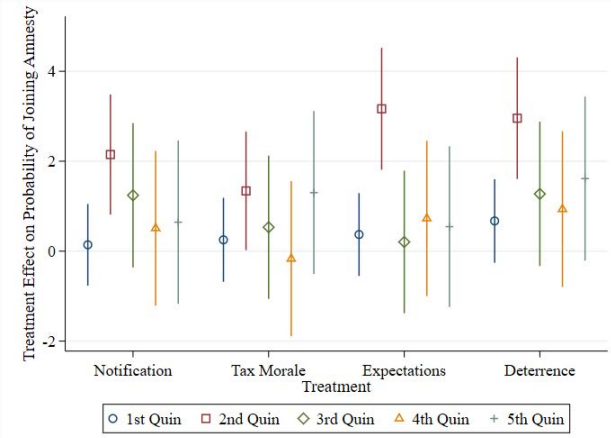


(b) Paid More than Liability by Taxpayer Size

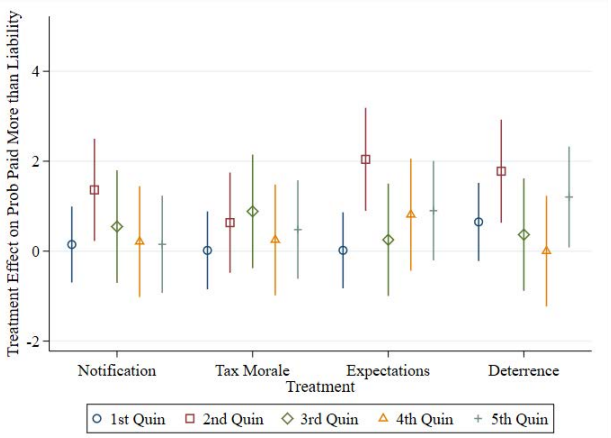


Panel II: Treatment Effects by Message and Known Liability

(c) Joined by Known Liability



(d) Paid More than Liability by Known Liability



Note: Panel (a) presents estimates from a linear regression of treatment effect indicators on an indicator for whether a taxpayer joined the amnesty by taxpayer size: for those with 1 employee and then quintiles of taxpayer size for those with more than 1 employee. Since we use the full distribution of taxpayer size in the country and there are few taxpayers in the 2nd quintile, we pool the 2nd and 3rd quintiles. Each coefficient represents the treatment effect of a particular message relative to taxpayers of the same size in the control group who did not receive a message. Panel (b) similarly estimates the treatment effects from a linear regression on an indicator for whether a taxpayer paid more than their known debt. Panels (c) and (d) estimate similar specifications by quintile of the known liability amount. Each coefficient represents the treatment effect of a particular message relative to taxpayers with the same known liability quintile in the control group. Standard errors are clustered by representative.

a 5 percentage point increase from a control group estimate of 35.3%. Our expectations treatment has similarly large effect sizes on both groups of about 5 percentage points.[22] Although it may be politically infeasible in many countries to implement very large penalties for evasion, such as prison sentences, our results suggest that changing the frequency of amnesty programs can be nearly as effective at reducing evasion by the largest taxpayers.

In terms of moderation, size is indeed a key variable as none of the treatment messages had a consistent and meaningful effect on smaller taxpayers. In general, our results show how behavioral interventions can improve the collection of past debts from the largest players in the market. Moreover, these results highlight that had we exclusively conducted our field experiment on small- and medium-sized taxpayers, like most experiments, we would have incorrectly concluded that the nudges are ineffective. In terms of practical significance, since smaller taxpayers do not account for a meaningful amount of tax revenue, and have low participation in the control, our results highlight that our ideas while successful for the modal tax dollar fail to move the modal taxpayer.

While documenting moderation is important, it is also useful to explore the underpinnings for the heterogeneity. In this case, we can rule out that the heterogeneity by taxpayer size is driven by the size of taxpayer's debts. Although the correlation between a taxpayer's known liability and the number of employees is positive, it is relatively small— only 0.144. We separately estimate Equation 2 by quintile of a taxpayer's known liability amount and present the estimates in Panels (IIc) and (IId) of Figure 3. We do not find a clear debt size heterogeneity pattern in the treatment effect estimates, except perhaps in the second quintile of the known liability distribution. The treatment effects on the largest taxpayers by number of employees in Panels (Ia) and (Ib) do not appear to be driven by the debt amount.

Although previous empirical evidence on how the size of the taxpayer relates to the response to interventions is mixed (e.g Pomeranz, 2015; Brockmeyer et al., 2019), an al-

[22]These estimates are presented in Table D1.

ternative potential driver of the heterogeneity we find is that large taxpayers may be more responsive to treatment messages because they believe that they are more likely to face consequences from evasion (Kumler et al., 2020; Kleven et al., 2016; Bachas et al., 2019). Holz et al. (2021) show that larger firms in the Dominican Republic are more likely to be audited and argue that these differences in audit rates are an important determinant of why the deterrence message was especially effective for increasing income tax payments of large firms. This group may believe that they are more likely to experience harsh consequences of non-payment, either because of the likelihood of hidden debt being uncovered by an audit or because of the costs of holding debt. We contribute to this evidence by additionally showing that information about the likelihood of future amnesties is also most effective on large taxpayers. Similarly to the deterrence message, the expectations treatment may signal credibility of tax enforcement and the costs of evasion. Subjects may believe that the IRSDR's announcement that it will not offer new future amnesties implies that it is increasing other enforcement activities to collect outstanding debt, but without a discount. The expectation message may also be more relevant for large taxpayers, who are unlikely to exit the market compared with small taxpayers.

6. Longer-Run Effects of Tax Amnesties

A potential concern of amnesty programs is that future negative compliance effects can outweigh other short-term benefits from increased payments today (Le Borgne and Baer, 2008). Taxpayers who pay into the amnesty and resolve outstanding debt may now perceive the consequences of a future audit to be lower, decreasing the costs of evasion. The amnesty may also affect taxpayers beliefs about the likelihood of a future amnesty or the government's tax capacity.

To explore whether amnesties increase future evasion, we employ a difference-in-differences model to estimate the effect of our treatments on future income taxes paid. While the amnesty included tax debt originating from any of the multiple taxes in the Dominican Re-

public, our data to study longer run effects is restricted to the income tax. Using yearly income tax payments from 2019-2022 as the outcome, we estimate:

$$Y_{i,t} = \gamma + \sum_{g \in G} \lambda_g \mathbb{1}[G = g]_i + \delta_g \mathbb{1}[\text{Post}]_t + \sum_{g \in G} \tau_g \mathbb{1}[G = g] \mathbb{1}[\text{Post}]_{i,t} + \epsilon_{i,t} \tag{3}$$

In this model, there are four time periods, $\mathcal{T}_{pre} = \{FY2019, FY2020\}$ before amnesty and $\mathcal{T}_{post} = \{FY2021, FY2022\}$ after amnesty, and as before $g \in G = \{$notification, tax morale, expectations, deterrence$\}$. The coefficient τ_g captures the treatment on the treated effect for treatment g.

We report the estimated coefficients in Table 4. Column (1) presents estimates for the full sample, and columns (2) and (3) divide the sample into firms and individuals, respectively. As we expect from randomization, we find that the λ_g coefficients are not statistically different from 0, supporting the parallel trends assumption. This assumption allows us to interpret τ_g as the causal effect of receiving a message g, relative to a control group, on income tax payments after amnesty.

We find that taxpayers who received a message, and were therefore nudged to join the amnesty and pay more known and unknown debt, do not decrease their future income tax payments, although the effects are imprecisely estimated. Since amnesty participation does not appear to affect future tax payments, our results provide suggestive evidence that the amnesty did not backfire, and so it can be an important tool to generate tax revenues. We also note that for the entire sample, in Column (1), we estimate a very small positive coefficient on the "Post" variable. While we do not interpret this effect causally, it further suggests that the amnesty program itself did not impact future tax payments among tax debtors in our control group. However, we do find that individuals in the control group pay less in taxes after the amnesty (Column 3), but this may be, in part, due to the COVID-19 pandemic rather than the amnesty.[23]

[23]Our sample only includes tax debtors. The amnesty program could have impacted non-debtors if the program affected morale or changed their beliefs about enforcement or other future amnesties.

Moreover, when we estimate heterogeneous treatment effects on income taxes paid by taxpayer size (Appendix F), the pattern of coefficients also suggests that the messages did not reduce subsequent income tax payments for firms of any size, but the estimates are also imprecise. In sum, we find no evidence that our treatments decreased future income taxes paid, although the results are imprecisely estimated.[24]

7. Conclusions

Despite the academic literature suggesting ambiguous effects of tax amnesties on short- and long-run tax revenue, tax amnesties continue to be a popular policy in both developed and developing countries. We conducted a large-scale natural field experiment in collaboration with the IRSDR to provide some clues about how taxpayers respond to tax amnesties and how governments can design effective tax amnesty programs. Our field experiment encourage debtors to join the amnesty and to pay back their known and hidden debts.

Our field experiment included 125,452 tax debtors who collectively owe 5.2 billion USD (5.5% of GDP) in back taxes. Our results show that receiving a message increases the likelihood of joining the amnesty, regardless of whether we included behaviorally motivated language. The deterrence message highlighting potential prison sentences substantially increased both known and hidden tax debt repayments. Overall, our simple messages increased tax revenue by $22 million. Theoretical predictions from tax amnesty opponents argue that amnesty programs may discourage future tax compliance, and that lower long-run tax revenue may erase small short-run tax revenue gains. However, examining tax payments after the amnesty, we do not find evidence that the amnesty caused a reduction in tax payments over the next two years.

A further contribution of our work relates to moderation. We were afforded an opportunity to intervene on the entire distribution of taxpayer size, which is rare for this type of experiment and indeed for experiments on other topics, such as charitable giving or markets

[24]The results do not change when including year and/or taxpayer FE.

Table 4: Treatment Effects on Post-Amnesty Income Taxes Paid

	(1) Income Tax Full Sample	(2) Income Tax Firms	(3) Income Tax Individuals
Notification	426.4	888.7	-21.6
	(550.7)	(1200.6)	(99.7)
Tax Morale	332.3	891.3	-123.3
	(550.8)	(1219.2)	(81.5)
Expectations	-376.2	-779.7	-97.6
	(404.3)	(890.2)	(85.9)
Deterrence	-101.8	-175.1	-55.7
	(424.1)	(933.7)	(88.3)
Post	26.2	329.6	-220.7***
	(204.5)	(447.5)	(69.6)
Notify x Post	-163.8	-429.0	51.1
	(398.9)	(870.6)	(88.9)
Tax Morale x Post	129.0	187.1	81.6
	(342.2)	(756.6)	(76.5)
Expectations x Post	52.1	47.7	47.2
	(231.3)	(504.4)	(78.4)
Deterrence x Post	-26.7	-153.7	75.6
	(276.6)	(607.6)	(78.3)
Constant	2412.5***	4557.4***	666.7***
	(351.7)	(775.9)	(74.2)
Notify Post = Morale Post	.505	.523	.633
Notify Post = Expectations Post	.548	.542	.952
Notify Post = Deterrence Post	.725	.747	.711
Observations	501,800	227,064	274,736

Note: The table displays coefficient estimates from a difference-in-differences on the total income taxes paid using a balanced sample of taxpayers from 2019 to 2022. Table also displays p-values from tests of message treatments against other content in the post-amnesty period. Column (1) presents estimates for the full sample, and columns (2) and (3) divide the sample into firms and individuals, respectively. Standard errors are clustered by representative. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

for goods or services, that typically exclude the largest players. We find that our messages induced larger payments from firms than from individuals and that the effects increase with firm size. This is important in practice because large taxpayers pay the lion's share of all taxes. What remains outstanding is why this moderation occurs and the causality behind the observed heterogeneity. While we can rule out debt size effects, several remaining channels, such as larger entities have developed a staff to handle tax matters or large entities fear penalties more than small entities because they have deeper pockets. Causal moderation should be the next step in this research agenda. Such explorations will also yield key insights into where we should anticipate our results to generalize (List, 2020).

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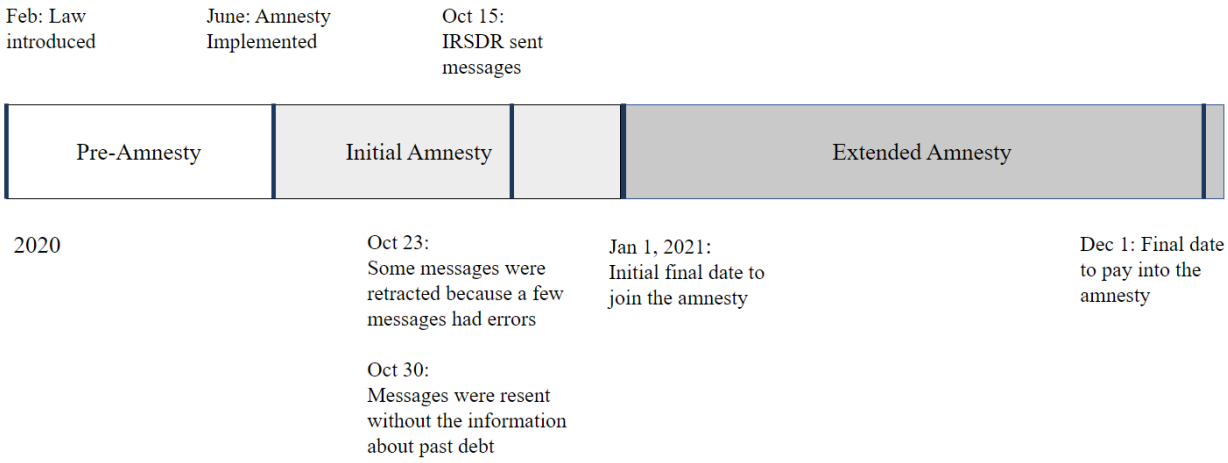
For Online Publication: Appendix

A. Amnesty Program Timeline

Figure A1: Amnesty Timeline



B. Treatment Messages

Figure B1: Notification Message

"Año de la Consolidación de la Seguridad Alimentaria"

RNC:

Razón Social:

Estimado contribuyente:

De acuerdo con la Ley No. 46-20 sobre Transparencia y Revalorización Patrimonial y sus modificaciones, hemos identificado que usted cumple con todas las condiciones para recibir los beneficios y descuentos que otorga la ley para el pago total de sus obligaciones tributarias vencidas.

Nuestro sistema indica que usted tiene obligaciones tributarias vencidas[1]. Para acceder al monto de su deuda, puede contactar a su Oficial de Control de Contribuyentes de su Administración Local o puede acceder a su Oficina Virtual utilizando el siguiente enlace: https://bit.ly/2FUlnSs, siguiendo los siguientes pasos: *Opción > consulta cuenta corriente*.

El descuento tiene un plazo establecido, por lo que una vez transcurrido el tiempo que otorga la Ley, deberá pagar el total de los impuestos, intereses, y recargos.

La Ley No. 46-20 y sus modificaciones también le otorgan la posibilidad de cerrar los ejercicios fiscales no prescritos y no determinados, evitando la fiscalización de la DGII, con un pago de 3.5% sobre el promedio de los ingresos operacionales netos declarados para los fines del ISR de los ejercicios fiscales 2017, 2018 y 2019. En los casos de Transparencia y Revalorización Patrimonial usted puede efectuar un pago único y definitivo del 2% sobre el valor de aquello que pretende sincerar.

Para más información puede visitar los siguientes enlaces:

https://bit.ly/2Fqnwrj

https://bit.ly/2GSBcce

Muchas gracias por su atención.

[1]El monto que visualiza en su OFV no incluye deudas que están en recursos de reconsideración, para conocer este monto debe consultar a su Oficial de Control de Contribuyentes.

Tu contribución es nuestro principio

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RNC: 401-50625-4

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dgii.gov.do

Figure B2: Tax Morale Message

"Año de la Consolidación de la Seguridad Alimentaria"

RNC:

Razón Social:

Estimado contribuyente:

De acuerdo con la Ley No. 46-20 sobre Transparencia y Revalorización Patrimonial y sus modificaciones, hemos identificado que usted cumple con todas las condiciones para recibir los beneficios y descuentos que otorga la ley para el pago total de sus obligaciones tributarias vencidas.

Nuestro sistema indica que usted tiene obligaciones tributarias vencidas[1]. Para acceder al monto de su deuda, puede contactar a su Oficial de Control de Contribuyentes de su Administración Local o puede acceder a su Oficina Virtual utilizando el siguiente enlace: https://bit.ly/2FUlnSs, siguiendo los siguientes pasos: *Opción > consulta cuenta corriente.*

El descuento tiene un plazo establecido, por lo que una vez transcurrido el tiempo que otorga la Ley, deberá pagar el total de los impuestos, intereses, y recargos.

Con esta Ley se busca generar los ingresos necesarios para el país en el contexto mundial de crisis sanitaria. Las consecuencias económicas de la pandemia del COVID-19 requieren de un esfuerzo conjunto y los ingresos del estado son una herramienta muy importante de ayuda a los más afectados en un momento crítico como el actual. Le pedimos que colabore acogiéndose a la Ley 46-20 y sus modificaciones.

La Ley No. 46-20 y sus modificaciones también le otorgan la posibilidad de cerrar los ejercicios fiscales no prescritos y no determinados, evitando la fiscalización de la DGII, con un pago de 3.5% sobre el promedio de los ingresos operacionales netos declarados para los fines del ISR de los ejercicios fiscales 2017, 2018 y 2019. En los casos de Transparencia y Revalorización Patrimonial usted puede efectuar un pago único y definitivo del 2% sobre el valor de aquello que pretende sincerar.

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Figure B3: Expectations about Future Amnesties Message

"Año de la Consolidación de la Seguridad Alimentaria"

RNC:

Razón Social:

Estimado contribuyente:

De acuerdo con la Ley No. 46-20 sobre Transparencia y Revalorización Patrimonial y sus modificaciones, hemos identificado que usted cumple con todas las condiciones para recibir los beneficios y descuentos que otorga la ley para el pago total de sus obligaciones tributarias vencidas.

Nuestro sistema indica que usted tiene obligaciones tributarias vencidas[1]. Para acceder al monto de su deuda, puede contactar a su Oficial de Control de Contribuyentes de su Administración Local o puede acceder a su Oficina Virtual utilizando el siguiente enlace: https://bit.ly/2FUlnSs, siguiendo los siguientes pasos: *Opción > consulta cuenta corriente.*

El descuento tiene un plazo establecido, por lo que una vez transcurrido el tiempo que otorga la Ley, deberá pagar el total de los impuestos, intereses, y recargos.

Esta es su última oportunidad para saldar su deuda con los importantes descuentos otorgados por la Ley 46-20 y sus modificaciones. No habrá nuevos descuentos como los de la Ley 46-20 y sus modificaciones en el futuro.

La Ley No. 46-20 y sus modificaciones también le otorgan la posibilidad de cerrar los ejercicios fiscales no prescritos y no determinados, evitando la fiscalización de la DGII, con un pago de 3.5% sobre el promedio de los ingresos operacionales netos declarados para los fines del ISR de los ejercicios fiscales 2017, 2018 y 2019. En los casos de Transparencia y Revalorización Patrimonial usted puede efectuar un pago único y definitivo del 2% sobre el valor de aquello que pretende sincerar.

Para más información puede visitar los siguientes enlaces:

https://bit.ly/2Fqnwrj

https://bit.ly/2GSBcce

Muchas gracias por su atención.

[1]El monto que visualiza en su OFV no incluye deudas que están en recursos de reconsideración, para conocer este monto debe consultar a su Oficial de Control de Contribuyentes.

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Figure B4: Deterrence Message

"Año de la Consolidación de la Seguridad Alimentaria"

RNC:

Razón Social:

Estimado contribuyente:

De acuerdo con la Ley No. 46-20 sobre Transparencia y Revalorización Patrimonial y sus modificaciones, hemos identificado que usted cumple con todas las condiciones para recibir los beneficios y descuentos que otorga la ley para el pago total de sus obligaciones tributarias vencidas.

Nuestro sistema indica que usted tiene obligaciones tributarias vencidas[1]. Para acceder al monto de su deuda, puede contactar a su Oficial de Control de Contribuyentes de su Administración Local o puede acceder a su Oficina Virtual utilizando el siguiente enlace: https://bit.ly/2FUlnSs, siguiendo los siguientes pasos: *Opción > consulta cuenta corriente.*

El descuento tiene un plazo establecido, por lo que una vez transcurrido el tiempo que otorga la Ley, deberá pagar el total de los impuestos, intereses, y recargos.

Es importante hacer de su conocimiento, que el no pagar sus deudas tributarias, es considerada como una acción voluntaria y no un error involuntario, lo cual constituye una violación de los deberes del contribuyente, tal como lo establecen los artículos 253 y 254 del Código Tributario. Además de que está sujeto a la penalización pecuniaria, de acuerdo a la nueva Ley 155-17 contra el Lavado de Activos y Financiamiento al Terrorismo, no pagar los impuestos puede ser penalizado con privación de la libertad.

La Ley No. 46-20 y sus modificaciones también le otorgan la posibilidad de cerrar los ejercicios fiscales no prescritos y no determinados, evitando la fiscalización de la DGII, con un pago de 3.5% sobre el promedio de los ingresos operacionales netos declarados para los fines del ISR de los ejercicios fiscales 2017, 2018 y 2019. En los casos de Transparencia y Revalorización Patrimonial usted puede efectuar un pago único y definitivo del 2% sobre el valor de aquello que pretende sincerar.

Para más información puede visitar los siguientes enlaces:

https://bit.ly/2Fqnwrj

https://bit.ly/2CSBcce

Muchas gracias por su atención.

[1]El monto que visualiza en su OFV no incluye deudas que están en recursos de reconsideración, para conocer este monto debe consultar a su Oficial de Control de Contribuyentes.

Tu contribución es nuestro principio

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C. Randomization and Balance

Table C1: Balance of Characteristics across Treatment Groups

	Treatment Arm						
	All (1)	No Letter (2)	Notification (3)	Tax Morale (4)	Expectations (5)	Deterrence (6)	p-value (7)
a. Debt Information:							
2020 Total Interest Owed	7846.428	6648.597	7121.241	9409.021	7404.725	8665.786	0.480
	(602.554)	(328.812)	(620.516)	(2388.216)	(849.706)	(1498.048)	
Total Debt Owed in 2020	40983.200	35829.773	39252.369	45240.552	39607.522	45019.683	0.487
	(2466.650)	(1628.038)	(3608.460)	(8617.932)	(3908.680)	(6910.069)	
Average Age of Debt	4.247	4.260	4.252	4.250	4.214	4.257	0.738
	(0.011)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	
Age of Subject's Oldest Debt	5.184	5.191	5.195	5.205	5.145	5.186	0.692
	(0.012)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	
b. Amnesty Information:							
Amnesty Liability	10874.068	9964.692	11169.847	11490.072	10809.917	10934.939	0.667
	(483.015)	(425.195)	(1068.490)	(1647.869)	(780.622)	(1095.486)	
Potential Savings from Amnesty	30109.131	25865.081	28082.521	33750.480	28797.606	34084.744	0.460
	(2009.092)	(1248.139)	(2580.213)	(6982.229)	(3207.031)	(5853.893)	
Potential Savings as Percent of Total Debt 2020	50.010	50.106	50.024	50.135	49.817	49.969	0.730
	(0.073)	(0.163)	(0.161)	(0.162)	(0.163)	(0.163)	
c. Subject Characteristics:							
Percent of Subjects who are Firms	45.250	44.870	45.694	44.876	45.068	45.728	0.806
	(0.141)	(0.314)	(0.312)	(0.315)	(0.316)	(0.314)	
Number of Employees in 2019	4.840	4.233	5.153	4.669	5.539	4.605	0.301
	(0.211)	(0.186)	(0.466)	(0.240)	(0.864)	(0.261)	
Taxpayers per Representative	2.987	2.416	3.734	2.121	1.700	4.928	0.235
	(0.045)	(0.064)	(0.110)	(0.051)	(0.038)	(0.170)	
d. Previous Taxes Paid:							
Filed Taxes in 2019	46.853	46.490	46.938	46.564	47.318	46.955	0.545
	(0.141)	(0.315)	(0.313)	(0.316)	(0.317)	(0.315)	
Filed Taxes in 2020	41.419	40.997	41.759	41.201	41.832	41.302	0.458
	(0.139)	(0.311)	(0.309)	(0.312)	(0.313)	(0.310)	
Declared Positive Income Taxes in 2019	25.114	24.862	25.234	25.045	25.528	24.904	0.467
	(0.122)	(0.273)	(0.272)	(0.275)	(0.277)	(0.273)	
Declared Positive Income Taxes in 2020	20.865	20.586	20.872	20.852	21.174	20.844	0.661
	(0.115)	(0.255)	(0.255)	(0.258)	(0.259)	(0.256)	
Taxes Declared in 2019	2454.743	2451.298	2799.567	2608.898	2326.922	2082.882	0.455
	(142.939)	(351.002)	(364.438)	(373.224)	(274.744)	(198.873)	
Taxes Declared in 2020	2483.926	2373.671	2878.238	2880.578	2294.368	1989.678	0.281
	(159.758)	(351.353)	(435.683)	(484.509)	(213.377)	(208.084)	
Observations	125,450	25,070	25,489	24,871	24,847	25,173	

Note: This table lists the means and standard errors of pre-treatment characteristics. The statistics in panel (a) are based on the subject's debt at the time of randomization. The statistics in panel (b) are the potential savings from the amnesty. The statistics in panel (c) are baseline characteristics, and the statistics in panel (d) are the corporate income tax values from the year before the experiment. Column (1) is based on the entire subject pool. Columns (2) through (6) are based on subjects randomized into the specified treatment. Column (7) reports the p-value of a test of equal means across all treatment groups.

D. Firm Size Heterogeneity Regression Tables

Table D1: Treatment Effects on Amnesty Take-Up by Firm Size

	1 Employee	1st Quin	2/3 Quins	4th Quin	5th Quin
	Joined Amnesty	Joined Amnesty	Joined Amnesty	Joined Amnesty	Joined Amnesty
Notification	0.86**	-1.36	0.17	4.19**	2.97
	(0.36)	(1.52)	(1.70)	(2.13)	(2.35)
Tax Morale	0.43	-0.32	-0.23	3.57*	2.66
	(0.36)	(1.53)	(1.70)	(2.16)	(2.33)
Expectations	0.81**	-0.75	1.67	4.91**	5.86**
	(0.36)	(1.53)	(1.72)	(2.19)	(2.37)
Deterrence	0.95***	0.26	2.59	4.80**	6.43***
	(0.36)	(1.54)	(1.73)	(2.17)	(2.38)
Constant	14.6***	25.9***	31.2***	35.3***	44.7***
	(0.25)	(1.08)	(1.21)	(1.50)	(1.72)
Observations	99897	8082	7563	5075	4833

Note: This table presents estimates from a linear regression of treatment effect indicators on an indicator (0 or 100) for whether a taxpayer joined the amnesty by firm size: for those with 1 employee and then quintles of taxpayer size for those with more than 1 employee. Since we use the full distribution of taxpayer size in the country, and there are few taxpayers in the 2nd quintile, we pool the 2nd and 3rd quintiles. Each coefficient represents the treatment effect of a particular message relative to taxpayers of the same size in the control group who did not receive a message. Standard errors are clustered by representative. $^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$.

Table D2: Treatment Effects of Paying More than Known Debt by Firm Size

	1 Employee	1st Quin	2/3 Quins	4th Quin	5th Quin
	Paid More than Liability	Paid More than Liability	Paid More than Liability	Paid More than Liability	Paid More than Liability
Notification	0.42	-0.11	-0.014	2.42	0.52
	(0.27)	(1.07)	(1.24)	(1.64)	(1.96)
Tax Morale	0.29	0.30	0.56	1.66	1.41
	(0.27)	(1.08)	(1.26)	(1.66)	(1.97)
Expectations	0.48*	0.73	1.88	2.84*	5.08**
	(0.26)	(1.08)	(1.30)	(1.72)	(2.06)
Deterrence	0.59**	-1.08	1.19	2.87*	4.88**
	(0.27)	(1.04)	(1.29)	(1.70)	(2.05)
Constant	7.18***	10.4***	13.5***	16.1***	22.5***
	(0.18)	(0.75)	(0.90)	(1.14)	(1.42)
Observations	99897	8082	7563	5075	4833

Note: This table presents estimates from a linear regression of treatment effect indicators on an indicator (0 or 100) for whether a taxpayer paid more than her known liability amnesty by firm size: for those with 1 employee and then quintles of taxpayer size for those with more than 1 employee. Since we use the full distribution of taxpayer size in the country, and there are few taxpayers in the 2nd quintile, we pool the 2nd and 3rd quintiles. Each coefficient represents the treatment effect of a particular message relative to taxpayers of the same size in the control group who did not receive a message. Standard errors are clustered by representative. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

E. Additional Results on Amnesty Take-Up and Payments

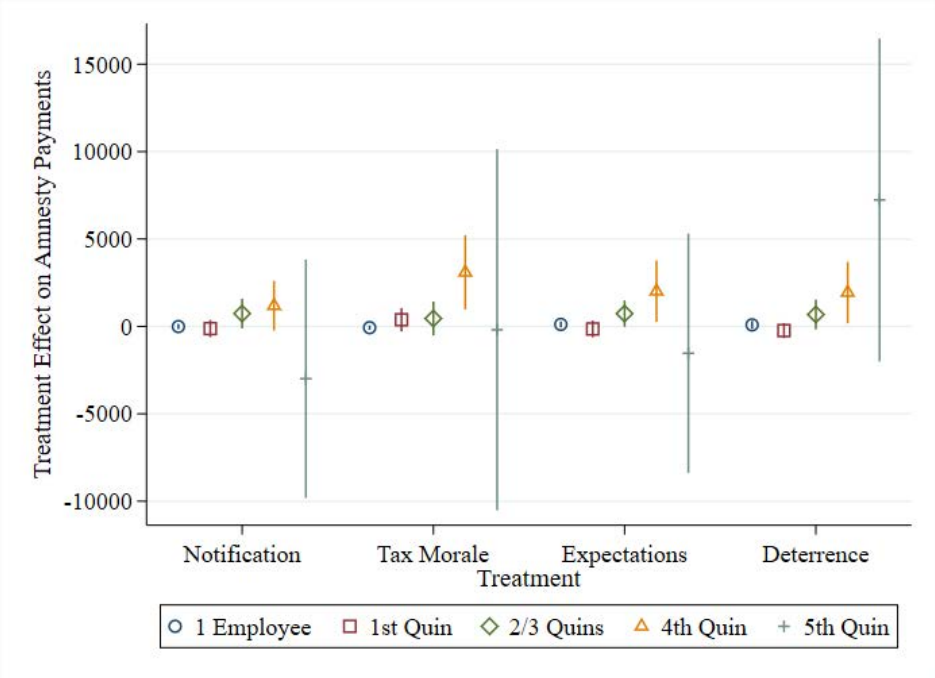
Table E1: Treatment Effects by Average Age of Liability

	(1) Joined	(2) Amnesty Payments	(3) Paid More than Liability	(4) Payments above Liability
Notification	1.28**	-3.51	0.97**	-45.2
	(0.52)	(188.9)	(0.42)	(133.0)
Tax Morale	0.98*	-186.9	0.98**	-137.8
	(0.52)	(141.1)	(0.43)	(90.0)
Expectations	1.35***	-29.7	1.21***	-50.8
	(0.52)	(160.7)	(0.42)	(96.6)
Deterrence	1.58***	162.3	1.28***	71.9
	(0.52)	(183.3)	(0.42)	(120.6)
Liability Age Above Median	-3.73***	658.6***	-6.16***	-53.5
	(0.49)	(224.1)	(0.36)	(156.7)
Notification x Above Median Age	-0.57	45.2	-0.95*	-84.7
	(0.70)	(307.4)	(0.51)	(201.9)
Tax Morale x Above Median Age	-0.61	773.0*	-1.06**	358.7
	(0.70)	(453.2)	(0.51)	(255.9)
Expectations x Above Median Age	-0.60	386.4	-0.80	51.7
	(0.70)	(318.1)	(0.51)	(186.0)
Deterrence x Above Median Age	-0.35	669.9	-1.04**	408.9
	(0.71)	(428.5)	(0.52)	(295.0)
Constant	20.2***	1594.6***	11.8***	685.4***
	(0.36)	(113.4)	(0.29)	(74.0)
N	125450	125450	125450	125450

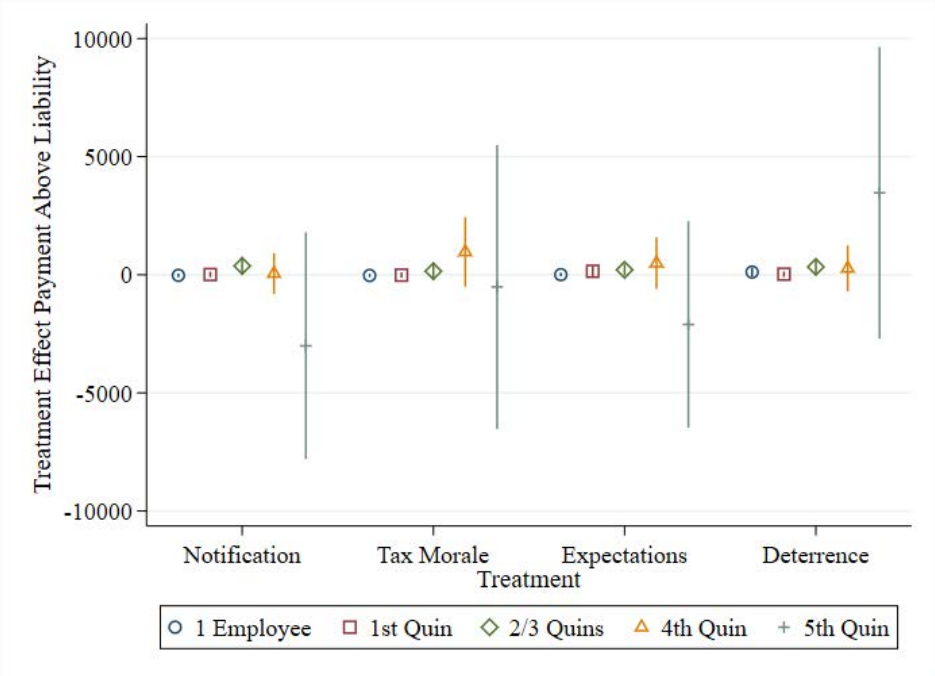
Note: The table displays coefficient estimates from a linear regression of several outcomes on treatment indicators and treatment indicators interacted with an indicator for whether the average age of the known liability is above the median (3.05 years). Standard errors are clustered by representative. $^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$.

Figure E1: Amnesty Payments and Taxpayer Size

(a) Amnesty Payment Amount



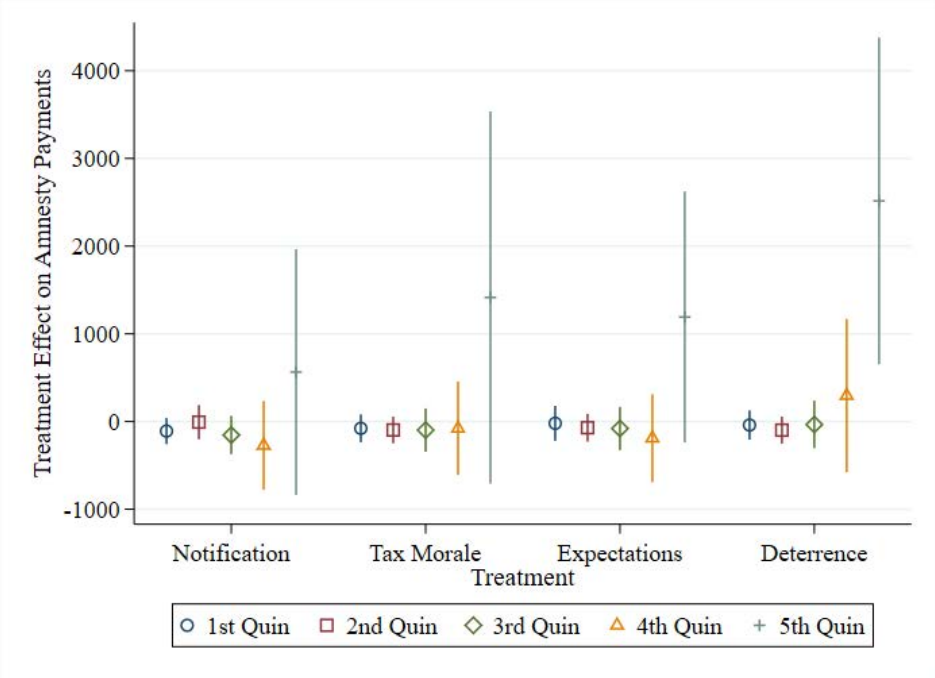
(b) Amount Paid More than Known Liability



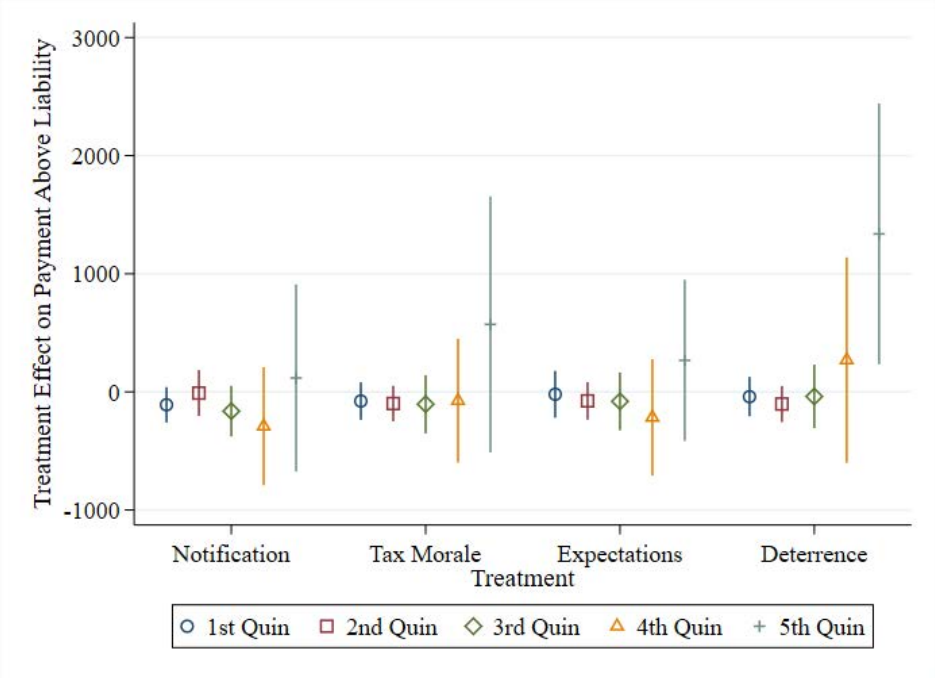
Note: Panel A presents estimates from a linear regression of treatment effect indicators on the amount of amnesty payments in USD for those with 1 employee and then quintiles of taxpayer size for those with more than 1 employee. Panel B similarly estimates the treatment effects from a linear regression on the amount paid in excess of known debt into the amnesty in USD by firm size. Standard errors are clustered by representative.

Figure E2: Amnesty Payments and Known Liability Amount

(a) Amnesty Payment Amount



(b) Amount Paid More than Known Liability



Note: Panel (a) presents estimates from a linear regression of treatment effect indicators on the amount of amnesty payments in USD by quintiles of known liability. Panel (b) similarly estimates the treatment effects from a linear regression on the amount paid in excess of known liability into the amnesty in USD by quintiles of known liability. Standard errors are clustered by representative.

F. Additional Results on Income Taxes

Table F1: Treatment Effects on Post-Amnesty Income Taxes Paid

	(1) Income Tax 1 Employee	(2) Income Tax 1st Quintile	(3) Income Tax 2nd/3rd Quintile	(4) Income Tax 4th Quintile	(5) Incomes Taxes 5th Quintile
Notification	304.8	-379.2	715.5*	-726.0	2363.3
	(213.4)	(583.9)	(406.5)	(2075.8)	(13011.2)
Tax Morale	-31.8	-282.0	431.2	1590.2	3160.6
	(72.0)	(605.7)	(433.3)	(2393.7)	(13530.5)
Expectations	-12.4	-576.1	254.4	-1423.3	-8416.4
	(71.4)	(571.2)	(284.7)	(2067.2)	(10316.6)
Deterrence	-40.9	-550.2	734.0**	-1927.0	-1825.7
	(64.3)	(576.8)	(352.8)	(2028.8)	(10760.0)
Post	-191.7***	-985.3**	-245.5	-482.3	7564.5
	(49.7)	(389.0)	(179.0)	(356.3)	(5411.5)
Notify x Post	190.3	490.2	115.9	-551.6	-8933.1
	(205.1)	(457.2)	(419.4)	(653.8)	(9378.0)
Tax Morale x Post	22.9	328.9	-446.9	-2302.7**	4393.0
	(68.0)	(482.2)	(341.2)	(1173.5)	(8500.9)
Expectations x Post	54.9	597.6	7.29	517.5	-1593.8
	(61.6)	(461.9)	(316.5)	(704.2)	(6009.9)
Deterrence x Post	37.1	499.9	-672.0**	276.9	-1905.2
	(57.7)	(457.5)	(306.4)	(485.2)	(7203.5)
Constant	574.1***	1896.7***	1963.8***	5823.8***	40253.5***
	(53.2)	(529.6)	(181.2)	(1982.5)	(9018.9)
Notify Post = Appeal Post	.413	.665	.239	.16	.186
Notify Post = Expect. Post	.503	.756	.814	.191	.365
Notify Post = Deter. Post	.446	.977	.082	.195	.436
Observations	399,588	32,328	30,252	20,300	19,332

Note: The table displays coefficient estimates from a difference-in-differences on the total income taxes paid using a balanced sample of taxpayers from 2019 to 2022. Table also displays p-values from tests of message treatments against other content in the post-amnesty period. Column (1) presents estimates for organizations with 1 employee, and columns (2)-(5) divide the remaining sample into quintiles of firm size for the entire country. Since there are relatively few firms in the 2nd quintile, we combine the 2nd and 3rd quintiles. Standard errors are clustered by representative. $^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$.