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## The Role of Gender in Tax Compliance

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## Abstract

The existing literature shows that women are more likely to pay taxes than men. Yet, there is less consensus on the gendered responses to interventions aimed at boosting tax compliance among non-payers. In this study, we exploit a field experiment designed to increase property tax compliance to investigate this gender disparity. Our findings reaffirm that women are typically more diligent in paying their taxes than men. Interestingly, while the receipt of a deterrence letter prompts women to pay earlier, it does not necessarily augment their overall compliance. Conversely, men, upon receiving a deterrence letter, show a marked improvement in overall compliance. We also find that the size of the tax bill influences women's compliance behavior (the likelihood of paying increases substantially for small bills), but not men's. To unpack this intriguing finding, we examine survey data to uncover the differing motivations and resources between genders. This analysis suggests that, although women may be more motivated to pay, they might encounter significant liquidity constraints. Our observations are consistent with a simple analytical model that correlates compliance to tax morale, risk aversion, and budget constraints. This research underscores the potential for tax policies and enforcement procedures to exacerbate income inequality between genders, especially in low tax-enforcement contexts where tax evasion is substantial.

**JEL classifications:** H26, H24, D31, J16

**Keywords:** Taxes, Tax compliance, Field experiment, Development, Latin America and the Caribbean

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# 1 Introduction

Do women and men behave differently when faced with tax obligations? Abundant evidence from field interventions (Wenzel, 2006; Kleven et al., 2011; Alstadsaeter and Jacob, 2013; Cabral, Myles, and Kotsogiannis, 2015; Advani, Elming, and Shaw, 2017) and laboratory experiments (Fortin, Lacroix, and Villeval, 2007; Bazart and Pickhardt, 2011; Eisenhauer, Geide-Stevenson, and Ferro, 2011; Finocchiaro Castro and Rizzo, 2014; Kogler, Mittone, and Kirchler, 2016; D’Attoma, Volintiru, and Steinmo, 2017; D’Attoma, Volintiru, and Malézieux, 2020) shows that women are more likely to comply with their tax obligations than men. The main hypotheses for explaining the difference are that women are more risk-averse than men (Hibbert, Lawrence, and Prakash, 2013; Engstrom et al., 2015; Skatun, 2017; Charness et al., 2018), and women have higher levels of tax morale than men (Alm and Torgler, 2006; Torgler, 2005; Torgler and Valev, 2010; Shafiq, 2015; Cyan, Koumpias, and Martinez-Vazquez, 2016).

If women are more likely to pay their taxes than men, does that imply they would respond more to a letter from the tax agency? There is no consensus on this matter. If women exhibit higher levels of tax morale or are more risk-averse, and non-compliance is driven by insufficient information or erroneous beliefs, an intervention could potentially be more successful in altering their behavior.<sup>1</sup> However, the intervention’s impact cannot be disentangled from their initial compliance level (potential ceiling effect) or disposable income (potential corner solution).

In this article, we investigate whether women respond more to a message aimed at enhancing compliance in property tax payment by evaluating the results from Castro and Scartascini (2015) across gender lines. Castro and Scartascini (2015) carried out a large field experiment exploring the determinants of property tax compliance in the municipality of Junín, Argentina, in 2011. The experiment included three treatment arms: one emphasizing penalty and detection probability (deterrence message), and two others conveying distinct tax morale messages (reciprocity and peer-effects messages).

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<sup>1</sup>This would suggest an interior solution to the decision.

The city government calculates the property tax based on basic indicators, such as the linear size of the lot fronting the street and the availability of public services in the neighborhood (serving as a low-accuracy proxy for housing values), and issues a tax bill bi-monthly. Informational asymmetries are absent, leaving taxpayers with a simple decision: to pay or not (no partial payments are accepted). The tax design, monitoring, availability of payment plans, or any other associated aspects do not factor in gender.

Our empirical findings reveal that women pay more than men, both at baseline and post-intervention. The data also suggest that women, following receipt of the deterrence message, tend to make earlier payments, hence increasing the likelihood of timely payment (intensive margin). However, overall compliance remains unchanged—those initially disinclined to pay remain unaffected by the intervention. In contrast, men in the treatment group exhibit an increased propensity to pay compared to their counterparts in the control group (extensive margin).

To understand these intriguing results, we perform multiple analyses. Firstly, we study the heterogeneous effects of the treatments and discover that the size of the tax liability impacts women’s compliance (higher compliance at lower tax levels) but not men’s, implying that women’s decisions may be contingent on their financial situation.

Secondly, we employ survey data, targeted at the same population as the original experiment (though not the same sample), to explore the differences in motivations and resources between men and women. The survey data indicates that female-headed households are more likely to internalize enforcement probabilities—i.e., they have a stronger belief in the city government’s enforcement capabilities. However, they are also more likely to be poorer and perceive the tax as excessively high. These findings suggest that women are responsive to the messages but may be hindered by budget constraints.

The context of the field experiment and the design of the tax point towards potential liquidity constraints. Given that the property tax is independent of current income level, it may exceed a taxpayer’s budget. In Argentina, mortgage financing is almost non-existent, contributing to less than 1% of GDP, one of the lowest rates globally. Thus, the correlation

between wealth stock and income flow is less significant than in other countries. This disconnect between taxation and current income is common in the developing world due to shallow credit markets, limited options for leveraging assets as collateral, and heavy reliance on indirect taxes—personal income taxes account for approximately 10% of total revenues in Latin America and the Caribbean, in contrast to around 25% in the OECD (Corbacho, Fretes Cibil, and Lora, 2013; Acosta-Ormaechea, Pienknagura, and Pizzinelli, 2022)).<sup>2</sup>

To gain insights into these results, we introduce a simple analytical model where the only decision taxpayers make is whether or not to pay the tax (with the government determining the size of the tax bill), mirroring the scenario with property taxes. The model predicts that individuals with higher levels of tax morale or risk aversion are more likely to enhance their compliance following an intervention that increases the perceived likelihood of detection. However, liquidity constraints could force a corner solution: if the tax exceeds current disposable income, individuals do not respond to the intervention.

Our results carry significant implications. Firstly, they highlight a gender disparity in compliance—women, given the same enforcement levels, comply more frequently than men. As a result, taxation could widen post-tax income inequality between genders in countries with low enforcement where a significant portion of the population evades taxes. This is compounded by the fact that women-led households typically have lower incomes. Therefore, they are disproportionately affected in developing countries where a substantial share of taxation is not income-based. Secondly, reactions to the same messages vary across individuals, implying that tax authorities might need to tailor their interventions accordingly. Lastly, liquidity constraints could influence tax compliance when the tax base does not correlate highly with income.

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<sup>2</sup>Moreover, in Argentina and other developing countries, a significant proportion of taxpayers owing income tax are part of a simplified tax regime. In these regimes, the tax owed remains constant within broad income brackets. For instance, in Argentina in 2021, individuals at the lower bound of the first bracket paid about 2% of their sales in income taxes, while those at the upper bound of the same bracket paid less than 1%.

## 2 Background and Data

The data for this analysis originate from a large-scale field experiment conducted by Castro and Scartascini (2015) to investigate the determinants of property tax compliance in Junín, Argentina, in 2011. The city government calculates the tax and sends the bills every two months. The property tax is levied on homes, farms, business premises, and most other real estate in the city of Junín. The tax is calculated based on the length of the street front of the property in meters (not in the size of the property nor its quality), the number of streetlights around the property, and the trash collection and street cleaning services provided to the area where the property is located. All of these variables are known by the city government and cannot be influenced by the taxpayer.

The intervention introduced a message into the tax bill. Three distinct treatment messages were used: a deterrence message detailing the penalties for late payment, a reciprocity message describing the uses of the collected funds, and a peer-effect message providing information about the overall compliance rate. Each message’s text can be found in Table 1. An example of the tax bill is available in Figure A1 in the Appendix.

The tax has two due dates. The initial due date typically falls in the second week of the month, with the secondary due date in the following week. While payment is expected by the initial due date, no late fees are levied if payment is made by the secondary due date. Any outstanding liabilities incur a monthly compound interest rate of 2%. We leverage this payment scheme to analyze compliance by gender at different times.<sup>3</sup>

The taxpayer database includes the names of each property owner and the individual responsible for paying the tax. From this information, we were able to infer the gender assigned at birth to the individual liable for the property tax. In Argentina, parents are permitted to select their children’s names from a pre-approved list of approximately 10,000 female and male names.<sup>4</sup> Using this list, we constructed a gender variable for 92% of the sample, or about 21,500 taxpayers, 34% of whom were women.<sup>5</sup> There are only a

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<sup>3</sup>More details about the intervention are available in Castro and Scartascini (2015).

<sup>4</sup><https://data.buenosaires.gob.ar/dataset/nombres>

<sup>5</sup>Due to data availability, our analysis is limited to gender differences assigned at birth.



few names that can be used by both women and men. The gender variable is balanced across treatments, control groups, and all other baseline observables (see Table A2 in the Appendix).

In order to analyze the interplay between liquidity constraints and the impact of the intervention, we use additional data from two external surveys. These surveys target the same demographic as the original experiment but do not necessarily include the exact same individuals. The first survey, conducted by the city government following the intervention, targets the household member responsible for property tax payment and asks about their attitudes towards the tax. The second survey is the Urban Household Survey of 2011 (Encuesta Anual de Hogares Urbanos, EAHU), which we use to understand the characteristics of households led by women.<sup>6</sup>

### 3 Empirical Results

Does gender affect compliance? Using the baseline (pre-treatment) information, we find that women are more likely to pay than men (44% versus 39%), to pay on time (24% versus 21%), and to have paid at least once in the past (54% versus 49%). These results align well with the existing stylized facts in the literature. In addition, properties owned by female-headed households share some common characteristics. Their properties are smaller and receive more public services from the municipal government—which means that they are more centrally located. Men own more properties than women on average. We control for all these characteristics (the log of the number of properties each taxpayer has, the log of the average linear font size of the properties, trash collection, and street lighting services) across our analysis. As we have mentioned, there is balance across treatment and control groups (characteristics of the tax and property by gender and balance test are in Table A1 and Table A2 in the Appendix).

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<sup>6</sup>The National Institute of Statistics and Censuses in Argentina ("Instituto Nacional de Estadísticas y Censos") conducts the EAHU annually. While the survey represents the sub-region level, it does not accurately represent the city level. Buenos Aires province is split into six sub-regions: Buenos Aires (city), Gran La Plata, Bahía Blanca, Partidos del GBA, Mar del Plata, and several smaller cities combined into one region. Junín is included in this final region.

Building upon Castro and Scartascini (2015)'s treatment assignment and property tax payment scheme, we assess three payment outcomes: payment by the first due date, payment by the second due date, and full payment within the two months billing cycle (*paid*). Castro and Scartascini (2015) reported that the deterrence message was the most successful on average for increasing compliance. Analyzing all individuals together, taxpayers who receive the deterrence letter are more likely to pay by the first and second due dates and more likely to pay overall.<sup>7</sup>

To explore gender disparities, we conduct two types of analyses. Firstly, we introduce an interaction term with the gender variable in Castro and Scartascini (2015)'s baseline regressions to assess gender differences in treatment. Secondly, we examine the treatment effects within each gender sample (results are presented in Table 2).

The results show very little difference across genders. When examining the main variable of interest—the payment of the tax by the end of the period—it appears that men respond slightly more to the reciprocity message. However, this result seems to be driven more by a decrease in women's compliance than an increase in men's, which aligns with Castro and Scartascini (2015)'s overall finding. In their study, taxpayers receiving more public goods from the government (in this case, women) showed a negative response to the government's depiction of the utilization of the tax revenue. Therefore, the observed effect appears to be contingent on location rather than gender.

Given baseline differences across genders, what happens when we look within samples? Once we divide the population according to gender, more significant differences appear, particularly for the deterrence message, which has been shown to be the most relevant on average. The deterrence message has two objectives: increasing the perception of risk as well as the salience of the penalty. It reminds the taxpayer of the legal tools the city government has to collect unpaid taxes; this part of the message aims to increase the perceived probability that the tax authority will enforce the penalty. The message also

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<sup>7</sup>Two percentage points more likely to pay by the first due date, three percentage points more likely to pay by the second due date, and five percentage points more likely to have paid the tax bill. Our results are slightly different from those presented in Castro and Scartascini (2015) because our sample is smaller—we could not infer the gender for all individuals.

explains the fines for not paying, illustrating how a compound interest rate works. This part of the message aims to make the fine more salient.

Looking first at *paid* (at the end of the period), we find that the deterrence letter did not significantly increase the overall payment among women. Still, it increased the timeliness of payment (*paid by the first and second due date*). For women who received the treatment letter, the probability of paying by the first due date and the second due date was four percentage points and three percentage points higher, respectively, than the women in the control group, both results significant at a 5%. In contrast, it had a larger effect on payment behavior among men. Men who received the deterrence letter are more likely to pay overall than men in the control group by two percentage points. There is no difference in the payment by the first due date between men in the treatment and control groups. Men in the deterrence group are one percentage point more likely to pay by the second due date than men in the control group, but that difference is only significant at 10%. Figure 1 and Figure 2 summarize the results. These results are compatible with an analytical model with cash constraints, which we present next.

## 4 A Gender-based Compliance Analytical Framework

There is some evidence that women are better taxpayers than men. There are two possible explanations in the literature: women are more risk-averse and have higher levels of tax morale. Disposable income could be another potential source of systematic differences in tax compliance if women face more liquidity constraints. This mechanism would have the opposite effect by making women less likely to pay their tax liabilities. To disentangle the impact of these three channels and focus on enforcement's role in tax payments, we build a simple model to understand compliance behavior, allowing for tax morale, risk aversion, and income differences. In our model, available in Appendix C, the taxpayers maximize their expected utility of after-tax income. They can pay their government-assessed tax,  $T$ , or they can enter a lottery, where they would pay the tax and a fine,  $\theta$ , with probability

$p$ , or keep their full income with probability  $(1 - p)$ . Following Dwenger et al. (2016), we model the intrinsic motivation to pay taxes,  $S$ , as a positive monetary value that is added to the income after tax.

We find that, in equilibrium, there is a probability  $p^*$  that makes the individuals indifferent between paying the tax or not. Suppose the taxpayer's perceived probability of enforcement is lower than this indifference probability. In that case, the taxpayer will decide not to pay the tax, but will definitely pay the tax if the perceived probability is higher (Figure A6 in Appendix C). This indifference probability decreases with respect to the intrinsic motivation parameter and the coefficient of absolute risk aversion. Those individuals with higher tax morale or risk aversion should react more to an intervention that increases the salience of the probability of being prosecuted for not paying the tax. Consequently, if women have higher tax morale and risk aversion levels than men, as identified in the broad literature, women will comply more than men and react more than men to an intervention.

While these predictions would hold for a tax proportional to income, predictions may be more nuanced if there are liquidity constraints. In many developing countries, where credit and housing markets are underdeveloped, the property tax is calculated based on some general characteristics of the house (such as lot and construction size) and not on the house's value. As such, the assessed tax may be disconnected from the asset's value. Also, because mortgages are rare and owners cannot convert the asset into income flows, the tax may be disconnected from current or liquid income. For instance, taxpayers were more likely to decrease their consumption after an increase in the property tax in Mexico City (Brockmeyer et al., 2021). To account for this fact, we add a budget constraint given by a minimum required consumption level to the model. When the disposable income (income minus assessed tax) is lower than the minimum level of consumption needed, the taxpayer does not pay the tax (in the model and the actual world, partial payments of the property tax are not possible). These cash-constrained taxpayers do not react to the intervention (tax agency deterrence message) even if the message successfully alters their perceptions (i.e., they find themselves in a corner solution).

Therefore, given the stylized facts about gender differences in the literature, the model predicts that if women have higher levels of tax morale or are more risk-averse, they will react more than men to an intervention that increases the salience of the probability of being prosecuted for not paying the tax. If women’s current income is lower than men’s, then there is a higher probability that more of them will face a corner solution and be unable to react even in the context of an intervention that increases their perceived probability of detection.

## 5 Discussion

The analytical model shows that if women are financially constrained, then the empirical results where women pay more on average—but those who do not pay do not react to the treatment—are plausible. To evaluate the likelihood of this, we turn to survey data. First, we look at the data from a survey of taxpayers in the city of Junín. Responses to the survey indicate that women indeed perceive higher levels of enforcement; see Figure A2 in the Appendix. Women are also more likely to think the property tax is too high and say that they are unwilling to pay a higher tax—see Figure A3 in the Appendix. Second, looking at the urban household survey, we learn that female-headed households are poorer (male income is about 30% higher) and less likely to have a steady income than male-headed households (men have a 13 percentage point higher probability); see Table A3 and Figure A4 both in the Appendix.

Our findings, in addition to the suggestive evidence coming from the survey data, seem to indicate that women might be more willing to pay taxes for fear of enforcement, react more to a deterrence treatment as indicated by the model, but have lower resources to face a tax that is not highly correlated to income. We find additional support for this hypothesis in the heterogeneous analysis by looking at the treatment’s impact according to tax size. The effect of the deterrence letter is positive and significant for women whose tax bill is lower (up to 10 percentage points). Yet the difference disappears as the tax liability

increases—suggesting that the amount of the tax is essential for women in deciding whether or not to pay. For men, however, the effect does not change significantly as the tax liability increases; see Figure 3).

## 6 Conclusion

Our findings reveal that women generally exhibit higher compliance with tax obligations than men and may be more responsive to deterrence letters issued by city governments. In the treatment group, women who received these letters were more inclined to make timely payments compared to those in the control group. Notably, the deterrent effect of the letters on women’s compliance was markedly pronounced when tax liability was low. However, this effect diminished as the tax liability increased, possibly due to the high illiquidity of the taxed asset. These outcomes align with an analytical model that considers budget constraints. Further analysis, using survey data, validates the model and empirical outcomes, indicating that women—more so than men—trust the government’s tax enforcement ability, yet are more vulnerable to cash constraints. This susceptibility likely stems from their generally lower income, lesser likelihood of earning a fixed income, and greater tendency to perceive the tax as high.

Our research highlights that in scenarios characterized by lax tax enforcement and significant evasion, tax policy and enforcement mechanisms could inadvertently widen the income gap between genders. Given that women typically earn lower salaries yet are more likely to comply with their tax obligations, this dynamic may exacerbate existing income disparities, particularly in developing countries where a small fraction of tax is proportional to income. As such, tax policy and enforcement initiatives should recognize and address these disparate impacts. Optimally, more robust enforcement under a given tax policy should strive to diminish, not amplify, inequality. Policy tools could potentially ameliorate this gender disparity without infringing upon the principle of horizontal equity in tax design. In the context of property taxes in illiquid markets, or taxes not proportional to

wealth, a plausible solution might involve tying property tax indirectly to current income levels. For example, low-income households could receive a property tax discount or access differentiated payment plans based on income.

We hope our study encourages additional field experiments that explicitly incorporate gender into their design and explore a variety of enforcement strategies. Tax authorities ought to pursue enforcement methods that are, at the very least, gender-neutral. Gaining a nuanced understanding of when and how such gender-neutrality can be achieved remains a critical endeavor.

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## Tables

Table 1: Message Included in the Property Tax Bill




Message / Group	Text	Image
Deterrence	Did you know that if you do not pay the CVP on time for a debt of AR\$ 1,000 you will have to disburse AR\$ 268 in arrears at the end of the year and the Municipality can take administrative and legal action?	
Reciprocity	In the first 6 months of this year, CVP's collection contributed to placing 28 new streetlights, water connections in 29 streets and sewerage networks in 21 blocks	
Peer-effects	Did you know that only 30% of taxpayers do not pay the CVP? What about you?	
Control	No message	No image

Table 2: Average Treatment Effect (Sep/Oct)

	Paid 1st Due Date			Paid 2nd Due Date			Paid		
	Men	Women	Int.	Men	Women	Int.	Men	Women	Int.
Men			-0.009 (0.009)			-0.009 (0.007)			-0.008 (0.007)
T1: Deterrence	0.006 (0.008)	0.036** (0.016)	0.037** (0.016)	0.013* (0.007)	0.028** (0.012)	0.029** (0.012)	0.020** (0.008)	0.011 (0.010)	0.012 (0.010)
T1: Deterrence × Men			-0.031 (0.019)			-0.016 (0.015)			0.008 (0.012)
T2: Reciprocity	0.006 (0.011)	-0.024* (0.012)	-0.023* (0.012)	0.005 (0.009)	-0.016 (0.011)	-0.014 (0.011)	0.006 (0.009)	-0.014 (0.011)	-0.013 (0.011)
T2: Reciprocity × Men			0.030* (0.017)			0.020 (0.012)			0.020* (0.011)
T3: Peer-Effect	0.005 (0.006)	0.000 (0.014)	0.000 (0.014)	0.006 (0.007)	0.001 (0.011)	0.002 (0.011)	0.001 (0.009)	-0.001 (0.011)	-0.001 (0.011)
T3: Peer-Effect × Men			0.005 (0.016)			0.004 (0.011)			0.002 (0.014)
N	14,003	7,301	21,304	14,003	7,301	21,304	13,995	7,292	21,287
Gender	Men	Women	Both	Men	Women	Both	Men	Women	Both
$F(\beta_{T1} = 0, \beta_{gender} = 0, \beta_{T1 \times gender} = 0)$			5.780			5.502			2.495
$p(\beta_{T1} = 0, \beta_{gender} = 0, \beta_{T1 \times gender} = 0)$			0.004			0.005			0.084
$F(\beta_{T2} = 0, \beta_{gender} = 0, \beta_{T2 \times gender} = 0)$			1.347			0.992			1.070
$p(\beta_{T2} = 0, \beta_{gender} = 0, \beta_{T2 \times gender} = 0)$			0.283			0.413			0.380
$F(\beta_{T3} = 0, \beta_{gender} = 0, \beta_{T3 \times gender} = 0)$			0.497			0.809			0.538
$p(\beta_{T3} = 0, \beta_{gender} = 0, \beta_{T3 \times gender} = 0)$			0.688			0.501			0.661
<b>Pr. of paying for each category</b>									
T1: Men	0.260		0.260	0.348		0.348	0.417		0.417
T1: Women		0.329	0.330		0.412	0.413		0.467	0.468
T2: Men	0.260		0.260	0.340		0.340	0.403		0.404
T2: Women		0.270	0.270		0.368	0.369		0.442	0.442
T3: Men	0.259		0.259	0.341		0.340	0.398		0.398
T3: Women		0.294	0.294		0.385	0.386		0.455	0.455
C : Men	0.254		0.254	0.335		0.335	0.397		0.397
C : Women		0.294	0.293		0.384	0.384		0.456	0.456

Notes: All regressions include as controls the lagged variable, fixed effects for blocks, variables for public service provision (trash collection and street lightning services during the period), the (log of the) number of properties that each taxpayer has, the (log of the) average linear front size of the properties, and a dummy that controls for those taxpayers who elected to pay monthly. Standard errors in parentheses are clustered by randomization blocks.

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01

# Figures

Figure 1: Effects of the Deterrence Treatment

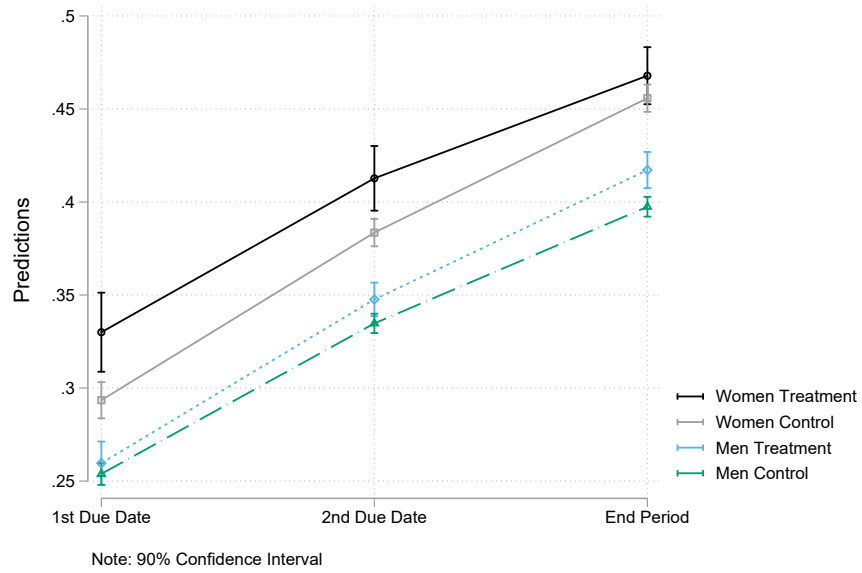


Figure 2: Marginal Effects of the Deterrence Treatment

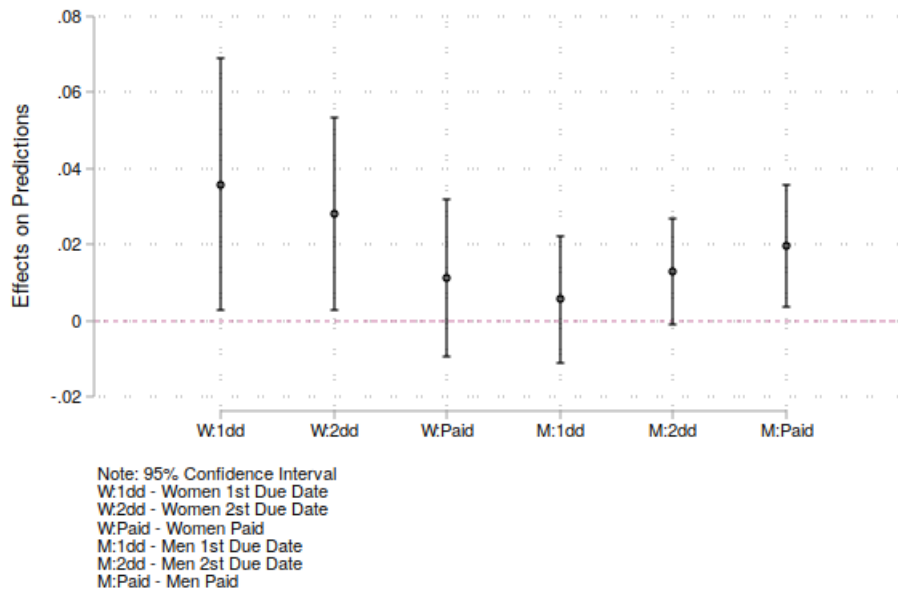
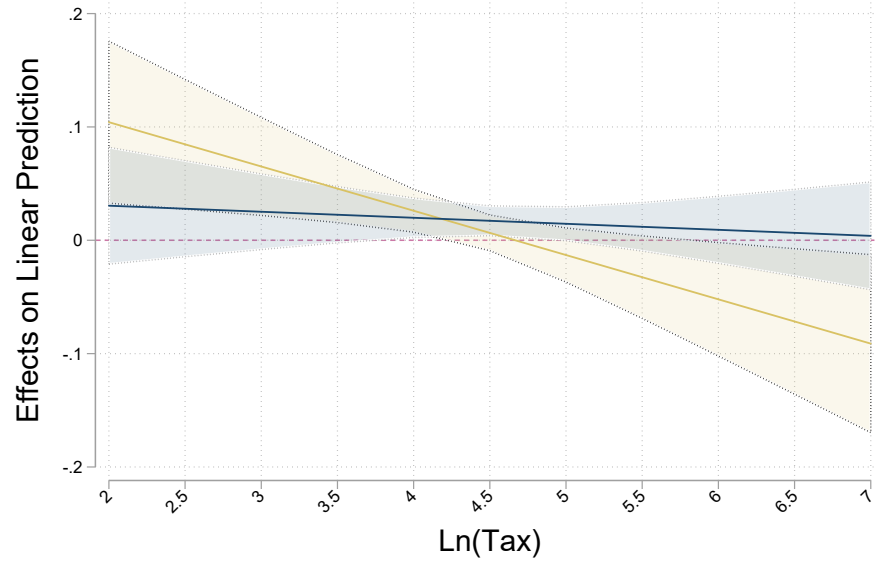


Figure 3: Heterogeneous Effects of the Deterrence Treatment by Tax Liability and Gender



Notes: Blue line corresponds to men and the yellow to women.

# Appendix

## A Tables

Table A1: Baseline Difference Between Women and Men (May/June)

	Diff.: Men		Women		N
Paid before 1st due date	-0.029	(0.006)	0.236	(0.005)	21,312
Paid before 2nd due date	-0.042	(0.007)	0.362	(0.006)	21,312
Paid	-0.055	(0.007)	0.441	(0.006)	21,310
Number street lights	-0.148	(0.017)	2.840	(0.014)	21,312
Paid monthly	-0.001	(0.002)	0.011	(0.001)	21,304
Log(number of properties)	0.046	(0.004)	0.783	(0.003)	21,312
Log(lineal front m)	0.031	(0.007)	2.568	(0.006)	21,312
Unrecoverable debtor	0.045	(0.007)	0.274	(0.005)	21,205
Paid all the liabilities	-0.055	(0.007)	0.441	(0.006)	21,310
At least one tax bill	0.055	(0.007)	0.541	(0.006)	21,341
Log(Mean property val.)	-0.099	(0.016)	9.151	(0.013)	21,466
Public services index	-0.142	(0.014)	0.456	(0.011)	21,312

Each row shows a regression of the pre-treatment variable in question on gender and a constant term. Observations are presented for the bimonthly period prior to treatment (May/June). The constant captures the value for the women. Unrecoverable debtors are taxpayers who have never paid their tax bill. Monetary amounts are in Argentine Pesos (AR\$).

Robust standard errors are in parentheses.

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01

Table A2: Baseline Difference Between Treatment Groups (May/June)

	Diff.: Deterrence-T1		Diff.: Reciprocity-T2		Diff.: Peer-effect-T3		Control		N
Paid before 1st due date	-0.0112	(0.0090)	0.0136	(0.0095)	-0.0034	(0.0083)	0.2126	(0.0234)	23,195
Paid before 2nd due date	-0.0142	(0.0103)	-0.0027	(0.0097)	-0.0076	(0.0104)	0.3316	(0.0350)	23,195
Paid	-0.0159	(0.0099)	0.0022	(0.0088)	-0.0039	(0.0107)	0.4037	(0.0401)	23,192
Number street lights	-0.0250	(0.0157)	-0.0116	(0.0216)	-0.0413	(0.0276)	2.7548	(0.1192)	23,195
Paid monthly	0.0020	(0.0026)	0.0055	(0.0029)	-0.0019	(0.0020)	0.0100	(0.0019)	23,186
Log(Number of Properties)	0.0052	(0.0037)	-0.0088	(0.0044)	-0.0036	(0.0057)	0.8101	(0.0117)	23,195
Log(lineal front m)	-0.0032	(0.0070)	-0.0034	(0.0109)	-0.0020	(0.0114)	2.5968	(0.0269)	23,195
Unrecoverable debtor	0.0039	(0.0092)	-0.0020	(0.0098)	-0.0085	(0.0095)	0.3041	(0.0384)	22,900
Paid all the liabilities	-0.0159	(0.0099)	0.0022	(0.0088)	-0.0039	(0.0107)	0.4037	(0.0401)	23,192
At least one tax bill	0.0121	(0.0093)	0.0059	(0.0094)	0.0017	(0.0109)	0.5763	(0.0404)	23,329
Log(mean property val.)	-0.0216	(0.0215)	-0.0024	(0.0174)	0.0101	(0.0215)	9.0990	(0.1677)	23,470
Public services index	-0.0268	(0.0132)	0.0002	(0.0166)	-0.0167	(0.0206)	0.3710	(0.1336)	23,195
Men	-0.0016	(0.0088)	0.0016	(0.0086)	-0.0194	(0.0140)	0.6589	(0.0104)	21,476

Each row shows a regression of the pre-treatment variable in question on treatment and a constant term. Observations are presented for the bimonthly period prior to treatment (May/June). The constant captures the value for the control group. Unrecoverable debtors are taxpayers who have never paid their tax bill. Monetary amounts are in Argentine Pesos (AR\$).

Standard errors are cluster by the block level.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table A3: Difference in Resources between Male- and Female-Headed Households  
Urban Household Survey (EAHU-2011)

	Diff.: Men		Women		N
Num. individuals in the household	0.641***	(0.004)	2.447***	(0.004)	1,023,748
Num. members household younger 10 years old	0.149***	(0.002)	0.288***	(0.001)	1,023,748
Members household 10 years old or older	0.492***	(0.003)	2.159***	(0.003)	1,023,748
Monthly income	1,513.940***	(9.027)	4,092.824***	(7.016)	1,023,748
Monthly income per capita	215.264***	(4.468)	1,971.834***	(3.599)	1,023,748
Number of rooms in the house	0.089***	(0.003)	2.999***	(0.002)	1,023,748
Pr. receiving a wage	0.133***	(0.001)	0.673***	(0.001)	1,023,748
Num. years of education of the household head	0.274***	(0.028)	7.498***	(0.026)	990,495
Pr. spouse/partner is part of the household	0.619***	(0.001)	0.154***	(0.001)	1,023,748

Each row shows a regression of the pre-treatment variable in question on gender and a constant term. The constant captures the value for the households where the head is female. Monetary amounts are in Argentine Pesos (AR\$). Robust standard errors are in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



# B Figures

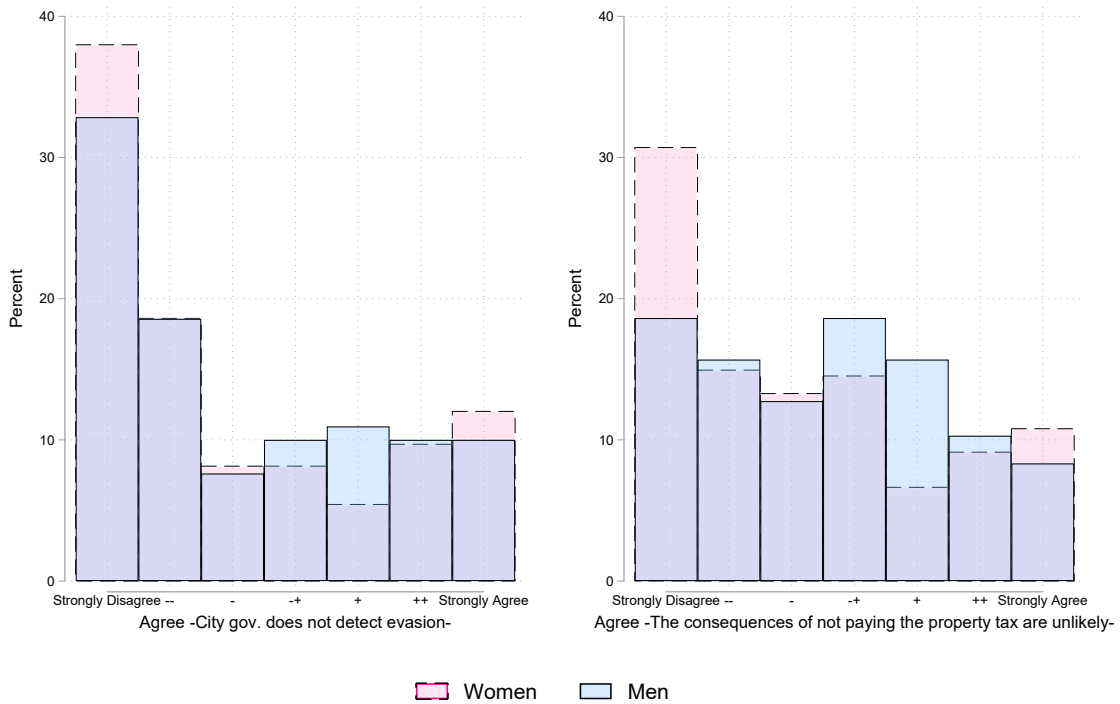
Figure A1: Sample Tax Bills with Treatment Messages (in Spanish)

The figure displays 12 sample tax bills from the Government of Junín, Peru, arranged in a 3x4 grid. Each bill is for a bi-monthly (Bimestral) C.V.P. (Contribución por Valor Predial) payment. The bills include the following information:

- Header:** JUNÍN GOBIERNO LOCAL, C.V.P. (Bimestral), and the recipient's name and address.
- Payment Information:** The amount due (e.g., 29151, 29199, 29153) and the payment date (05/2011).
- Messages:** Various messages in Spanish, such as:
  - "Basta basta que si no paga a tiempo el CVP para una deuda de, por ejemplo, 1,000 pesos deberá pagar 200 pesos adicionales a lo de año, y el municipio puede llegar a inmatriculo administrativa y hasta judicialmente?"
  - "La recaudación del CVP en los primeros 6 meses de este año contribuyó a colocar 28 luminarias y 248 luces colgantes, a instalar conexiones de agua en 29 calles, y cloacas en 21 cuadras de Junín."
  - "¡Basta Basta que sólo el 30% de los contribuyentes de Junín no paga el CVP! ¿Y Usted?"
- Payment Schedule Table:** A table showing the payment dates and amounts for the current and next period.
 

PERÍODO	FECHA	MONTOS
C.V.P. ACTUAL	12/09/2011	65.40
	18/09/2011	65.71
PRÓXIMO PERÍODO	12/09/2011	127.39
	18/09/2011	127.98
- QR Code and Barcode:** A QR code and a barcode for payment tracking.
- Footer:** JUNÍN GOBIERNO LOCAL logo and name.

Figure A2: Perception of the Tax Enforcement  
Survey: City government Junín



**Question:**

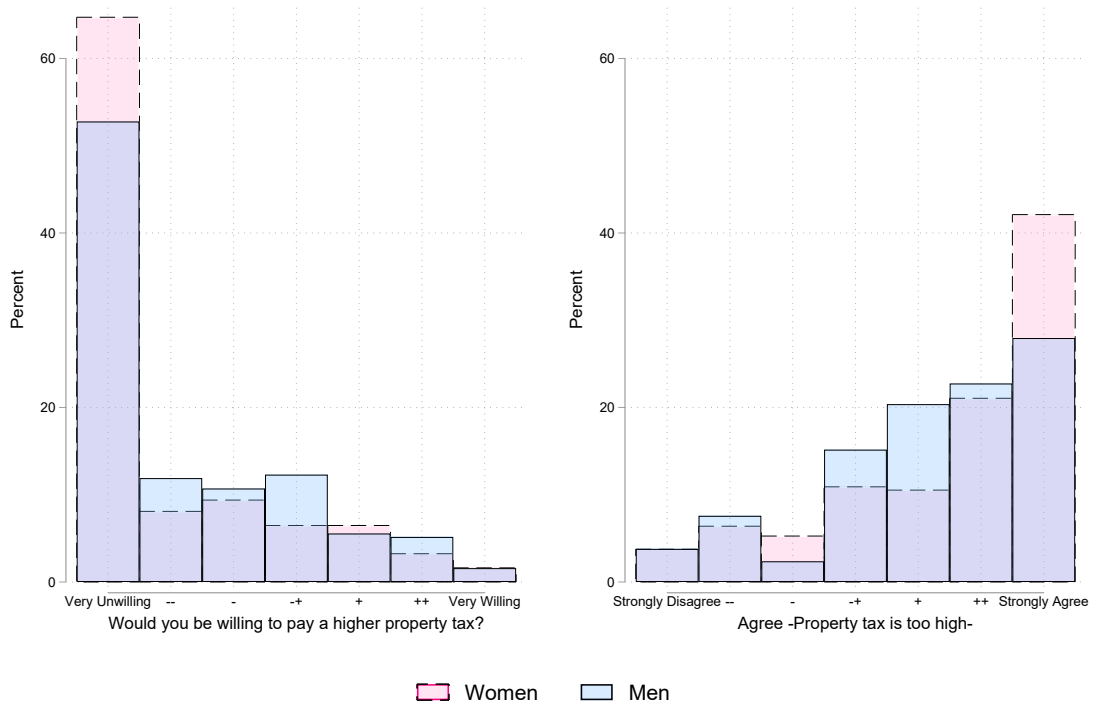
If you think of reasons people do not pay the property tax, use a scale of 1 to 7 where one means “strongly disagree” and seven means “strongly agree.” How much do you agree with the following affirmations?

**Left:** The risk that the city government becomes aware of the property tax evasion is low.

**Right:** The consequences of being discovered not paying the property tax are unlikely.

The City government of Junín sponsored the survey. It targeted the individuals in charge of paying the property tax and was made on December 2015.

Figure A3: Perception of the Tax Burden  
 Survey: City government Junín



**Question left:**

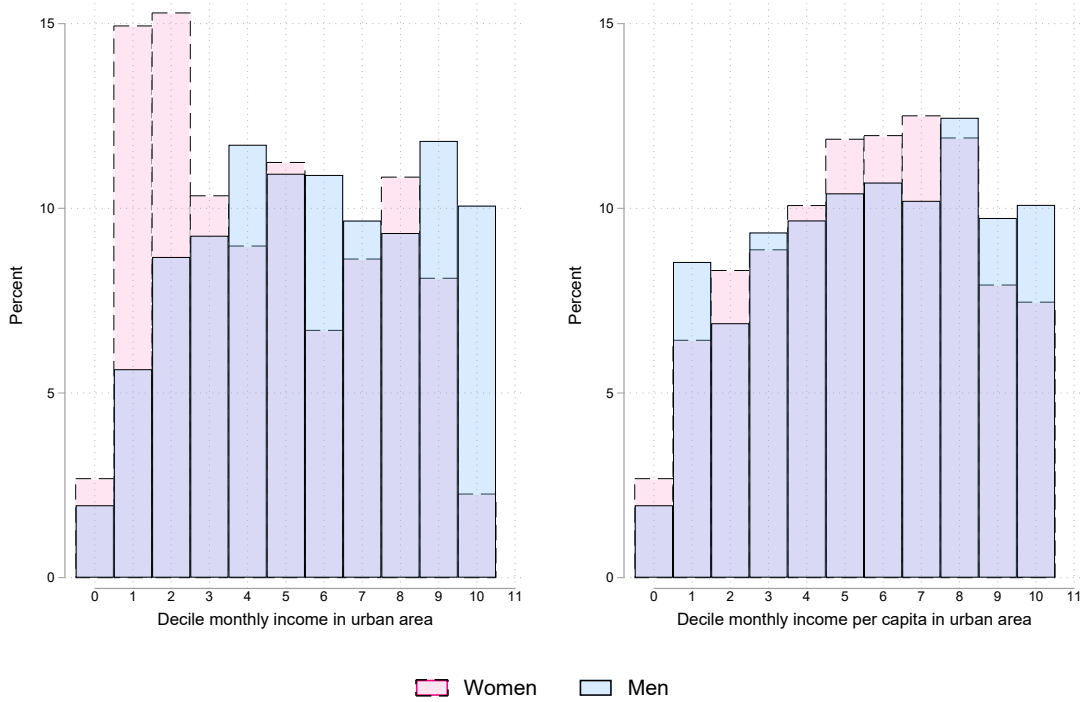
Using a scale from 1 to 7, one means “very unwilling” and 7 “very willing.” Would you be willing to pay higher property tax so that the services of the municipality of Junín would improve?

**Question right:**

If you think of reasons people do not pay the property tax, use a scale of 1 to 7 where one means “strongly disagree” and seven means “strongly agree.” How much do you agree with the following affirmations? People believe that the property tax is too high.

The City government of Junín sponsored the survey. It targeted the individuals in charge of paying the property tax and was made on December 2015.

Figure A4: Income Deciles  
Urban Household Survey (EAHU-2011)



Urban Household Survey - Third Quarter 2011  
EAHU-2011

## C Model

Imagine a taxpayer who has an income of  $Y$  and has to pay a property tax of  $T$ . There is no information asymmetry between the city government and the taxpayer. The government observes all the inputs used to calculate the tax liability. Therefore, the taxpayer has only one choice to make: whether or not to pay the tax. She will choose to pay the tax by maximizing the following utility function, where  $U(Y - T)$  is the utility received with certainty if she pays the tax.  $Y$  is her income,  $T$  is the billed tax. Following Dwenger et al. (2016), we consider a taxpayer who has intrinsic motivation to pay taxes, and  $S$  is the preference parameter that captures that relation, with  $\frac{\partial U(\cdot)}{\partial S} > 0$ ,  $\frac{\partial^2 U(\cdot)}{\partial S^2} < 0$ .  $S$  is greater than zero only if the taxpayer pays the tax; the utility function becomes  $U(Y - T + S)$ .

If the taxpayer decides not to pay the tax, she enters a “lottery” with probability  $p$  there is enforcement and she has to pay a fine, and with probability  $1 - p$  she can enjoy her full income.  $(1 - p)U(Y) + pU(Y - \theta T)$  is the expected utility of not paying the tax.  $p$  is the probability that the tax authority enforces the penalty proportional to the unpaid tax  $\theta T$ , where  $\theta > 1$ .

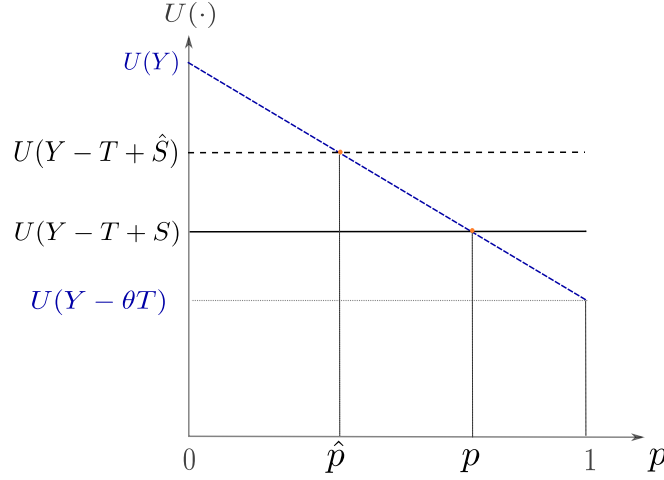
$$\max \{U(Y - T + S), (1 - p)U(Y) + pU(Y - \theta T)\} \quad (1)$$

An individual with income  $Y$ , tax  $T$ , and intrinsic motivation preference parameter  $S$  who faces a probability of enforcement  $p$ , and a penalty  $\theta$  will decide not to pay the tax if the perceived probability of enforcement is lower than  $p^*$ , and will definitely pay if it is higher.

$$p^* = \frac{U(Y) - U(Y - T + S)}{U(Y) - U(Y - \theta T)} \quad (2)$$

From the comparative statics of the model, we can observe that the probability at which the taxpayer decides definitely to pay the tax  $p^*$  decreases with respect to the intrinsic motivation parameter and the coefficient of absolute risk aversion. The relation between

Figure A5: Model with an Increase in Intrinsic Motivation



the probability and the intrinsic motivation parameter follows from the definition of  $p^*$  ( $\frac{\partial p^*}{\partial S} = \frac{-U'(Y-T+S)}{U(Y)-U(Y-\theta T)} < 0$ ). The relation between the probability and the coefficient of absolute risk aversion is less obvious and requires some algebra manipulation to allow us to write  $p^*$  in the following way:

$$p^* = \frac{(T - S) + \frac{(T-S)^2}{2} R_A(Y)}{\theta T + \frac{(\theta T)^2}{2} R_A(Y)} \quad (3)$$

From equation 3 it follows that  $\frac{\partial p^*}{\partial R_A(Y)} = \frac{\theta T \frac{(T-S)}{2} [(T-S) - \theta T]}{[\theta T + \frac{(\theta T)^2}{2} R_A(Y)]^2} < 0$ . In order to get these results, we rewrite  $U(Y - T + S)$  and  $U(Y - \theta T)$  as a Taylor series expansion, and notice that  $0 < T - S < \theta T$  because  $U(Y) > U(Y - T + S) > U(Y - \theta T)$  and  $U(\cdot)$  is strictly an increasing function. The detailed manipulation can be found at the end of this section.

The property tax is calculated based on the characteristics of the house and not the level of income of the taxpayer. We need to consider a special case when the tax is too high relative to the current income. To analyze this case, we add a constraint of a minimum level of consumption that the taxpayer requires  $U(\bar{C})$ . The decision problem for the taxpayer becomes:

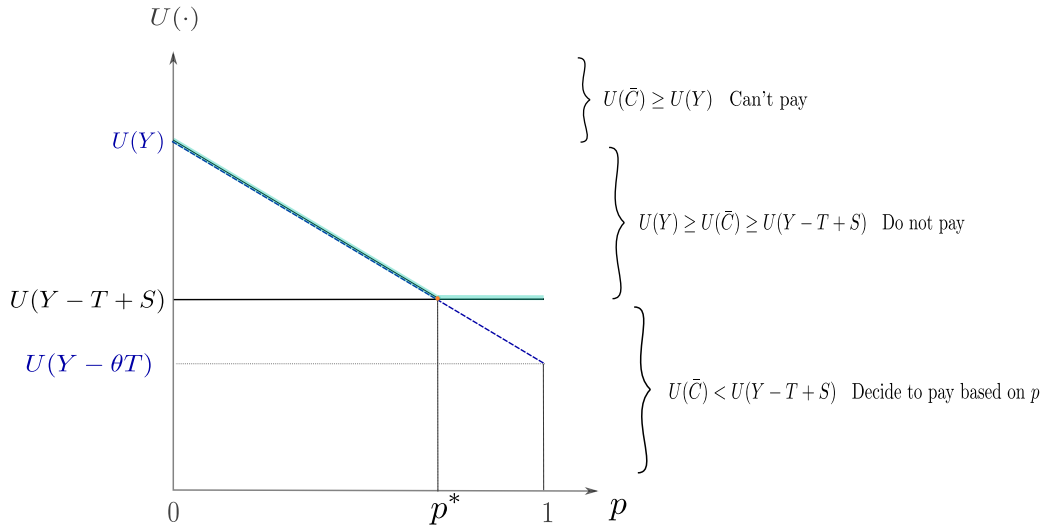
$$\begin{aligned}
& \max && \{U(Y - T + S), (1 - p)U(Y) + pU(Y - \theta T)\} \\
& \text{s.t.} && \\
& && U^* > U(\bar{C})
\end{aligned} \tag{4}$$

where  $U^*$  is the utility level reach at the maximum.

Let us consider the effect of the restriction first: there are three relevant cases, described below and in Figure A6.

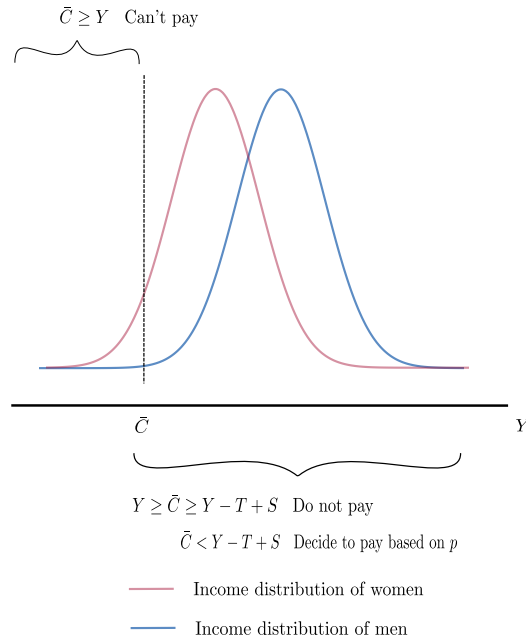
- $U(\bar{C}) \geq U(Y)$ : The taxpayer's income is not enough to cover the minimum consumption, so the taxpayer cannot pay the tax. Hence, this case is a corner solution.
- $U(Y) \geq U(\bar{C}) \geq U(Y - T + S)$ : If the taxpayer pays the tax, even taking into account the intrinsic motivation, she cannot reach the minimum consumption utility level. Therefore, she will not pay the tax. This case is also a corner solution.
- $U(\bar{C}) < U(Y - T + S)$ : If the taxpayer is rich enough to pay the tax and reach the minimum consumption utility level, there is an internal solution of the problem equivalent to the unconstrained problems described above.

Figure A6: Model with Intrinsic Motivation and a Minimum Consumption Constraint



The model predicts that if women have higher levels of tax morale or are more risk-averse, they will react more than men to an intervention that increases the salience of the probability of being prosecuted for not paying the tax. If the property tax is a fixed tax that does not directly relate to the current stream of income, unlike an income tax that is proportional to the current income, there could be a mismatch between income and tax. If we assume that there is a minimum level of consumption  $\bar{C}$  that individuals need to attain (and given that taxpayers can only pay  $T$  or zero), it is possible that individuals whose perception of  $p$  was altered by the intervention will not comply due to the liquidity constraint. If there are systematic differences in the distribution of income between two groups, in this case, women and men, the effect of the intervention that changes the perceived probability of deterrence can be entangled with the effect of the liquidity constraint. To illustrate that point, consider two distributions of income like the ones shown in Figure A7. In this simple example, the income distribution of men is the same as the income distribution of women, but it is displaced to the right (i.e., men are more likely to be richer than women).

Figure A7: Effect of the Liquidity Constraint on Different Income Distributions





In this case, women are more likely than men to solve the problem in a corner solution, so changes in the perceived probability of detection will not affect their overall compliance.

## Comparative Statics of the Model

### Probability and Intrinsic Motivation Parameter

$$\begin{aligned}
\frac{\partial p^*}{\partial S} &= \frac{-U'(Y-T+S)}{U(Y)-U(Y-\theta T)} < 0 \\
\frac{\partial p^*}{\partial \theta} &= \frac{-TU'(Y-\theta T)[U(Y)-U(Y-T+S)]}{[U(Y)-U(Y-\theta T)]^2} < 0 \\
\frac{\partial^2 p^*}{\partial \theta \partial S} &= \frac{TU'(Y-\theta T,S)U'(Y-\theta T)}{[U(Y)-U(Y-\theta T)]^2} > 0
\end{aligned} \tag{5}$$

### Probability and Coefficient of Absolute Risk Aversion

Rewrite  $U(Y - T + S)$  and  $U(Y - \theta T)$  as a Taylor series expansion:

$$\begin{aligned}
U(Y - T + S) &= U(Y) - (T - S)U'(Y) + (T - S)^2 \frac{U''(Y)}{2} \\
U(Y - \theta T) &= U(Y) - \theta T U'(Y) + (\theta T)^2 \frac{U''(Y)}{2}
\end{aligned}$$

Rewrite  $p^*$  using the Taylor series expansions:

$$\begin{aligned}
p^* &= \frac{U(Y)-U(Y-T+S)}{U(Y)-U(Y-\theta T)} \\
&= \frac{(T-S)U'(Y) - (T-S)^2 \frac{U''(Y)}{2}}{\theta T U'(Y) - (\theta T)^2 \frac{U''(Y)}{2}} \\
&= \frac{(T-S)U'(Y) - (T-S)^2 \frac{U''(Y)}{2}}{\theta T U'(Y) - (\theta T)^2 \frac{U''(Y)}{2}} \frac{\frac{1}{U'(Y)}}{\frac{1}{U'(Y)}} \\
&= \frac{(T-S) - \frac{(T-S)^2}{2} \frac{U''(Y)}{U'(Y)}}{\theta T - \frac{(\theta T)^2}{2} \frac{U''(Y)}{U'(Y)}}
\end{aligned}$$

To get equation 3, we replace the definition of the coefficient of absolute risk aversion  $R_A(Y)$  is  $-\frac{U''(Y)}{U'(Y)}$ .