

Taxation, Information, and Withholding

Evidence from Costa Rica

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Abstract

This paper studies tax withholding on business sales, a widely used compliance mechanism which is ignored by public finance theory. A withholding scheme, whereby the payer in a transaction collects tax from the payee, is introduced in a standard evasion model with third-party reporting. If the taxpayer can fully reclaim the tax withheld, withholding is irrelevant to her evasion decision. However, in the presence of costly reclaim, low salience of enforcement or extensive margin compliance gaps, withholding can raise tax payment. To show this empirically, the study exploits a ten-year panel of income tax and sales tax records from 400,000 firms in Costa Rica, and over 20 million third-party information and withholding reports. First, an anatomy of

compliance shows that firms are relatively compliant with third-party information on the extensive, intensive and payment margin. An event study then shows that coverage by third-party reporting leads to a 20–50 percent increase in reported taxable income. Finally, a difference-in-difference and regression discontinuity estimation of a withholding rate increase isolates the impact of withholding. A doubling of the withholding rate leads to a 33 percent increase in sales tax payment among treated firms and an 8 percent increase in aggregate sales tax revenue. The mechanisms are reduced misreporting and incomplete reclaim of the tax withheld. The large compliance impact of withholding rationalizes its widespread use in low compliance contexts.

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1 Introduction

Developing economies are characterized by low tax-to-GDP ratios and a different mix of tax instruments than high income countries (Besley & Persson 2013, Best *et al.* 2015). Withholding on firms' sales is a tax instrument that is extensively used in developing countries and in low compliance sectors in high income countries (Samanamud 2013, Soos 1990, OECD 2009).¹ In a sample of 118 countries, 66 countries were found to use some form of withholding on firms' sales, and per capita income in these countries was on average 40% lower than the per capita income in countries without withholding.² In the typical withholding scheme, the payer in a transaction withholds tax from the payee, remitting the tax to the government as an advance tax payment for the payee.³ The payer cum withholding agent can be a state agency, financial institution, or another firm.

The widespread use of withholding stands in contrast to the theoretical prediction that withholding should be irrelevant to evasion. If withholding applies to transactions that are already third-party reported, and the taxpayer can claim full credit for tax withheld, withholding is merely a different method of tax collection. It shifts the collection task from the tax authorities to the withholding agent, with no direct relevance for evasion decisions. In a typical withholding scheme, the tax withheld is fully creditable against a taxpayer's income or sales tax liability and can give rise to a cash refund if the amount withheld exceeds the liability. In practice, however, taxpayers incur an administrative cost to make a reclaim and they can reclaim only if they are compliant on the extensive margin. Withholding may also increase the salience of tax enforcement, if the withholding agent regularly informs the taxpayer of the amount of tax withheld.⁴ For these reasons, withholding can establish a compliance default, increasing total tax payment.

This paper studies the compliance impact of withholding conceptually and empirically. We extend a simple evasion model with third-party reporting based on Allingham & Sandmo (1972), allowing the third party to both report a taxpayer's sale and withhold a share of the transaction amount as advance tax payment for the taxpayer. Third-party reporting puts a lower bound on reported sales. Adding withholding does not affect the taxpayer's evasion decision if she can fully reclaim the tax withheld. If reclaim is costly, however, only a fraction of taxpayers reclaim the tax withheld and an increase in the withholding rate may increase reported taxable income.

To test the predictions of our model empirically, we exploit various sources of quasi-experimental

¹This is distinct from withholding on wages, a tax compliance mechanism that is applied almost universally and well understood (Kleven *et al.* 2011).

²See Figure I for an analysis of the use of withholding on business sales by country income levels.

³In some countries, the payee also withholds from the payer, adding tax to the invoice.

⁴Note that salience in this context refers to the salience of tax *enforcement* as perceived by tax paying firms, rather than to the salience of tax *rates* as perceived by consumers, which has featured prominently in the literature (Chetty *et al.* 2009, Finkelstein 2009).

variation in the income and sales tax system in Costa Rica, and a ten-year panel of administrative tax records. We construct the Costa Rican tax register from the universe of registration and deregistration records since 2006. We match the register with income and sales tax records from the universe of firms, including both self-employed and corporations. We further match these data with over 20 million third-party and withholding records from firms' transaction partners, financial institutions and state institutions.

Our analysis is divided into three parts. In the first part, we leverage the data to conduct a detailed anatomy of compliance.⁵ To our knowledge, this is the first study to use population-wide third-party and withholding data from a developing country, and to analyze all compliance margins, including the extensive, intensive and payment margin. On the extensive margin, we find that about 50% of tax-liable firms fail to file their income tax declaration. The vast majority of these non-filers are identified through third-party reports, and thus definitely economically active. However, non-filers are disproportionately small. We estimate that total income tax revenue could be increased by at most 10% if all non-filers were made to file. However, a companion paper by [Brockmeyer *et al.* \(2015\)](#) shows that the gains from a communication intervention to non-filers are actually orders of magnitude smaller. On the intensive margin, we find that 14-17% of firms under-report their sales, while 30-50% of them under-utilize their costs compared to third-party reports. The potential revenue gains from perfectly enforcing tax liabilities on third-party reported sales are again approximately 10% of income tax revenue. However, evidence from the impact of desk audits shows that realized revenue gains are orders of magnitude smaller. On the payment margin, we find that 5-25% of small firms pay their taxes with significant delay. After accounting for these delays, however, payment is above 95% of liabilities for both the income tax and the sales tax.

We interpret this as evidence that a country like Costa Rica, with relatively high institutional capacity, achieves a satisfactory level of tax compliance on third-party reported margins. Some administrative follow-up interventions on detectable compliance gaps are necessary as deterrence, to maintain the level of compliance, but increasing investments in these administrative interventions is unlikely to yield substantial revenue gains. This does not mean that tax compliance in Costa Rica is near perfect. The Ministry of Finance estimates, based on macro data, that 30% of sales tax liabilities and 70% of corporate income tax liabilities are evaded or avoided ([Hacienda 2015](#)). A large part of these liabilities are simply not observable to the government. We thus investigate whether expanding the coverage of third-party information reporting, and of associated withholding mechanisms, holds more promises to increase tax revenues substantially.

We turn to analyze the impact of information reporting in the second part. We begin by showing

⁵We borrow the term from [Kleven *et al.* \(2011\)](#) who conduct an anatomy of compliance for wage earners and the self-employed in Denmark.

that bunching at the first bracket threshold in the income tax schedule - a proxy for misreporting⁶ - is large and sharp in the full sample, but significantly smaller among firms covered by information-reporting from other firms. Bunching is even smaller among firms covered by reporting by state institutions or credit/debit card companies, the two reporting mechanisms which are also associated with withholding. We then exploit within-firm changes over time in the coverage by information reporting in an event study. We find that reported tax liability increases by up to 50% after firms are reported for the first time by another firm, by 22% after the first report from a state institution and by 25% after the first report from a credit/debit card company. These effects emerge suddenly at event time and can thus not be reconciled with a pure growth effect.

Finally, we isolate the impact of withholding by exploiting a quasi-experimental increase in the withholding rate applied by credit/debit card companies to firms' card sales. As all card sales were already reported to the tax authorities and credit card usage hardly responds to the reform, this rate change did not affect the information environment. Applying a difference-in-difference estimation, we find that a doubling of the withholding rate leads to a 33% increase in sales tax payment among taxpayers subject to withholding. In aggregate, the withholding rate reform increased sales tax payments by about 8%.⁷ This effect is driven by incomplete reclaim of the tax withheld, and an increase in reported taxable income among firms subject to withholding. We argue that this reporting response is due to a salience of enforcement effect. Indeed, the response is driven by firms for whom the withholding rate changes from zero to a positive rate (as opposed to firms experiencing a similarly-sized change from a positive to a larger rate), and which are thus informed of the amount of tax withheld for the first time on their credit/debit card machine statement. We also confirm that only a tiny fraction of taxpayers reclaim the tax withheld through other channels, for instance by requesting a cash refund.

Our paper contributes to several strands of literature. First, our work contributes to the literature on taxation and development, as reviewed in [Besley & Persson 2013](#). Theoretical contributions in this literature have discussed why tax systems in developing countries differ from those in high income countries ([Keen 2008](#), [Gordon & Li 2009](#), [Best et al. 2015](#)). Our results rationalize the prevalence of withholding schemes for firms as an enforcement tool in low compliance environments. Our results are also consistent with [Kopczuk et al. \(2016\)](#) and [Slemrod \(2008\)](#) who argue that the tax remittance arrangement affects compliance, an argument for which we propose a new mechanism. More generally, our evidence highlights the important role of firms in enforcing taxes (here as infor-

⁶Previous studies have shown that bunching is largely driven by misreporting rather than real responses (e.g. [Best et al. 2015](#) for the minimum tax kink in Pakistan, [Almunia & Rodriguez 2015](#) for an enforcement notch in the Spanish corporation tax).

⁷Overall, withholding agents collected 10% of corporate income tax revenue and 20% of sales tax revenue in 2014.

mation reporting and withholding agents), as suggested theoretically by [Kopczuk & Slemrod \(2006\)](#) and [Kleven *et al.* \(2016\)](#), and demonstrated empirically by [Best \(2014\)](#) in the context of employer reporting on employees' earnings. In addition, our results contribute to the empirical literature on third-party reporting and compliance. Consistent with [Naritomi 2015](#) and [Pomeranz 2015](#), we show that expanding the coverage of information reporting increases reported taxable income substantially. We can also reconcile these findings with [Carrillo *et al.* 2016](#) and [Slemrod *et al.* 2015](#), who provide evidence of evasion shifting to the cost margin. Indeed, our analysis suggests that most firms are responsive to the presence of third-party reporting when they are aware of such reporting *ex ante*, but the remaining misreporters are not responsive to requests to correct their reports *ex post*. Put differently, most firms voluntarily comply on third-party reported margins, but enforcing compliance among the remaining non-compliers is difficult.

Second, our study extends the literatures on tax withholding and the impact of defaults. A large literature has analyzed withholding for the personal income tax, focusing mostly on the United States ([Barr & Dokko 2008](#), [Gandhi & Kuehlwein 2014](#), [White *et al.* 1993](#), [Highfill *et al.* 1998](#)). Aside from descriptive policy reports ([Samanamud 2013](#), [OECD 2009](#)) and legal writing ([Soos 1990](#)), the only study analyzing withholding on firms is [Carillo *et al.* \(2012\)](#). They show that firms bunch at a withholding rate kink, and interpret this as evidence for a (perceived) discontinuity in the audit function. Our paper is the first to quantify the tax revenue impact of withholding for firms, and identify the impact mechanisms. By showing that withholding establishes a compliance default, we contribute to the behavioral literature on defaults, which shows that defaults increase organ donation ([Johnson & Goldstein 2003](#)) and retirement savings ([Chetty *et al.* 2014](#), [Thaler & Benartzi 2004](#), [Madrian & Shea 2001](#)). We show that a default can also be used to induce people into a behavior such as tax compliance that even rational agents may not display.

Finally, we draw on methodological contributions from two literatures. We follow the lead of [Fisman & Wei \(2004\)](#) in identifying misreporting by comparing two data reports on the same tax base. This approach is also used in [Zucman \(2013\)](#), [Kumler *et al.* \(2015\)](#), [Best \(2014\)](#) and [Rijkers *et al.* \(2015\)](#). Using the approach, we show that firms under-report sales as well as costs, consistent with [Carrillo *et al.* \(2016\)](#). We also construct novel estimates of compliance gaps on the extensive and payment margin. Shedding light on payment delays, we highlight the importance of analyzing payment data in addition to tax liability data, which previous studies have focused on. We also draw on the bunching literature in public finance, initiated by [Saez \(2010\)](#), [Chetty *et al.* \(2011\)](#) and [Kleven & Waseem \(2013\)](#), and summarized in [Kleven \(2016\)](#). This literature provides the techniques to estimate taxpayers' behavioral responses to discontinuities in the tax schedule, and translate them into income elasticities.

The remainder of the paper is organized as follows. We start by describing a simple conceptual framework in Section 2. Section 3 presents the Costa Rican tax system and administrative data. Sections 4, 5 and 5 present the anatomy of compliance, the impact of information reporting and the impact of withholding. Section 7 concludes.

2 Conceptual Framework

This section presents a simple conceptual framework to analyze behavioral responses to withholding. The framework is based on the canonical tax evasion model by Allingham & Sandmo (1972), extended by Kleven *et al.* (2011) and Carrillo *et al.* (2016) to include third-party reporting for individuals and firms respectively. We first present the basic setup of the model, then introduce withholding with full reclaim and with costly reclaim, and finally consider salience effects.

2.1 A Tax Evasion Model with Third-Party Reporting

The basic setup of our model follows Carrillo *et al.* (2016). Firms have revenue $R = R_T + R_S$, where revenue can be either third-party reported or self-reported, indexed by T and S , and firms declare \hat{R} . Firms have costs $C = C_s$, which we assume for simplicity to be fully self-reported, and firms chose to report \hat{C} . The government levies tax at rate τ on declared profits $\hat{\pi} = \hat{R} - \hat{C}$. The tax liability is $T = \tau\hat{\pi}$. With probability p , firms are audited, in which case any evasion is certain to be detected, and evaders pay a fine θ which is proportional to the evaded liability. Firms maximize expected utility⁸ over after-tax income in the audited and non-audited state of the world, Y_A and Y_N :

$$\begin{aligned} EU &= (1 - p)U(Y_N) + pU(Y_A) \\ &= (1 - p)U(\pi - \tau\hat{\pi}) + pU(\pi - \tau\pi - \theta\tau(\pi - \hat{\pi})). \end{aligned}$$

To take into account the tax authorities' use of risk scores to target audits (or enforcement interventions in general), we further follow Carrillo *et al.* (2016) by assuming that the audit probability is decreasing in the reported profit rate, $p = p((\hat{\pi} + \epsilon)/\hat{R})$ with $p' < 0$. Mis-reporting against third-party information leads to certain detection: $p = 1$ if $\hat{R} < R_T$.⁹ With these assumption, firms choose to report $\hat{R}^* \geq R_T$, and choose $\hat{C}^* \geq C$ to satisfy the first-order condition.

⁸As Carrillo *et al.* (2016), we consider that modeling firms in a developing country context as risk-averse is reasonable, since more than half of the firms in our sample are unincorporated, and most firms are vulnerable to income volatility.

⁹The inclusion of ϵ , a small positive number, ensures that firms declaring zero profits on a large revenue base incur a higher audit probability than firms declaring zero profits on a small revenue base, thus differentiating the two corner cases where $\hat{\pi} = 0$. Assuming $p = 1$ instead of the more realistic specification $p = \bar{p} = \max(p)$ if $\hat{R} < R_T$ simplifies the exposure, but results are similar in the latter case.

To ensure that the government always prefers less evasion, i.e. $\partial R/\partial \hat{\pi} > 0$, we assume that θ and p' are small, which are reasonable assumptions in most countries. As is also standard in the literature, we assume that the second-order condition is met and avoid non-concavities by imposing $p'' \geq 0$.

2.2 Withholding with Full Reclaim

We introduce withholding into the model by assuming that tax is withheld at a rate μ on third-party reported revenue R_T . The information reporting agent thus also becomes the withholding agent. As firms are already choosing to report revenue larger than or equal to third-party reported revenue, the introduction of withholding leaves the information environment unchanged. In a first step, we assume that the tax withheld can be fully reclaimed, as is technically the case in most withholding systems. This means that firms' net tax liability and hence payment is $P = T - \mu R_T$, where the tax withheld is deducted from the gross tax liability. There are no restrictions on the sign of P , $P \geq 0$, so that firms can request a refund if the reported tax liability is smaller than the tax withheld.

In this model, firms' after-tax income in the audited and non-audited state of the world are

$$\bar{Y}_N = \pi - \mu R_T - [\tau \hat{\pi} - \mu R_T] = \pi - \tau \hat{\pi} = Y_N,$$

$$\bar{Y}_A = \pi - \mu R_T - [\tau \pi - \mu R_T] - \theta[(\tau \pi - \mu R_T) - (\tau \hat{\pi} - \mu R_T)] = \pi - \tau \pi - \theta \tau (\pi - \hat{\pi}) = Y_A.$$

After-tax income in both states is exactly equal to after-tax income in the model without withholding. Withholding is thus irrelevant to firms' evasion decisions. This trivial result obviously relies on the assumption of full and costless reclaim, which we relax in the next section. It is also obvious that withholding would mechanically increase tax payment in the case of compliance gaps on the extensive margin or payment margin.

2.3 Withholding with Costly Reclaim

To bring the model closer to reality, we assume that firms pay a firm-specific fixed cost f_i , distributed according to the cumulative distribution function $H(f)$, to reclaim the tax withheld μR_T .¹⁰ This fixed cost can represent the cost of collecting withholding receipts for each transaction and adding up the amounts when preparing the tax return.¹¹ The presence of the fixed cost generates a cut-off $\bar{f} < \mu R_T$ such that firms with $f_i < \bar{f}$ reclaim the tax withheld and firms with $f_i \geq \bar{f}$ do not reclaim.¹²

¹⁰We are also currently extending the model to allow the salience of tax enforcement (information reporting) to vary with the withholding rate.

¹¹It can also capture, albeit in a crude way, the monetary cost of an increase in the monitoring or audit probability that firms may face when reclaiming tax withheld. The latter mechanism could also be modeled more explicitly as a discontinuous increase in the audit probability p for reclaimers, e.g. $p = 1$ for firms reclaiming $\mu R_T > \tau \hat{\pi}$, which would generate bunching at the threshold where the reported tax liability equals the tax withheld, for sufficiently risk averse firms, as show in [Carillo et al. \(2012\)](#).

¹²Note that the $\bar{f} \neq \mu R_T$, as taxpayers also consider the audited state, in which non-reclaimers get the tax that withheld accredited against their liability, without having made a reclaim.

A first testable prediction of the model is thus that reclaim of the tax withheld is incomplete, $H(\bar{f}) < 1$, and that the share of reclaimers increases in the withholding rate, $\partial H(\bar{f})/\partial \mu > 0$.

Comparative Statics for Firms Absent any behavioral response, reclaimers experience a decrease in their after-tax income of $f_i < \mu R_T$ in both the audited and non-audited state, and non-reclaimers experience a decrease of their after-tax income of μR_T in the non-audited state only. In the case of an audit, the tax withheld is reccredited by the tax authorities against any outstanding liability and fines. Taxpayers adjust their reporting behavior in response to the decrease in after-tax income. Under decreasing absolute risk aversion, as in Allingham & Sandmo (1972), one can show that reclaimers declare $\hat{\pi}_R$ and non-reclaimers declare $\hat{\pi}_{NR}$ with $\hat{\pi}_R > \hat{\pi}^* > \hat{\pi}_{NR}$, where $\hat{\pi}^*$ is the taxpayers' optimum in the baseline model without withholding. Intuitively, the decrease in after-tax income hurts reclaimers more in the audited state, and thus induces them to become more compliant. This simultaneously reduces the likelihood of detection and increases after-tax income in the case of detection. The opposite is true for non-reclaimers.¹³ It is trivial to see that $\partial \hat{\pi}_R/\partial f > 0$ for reclaimers, with μ being irrelevant, and $\partial \hat{\pi}_{NR}/\partial \mu < 0$ for non-reclaimers. However, an increase in the withholding rate also pushes some non-reclaimers to become reclaimers. The impact of a withholding rate increase on total reported profits is thus ambiguous.

Comparative Statics for the Government Government revenue G is equal to total tax payment by all firms. Assume a continuum of firms of measure 1 with fixed costs distributed according to $H(f)$. Then government revenue is the weighted average of revenue across the audited and non-audited state of the world, where in each state, a fraction $H(\bar{f})$ of firms are reclaimers who pay exactly the declared (or true) tax liability and the remaining fraction $(1 - H(\bar{f}))$ of firms are non-reclaimers from whom the government collects the reported tax liability plus the tax withheld in the non-audited state, and the true tax liability in the audited state:

$$G = (1 - p) [H(\bar{f})[\tau \hat{\pi}_R] + (1 - H(\bar{f}))[\tau \hat{\pi}_{NR} + \mu R_T]] \\ + p [\tau \pi + H(\bar{f})\theta \tau (\pi - \hat{\pi}_R) + (1 - H(\bar{f}))[\theta \tau (\pi - \hat{\pi}_{NR})]].$$

On the one hand, a higher withholding rate pushes a larger share of firms to become reclaimers, who report higher profits and accordingly pay a higher liability. On the other hand, non-reclaimers reduce their reported profits, but by less than the amount of tax withheld, and thus pay more tax

¹³As has been shown in the referenced papers, $\hat{\pi}$ also increases in p , θ and R_T .

than they otherwise would. Assuming that p and/or θ is small, a withholding rate increase raises total tax revenue.

2.4 Withholding and Salience of Enforcement

If taxpayers are not fully aware of third-party reporting about them (i.e. misperceive R_T), the withholding system may affect their behavior through a salience channel. Third-party reporting mechanisms usually require information reports to be submitted by the reporting agent to the tax authorities, but not necessarily to the taxpayer. Withholding mechanism, however, normally require the withholding agent to inform both the tax authorities and the taxpayer about the amount of tax withheld, so as to enable the taxpayer to make a reclaim.¹⁴ For taxpayers unaware of third-party reporting, the introduction of withholding thus raises (their perception of) third-party reported sales from 0 to R_T and moves reported profits from $\hat{\pi}^*(0)$ to $\hat{\pi}^*(R_T)$ with $\hat{\pi}^*(R_T) > \hat{\pi}^*(0)$ if $p' \neq 0$. Furthermore, the introduction of withholding and the associated communication of the amount of tax withheld to the taxpayer by the withholding agent may increase the salience of tax enforcement in general, captured by the audit probability p in our simple framework. For instance, taxpayers may react to a perceived audit probability \tilde{p} which is a function of the number of times they have witnessed tax enforcement in practice (e.g. have observed an audit or received a communication from the tax authorities). Being confronted with the tax withholding mechanism (another form of enforcement) may then lead taxpayers to revise \tilde{p} upwards and increase $\hat{\pi}$.¹⁵ We proceed to estimate the impact of third-party reporting and withholding empirically using policy variation in Costa Rica.

3 Context and Data

Costa Rica's tax system relies predominantly on the income tax for firms and the sales tax. Firms in Costa Rica register either as *persona física* (unincorporated firm, i.e. self-employed individuals) or as *persona jurídica* (corporation), using the D140 registration form. There are no size thresholds or other requirements obliging firms to chose one firm type or the other, but the governance structure and income tax schedule for the two firm types differ.¹⁶ This section presents first the income and sales tax system in Costa Rica, and then the compliance mechanisms used to enforce taxes, and finally the administrative data used in this study.

¹⁴See Figure XII for an illustration of the type of information provided by card processing companies in Costa Rica to affiliated businesses.

¹⁵Note however that a model as in Finkelstein (2009), in which salience merely increases the link between the perceived and actual tax rate, but without moving the misperception in a particular direction, a change in salience has an ambiguous effect on taxpayer behavior.

¹⁶Wage earners are taxed according to yet another tax schedule, which features three tax brackets with marginal rates of 0, 10 and 15% respectively. The highest kink for wage earners is below the lowest kink for the self-employed.

3.1 Income Tax

For all firms, income tax is levied on taxable profits, and filed annually by December 15, with three quarterly advance payments made in March, June and September.¹⁷ The self-employed face a kinked tax schedule on profits, with five tax brackets. As Table I shows, the location of all the kinks is adjusted annually for expected inflation. The new kink locations are announced by decree each year in the early fall, before the beginning of the new fiscal year. The marginal tax rates which apply to incomes in the five brackets are 0, 10, 15, 20 and 25% respectively. These rates do not change over the period 2006-2014. The first kink is the largest kink, representing a 10-percentage-point jump in the marginal tax rate, and the most salient one, as crossing the kink generates a payment obligations. [Chetty *et al.* \(2011\)](#) suggest that larger kinks generate stronger bunching, as the size of the tax incentive allows some taxpayers to overcome optimization frictions that would otherwise prevent them from bunching.

Corporations face a notched tax schedule on revenue, with three tax brackets and no exempt amount.¹⁸ A firm's revenue determines its average tax rate, which is then applied to profits. The notch locations are again inflation-adjusted annually, and the average tax rates of 10, 20 and 30% have not changed during the period we study. Note that the annual adjustment of kink and notch locations generates 54 different thresholds over 2006-2014. Out of these, only two are at a round number (kink 1 in 2011, and kink 2 in 2009). This means that persistent bunching at the thresholds cannot be driven by round-number bunching.¹⁹

3.2 Sales Tax

Costa Rica does not have a fully-fledged VAT, but levies a sales tax which firms need to declare monthly by the tenth working day of the following month. The base for the sales tax is the sale of goods and certain specified services, which includes for example hotels, tailors, and florists, but excludes most professional services, for instance those provided by lawyers and doctors. The standard rate has been constant at 13% for the entire period of our study, and reduced rates of 10% and 5% respectively are levied on wood and residential electricity. Sales tax paid on inputs can be claimed as credit, which makes the sales tax effectively a VAT with a narrow base. Any

¹⁷Fiscal year t in Costa Rica starts on October 1 in year $t - 1$ and ends on September 30 in year t . Taxpayers can request to pay taxes according to a different fiscal period, which we take into account in our analysis. The quarterly advance payment is a quarter of either the previous year's tax liability, or the average liability over the last three years, whichever is higher.

¹⁸Corporations also claim a different set of deductions than unincorporated firms.

¹⁹Retailers in certain sectors and below certain size thresholds (annual purchases less than 150 base salaries, fixed assets less than 350 base salaries, less than six employees) can opt into a simplified regime. In this regime, tax is levied on input at sector-specific rates that vary from 3% to 9.8%. Firms in this regime declare and present quarterly, and can claim credit for withholding by state institutions for the income tax, but not for withholding by credit card institutions for the sales tax. Firms can opt out of the regime by submitting a D140 modification form. For details, see [United Nations \(2014\)](#).

sales taxpayer is liable for the income tax, but the reverse is not necessarily true. In our sample, approximately 15% of income tax compliant firms also file sales tax.

3.3 Compliance Mechanisms

To enhance tax compliance among firms, the tax authorities in Costa Rica make use of third-party information and tax withholding from different sources. The relevant *informative declarations*, submitted by public or private sector agents about the economic activities of tax-liable firms and individuals, are listed in Table III. An informant submits one informative declaration for each customer/provider, specifying the tax identification number of the informant and the taxpayer, the transaction amount, the tax withheld if applicable, and the income/transaction type. All information reporting and withholding mechanisms apply in the same way to the self-employed and corporations. Unlike in the United States, taxpayers are not provided with the informative declarations at the time they file their declaration, and are not notified about the existence of an informative record. However, given the structure of reporting requirements explained below, the tax authorities expect firms to be aware of any third-party records about them.²⁰

The authorities use all informative declarations, combined with customs declarations D166 and D167 on imports and exports, to automatically cross-check all income tax declarations. Taxpayers with strong discrepancies between the third-party information and the self-assessment declaration are then selected for intensive margin controls or audits.

3.3.1 Information Reporting

Declarations D151 and D158 are pure reporting declarations, not involving any withholding. Declaration D151 must be filed by all firms conducting purchases or sales above a certain threshold. Purchases and sales must be reported if the accumulated annual amount of transactions with a single transaction partner reaches ₡ 2.5 mio. The payment of rent, commissions, professional service fees or interests must be reported if the annual transaction amount with a single transaction partner reaches ₡ 50,000. These transactions must be reported by both the seller and the purchaser. Declaration D158 must be filed by the organizers of agricultural auctions, and covers all sales and purchases at the auction. Each transactions must be reported only once, either by the seller or the buyer.

²⁰In the rare case that a taxpayer inquires with the tax authorities about the information held about her economic activities, the authorities are legally obliged to provide the information to the taxpayer.

3.3.2 Withholding System

Declarations D150 and D153 are filed by withholding agents, and are accompanied by remittance of the tax withheld to the tax authorities. Declaration D150 is filed by state institutions making purchases from firms, and by firms purchasing certain specified services (e.g. transport, communications) from non-resident firms. State institutions withhold tax at a rate of 2% on all purchases, and firms withhold at a rate of 3% on the specified purchases. This withholding applies to the income tax only.

Declaration D153 is filed for the purpose of sales tax withholding by companies processing credit/debit card payments. The companies report all sales that their sales-tax-liable customers conduct through card transactions. On this base, they withhold sales tax at a firm-specific rate varying between 0 and 6% of the transaction value.

The sales tax withholding rate schedule is displayed in Table II. Prior to August 2011, the withholding rate was determined by a notched schedule on value-added. Value-added is defined as the ratio of taxed sales over taxed purchases and imports reported on the sales tax declaration. The notches are located at 5, 20, 30, 40, 55, and 75% of value-added. All notches are associated with a one percentage point increase in the withholding rate. Prior to August 2011, 40.3% of firms subject to D153 reporting benefited from the zero-withholding rate, and only 21.8% were subject to the 6% rate.

To increase the extent of withholding, a reform announced by decree in July 2011 and effective since August 2011 consolidated the withholding rate schedule to three rates of 0, 3 and 6% and changed the rate determination. The rates are now based on the share of local sales in total sales, with notches at 0 and 50%. Since the reform, 68.7% of D153-covered firms are subject to a withholding rate of 6%.

For the entire period of our study, withholding rates are determined each semester t with reference to the value-added/share of local sales in semester $t - 2$. The tax authorities determine the withholding rate based on firms' tax returns, using sector averages for firms with no tax history, and communicate the withholding rate to the withholding agent. In special circumstances, firms can request the tax authorities to change the withholding rate before the end of the semester. In this case, the realized withholding rate may differ from the rate predicted by value-added or share of local sales in semester $t - 2$.

The taxpayer whose tax payment has been (partially) withheld can deduct the corresponding amount on the relevant tax declaration (income or sales tax) for the same fiscal period (henceforth called "reclaim"), or in future fiscal periods (through the tax return box "compensation request"). If the taxpayer has a tax liability of zero in three consecutive months, and can thus not make

use of these deduction options, the taxpayer can make a refund request through form 402. This form requires detailed information on the withholding agent, amount of tax withheld and timing of withholding, and asks the taxpayer to certify that she has no outstanding liabilities in any other tax.

3.4 Data

Our analysis combines anonymized tax return data and third-party and withholding declarations from the General Directory for Taxation in Costa Rica. The tax return data contains the universe of income tax declarations (D101) for 2006-2014 and sales tax declarations (D104) for 2008-2014, as well as the corresponding payment returns (D110) for the income and sales tax. Since 2006, all tax returns have been digitized, and electronic filing has gradually been introduced for the different declarations, ensuring that the data have nearly complete coverage and a high degree of accuracy. The filing software EDDI-7 conducts automatic validation checks to ensure the internal consistency of filed returns. The data contain all line items of the tax return, including firm type and sector, income sources, cost items, deductions, gross and net liability and payment. The final data set contains 112,000 to 250,000 self-employed per year, 90,000 to 150,000 corporations and 58,000 to 70,000 sales tax filers per month.²¹

We merge the tax records with the informative declarations D150, D151, D153 and D158, also for the period 2006-2014. These data have been filed electronically through the DECLAR@7 system, which conducts similar validation checks as EDDI-7. Table III provides an overview of the number of records and their coverage for each of the informative declarations.

Declaration D151 registers both the largest number of observations, and the widest coverage, being available for approximately half of all firms. The coverage is similar for the self-employed and corporations. The filing of informative declarations is more concentrated than the coverage, meaning that an even small share of firms act as informants (results available upon request). Note that information reporters are slightly more likely to report their own costs rather than their own sales, as evidence by the fact that 54.3% of the D151 records represent sales records. Declaration D158 is similar to D151 in that sense, but has much lower coverage, given the specific nature of the transactions it covers (agricultural auctions). In our analysis, we thus use the sum of third-party information on sales/costs from D151 and D158. We henceforth refer to these reports as information reports by other firms or D151 reports.

Withholding by state institutions and financial institutions, as reported in D150 and D153, has a

²¹Only the tax records for 2012-2014, and a small share of records for 2010 and 2011 have firm type indicators (self-employed or corporation). During this period, we observe only a handful of firms switching firm type. We therefore use the 2010-2014 tax return data and the tax register to assign a firm type to the tax returns for 2006-2011. We drop returns for which we cannot determine the firm type with this strategy.

much lower coverage among firms than pure information reporting, especially for the self-employed. D150 and D153 records are available for only 5.0% and 5.8% of the self-employed and 8.4% and 11.% of corporations respectively.²² 98.5% of D150 records are submitted by state institutions, meaning that withholding by private non-financial firms is minimal. A significant share of informative declarations cannot be matched with income tax records, suggesting that a large number of firms covered by third-party information or withholding are incompliant on the extensive margin.

In addition to the tax returns and informative declarations, we use the D140 and D141 registration and deregistration records for 2006-2014 to construct snapshots of the tax register for each fiscal period. Firms use the D140 form both for registration purposes, as well as for modification and deregistration. If the government deregisters a firm *de officio*, which happens if a firm has not filed taxes for at least three years, a D141 form is used.

4 Anatomy of Compliance

This section presents the anatomy of tax compliance in Costa Rica, identifying mis-reporting through discrepancies between two data reports on the same tax base, as applied by [Fisman & Wei \(2004\)](#). We start with the extensive margin, estimating the share of non-filers by matching tax declarations filed to the set of tax liable firms as constructed from the tax register and available third-party reports. We then consider the intensive margin, estimating misreporting by comparing third-party reported and self-reported sales and costs. Finally, we estimate compliance with the payment obligation, comparing tax returns with payment receipts. We compare compliance by the self-employed and by corporations, as the two groups face different tax schedules and the self-employed have been identified in the literature as a particularly evasion-prone segment of taxpayers.

4.1 Extensive Margin Compliance

To examine compliance on the extensive margin, we construct the set of tax liable firms and compare it to the self-assessment declarations filed for the income tax and the sales tax. A firm is considered income tax liable for fiscal year t if it fulfills at least one of the following conditions: (i) the firm is in the tax register in year t , (ii) has filed income tax in t , (iii) is covered by at least one third-party informative declaration in t ,²³ (iv) has filed income tax in $t - 1$ and has not deregistered since, or (v) has registered in the last year and has not deregistered since. For the sales tax, we consider only firms that have either (i) filed sales tax between month m and $m - 4$, (ii) registered as liable for the

²²As indicated by the percentages in squared brackets in Table III, the coverage of D153 declarations among sales-tax-liable firms is higher, since they constitute only a small subsample of income taxpayers.

²³We exclude information from D151 cost reports, which could pertain to wage-earning individuals who purchased goods from a firm.

sales tax in the last four months and have not changed their registration status since, or (iii) are subject to withholding by credit/debit card providers for the purpose of sales tax compliance.²⁴

Table IV reports the share of non-filers for different taxes and subsamples. The overall share of non-filers for the income tax is substantial in all years, having increased from 38% to 55% of tax liable firms from 2010 to 2013 (panel A, column 1). It seems that non-filing for the sales tax is less prevalent, with a non-filing share of about 20%, which is consistent with the self-enforcing nature of the VAT. However, the fact that only a subsample of income taxpayers are liable for the sales tax lowers our estimates. Non-filers that are identified only through third-party reports, and are not subject to withholding, need to be dropped from the pool as it is not possible to determine whether they are sales tax liable. The majority of sales tax non-filers are thus registered firms which file only intermittently. In contrast, the majority of income tax non-filers are identified through third-party information (column 2). This suggests that, though third-party information helps to identify taxable activities, it does not necessarily induce the reportees to comply with their tax filing obligations.

An analysis of filing behavior across firm types shows that non-filing rates are generally lower for registered firms (panel B, column 1), and lower for registered corporations than for registered self-employed (columns 2 and 4).²⁵ Besides, there is a positive correlation between coverage by information reporting and filing, as theory would predict (columns 3 and 5). This correlation is stronger for corporations, where non-filing rates fall from around 7% for all corporations to 3.5% for corporations covered by third-party information. Distinguishing different sources of third-party information, panel C shows that firms reported by state institutions or credit/debit card companies display significantly lower non-filing rates than firms reported only by their suppliers or clients. This suggests that reporting mechanisms which are accompanied by withholding may have a stronger compliance impact.

The estimated share of undeclared sales represents 16-23% of declared sales, and the estimated share of unreported liabilities represents 7-10% of reported liabilities for the income tax (panel A, columns 4 and 5). The estimates rely on non-filers' third-party reported sales or their most recent available tax return, the assumption that the distribution of profits rates by firms size is similar for non-filers and filers and that the tax schedule is applied as per the law (see the notes to Table IV

²⁴This algorithm is described in more detail in appendix section 8.1. Note that our algorithm is more conservative than the tax authorities' own algorithm, which consider firms that filed in the past three years and have not deregistered since as tax liable. We report estimates using a more lenient algorithm (going back three years for the income tax and 12 months for the sales tax) in appendix table VIII. The estimates are marginally higher for the income tax, and about one third higher for the sales tax. The three-year window reflects the tax authorities' practice of deregistering a firm *de oficio* if it has not filed for three years. According to the *codigo de normas y procedimientos tributarios*, the period until a taxpayer gets deregistered *de oficio* is three years until September 2012 (when the relevant article was amended), and four years from then on.

²⁵Note that column 1 in panel B is not the average of columns 2 and 4, as column 1 also includes firms for which the firm type indicator, identifying self-employed and corporations, is missing.

for details). The numbers suggest that even if the tax authorities were able to perfectly enforce the tax filing obligation at no cost, income tax revenue would increase by 10% at most.

Given the incomplete nature of the third-party information trail, these estimates are a weak lower bound of extensive margin compliance gaps. Our algorithm does not capture firms that are fully informal and do not transact with any withholding or information reporting agents. However, we consider that our estimates capture the policy-relevant subsample of extensive margin non-compliers. Indeed, while several studies find that formalizing fully informal firms is difficult and costly (de Mel *et al.* 2013, Bruhn & McKenzie 2014), a companion paper by Brockmeyer *et al.* (2015) shows that filing rates among firms known to the tax authorities can be increased significantly through low-cost deterrence messages. Nonetheless, filing rates still remain below 40% in the sample of initial late-filers, and revenue gains from increased filing are very marginal (below .1% of initial income tax revenue).

4.2 Intensive Margin Compliance

To examine compliance on the intensive margin, we first compare self-reports and third-party reports, for sales and costs respectively. We construct a taxpayer’s third-party reported sales as the sum of sales reported by other firms (the taxpayer’s clients, D151 sales), state institutions (D150), debit/credit card companies (D153) and exports. While inter-firm sales could technically be conducted through a card transaction and would thus appear both on the D151 and on the D153 declaration, in which case our measure would over-estimate third-party reported sales, the tax authorities consider this is unlikely. A taxpayer’s third-party reported costs are the sum of sales reported by the taxpayer’s suppliers (D151 costs). Underreporters (overreporters) are firms reporting an amount at least 0.25% smaller (larger) than the relevant comparison amount.

Table V shows the estimates of under-reporting for tax year 2010, distinguishing sales reports and cost reports, and reports by the self-employed and corporations respectively. Panel A focuses on under-reporting for the income tax, panel B on estimating the under-reported income tax liability, and panel C on internal consistency between the different declarations submitted by a taxpayer. Estimating under-reporting for the sales tax is more challenging, given its narrow base and the fact that third-party reports do not distinguish between sales tax liable and non-liable sales.

While 17% of the self-employed and 14% of corporations under-report sales compared to third-party reports, the share of firms under-reporting their costs is even higher, 50% and 30% respectively for the self-employed and corporations (row 1). Firms thus under-report not just sales but scale, as shown also in Carrillo *et al.* (2016). The higher share of cost under-reporters among self-employed can be explained by the presence of an exempt tax bracket in the self-employed tax schedule. The

under-reported amounts are substantial as a share of under-reporters' own third-party reports (30-40%, row 5), but a smaller share of total third-party reports. The share of un-reported sales in total third-party reported sales is just slightly smaller than the share of sales under-reporters, suggesting that under-reporters are not disproportionately small firms. The share of under-reported costs in total third-party reported costs is significantly smaller than the share of cost under-reporters (row 6). This suggests that marginal cost under-utilization is widespread, but substantial under-utilization is not.

With a few assumptions, it is possible to translate the unreported sales amounts into unreported tax liability. We assume that under-reporters declare all third-party reported sales, apply the initially reported profit rate to their initially unreported sales, and then apply the tax schedule. This means we allow under-reporters to offset additional reported sales with additional reported costs, proportionately to the initial declared profit rate. This is a realistic assumption, given the evidence in Carrillo *et al.* (2016) and Slemrod *et al.* (2015), and consistent with firms' response to desk audits discussed further below. We estimate that reported tax liabilities would increase by 9% for corporations and by 48% for the self-employed if all third-party reported sales were declared (row 11). This large increase for the self-employed is driven by their high initial reported profit rates, given the exempt tax bracket. However, as the self-employed's tax liabilities represents only 3% of corporate tax liabilities, the general conclusion still is that the tax authorities could increase income tax revenue from firms by 10% at most if they were able to perfectly enforce all third-party reported sales.

Evidence from the impact of desk audits further supports the conclusion that simply improving enforcement on third-party reported margins cannot increase tax revenue substantially. The tax authorities systematically cross-check third-party reports and self-assessment declarations, and conduct periodic desk audits for firms that exhibit discrepancies. A desk audit entails a one-day examination of the case by a tax officer and a phone call to the taxpayer. Figure II displays the results of desk audits for the income tax (panel A) and the sales tax (panel B). Comparing a firm's initial tax return to the post-audit revised return, the figure plots the change in reported costs against the change in reported revenue for panel A, and the change in reported input tax credit against the change in sales tax collected in panel B. The figures focus on the small share of firms that actually revise their declaration in response to the phone call: 19% of desk-audited firms for the income tax and 16% for the sales tax. Revisers clearly offset revenue increases by cost increases, by almost 100% for the income tax and by about two-thirds for the sales tax. The revisers' reported tax liability more than doubles nonetheless, as the initial base is extremely low. The interventions are also highly cost-effective, considering the daily salary of a tax officer, and the load of one case

per day. However, the number of revisers and their scale is so small that the revisions increase total revenue by less than .5%.²⁶ The low response rate, offsetting cost adjustments and marginal tax revenue gains of these desk audits are all consistent with the fact that the under-reporting rates in Table V are very similar when considering firms' initial returns rather than their final returns, or earlier or later fiscal years.

This analysis has thus shown that, although misreporting compared to third-party information is present, its levels are moderate, probably due the deterrence effect of routine cross-checks, desk audits and other compliance interventions by the tax authorities. Perfectly enforcing reporting of third-party reported margins could increase income tax revenue by 10% in theory, but the realized effect of desk audits is orders of magnitude smaller.

4.3 Payment Compliance

To examine taxpayers' compliance with the obligation to pay their net tax liability, we match the income and sales tax returns with payment records from the D110 payment receipts. Importantly, the payment receipts display both the payment date and the tax period and taxpayer to which the payment corresponds, allowing us to exactly match payments with liabilities. To our knowledge, this is the first attempt at estimating payment compliance for the income and sales tax, testing the previously implicit assumption that declared tax liabilities automatically translate into payments.²⁷ The relevant liability is the taxpayer's final tax liability to be paid as per the final (revised) tax returns, after deductions, advance payments and tax withheld have been subtracted.²⁸ We compare this liability to the tax payment that the taxpayer makes herself, excluding payments made by withholding agents and advance payments made by the taxpayer.²⁹ We then take the share of payment over liability for each taxpayer, and average this share across all taxpayers in each fiscal period.

The results are displayed in Figure III, where panel A corresponds to the income tax and panel B correspond to the sales tax, and red and blue lines correspond to corporations and self-employed respectively. In both panels, the average payment share is below 100% in all fiscal periods, and decreases as we consider more recent tax periods, dropping to 70% for the income tax and 85%

²⁶Whether the desk audits improve reporting behavior in future tax periods is an open question that we currently study. More generally, whether it is optimal for the tax authorities to invest in desk audits rather than full audits or follow-up communications with non-filers or late-payers depends on the relative revenue elasticities of these different enforcement activities, in the spirit of Keen & Slemrod (2016).

²⁷Del Carpio (2014) provides estimates of property tax compliance in Peru, which are conceptually different from our estimates as property taxes are assessed by the government and thus have no misreporting margin.

²⁸Note that we use the net liability as derived on the firm's tax return, and taking into account only the amount of advance tax payments and tax withheld that the taxpayer chose to reclaim on her tax declaration.

²⁹Including payments that are enforced retroactively by the tax authorities through administrative or judicial procedures makes little difference to the results.

for the sales tax in the most recent period considered (solid lines). This is despite the fact that we consider payments made until April 2015, the payment deadline for fiscal year 2014. There are two potential explanations for this downward sloping profile of the average payment rate: a fall in payment compliance over time, and the presence of late-payers. If taxpayers service their tax obligations with substantial delays, then more recent periods will display lower payment compliance than earlier periods, for which a longer series of payment data is available.

To distinguish these two explanations, we add the average payment profiles based on payments made until April 2013 and April 2011 respectively (dashed and dotted lines). These payment profiles are similarly downward sloping and shifted to the left, suggesting that payment delays are indeed at play. For instance, while the income tax payment share for 2010 is about 88% when measured by April 2011, it is above 95% when measured in April 2015. A small share of taxpayers thus pay with large delays. This is consistent with anecdotal evidence that cash-constrained firms make tax payments when they are liquid rather than when the payment is due, as fines and interest fees are small.³⁰ At the same time, the payment share, as measured by the period-specific payment deadline, is also decreasing over time, from 88% for the income tax in 2010 to 81% in 2014. This suggests that payment compliance has also fallen over time. Overall, however, payment compliance is relatively high, not only across firms, but especially in the aggregate. As non-payers and late-payers are disproportionately small, the aggregate payment rate, that is the sum of payments divided by the sum of final liabilities, is close to 100% soon after the payment deadline and stable over time.³¹ Although the enforcement of outstanding payments through administrative and judicial procedures is part of the regular activities of the tax authorities in Costa Rica, and important from a deterrence perspective, increasing enforcement on this margin is unlikely to increase tax revenue substantially.

To summarize, the anatomy of compliance allows the following conclusions. First, a substantial share of firms fail to file their taxes, and there are limits to the extent to which third-party information induces compliance on the extensive margin. Second, a non-negligible share of firms under-report sales compared to third-party reports, despite the fact that the authorities systematically cross-check tax returns and informative declarations and request corrections of discrepancies. Finally, a group of predominantly small firms pay their outstanding liabilities with several years of delay. While compliance gaps are present on all margins, they are relatively modest compared to total tax revenue. As evidence from a filing intervention and desk audits show, increased enforcement

³⁰The payment rate seems to be lower for corporations than for the self-employed, but this is likely driven by a small number of missing payment records. Our current data does not contain payments filed through a special online platform which is mainly used by large taxpayers. To ensure that our main results on the causal impact of withholding are not driven by gaps in the payment data, we conduct a series of robustness checks explained below and displayed in the appendix.

³¹Results available upon request.

on third-party reported margins is unlikely to yield large revenue gains. In such an environment, expanding the coverage of third-party information, and the application of withholding mechanisms to third-party reported sales, may be a much higher-return investment than increased enforcement, a question that we turn to in the next two sections.

5 Impact of Information Reporting

This section examines the compliance impact of information reporting while section 6 isolates the impact of withholding. We first analyze the heterogeneity of bunching, as a proxy for misreporting, across subsamples of firms with different degrees of information reporting coverage, and then conduct an event study of the response to information reporting.

5.1 Heterogeneity in Bunching

Bunching at kinks or notches in the tax schedule has been used in numerous studies to estimate the response of reported taxable income to the tax rate, and bunching is usually shown to be driven by an evasion/avoidance response rather than a real response (e.g. [Bachas & Soto 2016](#), [Almunia & Rodriguez 2015](#), [Seim 2015](#)). Consistent with this, we observe large and sharp bunching at the first kink in the self-employed tax schedule and at the first notch in the corporate tax schedule.³² Taking the example of the self-employed (results are similar for corporations), Figure IV shows that bunching moves every single year with the location of the kink. There is rarely any excess mass at the previous year's kink, suggesting that firms adjust almost immediately and fully to the new kink location. The consistent and speedy adjustment supports the interpretation of bunching as a reporting response rather than a real production change.³³ We thus use bunching as a proxy for misreporting.

To examine the heterogeneity of bunching with coverage by information reporting, we pool the data for 2006 to 2015 and display the distribution as percentage difference from the year-specific

³²The first threshold in each schedule is the most salient one, and also the largest in terms of the tax rate change for the self-employed. Bunching is also present but smaller at the other thresholds.

³³Strikingly, the excess mass is always concentrated to the left of the kink. For the years 2010 to 2014, the distribution also displays a clear missing mass to the right of the kink, which is at odds with the prediction of standard utility theory. This theory predicts that kinks generate symmetric bunching around the threshold, and notches generate asymmetric bunching below the threshold and a missing mass in a dominated range above the threshold [Kleven & Waseem \(2013\)](#). However, as discussed in [Kleven \(2016\)](#), several studies have found asymmetric bunching also at kink points, suggesting that taxpayers may perceive a kink as a notch. One possible explanation is that crossing the kink may be associated with a fixed cost, such as having to make a payment, as is the case for the first kink in the self-employed tax schedule in Costa Rica. However, tax payments can be done online and should generate little transaction cost in Costa Rica. Another explanation is that the threshold creates a reference point, which constitutes a notch in the firm's utility function, so that bunching is driven by reference point dependence rather than the traditionally assumed response to the financial incentive change at the kink. This warrens caution when using bunching to estimate the elasticity of taxable income, but does not prevent us from interpreting bunching as a measure of misreporting which generates a revenue loss for the government.

threshold location in 1% bins. To estimate the size of bunching, we fit a flexible polynomial to the observed distribution, excluding a range around the thresholds, as is standard in the bunching literature (Chetty *et al.* 2011, Kleven & Waseem 2013). Given the asymmetric nature of bunching, we estimate bunching to the left of the kink and the missing mass to the right of the kink. As the missing mass does not seem to be the same size as the excess mass, at least for the self-employed, we apply the estimation strategy suggested by Best & Kleven (2015) rather than the convergence method. We choose the lower bound of the excluded range as the point where bunching starts and the upper bound as the point where the derivative of the observed distribution shifts from positive to negative.³⁴ The convergence method would require the missing mass and the excess mass to be of the same size and assumes that there are no extensive margin responses, which is unlikely in a context with high shares of non-filers even among registered firms.

Figure V displays the observed distribution (dotted blue line), the estimated counterfactual (solid red line) and excess mass and missing mass estimates for different subsamples. The top row (A) shows the distribution of taxable income for the self-employed around the first kink; the bottom row (B) shows the distribution of revenue for corporations around the first notch. In each row, panel 1 reflects the firm-year observations not covered by any information reporting or withholding mechanisms, panel 2 reflects observations that are subject to information reporting by other firms only (declaration D151 by suppliers and clients), and panels 3 and 4 reflect observations subject to reporting by state institutions and credit/debit card companies respectively (declarations D150 and D153). While several papers have analyzed the heterogeneity in bunching by proxies of evasion propensity (e.g. Best 2014, Almunia & Rodriguez 2015), this is to our knowledge the first exercise of estimating the heterogeneity of bunching by actual third-party information coverage.

Among both firm types, the largest excess mass is found in the sample of firms not subject to information reporting (panel 1). The subsample of firms subject to information reporting by other firms (panel 2) still exhibits a large excess mass around both the kink and the notch, but in both cases, the excess mass estimate is significantly smaller than the estimate for firms not subject to information reporting. The excess mass drops from 4.5 to 2.08 for the self-employed and from 4.49 to 3.17 for corporations, and those drops are statistically significant at the 1% level.³⁵ The fact that bunching is smaller but still highly significant among information-covered firms is consistent with the fact that bunching can be partly driven by legal avoidance, and that the information trail

³⁴The location of the upper bound is less clear from visual inspection. In a forthcoming appendix table, we provide robustness checks varying the degree of the polynomial and the size of the excluded range below and above the kink.

³⁵Note that the change in the missing mass estimate is driven by a change in the counterfactual density which scales the excess mass, rather than by a change in the absolute size of the excess mass. The missing mass drops for corporations, but increases for the self-employed. In fact, the missing mass for the self-employed is clearly visible only in panels 2 and 3. This suggests that the threshold may be perceived as a kink by some self-employed in the subsample not covered by information reporting.

is incomplete, covering only large transactions. Firms can still manipulate their taxable income by misreporting small and cash transactions and sales to the final consumer, or inflating costs, deductions and exemptions.³⁶

Information reporting by state institutions and credit/debit card companies, which also act as withholding agents, is associated with a further reduction in misreporting behavior (panels 3 and 4). For the self-employed, the excess mass among firms subject to state reporting is similar to the excess mass among firms subject only to information reporting by other firms, but the excess mass drops to .52 for firms subject to credit/debit card reporting. For corporations, the excess mass drops from 3.17 among firms subject to information reporting by other firms to 1.44 and 1.35 respectively for firms subject to state reporting and credit/debit card reporting. These drops are again highly statistically significant.

The heterogeneity of bunching across subsamples is thus consistent with a compliance impact of information reporting, and an even stronger impact of withholding. Our results are also consistent with estimates from the United States, where the Internal Revenue Service reports tax evasion rates of 56%, 8% and 1% respectively on income covered by little information reporting, income covered by substantial information reporting and income subject to withholding (IRS 2012). However, just like the IRS estimates, our estimates do not capture a pure causal effect. Firms subject to information reporting, and especially firms subject to withholding, are on average larger, more urban and probably equipped with more sophisticated management and accounting systems. It is possible that these characteristics, rather than coverage by the tax compliance mechanisms, explain at least part of the heterogeneity in bunching. In addition, the different reporting mechanisms apply to different types of transactions, firm-to-firm, firm-to-state and card transactions respectively, so that the corresponding informative declarations and the firms covered by them are not strictly comparable.³⁷

5.2 Event Study

To move a step further towards estimating a causal effect of information reporting, we exploit within-firm variation across time in the coverage by information reporting. Each year, over a thousand firms switch from not being reported to the tax authorities by any third party to being reported by at least one transaction partner. If third-party reporting of transactions to the tax authorities forces firms to declare a larger share of their transactions on their self-assessment declarations, coverage by information reporting should be associated with an increase in reported taxable sales and income.

³⁶Bunching is also present in all economic sectors and relatively homogenous across sectors.

³⁷For example, managers of firms deciding to sell their output to a state institution may have higher tax morale, or be more committed to public goods provision, than managers transacting only with other private sector firms.

This prediction is motivated by the fact that the tax authorities regularly follow up on firms with discrepancies between third-party and self-reports, leading most firms to report sales weakly larger than the third-party reported amounts (section V).

We thus conduct an event study of reported taxable income around the time of the first information report about a firm, distinguishing reports by the different informing agents (other firms, state institutions, credit/debit card companies).³⁸ Of course, whether or not a firm becomes subject to information reporting is partly under the firm’s control. A firm is nearly certain to be reported to the tax authorities if it sells to a state institution or conducts sales via a credit/debit card terminal, as state institutions and card companies are considered highly compliant with their reporting obligations. Conducting transactions with another firm above the relevant annual threshold amount should also trigger information reporting, although firms may be less compliant with their reporting obligations, and transacting partners may collude not report their transactions. An additional concern is that the event of becoming subject to information reporting may increase not only the share of true taxable income that is reported to the tax authorities, but also the level of true taxable income and hence of reported taxable income, even if the share of income that is reported remains unchanged. For instance, securing a government contract has been shown to increase firm growth (Ferraz et al 2016), and offering consumers the opportunity to pay by credit/debit card may allow firms to attract additional customers. While there are no credible estimates of the potential size of these demand effects, we discuss below why our estimates are unlikely to be fully driven by them.

To address the identification concerns, we consider the event group E of firms that switch into information reporting coverage for the first time at event time $k = 0$, and the event control group C of firms which have not switched into coverage by $k = 0$. As a careful precaution, but without substantively modifying the core results, we follow Hilger (2014) and Naritomi (2015) in reweighting the control group to resemble the treatment group pre-event trend. For each event period, we estimate the firms’ propensity score of switching into information reporting coverage.³⁹ Following DiNardo *et al.* (1996), we re-weight the control group by quintile bins of the propensity score to match the distribution of the event group. We consider the event’s impact on income tax declarations and sales tax declarations. For the income tax, we consider a balanced panel of firms that we can

³⁸The Costa Rican tax authorities, unlike the Internal Revenue Service in the United States, do not notify taxpayers about the informative reports received about them. However, given the structure of reporting requirements, each firm should be aware of the informative declarations held by the tax authorities about its business activities. Each inter-firm transaction above the relevant threshold amount needs to be reported by both the seller and buyer (declaration D151). State institutions and credit/debit card companies acting as withholding agents are obliged by law to provide taxpayers with a receipt stating the amount of tax withheld. Compliance with this information requirement is considered to be high.

³⁹The propensity score of a firm receiving its first informative declaration is estimated separately for each declaration type and event year, using firm type and tax administration dummies, and the two lags of a third-order polynomial of total income and taxable income. See also Yagan (2015) for a detailed description of the reweighting procedure.

observe for at least four years before and three years after the event, allowing us to evaluate events happening in event periods $p = \{2010, 2011, 2012\}$. For the sales tax, we consider a balanced panel of firms that we can observe for at least five months before and after the event, allowing us to evaluate events happening in event periods between February 2009 and August 2014.⁴⁰

Each panel in Figure VI displays the trend in (real) reported taxable income for the event group (orange dots) and the control group (blue crosses), scaled by the pre-event average, along with the difference-in-difference coefficient obtained from estimating

$$y_{i_p k} = \gamma_k + \alpha_{i_p} + \beta \cdot I\{k \geq 0, g = E\} + u_{i_p k}. \quad (1)$$

The unit of observation in this estimation is a firm i in event period p at event time k . For instance, a firm may be in the control group for events happening in 2010 and 2011, but in the treatment group for event happening in 2012. Each firm-year observation for this firm will thus appear in the event dataset three times, for event years 2010, 2011 and 2012. We estimate the firm’s reported taxable income as a function of event-time dummies γ_k , firm-event-period fixed effects α_{i_p} , and the post-event and treatment group dummy $I\{k \geq 0, g = E\}$.⁴¹ Outcomes are in levels rather than logs, to include the large number of firms with zero values, and winsorized at the 95th percentile to limit the influence of outliers. Panels on the left side of figure VI correspond to the self-employed, and panels on the right side correspond to corporations.

For most firms, the first transacting partner reporting to the tax authorities is a supplier, leading to a D151 cost report about the firm’s purchase. As panels A1 and B1 show, receipt of this first information report is associated with a 26% increase in reported taxable income for the self-employed and a 49% increase for corporations. This large effect emerges precisely at event time, after otherwise identical trends in the event and control group, which means it is unlikely to be driven purely by true income growth.

Over time, firms gradually become covered by more information reports, such as reports from their clients (D151 sales). This event, which happens on average a year after the first cost report, is considered in panels A2 and B2. The first sales report is associated with a much smaller increase in taxable income than the first cost report, possibly because part of the relevant transactions have already been reported to the tax authorities in response to the first cost report. The effect size is again larger for corporations than for the self-employed. Consistent with the fact that firms under-

⁴⁰Results are robust to considering fewer or more event periods, or omitting the propensity score reweighting.

⁴¹Contrary to Naritomi (2015), we conduct the estimation at the firm level rather than on the collapsed data, to estimate the standard errors. The results are qualitatively similar in a simple event study without control group, in which we estimate coefficients for each event time. However, limited statistical power makes the point estimates significantly more noisy. Firm-event-period fixed effects and clustering of standard errors at the firm level account for potentially repeated appearance of firm-year/firm-month observations.

report both sales and costs, the taxable income response to all events is driven by a similarly-sized increase in reported sales and reported costs, as the numbers in squared brackets demonstrate.

Reporting by state institutions or credit/debit card companies (panels A3-B4) has a relatively homogenous effect on the self-employed and corporations, leading to a 21-26% increase in reported taxable income in both samples.⁴² Although most firms are already subject to reporting by other firms when being first reported by a state institution or card company, these new reports enforce a different margin - sales to state institutions and final consumers, as opposed to inter-firm transactions - and may thus have an additional effect on reporting.⁴³ However, the result could also be driven by the fact that information reporting mechanisms that are associated with withholding have a stronger compliance impact than pure reporting mechanisms. The next section will show that withholding indeed increases reported taxable income even when information reporting requirements are held constant.

In all figures, the event and control group follow similar, almost identical trends until the event, and then diverge precisely at event time $k = 0$ ⁴⁴, until the difference between the two groups stabilizes at approximately $k = 1$. In the monthly sales tax data, the event group has a slightly higher pre-event growth rate than the control group, but the sudden divergence in the event month still supports a causal interpretation of the effect. Although offering consumers the possibility to pay by credit/debit card may increase sales, this effect is unlikely to materialize immediately, as consumers need to acquire the new information and adjust their purchasing behavior. We thus conclude that the size and timing of the effect is hard to reconcile with a pure growth effect, and must be at least partly driven by a compliance response to information reporting.

6 Impact of Withholding

Having shown that information reporting increases reported taxable income, this section studies whether withholding has an impact on compliance beyond the impact generated by information reporting. We use the August 2011 reform of the sales tax withholding rate schedule to isolate the impact of withholding, holding the information environment constant. We start by analyzing the first stage impact of the reform on realized withholding rates and card use, then conduct a

⁴²Note also that the increase in reported taxable income (reported tax liability for the sales tax) is associated with an increase in the reported profit rate (reported value-added rate for the sales tax).

⁴³For the event of credit/debit card reporting (last two figures) we use the reported tax liability (rather than reported taxable income) as outcome variable, and sales tax collected and input tax credits deducted (rather than sales and costs) for the decomposition, as these variables are available on the monthly sales tax declarations. The results are similar when conducting the analysis at the annual level with reported taxable income for the income tax as outcome. However, the event is less sharp in this case, as the first credit card report may be filed in the middle of a tax year rather than at the beginning of the year.

⁴⁴This is true except in the case of corporations receiving a first sales report from other firms (fourth panel), whose trend diverges from the control group at $k = -1$ rather than $k = 0$.

difference-in-difference estimation of the payment response to the withholding rate increase, and finally examine the mechanisms of the withholding impact.

6.1 First Stage and Impact on Card Use

As discussed in section 3.3.2, a reform in August 2011 revised the sales tax withholding rate schedule. Panel A in Figure VII shows that the reform led to a large increase (approximately a doubling) of the average withholding rate, as intended. This also confirms the high compliance of card companies with the government-assigned withholding rates. The graph displays small jumps every semester, when the withholding rates are revised by the tax authorities and communicated to the withholding agents. The graph also displays a gradual decrease in the withholding rate after the initial post-reform jump, suggesting that a number of firms obtained a lowering of their withholding rate, probably by making a revision request to the tax authorities.⁴⁵ To understand the extent of deviation between the assigned and realized withholding rate, we predict each firm's withholding rate based on its past tax returns and the withholding rate schedule in Table II. As panel B shows, the predicted rate tracks the realized rate closely, for firms for which we can observe both rates, but the realized withholding rate is always slightly higher. This is consistent with the fact that firms can request a lowering of the withholding rate from the tax authorities, for instance if they have losses for several consecutive months.

Panel C and D investigate the possibility that the reform may have discouraged firms from filing their sales declaration, or using their credit/debit card machine, which would have limited information reporting and withholding by card companies. Both the number of sales tax declarations and of credit/debit card reports (D153 informative declaration by card processing companies) filed with the tax authorities is steadily increasing and smooth at reform time. Similarly, the share of sales tax declarations that can be matched with at least one credit/debit card report and vice-versa does not display a discontinuity at reform time. In fact, the share of credit/debit card reportees that file sales tax was decreasing prior to the reform (driven by an increase in the number of credit/debit card reportees), but then stagnated after the reform. The possibility of reclaiming the tax withheld may have increased withholder's propensity to file sales tax. Overall, we conclude that the reform did not reduce tax filing and credit/debit card machine usage on the extensive margin.

A remaining concern is that the reform may have decreased the intensity of card machine usage. However, as panels E and F show for firms using a card machine (i.e. reported by at least one credit/debit card company), neither the sum of card sales over total sales nor the average

⁴⁵There is only a weak behavioral response to the withholding rate notches in reported value-added and the share of local sales, suggesting that few firms, if any, can manipulate the withholding rates by manipulating the relevant line items on their sales tax declaration.

over the firm-specific share of card sales changes discontinuously at reform time. While both series display a small drop at reform time, this drop is statistically significant only when considering the average share of card sales, suggesting it is driven by firms with a relatively small sales volume. The size of the drop is economically insignificant even in this sample - one percentage point of an average share of 50%.

This suggests that most firms have not attempted or do not have the market power to refuse card transactions with the objective of avoiding the withholding rate increase or reducing its scope of application. We can thus consider the information reporting environment constant around the reform, and use the reform to isolate the effect of withholding.⁴⁶

6.2 Difference-in-Difference Estimation

To estimate the impact of the withholding rate increase on total tax payment and other intermediate outcomes, we conduct a difference-in-difference estimation on the balanced panel of firms which consistently submitted sales tax declarations during a 30-months window around the reform. Only firms that experienced an increase in the *predicted* withholding rate between July and August 2011 are considered treated. The control group consists of firms that experienced no rate increase or are not subject to withholding.⁴⁷ Note that we condition on the predicted rather than the realized increase in the withholding rate, as the latter may be affected by a firm-specific request or connection to the tax authority which allowed the firm to obtain a lower withholding rate.⁴⁸ The predicted rate change depends on value added and the share of local sales in the second semester of 2010, long before the reform decree was designed in July 2011, so that firms could not possibly have gamed the system to avoid an increase in the predicted withholding rate.⁴⁹ We estimate the effect of the rate increase using the specification

$$y_{it} = \alpha_i + \gamma_t + \mu_i \cdot t + \beta \cdot Treat_i \cdot Post_t + \epsilon_{it}, \quad (2)$$

where y_{it} is the outcome reported by firm i in month t ; α_i and γ_t are firm and month fixed effects and μ_i is a firm-specific linear time trend; and $Treat_i$ and $Post_t$ are dummies indicating the treatment group and post-reform period. ϵ_{it} is the error term. We consider as outcomes all main line items

⁴⁶Any reduction in credit/debit card usage would simply downward bias our difference-in-difference estimates below. Similarly, if the (small number of) firms that reduced card usage after the withholding rate reform were the firms with the largest potential evasion rents, our estimates would constitute a lower bound on the true compliance impact of withholding.

⁴⁷Results are similar but more noisy when excluding firms that are not subject to withholding. We always exclude firms that experience a reduction in their withholding rate, as the small size of this sample does not allow for separately estimating the impact of a rate reduction.

⁴⁸We consider collusion between the withholding agent and the firm unlikely, given the small number of withholding agents and the high monitoring intensity they are subject to.

⁴⁹We do not observe firms starting to revise tax returns for 2010 after the reform was announced.

on the rough sales tax return, as shown in table VI. The table reports the pre-reform mean in the treatment group, and the coefficient β for different specifications, either using the raw data, or winsorizing by the 99.9th, 99th and 95th percentile, in addition to the first percentile. As several outcome variables take value zero for a large share of observations, we use levels rather than logs, and report the treatment effect as marginal effect on the pre-reform average. However, the results are qualitatively similar when using $\log(\text{outcome}+1)$ or a dummy variable indicating if the outcome is non-zero.

To visualize the identifying assumption and treatment effect on total tax payment, Figure VIII plots the month-on-month change in total tax payment for the treatment and control group, together with the DiD coefficient estimates from Equation 2. For the purpose of this figure, the data is winsorized by the 99th percentile. Total tax payment is the sum of the tax withheld and the taxpayer’s payment. Despite seasonal fluctuations with peaks during the December shopping season, the two groups exhibit parallel pre-reform trends, which confirms the suitability of the control group. At the time of the reform, tax payments in the treatment group increase sharply by about 33% and remain at this higher level for the next 15 months.⁵⁰ As there is no corresponding decrease in tax payment in the control group, and the treatment group represents a substantial share of total sales, the withholding rate reform increased aggregate sales tax revenue by 8.4%. Figure IX illustrates this results, using a simple linear regression discontinuity design on demeaned semester-wise revenue data (from official government statistics). We display the evolution of revenue from the quarterly simplified regime tax as a counterfactual, to show that the discontinuity at reform time is not driven by business cycle fluctuations.⁵¹

A concern is that taxpayers may have countered the effect of the withholding rate reform by changing their behavior on other margins. The last three rows in table VI show that this is not the case. Where tax has been withheld in excess of liabilities, taxpayers can either request a refund of the excess amount, or subtract it as compensation from their income tax liability. However, this applies to a very small number of taxpayers.⁵² We find that the main treatment effect barely changes when considering as outcome total sales tax payments net of any refunds requests and income tax compensations. Furthermore, the last row shows that the withholding rate reform was not met by a decrease in income tax payment. When using the sum of total income and sales tax

⁵⁰There is an additional increase over time during the post-reform period, but this parallels a qualitatively similar development in the control group.

⁵¹The results are similar when running the estimation on the un-demeaned data, or aggregating at the quarter or month-level. See footnote 19 for details on the simplified tax regime.

⁵²In the raw data, the number and total amount of the refund requests increased slightly at the time of the reform (results available upon request). However, there are usually less than 300 refund requests per month, compared to about 6000 treated firms in our balanced panel, and less than half of the refund requests are filed by sales tax payers. The delay in receiving a refund is reportedly several months, and the request procedure is cumbersome and thus undertaken primarily by large and sophisticated firms.

payments minus refunds as dependent variable (dividing annual income tax payments equally across months of the relevant fiscal year for estimation purposes), we estimate that the reform increased tax payment by 22.5% (column 5). Given that annual sales tax payments are on average almost twice as high as income tax payments, this is consistent with the demonstrated increase of sales tax payments by 33% and even a slight increase of income tax payments. Indeed, to the extent that taxpayers are internally consistent, i.e. report the same tax base on the income and sales tax declaration, an increase in sales tax compliance would spillover to the income tax.

6.3 Mechanisms of Withholding Impact

One potential mechanism is the default mechanism, by which incomplete reclaim of the tax withheld, *ceteris paribus*, leads to an increase in total tax payment. Panel A and B of Figure X show evidence for this. The share of withholdees making a reclaim on their sales tax declaration, conditional on having a non-zero gross tax liability, is only around 50% before the reform, and drops close to 40% at the time of the reform. This drop occurs because the reform increases the number of taxpayers subject to withholding, and many of the new withholdees might not be familiar with the reclaim procedure, or might not even realize that they are subject to withholding. As these new withholdees start to reclaim the tax gradually, the share of withholdees making a reclaim increases, and eventually surpasses the pre-reform share of reclaimers by approximately 10 percentage points. The average share of withheld tax reclaimed, as displayed in the second panel, follows a similar pattern. The share fluctuates between 80% and 95% before the reform, then drops sharply at the time of the reform, and recovers gradually. However, the share of withheld tax reclaimed is much higher than the share of reclaimers. This provides evidence that incomplete reclaim is indeed a mechanism through which withholding increases total tax payment, but mostly for small firms. Indeed, columns 1 and 2 in table VII show that the withholding rate increase generates a larger payment increase for the self-employed than for corporations.⁵³

This suggests that a second mechanism must be at play, which is analyzed in the bottom panels of Figure X. The figures display results from estimating Equation VIII, as in Figure VIII, with different outcome variables, as indicated in the panel titles. The figures confirm that the reform did not affect the amount of sales tax collected (nor the amount of total reported sales), suggesting that production has not decreased as a result of the reform. Yet the reform led to a 3% reduction in reported input tax credits in the treatment group. Combining these two results means that the reported gross tax liability in the treatment group increased by 17%. This is consistent with a world in which firms evaded sales tax by over-reporting input tax credits, but report more accurately after

⁵³We chose the firm type division as it is based on a time-invariant characteristics that is unlikely to be misreported. Results are similar when splitting the sample by median pre-reform revenue.

the withholding rate is increased. We also find a similar increase in reported taxable income after the introduction of tax withholding by credit/debit card companies for the purpose of income tax compliance in 2015 (a reform which again maintained the information environment constant). The results are shown in Appendix Figure [XI](#).

The findings raise the question of what drives the improvement in reporting, given that enforcement by the tax authorities has not increased, as evidence in panel F by the relatively constant audits rates. One possibility is that firms increase reported taxable income when reclaiming the tax withheld, in anticipation of a higher probability of cross-checks or monitoring. However, columns 3 and 4 of table [VII](#) show that firms which never make any reclaim experience a similar increase in reported tax liability as firms making a reclaim. This shows that the reporting effect is not driven by reclaimers.

Another possibility is that a withholding rate increase raises the salience and hence the perceived but not the true intensity of enforcement for some taxpayers. To see this, it is important to know that firms learn from their daily (or occasionally monthly) credit/debit card machine statements the volume of card sales processed, any commissions applied by the card processors, and the amount of tax withheld and transmitted to the tax authorities.⁵⁴ Firms experiencing an increase in the withholding rate from a positive rate to a larger rate would notice the rate increase on their card machine statement only if they pay close attention to the amount of transactions processed and the amount of tax withheld, to back out the withholding rate applied. Firms experiencing an increase in the withholding rate from zero, however, are much more likely to notice the rate increase, as the box for tax withheld on their card machine statement switches from being blank to carrying a number. Noticing the application of withholding for the first time may raise the salience of possible enforcement interventions like desk audits, and lead firms to increase compliance. Consistent with this, columns 5 and 6 show that firms experiencing a withholding rate increase from zero exhibit a larger increase both in their reported tax liability and in their total tax paid than firms experiencing a similarly-sized rate increase from a positive to a larger rate.⁵⁵ This significant interaction does not disappear when additionally interacting with the self-employed and claimer indicator, and is always larger than the latter. We thus label the increase in reported tax liability among treated firms the salience of enforcement effect, as per the panel title in Figure [X](#).⁵⁶

⁵⁴See Figure [XII](#) for an illustration of the type of information provided by card processing companies in Costa Rica to affiliated businesses.

⁵⁵We exclude from the “From-Zero Rate Increase” group all firms that experience the maximum rate increase of six percentage points, to ensure that the average rate increase in this group is not larger than the average rate increase among other treated firms.

⁵⁶An alternative explanation might posit that firms are unaware of their true tax liability and thus report with error, but start to report more correctly after the withholding rate reform, as the withholding system provides them with information of their true tax liability. However, this explanation would be consistent with our results only if firms systematically (but non-strategically) underestimated their tax liability.

To quantitatively decompose the impact of the withholding rate increase into the default effect, the salience of enforcement effect, and a possible reduction in under-payment, we are currently awaiting a new payment dataset that contains payments by all taxpayers, including the large firms paying through a special online platform.

7 Conclusion

Although withholding schemes for firms are widespread in low income countries, and in low compliance sectors in high income countries, they have been largely ignored by the public finance literature. This paper proposes an explanation for the attractiveness of withholding schemes. In a simple Allingham-Sandmo model with third-party reporting, withholding can create a compliance default if reclaiming the tax withheld is costly, and can enhance the salience of tax enforcement.

Exploiting a unique ten-year panel of tax declarations and third-party information and withholding reports for the universe of firms in Costa Rica, we estimate compliance gaps on the extensive, intensive and payment margin. The estimates suggest that compliance is satisfactory on third-party reported margins, and expanding the coverage of information reporting leads to substantial increases in reported taxable income. An event study finds that firms increase their reported taxable income by 20-50% when being information-reported for the first time by a trading partner. Withholding further enhances compliance. A doubling in the sales tax withholding rate increases tax payments by 33% among firms subject to withholding and by 8% in aggregate. This effect is driven by incomplete reclaim of the tax withheld, and reduced misreporting. We find no evidence that withholding reduces output, which suggests that the liquidity costs associated with the regime are negligible. As withholding has the largest impact on small firms, analyzing the distributional consequences of withholding is an important avenue for future research.

TABLE I: INCOME TAX SCHEDULE

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Panel A: Self-Employed										
Kink 1	1,858	2,074	2,252	2,599	2,747	2,890	3,042	3,171	3,339	3,522
Kink 2	2,775	3,097	3,362	3,880	4,102	4,316	4,543	4,735	4,986	5,259
Kink 3	4,629	5,167	5,609	6,473	6,843	7,199	7,577	7,898	8,317	8,773
Kink 4	9,276	10,354	11,241	12,972	13,713	14,427	15,185	15,827	16,667	17,581
Panel B: Corporations										
Notch 1	27,811	31,043	33,701	38,891	41,112	43,253	45,525	47,451	49,969	52,710
Notch 2	55,943	62,444	67,791	78,231	82,698	87,004	91,573	95,447	100,513	106,026

Notes: The table shows the income tax schedule for the years 2006 to 2015. Amounts are in thousands of Costa Rican colones (CRC, ₡). Panel A shows the location of the kinks on taxable income that separate the five tax brackets for the self-employed. The tax is applied to taxable income at marginal rates of 0, 10, 15, 20 and 25% respectively for the first to fifth tax bracket. Panel B shows the location of the notches on revenue that separate the three tax brackets for corporations. The tax is applied to taxable income at *average* rates of 10, 20 and 30% respectively for the first to third tax bracket. For more information on the tax base, tax schedule and the filing procedure, see <http://www.hacienda.go.cr/contenido/12994-regimen-tradicional>.

TABLE II: WITHHOLDING RATE SCHEDULE FOR SALES TAX

	Withholding Rate						
	0	1	2	3	4	5	6
Base before 08/2011: Value-Added Rate \leq	5	20	30	40	55	75	∞
Base since 08/2011: Share of Local Sales \leq	0	-	-	50	-	-	100

Notes: The table shows the withholding rate which credit/debit card companies apply to the sales of their sales-tax-liable clients. Prior to August 2011, the average withholding rate was determined by a notched schedule on value-added, with notches at value-added rates of 5, 20, 30, 40, 55 and 75%, and resulting withholding rates between 0 and 6%. Since August 2011, the schedule has been consolidated to three withholding rates of 0, 3 and 6%. The rates are determined by a notched schedule on the share of local sales, with a notch at 50%.

TABLE III: INFORMATIVE DECLARATIONS TO TAX AUTHORITIES

(1) Form	(2) Purpose	(3) Record Type	(4) Coverage of Corporations	(5) Coverage of Self-Employed	(6) % Matched With Income Tax Records
D151	Reporting of firm-firm transactions N=17,125,017 (54.3% sales)	Sales	46.5	38.9	37.0
		Purchases	49.3	54.1	65.5
D158	Reporting of transactions at auctions N=369,002 (71.0% sales)	Sales	0.5	1.7	16.4
		Purchases	0.3	0.9	23.5
D150	Withholding on purchases N=759,391 (98.5% state purchase)	State purchases	8.4	5.0	78.7
		Private purchases	0.22	0.08	39.9
D153	Withholding on card transactions for GST N=4,198,384	Sales	11.5 [26.7]	5.8 [18.4]	67.8 [48.7]

Notes: This table provides information about the nature and coverage of third-party informative declarations used by the tax authorities in Costa Rica, for 2006 to 2014. Columns 1-3 provide the form number, its purpose, the number of observations and the record type. Columns 4 and 5 display the share of income tax filers covered by the different third-party declarations, distinguishing corporations and the self-employed. Column 6 displays the share of informative declarations which are matched with an income tax declaration. In the last row, the shares in brackets refer to the match rate with the monthly sales tax declarations for 2008-2014. The shares are calculated on the pooled data for all years/months. All declarations identify the reporter and taxpayer by their administration-internal anonymous tax ID, and provide information on the transaction amount, and (where applicable) the amount of the tax withheld. Amounts are accrued. Since January 2012, all declarations must be prepared using the DECLAR@7 software. Sanctions for non-compliance with the obligation to submit informative declarations are specified in the Código de Normas y Procedimientos Tributarios. All declarations are annual, except D153, which is monthly. D151 requires reporting of transactions >2.5 mio ¢ annually with a transaction partner, and transactions of >50,000 ¢ annually for rent, commissions, professional services or interests. For D150, the withholding rate is 2% and 3% respectively for state and private purchases. For D153, the withholding rate is firm specific, following the schedule in Table II. For more information on the filing of informative declarations, see <http://www.hacienda.go.cr/contenido/12997-declaraciones-informativas>.

TABLE IV: NON-FILING

Panel A: Non-filing among all tax-liable firms					
	(1)	(2)	(3)	(4)	(5)
	% Non-filers	Of which registered non-filers	Non-filers' TPI sales as % of declared TPI sales	Undeclared sales as % of declared sales	Unreported liability as % of declared liability
Income Tax 2010	0.384	0.185	0.155	0.211	0.071
Income Tax 2011	0.485	0.125	0.195	0.230	0.069
Income Tax 2012	0.528	0.116	0.115	0.168	0.071
Income Tax 2013	0.556	0.121	0.114	0.181	0.099
Sales Tax 2011	0.196	0.894	.	.	.
Sales Tax 2012	0.185	0.884	.	.	.
Sales Tax 2013	0.198	0.891	.	.	.

Panel B: Non-filing among registered firms					
	All	Self-Employed	Self-Employed with TPI	Corporations	Corporations with TPI
Income Tax 2010	0.104	0.095	0.082	0.081	0.045
Income Tax 2011	0.105	0.090	0.078	0.061	0.033
Income Tax 2012	0.115	0.080	0.070	0.065	0.028
Income Tax 2013	0.131	0.128	0.094	0.137	0.043
Sales Tax 2011	0.180	0.263	0.122	0.094	0.060
Sales Tax 2012	0.168	0.247	0.103	0.085	0.045
Sales Tax 2013	0.181	0.269	0.079	0.085	0.034

Panel C: Non-filing among firms covered by information reporting				
	All	Reported by firms	Reported by state	Reported by card companies
Income Tax 2010	0.574	0.579	0.235	0.293
Income Tax 2011	0.653	0.659	0.202	0.297
Income Tax 2012	0.673	0.679	0.186	0.308
Income Tax 2013	0.677	0.682	0.177	0.319

Notes: These three panels show the share of non-filers for the income tax (rows 1-4) and the sales tax (rows 5-7). Non-filers are tax liable firms which have not submitted their own tax declaration for the relevant fiscal period. The algorithm used to construct the share of non-filers is explained in appendix section 8.1. The share of non-filers for the sales tax is an average across months in a fiscal year. Panel A shows the share of non-filers among all tax liable firms (column 1), the share of non-filers that a registered (2), non-filers' third-party reported sales as share of filers' reported sales (3), non-filers' estimates sales as share of declared sales (4), and non-filers' estimated tax liability as share of declared tax liability (5). TPI stands for third-party information, and TPI sales is the sum of all third-party reports except cost reports. A non-filing firm's estimated sales in in period t are the maximum of its third-party reported sales in t and its self-reported sales in the most recent prior reporting period. A non-filers' tax liability is estimated using its estimated sales, applying the average profit rate of filers in the corresponding decile of the sales distribution of filers, and the applying the tax schedule. Panel B reports the share of non-filers among all registered firms (1), and among subsamples and registered firms as indicated by the column headings (2-5). Panel C reports the share of non-filers among all firms covered by information reporting (1), and among subsamples of firms reported by different informing agents, as indicated by the column headings (2-4).

TABLE V: MISREPORTING

	(1)	(2)	(3)	(4)
	Sales Reports		Cost Reports	
	Self-Employed	Corporations	Self-Employed	Corporations
Panel A: Underreporting IT				
1) % Underreporters IT vs TPI	16.9	14.2	50.6	29.8
2) Unreported Amount	270.6	2799.7	271.1	1021.1
3) Underreporters' TPI	652.9	7010.6	953.2	3603.3
4) Total TPI	1859.8	20664.1	1507.5	16421.4
5) Unreported Amount(% UR TPI)	41.4	39.9	28.4	28.3
6) Unreported Amount(% TPI)	14.5	13.5	18	6.2
Panel B: Underreported Liability				
7) Unreported Tax IT	12.7	71.1		
8) Underreporters' Reported Tax	3.3	51.8		
9) Total Reported Tax	26.6	800.1		
10) Unreported Tax (% UR Tax)	385.6	137.4		
11) Unreported Tax (% Tax)	47.7	8.9		
Panel C: Internal Consistency				
12) % Underreporters IT vs OTPI	3.6	5.3	17	8.3
13) % Overreporters IT vs OTPI	43.5	62.9	81.1	90.2
14) % Underreporters IT vs ST	9.4	9.6	14	5.9
15) % Overreporters IT vs ST	53.8	61.6	83.5	93.6

Notes: This table displays estimates of compliance gaps between third-party reports and self-reports for the income tax. Third-party reported sales for the income tax is the sum of sales reported under D150, D151, D158, D153, and exports. Third-party reported costs for the income tax is the sum of costs reported under D151 and D158. Third-party reported sales for the sales tax is the sum of sales reported on D153 declarations. Columns 1-2 are for sales reports, and columns 3-4 for cost reports. In both analyses, we consider separately the self-employed (columns 1 and 3) and corporations (columns 2 and 4). All figures in this table are either in percent (as indicated), or in billions of constant 2015 colones. Underreporters (overreporters) are firms reporting an amount at least 0.25% smaller (larger) than the relevant comparison amount. Rows 1-6 examine underreporting of third-party reported sales/costs. They show the share of under-reporters among firms subject to third-party reporting for the income tax (1), the amount unreported (as compared to third-party reports) (2), the total third-party reports for under-reporters (3), the total third-party reports for the full sample (4), and the unreported amount as a share of the underreporters third-party reports (5), and as a share of total third-party reports (6). Rows 7-11 convert unreported sales into tax liabilities. They show an estimate of the unreported tax liability (7), the underreporters' reported tax liability (8), and the total reported tax liability (9), and the unreported tax as share of the underreporters' reported tax (10), and as a share of the total reported tax (11). The estimation of the unreported (gross) tax liability assumes that the profit rate on unreported sales is the same as the profit rate on reported sales (capped at 100%), and applies the tax schedule as displayed in Table I. Rows 12-15 analyze internal consistency in filing. Rows 12 and 13 compare self-reports for the income tax to a firm's own third-party reports (third-party reports submitted by the firm itself about transactions with other firms), and rows 14 and 15 compare income tax reports to sales tax reports. All calculations are based on 2010 data. Results are similar for other years, and when focusing only on firms that file according to the regular fiscal period.

TABLE VI: IMPACT OF WITHHOLDING RATE INCREASE

	(1)	(2)	(3)	(4)	(5)	(6)
	Pre-Reform Mean Treated, 99.9th pctile	Pre-Reform Mean Treated, 99th pctile	Baseline Raw Data	Winsorized 99.9th pctile	Winsorized 99th pctile	Winsorized 95th pctile
Total Sales Reported	71560.380 (996.541)	51664.220 (329.431)	0.200 (0.293)	0.042* (0.018)	0.002 (0.008)	0.003 (0.006)
Sales Tax Collected	5114.702 (59.499)	3782.567 (19.500)	0.030 (0.023)	-0.008 (0.019)	-0.012 (0.008)	0.011 (0.006)
Input Tax Credits	4309.865 (43.137)	3192.292 (14.898)	-0.087* (0.041)	-0.068** (0.022)	-0.038*** (0.010)	-0.036*** (0.006)
Import Credits	1509.174 (22.230)	882.316 (7.134)	-0.196* (0.081)	-0.120*** (0.036)	-0.024 (0.020)	-0.076*** (0.017)
Local Purchase Credits	2752.913 (27.976)	2064.536 (8.237)	-0.559 (0.546)	-0.055* (0.023)	-0.029** (0.010)	-0.031*** (0.006)
Gross Tax Liability	844.611 (21.245)	548.881 (5.437)	0.096 (0.061)	0.160*** (0.030)	0.167*** (0.021)	0.216*** (0.015)
Withholding Base	10827.196 (146.869)	7293.079 (37.665)	-0.032 (0.035)	0.018 (0.021)	0.017 (0.010)	-0.031*** (0.008)
Withheld Tax	146.758 (5.691)	78.916 (1.222)	1.419*** (0.375)	1.872*** (0.191)	2.423*** (0.093)	2.667*** (0.063)
Withheld Tax Reclaims	137.523 (4.965)	67.647 (1.055)	1.464** (0.543)	1.533*** (0.172)	2.141*** (0.109)	2.309*** (0.075)
Net Tax Liability	703.196 (18.402)	458.880 (4.549)	-0.191 (0.161)	-0.068 (0.043)	-0.049* (0.023)	-0.048** (0.015)
Compensation Requests	15.696 (0.508)	5.116 (0.108)	0.763** (0.281)	0.476* (0.208)	0.123 (0.163)	0.000 (.)
Final Tax To Pay	664.067 (17.415)	419.057 (4.084)	-0.222 (0.182)	-0.094* (0.047)	-0.115*** (0.024)	-0.111*** (0.015)
Taxpayer Sales Tax Payment	646.775 (17.431)	423.248 (4.144)	-0.251 (0.195)	-0.108* (0.047)	-0.098*** (0.024)	-0.100*** (0.016)
Total Sales Tax Payment	802.957 (20.679)	528.147 (5.215)	0.158 (0.083)	0.254*** (0.034)	0.326*** (0.022)	0.519*** (0.018)
Tot. Payment - Refund	802.576 (20.672)	527.766 (5.212)	0.160 (0.084)	0.253*** (0.034)	0.327*** (0.022)	0.518*** (0.018)
Tot. Payment - Refund - IT Comp.	784.958 (20.600)	512.144 (5.179)	0.174* (0.079)	0.257*** (0.034)	0.327*** (0.023)	0.546*** (0.019)
ST + IT - Refund	1237.233 (31.134)	813.674 (8.589)	0.090 (0.060)	0.145*** (0.026)	0.225*** (0.016)	0.347*** (0.013)
Observations	1069680	1069680	1069680	1069680	1069680	1069680
R^2	0.001	0.008	0.962	0.916	0.899	0.880

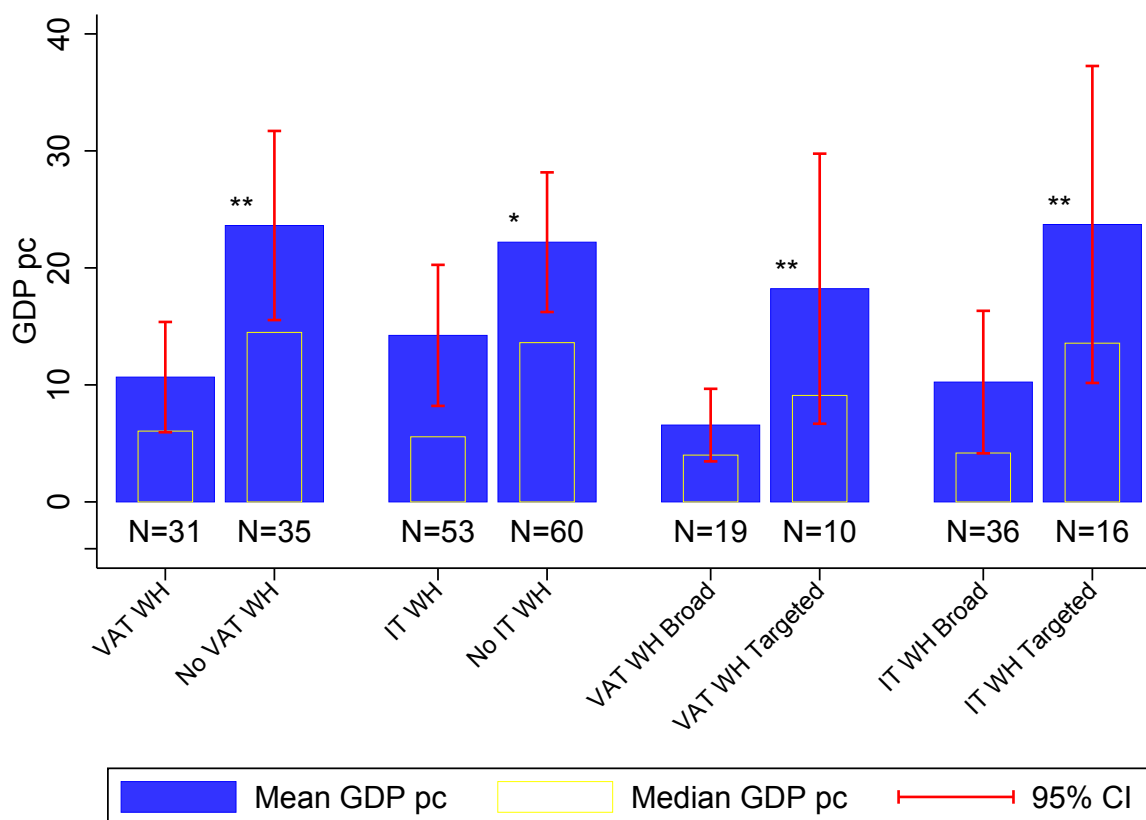
Notes: This table displays pre-reform means in the treatment group (columns 1 and 2) and OLS estimates of the impact of the withholding rate increase on firms in the treatment group (firms with a predicted rate increase at reform time), as per equation 2 (columns 3-6). The rows reflect different outcome variables, the columns reflect different specifications, as per the row and column titles. For columns 1 and 2, the data is winsorized at the 99.9th and 99th percentile respectively. Columns 3-6 allow for year and firm FE and a firm-specific linear time trend. Point estimates are marginal effects compared to the pre-reform average. Standard errors, clustered at the taxpayer level, are in parantheses. All amounts are in '000 CRC, deflated with base in 01/2015 (1USD=530CRC). All outcome variables correspond to boxes on the sales tax return form, except the variables in the last three rows. Compensation requests are used to deduct any net credits or unreclaimed tax withheld from previous tax periods or from other taxes. Taxpayer payment is the payment made by the taxpayer at the end of each month. Total payment is the sum of taxpayer payment and any tax withheld. Total payment - refund subtracts any refund that taxpayers may have claimed on a separate form (refund request form 402). Total tpayment - refund - IT compensation additionally subtracts any compensation requests that the taxpayer requested on her income tax declaration. ST + IT - refund is the sum of total sales tax and total income tax payment (including tax withheld) minus any refund requested.

TABLE VII: HETEROGENEITY OF WITHHOLDING RATE IMPACT

	(1)	(2)	(3)	(4)	(5)	(6)
	Payment	Liability	Payment	Liability	Payment	Liability
Treat	0.290*** (0.021)	0.137*** (0.018)	0.328*** (0.021)	0.188*** (0.017)	0.231*** (0.018)	0.116*** (0.015)
Treat x Self-Employed	0.554*** (0.042)	0.256*** (0.042)				
Treat x Never-Reclaimer			0.261*** (0.078)	-0.059 (0.072)		
Treat x From-Zero WHR Increase					1.681*** (0.167)	0.400*** (0.135)
Observations	1069680	1069680	1069680	1069680	1010120	1010120
R^2	0.757	0.743	0.730	0.737	0.750	0.743

Notes: This table displays OLS estimates of the impact of the withholding rate increase on firms in the treatment group (firms with a predicted rate increase at reform time), as per equation 2. The columns denote the outcome variables, which are winsorized at the 99th percentile. Payment is total tax payment (constructed) and liability is gross tax liability, as in table VI. All amounts are in '000 CRC, deflated with base in 01/2015 (1USD=530CRC). The treatment and control group are specified as in table VI. Never-Reclaimers are treated firms that do not make any reclaim, compensation request or refund request during the post-reform period. The label “From-Zero Withholding Rate Increase” indicates that firms experience an increase of the predicted withholding rate from zero to a positive rate at reform time, as opposed to other treated firms that were already subject to a non-zero withholding rate prior to reform time. We exclude from the former group all firms that experience that maximum rate increase of six percentage points, to ensure that the average rate increase in this group is not larger than the average rate increase among other treated firms.

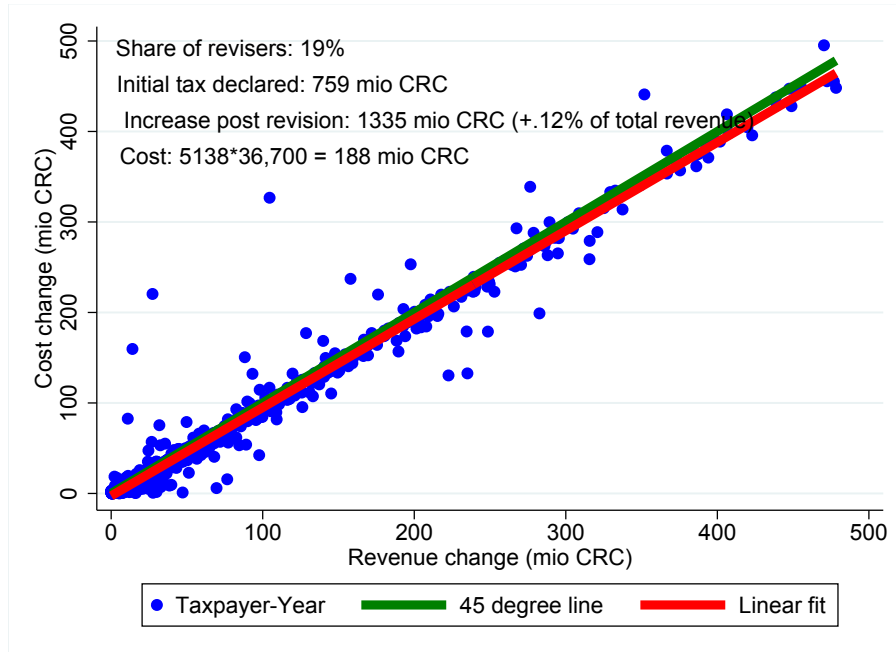
FIGURE I: WITHHOLDING SYSTEMS AND GDP PER CAPITA



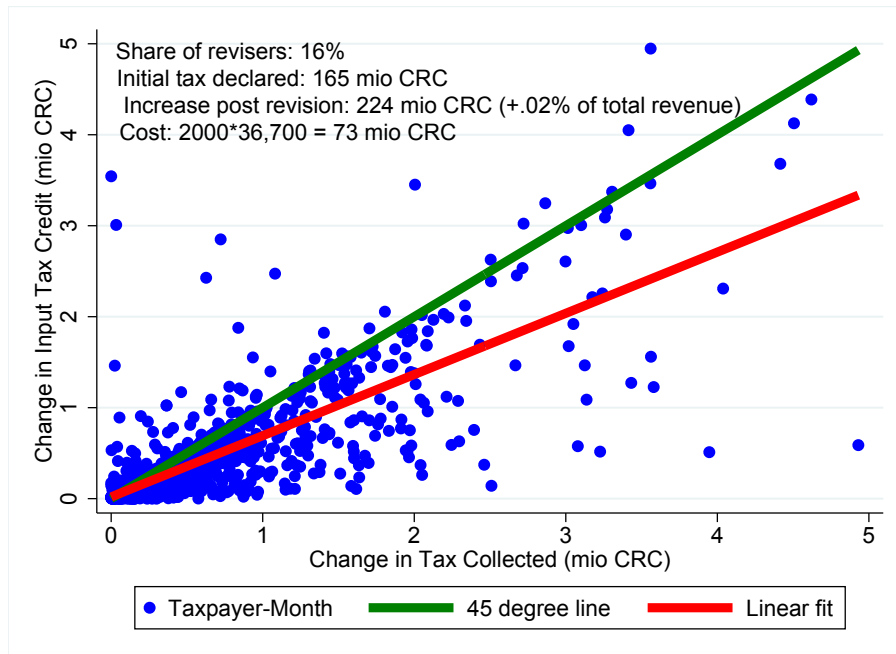
Notes: This figure displays the mean and median GDP per capita, and the 95% confidence interval of the mean, for different subsamples of countries. GDP per capita is measured in thousands of current USD from the World Development Indicators for 2013. The number below each bar displays the sample size. The stars reflect the significance levels of the mean difference between two adjacent bars. The first and second bar refer to countries that use and do not use withholding on the VAT/sales tax respectively. The third and fourth bar refer to countries that use and do not use withholding on business income taxes (i.e. income taxes on corporations and the self-employed/unincorporated businesses) respectively. The fifth and sixth (seventh and eighth) bar further divide the subsample of countries with VAT (income tax) withholding into countries that use a broad withholding regime (that applies across sectors), and those that use a targeted withholding regime, applicable only to certain sectors (e.g. construction, fishing). The analysis is based on a sample of 118 countries for which data was available from the [PKF International Worldwide Tax Guide 2015](#), recent [EY International Tax Alerts](#), [PWC Tax Summaries](#), or the secondary sources referenced in the introduction. The results are robust to using different definitions of GDP (e.g. purchasing power parity), limiting the sample to the 109 countries for which information was available from the PKF Guide, coding countries for which the guide does not specifically mention withholding either as missing or as not having withholding, and different ways of defining targeted withholding systems.

FIGURE II: IMPACT OF DESK AUDITS

A: Income Tax



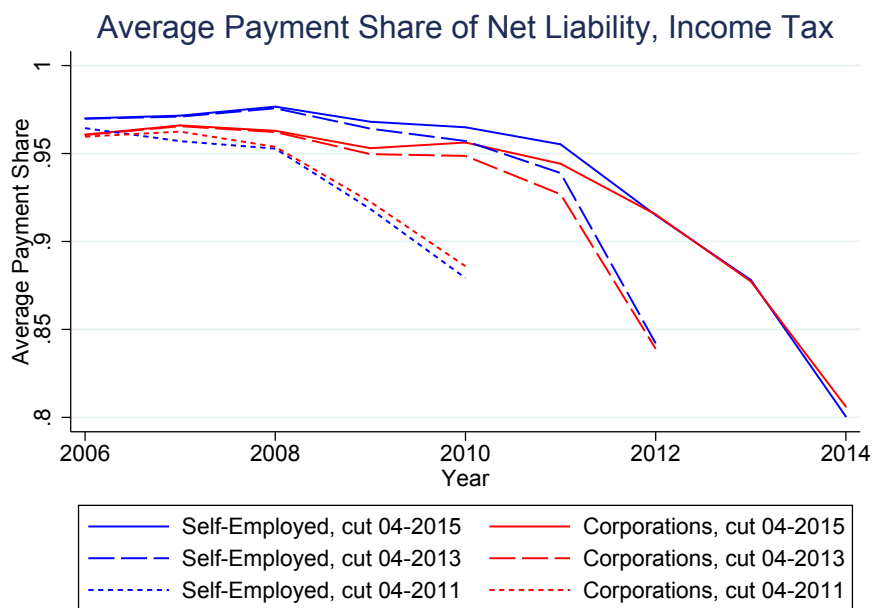
B: Sales Tax



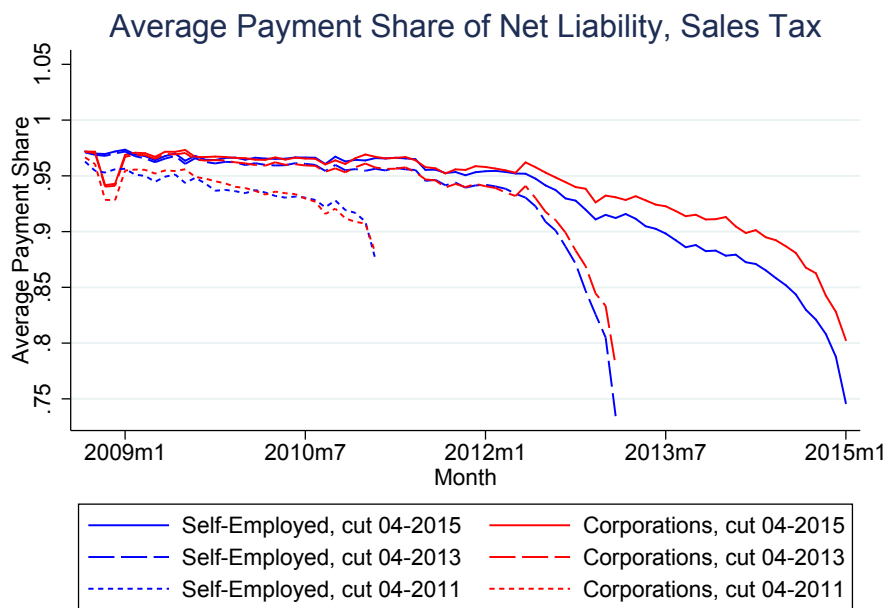
Notes: The figure shows the revenue and cost adjustments made by firms contacted via phone calls by tax officers, after a desk audit uncovered a discrepancy between self-reported and third-party reported sales. The desk audits are for income tax returns for 2013 and 2014, and for sales tax returns for 2013. The figures focus on firms submitting a revised tax return, and display the change in revenue and costs (sales tax collected and input tax credit deducted in panel B), comparing the initial return with the revised return. The text displays the share of revisers, the initial tax declared by revisers, the difference between their final tax paid after revision and the initial tax declared, this difference as a share of initial total tax revenue for the relevant tax and fiscal year, and the cost of the desk audit intervention. The cost is calculated by multiplying the number of cases by the daily wage of a tax officer, accounting for the fact that tax officers are asked to handle one case per day.

FIGURE III: PAYMENT OF TAX LIABILITIES

A: Income Tax

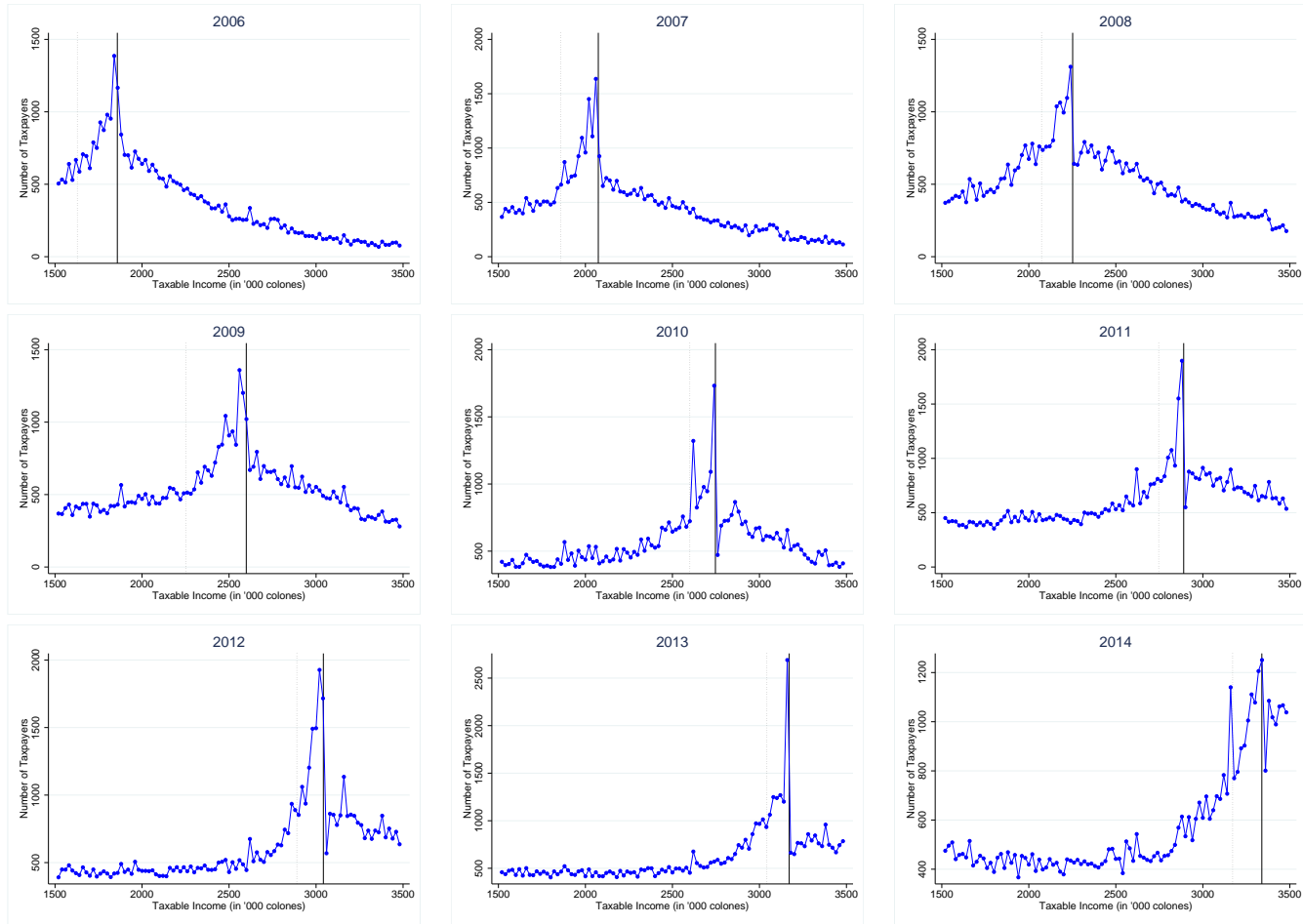


B: Sales Tax



Notes: This figure shows the average of the payment share, defined as the total payment made by the taxpayer for a specific tax period, divided by the final tax liability to be paid for that period. The average is an unweighted average across all taxpayers with a positive final liability for each fiscal period. The final tax liability is net of any deduction made for tax withheld, and the payment data does not include tax withheld. The income tax data includes all declarations filed and payments made by June 2015. The sales tax data includes all declarations filed and payments made by October 2015. The blue series correspond to the self-employed and the red series corresponds to corporations. We show the series for three different cuts in the payment data, taking into account all payments made before the cut date.

FIGURE IV: BUNCHING AT FIRST INCOME TAX KINK FOR SELF-EMPLOYED

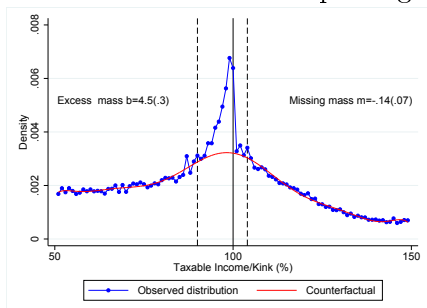


Notes: The figures show the frequency distribution of taxable income of the self-employed (personas físicas con actividad lucrativa) around the first kink in the income tax schedule, for the years 2006-2014. The data is aggregated in bins of ₡ 20,000. The black solid line marks the kink in year t (as per the figure title), the black dashed line marks the kink in year $t - 1$.

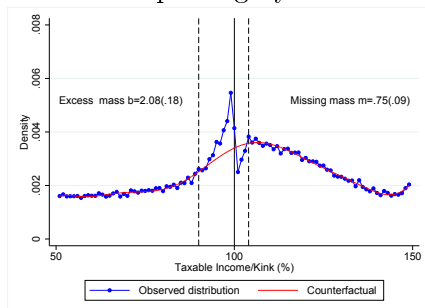
FIGURE V: BUNCHING, INFORMATION REPORTING AND WITHHOLDING

A: Self-Employed

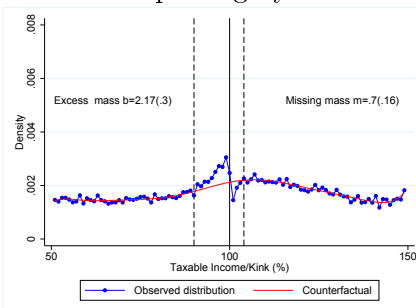
A1: No Information Reporting



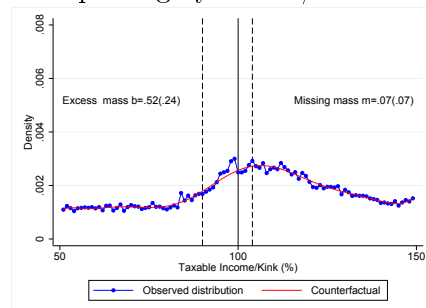
A2: Reporting by Firms



A3: Reporting by State

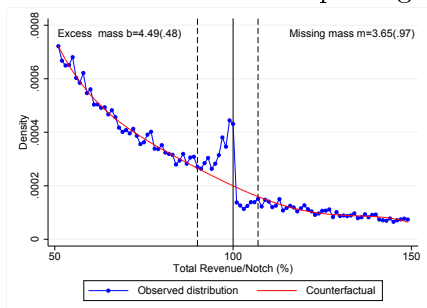


A4: Reporting by Credit/Debit Card

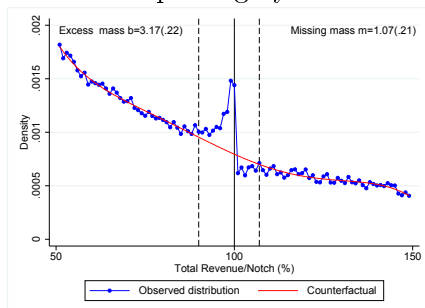


B: Corporations

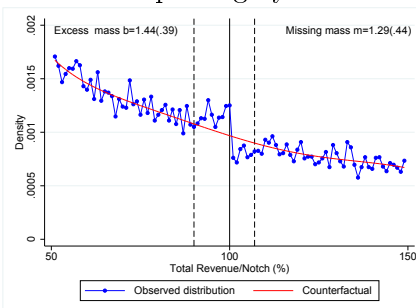
B1: No Information Reporting



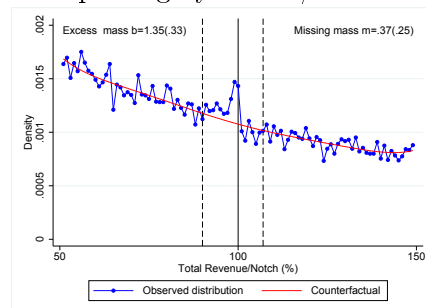
B2: Reporting by Firms



B3: Reporting by State



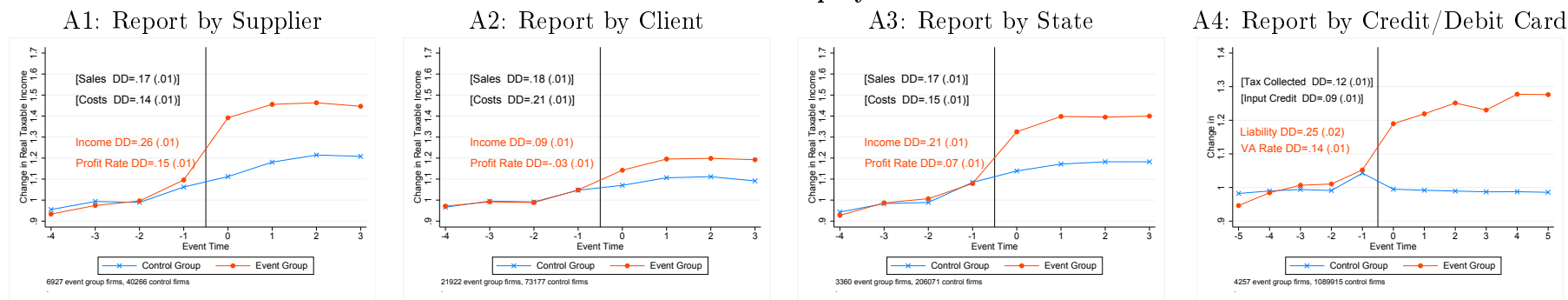
B4: Reporting by Credit/Debit Card



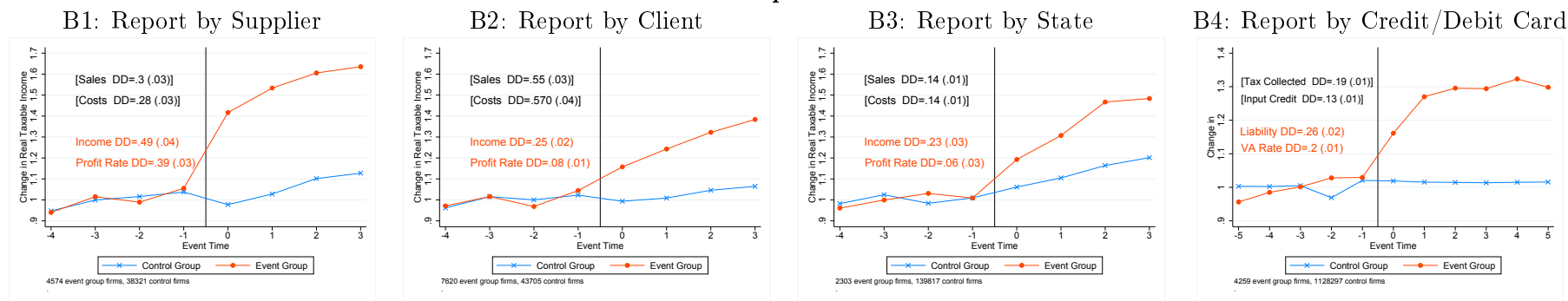
Notes: The figure shows the density distribution of taxable income for the self-employed around the first kink in the income tax schedule (top row, A), and the density distribution of total revenue for corporations around the first notch in the corporation tax schedule (bottom row, B). The data is pooled for years 2006-2015, represented as percentage distance from the kink, and aggregated in taxable income bins of 1%. The panels show the distribution for different subsamples, as per the panel titles that indicate whether and by what type of information reporting firms in the subsample are covered. The blue dotted line marks the empirical distribution, the red solid line marks the counterfactual, fitted as a flexible polynomial to the observed distribution outside the excluded range. We use a tenth-degree polynomial for self-employed and a sixth-degree polynomial for corporations. The excluded range above the threshold covers four and seven bins respectively in the two groups of firms. The excess mass b and missing mass m are estimated as the difference between the observed and estimated density, weighted by the height of the counterfactual density. The standard errors are bootstrapped.

FIGURE VI: EVENT STUDY OF COMPLIANCE AFTER FIRST INFORMATION REPORT

A: Self-Employed

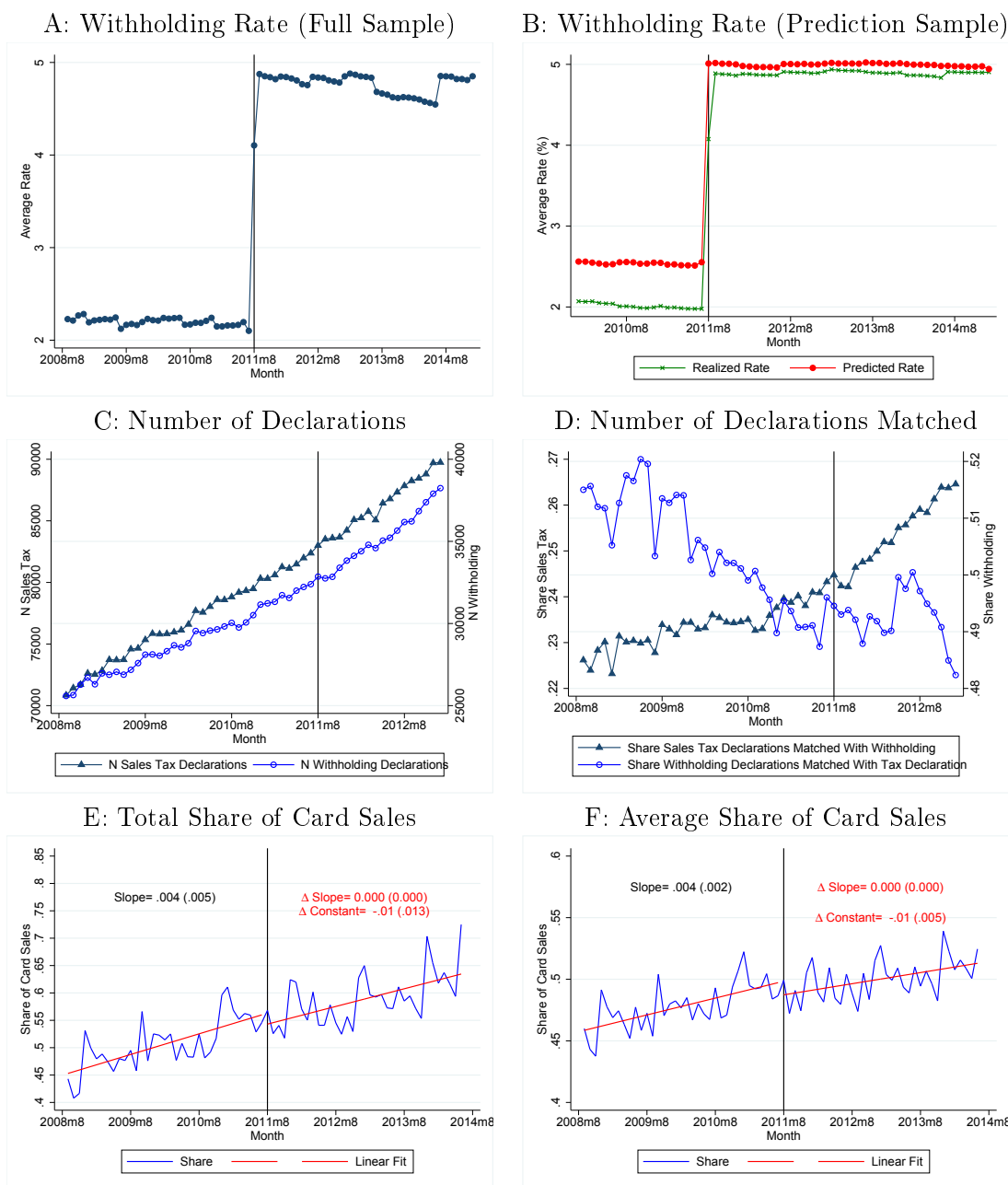


B: Corporations



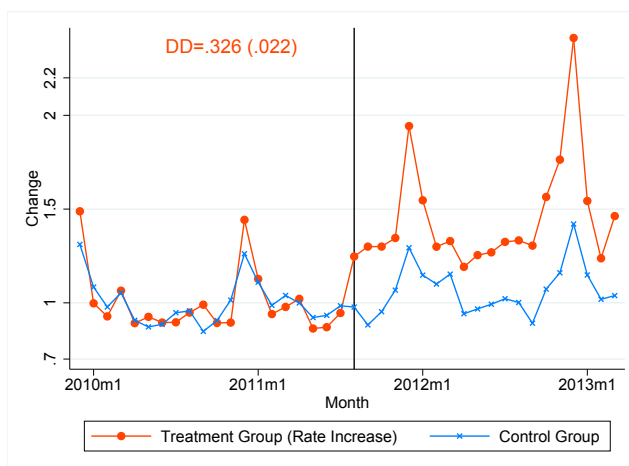
Notes: This figure displays event studies for different events, as indicated by the panel titles (first information report filed by the relevant reporting agent). The top row (A) is for the self-employed and the bottom row (B) for corporations. Each panel displays the year-on-year change (month-on-month change for credit/debit card reporting) in real reported taxable income (tax liability) for an event group (orange dotted line) and an event control group (blue crossed line). The black solid line marks event time 0, when firms in the event group are reported to the tax authorities for the first time by the reporting agent indicated in the panel title. The control group is reweighted by its propensity score of experiencing the event (cf. section 5.2, especially footnote 39, for details). Each group consists of a balanced panel of firms that can be observed for the entire period displayed. Panels A1-A3 and B1-B3 consider events happening in 2010-2012. Panels A4 and B4 consider events happening in 02/2009-08/2014. The text displays the difference-in-difference coefficient from estimating equation 1, for different outcomes variables as noted. VA stands for value-added rate.

FIGURE VII: WITHHOLDING RATE REFORM



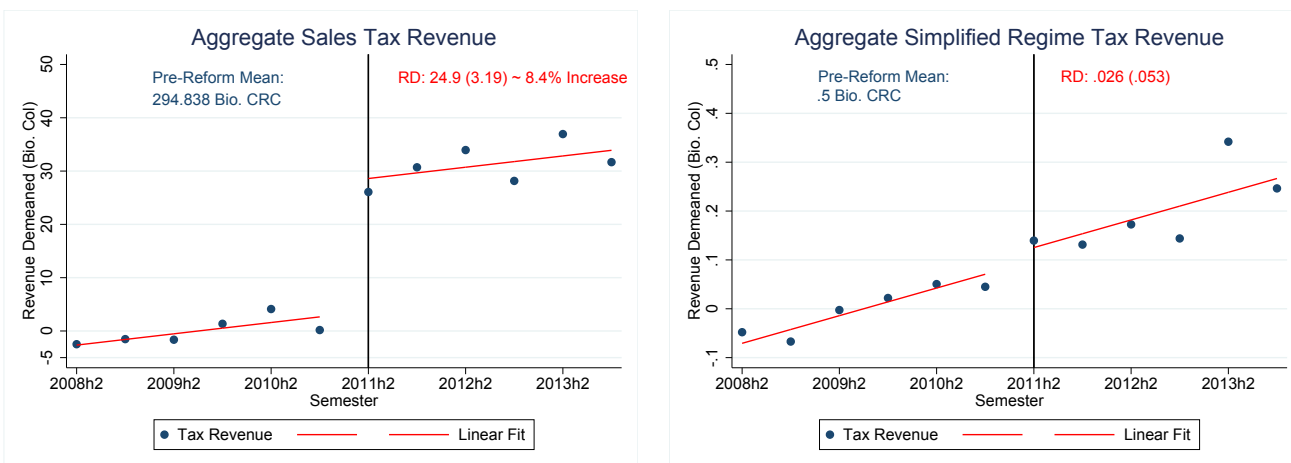
Notes: The figure displays the first stage of the withholding rate reform and analyzes the reform's effect on credit/credit card use. Panel A shows the average realized withholding rate among all firms subject to withholding. Panel B shows the average realized and predicted withholding rate among firms for whom we can predict the withholding rate based on previous semester's tax returns and the withholding rate schedule in Table II. Panel C shows the number of sales tax declarations and credit/debit card withholding declarations presented to the tax authorities, correcting for revisions and duplicates. Panel D shows the share of sales tax declarations matched with at least one withholding declaration and vice-versa. Panel E shows the share of card sales in total sales among firms with a credit/debit card machine, and panel F shows the average over the firm-specific shares of card sales among firms with a credit/debit card machine. The black solid line in all panels marks 08/2011, when the increase in the withholding rate for the sales tax entered into effect. Panel E and F show a linear fit that allows for a different trend and constant after the reform. The text displays the pre-reform slope of the linear fit, and the change in slope and constant after the reform, along with standard errors in parentheses.

FIGURE VIII: IMPACT OF WITHHOLDING RATE INCREASE



Notes: The figure displays the results of the difference-in-difference estimation of Equation 2, with total tax payment as outcome variable. It considers the overall impact of the reform, pooling all firms with a predicted rate increase in the treatment group. The control group includes firms experiencing no increase in the predicted withholding rate and firms not subject to withholding. The black solid line marks 08/2011, when the increase in withholding rates entered into effect. The data is winsorized by the 99th percentile, and scaled by the pre-reform average. The text displays the coefficient β (marginal effect compared to pre-reform average) from estimating Equation 2.

FIGURE IX: AGGREGATE IMPACT OF WITHHOLDING RATE INCREASE

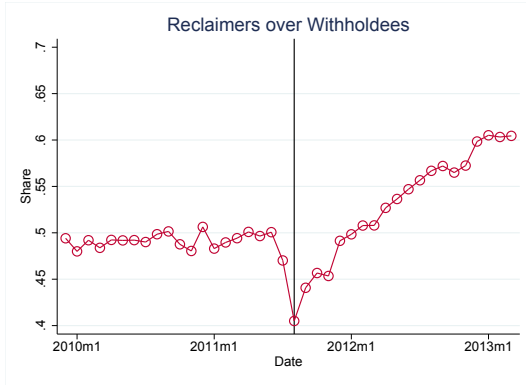


Notes: This figure shows the impact of the withholding rate reform in August 2011 on aggregate sales tax revenue (upper panel), and on aggregate revenue from the quarterly simplified regime tax, as a counterfactual (bottom panel). The sales tax data is based on official statistics from the Ministry of Finance, and the simplified regime data is based on firm-level tax declarations. The dots represent semester-wise tax revenue in billions of Costa Rican colones demeaned by the pre-reform semester-level means. For the upper panel, semesters are defined to fit exactly around the time of the reform. For each year, the first semester includes February to July, and the second semester includes August to December, and January of the following year. The red line is a linear fit, allowing for a discontinuity at the time of the reform. The text displays the pre-reform semester-level mean revenue from the tax (in blue), and the coefficient and standard error on the post-reform dummy (in red). The results are robust to running the analysis on monthly or quarterly data, using shorter or longer time series, and adding controls for the months of December and January (in the monthly data).

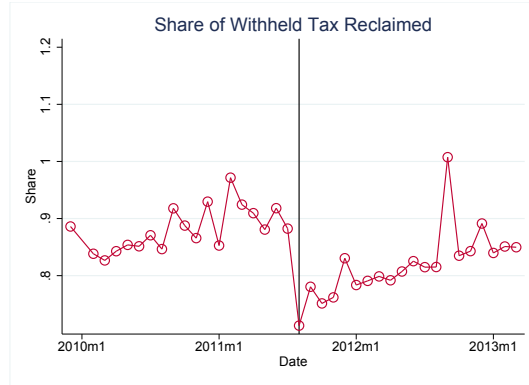
FIGURE X: MECHANISMS OF WITHHOLDING RATE IMPACT

Default Mechanism: Incomplete Reclaim

A: Share of Reclaimers

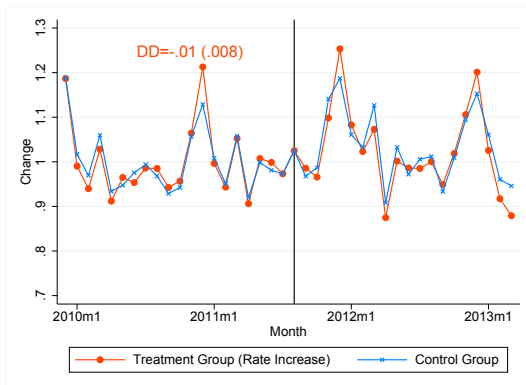


B: Share of Withheld Tax Reclaimed

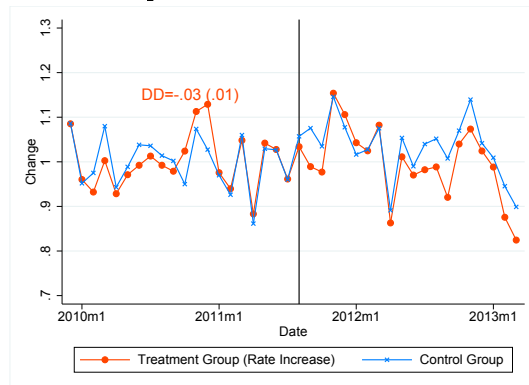


Salience of Enforcement Mechanism: Increased Reporting

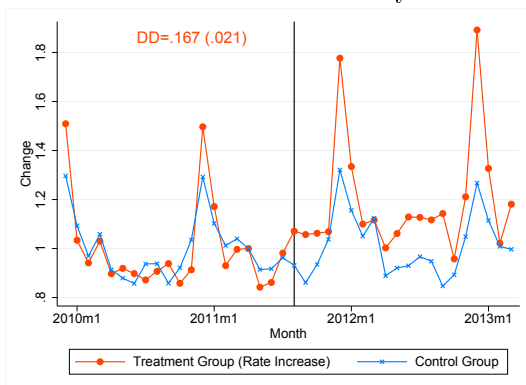
C: Sales Tax Collected



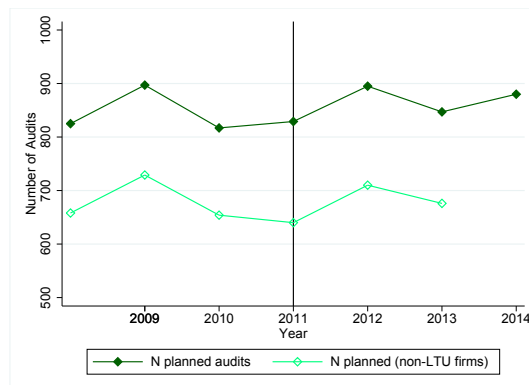
D: Input Tax Credit Deducted



E: Gross Tax Liability



F: Number of Audits



Notes: The figure displays evidence on the mechanisms for the withholding rate impact. In all panels, the black solid line marks 08/2011, when the increase in withholding rates entered into effect. Panels A and B display, for all firms subject to withholding in a given month, the share of firms making a reclaim, and the average share of withheld tax reclaimed. The shares are winsorized by the 99.9th percentile. Panels C, D and E show results of the difference-in-difference estimation of Equation 2, with different outcome variables, as indicated by the figure titles. The treatment group includes firms experiencing an increase in the predicted withholding rate in 08/2011, the control group includes firms experiencing no increase in the predicted withholding rate and firms not subject to withholding. The data is winsorized by the 99th percentile, and scaled by the pre-09/2011 average. The text displays the coefficient β (marginal effect compared to pre-reform average) from estimating Equation 2. Panel F shows the evolution over time of the number of planned audits for all taxpayers and for taxpayers who are part of the large taxpayer unit, as per the annual work programs of the audit department.

8 Appendix

8.1 Algorithm to Estimate Non-Filing: Income Tax

This section describes the procedure by which the pool of income tax-liable taxpayers is constructed for each year between 2010 and 2013. This pool forms the sample for Tables IV and VIII. The following algorithm is used to identify tax-liable firms:

- **Income tax filing:** Firms that declare income tax in current fiscal year t and are not found to have deregistered or switched to a simplified (non-tax-liable) regime by year t are included in the pool of income tax-liable taxpayers. Additionally, firms that filed in the previous year $t - 1$ and did not deregister or switch regimes in the interim are included to capture taxpayers who were previously identified as income tax-liable and then do not file in subsequent years. This condition is applied to generate the sample used in Table IV; for the sample used in Table VIII, the rule is extended to include firms that declared income tax in any year between $t - 1$ and $t - 3$ for years 2011 and later and between $t - 1$ and $t - 4$ for years prior to 2011, which are the historical rules officially applied by the tax authority for determining income tax liability, though in practice this condition may not have been systematically applied.
- **Registration:** Firms that are found to have registered with the tax authority in any of the previous three years prior to the current fiscal year t but did not file income tax returns in the current fiscal year are included. This step identifies firms that are officially registered as tax-liable but which did not file for the years during which these firms were registered, which step 1 does not capture as it relies only on the records of filings.
- **Subsequent deregistration:** In addition to identifying firms that are registered but do not file for income tax in prior years in step 2, firms that deregister in years following the current fiscal year t but are not found to have registered in year t or the previous three years are classified as having been income tax-liable despite not appearing on the official registration roster.
- **Declaring sales tax in current fiscal year:** Firms that declare sales tax in any of the months of the current fiscal year t - which spans from October of year $t - 1$ to September of year t - are included in the pool of income tax-liable taxpayers. This rule corresponds to the tax authority's official regulation that firms liable for sales tax are also deemed liable for paying income tax (though the reverse is not true).
- **Informative declarations:** Records of transactions between firms or between firm and the government provide information on the sales and costs of individual firms that can be used to

identify income tax-liable taxpayers. Firms that report or are reported as having tax-liable sales in the current fiscal through the third-party reporting mechanisms described above are included in the pool of income tax-liable firms.

8.2 Algorithm to Estimate Non-Filing: Sales Tax

This section describes the procedure by which the pool of sales tax-liable taxpayers are constructed for each month of fiscal years 2011 to 2013. This pool forms the sample for Tables IV and VIII, which reports the average of the monthly values for each measure in corresponding fiscal year. The following algorithm, which is similar to the method used to identify income tax-liable firms, is used to identify sales tax-liable firms:

- **Income tax filing:** Firms that declare sales tax in month m of the current fiscal year t and are not found to have deregistered or switched to a simplified (non-tax-liable) regime by month m in year t are included in the pool of sales tax-liable taxpayers. Additionally, firms that filed in the previous four months - $m - 4$ to $m - 1$ - and did not deregister or switch regimes in the interim are included to capture taxpayers who were previously identified as sales tax-liable and then do not file in subsequent months. This could include firms that either declare sales tax in previous months within the same fiscal year or in months falling within the previous fiscal year $t - 1$, depending on the month. This condition is applied to generate the sample used in Table IV; for the sample used in Table VIII, the rule is extended to include firms that declared sales tax in months between $m - 12$ and $m - 1$.
- **Registration:** Firms that are found to have registered with the tax authority in any of the previous thirty six months (three years) prior to the current month m of fiscal year t but did not declare sales tax in month m are included. This step identifies firms that are officially registered as tax-liable but which did not file for the years during which these firms were registered, which step 1 does not capture as it relies only on the records of filings.
- **Subsequent deregistration:** In addition to identifying firms that are registered but do not file for income tax in prior years in step 2, firms that deregister in months following the current month m but are not found to have registered within the previous thirty six months are classified as having been income tax-liable despite not appearing on the official registration roster.
- **Informative declarations:** Firms that are reported as having been subject to withholding by credit/debit card companies are considered tax-liable for the sales tax.

TABLE VIII: NON-FILING [LESS CONSERVATIVE ESTIMATES]

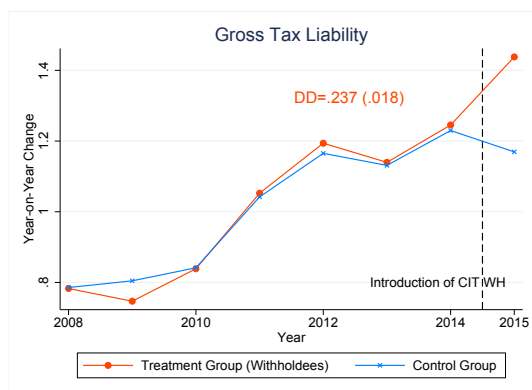
Panel A: Non-filing among all tax-liable firms					
	(1)	(2)	(3)	(4)	(5)
	% Non-filers	Of which registered non-filers	Non-filers' TPI sales as % of declared TPI sales	Undeclared sales as % of declared sales	Unreported liability as % of declared liability
Income Tax 2010	0.420	0.335	0.154	0.225	0.081
Income Tax 2011	0.509	0.239	0.195	0.246	0.077
Income Tax 2012	0.547	0.218	0.114	0.189	0.076
Income Tax 2013	0.586	0.266	0.112	0.203	0.104
Sales Tax 2011	0.335	0.960	.	.	.
Sales Tax 2012	0.325	0.955	.	.	.
Sales Tax 2013	0.372	0.962	.	.	.

Panel B: Non-filing among registered firms					
	All	Self-Employed	Self-Employed with TPI	Corporations	Corporations with TPI
Income Tax 2010	0.195	0.158	0.131	0.155	0.073
Income Tax 2011	0.198	0.161	0.134	0.143	0.071
Income Tax 2012	0.209	0.153	0.126	0.128	0.051
Income Tax 2013	0.273	0.215	0.158	0.216	0.067
Sales Tax 2011	0.326	0.439	0.155	0.192	0.073
Sales Tax 2012	0.315	0.423	0.126	0.185	0.054
Sales Tax 2013	0.363	0.478	0.101	0.185	0.040

Panel C: Non-filing among firms covered by information reporting				
	All	Reported by firms	Reported by state	Reported by card companies
Income Tax 2010	0.573	0.578	0.235	0.293
Income Tax 2011	0.652	0.658	0.202	0.297
Income Tax 2012	0.672	0.678	0.186	0.308
Income Tax 2013	0.676	0.681	0.177	0.320

Notes: These three panels show the share of non-filers for the income tax (rows 1-4) and the sales tax (rows 5-7). Non-filers are tax liable firms which have not submitted their own tax declaration for the relevant fiscal period. The algorithm used to construct the share of non-filers is explained in appendix section 8.1. The share of non-filers for the sales tax is an average across months in a fiscal year. Panel A shows the share of non-filers among all tax liable firms (column 1), the share of non-filers that a registered (2), non-filers' third-party reported sales as share of filers' reported sales (3), non-filers' estimates sales as share of declared sales (4), and non-filers' estimated tax liability as share of declared tax liability (5). TPI stands for third-party information, and TPI sales is the sum of all third-party reports except cost reports. A non-filing firm's estimated sales in in period t are the maximum of its third-party reported sales in t and its self-reported sales in the most recent prior reporting period. A non-filers' tax liability is estimated using its estimated sales, applying the average profit rate of filers in the corresponding decile of the sales distribution of filers, and the applying the tax schedule. Panel B reports the share of non-filers among all registered firms (1), and among subsamples and registered firms as indicated by the column headings (2-5). Panel C reports the share of non-filers among all firms covered by information reporting (1), and among subsamples of firms reported by different informing agents, as indicated by the column headings (2-4).

FIGURE XI: IMPACT OF INCOME TAX WITHHOLDING FOR FIRMS



Notes: This figure shows the impact of the introduction on withholding for the income tax in 2015 (corporation and self-employed) on reported gross tax liability, using a difference-in-difference estimation similar to equation 2, but on annual data. The treatment group contains firms that are subject to income tax withholding for the first time in fiscal year 2015.

FIGURE XII: CARD MACHINE STATEMENT

Pag. 1

Banco Nacional de Costa Rica
Dirección de Medios Electrónicos de Pago
Resumen de Depósitos para Comercios Afiliados
 De: 01/05/2016 Hasta: 31/05/2016

Fecha: 08/06/2016

Numero de Cuenta: [REDACTED]

Nombre de Cuenta: [REDACTED]

COLONES		Reporte Emitido por Cuenta				
		Valor Total	Ret. Venta	Ret. Renta	Comision	Neto a Pagar
01/05/2016	AUTOMATICO POR POS	1,356,380.00	0.00	23,872.29	53,945.20	1,278,562.51
02/05/2016	AUTOMATICO POR POS	483,100.00	0.00	8,502.56	19,135.55	455,461.89
03/05/2016	AUTOMATICO POR POS	1,465,575.00	0.00	25,794.12	58,448.16	1,381,332.72
04/05/2016	AUTOMATICO POR POS	1,026,590.00	0.00	18,067.98	40,844.40	967,677.62
05/05/2016	AUTOMATICO POR POS	687,650.00	0.00	12,102.64	27,452.58	648,094.78
05/05/2016	MANUAL/CARGO AUTOMATIC	944,500.00	0.00	16,623.20	37,543.50	890,333.30
06/05/2016	AUTOMATICO POR POS	818,500.00	0.00	14,405.60	32,657.50	771,436.90
07/05/2016	AUTOMATICO POR POS	676,900.00	0.00	11,913.44	26,774.45	638,212.11

Notes: This figure shows an example of the credit/debit card machine statement, that card processing companies provide to their affiliated businesses (clients) on a daily or monthly basis. The statement lists transaction amounts, withholding for the income tax and the sales tax remitted to the tax authorities and commissions to the card processing company.

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