Taxation, Information, and Withholding

Evidence from Costa Rica

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WORLD BANK GROUP
Macroeconomics and Fiscal Management Global Practice Group
March 2016
Abstract

This paper studies tax withholding on business sales, a widely used compliance mechanism which is largely ignored by public finance theory. The study introduces a withholding scheme, whereby the payer in a transaction collects tax from the payee, in a standard evasion model. If the taxpayer can fully reclaim the tax withheld, withholding is irrelevant to her evasion decision. If reclaim is costly, however, withholding establishes a compliance default. To show this empirically, the analysis exploits a ten-year panel of registration, income tax and sales tax records from 400,000 firms in Costa Rica, and over 20 million third-party information and withholding reports. The paper first documents the anatomy of compliance, providing novel measures of compliance gaps on the extensive, intensive and payment margins. It then shows that interventions leveraging the existing third-party information reduce these compliance gaps only marginally. Coverage by a withholding scheme, in contrast, is correlated with higher reported taxable income both across firms and within firms across time. Quasi-experimental estimations show that a doubling of the withholding rate leads to a 40 percent increase in tax payment among treated firms and a 10 percent increase in aggregate revenue. The mechanisms are incomplete reclaim of the tax withheld and reduced misreporting.

This paper is a product of the Macroeconomics and Fiscal Management Global Practice Group. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at abrockmeyer@worldbank.org.
Taxation, Information, and Withholding: Evidence from Costa Rica*

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*Corresponding author: Anne Brockmeyer, abrockmeyer@worldbank.org  Marco Hernandez: marcohernandez@worldbank.org. This paper is an update of World Bank Policy Research Working Paper 7600 (March 2016). The last version of this paper can be found at https://sites.google.com/site/annebrockmeyerworldbank/home. We are exceedingly grateful to the Ministry of Finance and the General Directory for Taxation of Costa Rica for outstanding collaboration. In particular, we are indebted to Fernando Rodriguez Garro and Carlos Vargas Duran, as well as to Laura Badilla Castro, Lorena Chacon Sanchez, Graciela Garcia Santamaria, Mercedes Padilla Delgado, Manuel Enrique Ramos Campos, Karla Salas Corrales, Ronald Solorzano Vega and Giovanni Tencio Pereira. We thank François Gérard, Henrik Kleven, David McKenzie and Joana Naritomi and seminar participants at LSE STICERD, the National Tax Association conference, Public Economics in the UK conference, and the World Bank for helpful comments. Juliana Londoño Vélez, Spencer Smith and Gabriel Tourek provided excellent research assistance. All errors are our own.
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). In a 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. 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 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 Costa Rica, the law states that 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, it is costly for the taxpayer to reclaim the tax withheld. Taxpayers incur an administrative cost to make a reclaim, they can reclaim only if they are compliant on the extensive margin, and reclaimers may face a higher audit probability. 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 start by introducing withholding in a simple model of tax evasion following Allingham & Sandmo (1972). We show that, if the withheld tax can be fully reclaimed, withholding is irrelevant to the taxpayer’s evasion decision. We then propose a model with costly reclaim, which predicts that only a fraction of taxpayers reclaim the tax withheld and an increase in the withholding rate increases reported taxable income.

To test the predictions of our model empirically, we exploit various sources of quasi-experimental variation in the income and sales tax system in Costa Rica, and a nine-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

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1 This is distinct from withholding on wages, a tax compliance mechanism that is applied almost universally and well understood (Kleven et al. 2011). See Figure I for a preliminary analysis of the use of sales withholding by country income levels.

2 In some countries, the payee also withholds from the payer, adding tax to the invoice.
with over 20 million third-party and withholding records from firms’ transaction partners, financial institutions and state institutions. We match each firm with the information reports it provided and the information reports received about its activities.

Our analysis is divided into two parts. In the first part, we leverage the data to conduct a detailed anatomy of compliance. 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 over 30% of tax-liable firms fail to file a self-assessment declaration for the income tax. The share of non-filers is equally high in the subsample of tax-liable firms covered by third-party information and thus definitely identified as economically active. Overall, 10% of third-party reported sales are not declared by the taxpayer. Unlike survey or macro-based measures of informality, our method uses micro-administrative data to identify compliance gaps at the margin between full informality and formality. Our estimates do not capture fully informal firms, but we argue that they identify the policy relevant segment of tax payers in which compliance can be enhanced at low cost.

We also find significant compliance gaps on the intensive margin, as evidenced by under-reporting of sales compared to third-party information, and large and sharp bunching at the first income tax kink. The share of under-reporters for the income tax constitutes 18% of the self-employed and 9% of corporations. In this sample of under-reporters, over 40% of third-party reported sales remain undeclared. These compliance gaps persist even several years after the relevant filing period, and despite systematic government cross-checks of third-party information with tax records.

On the payment margin, we find that compliance is relatively high, although a non-negligible fraction of small firms pay their liabilities with several years of delay. Together, this evidence of non-filing, misreporting on the intensive margin and significant payment delays among small taxpayers suggests that there are limits to the extent to which third-party information, reminders and audits can help to enhance tax compliance. This provides a rationale for the use of withholding as an alternative enforcement mechanism.

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3 We borrow the term from Kleven et al. (2011) who conduct an anatomy of compliance for wage earners and the self-employed in Denmark.

4 In a companion paper, Brockmeyer et al. (2015) show that credible deterrence messages from the tax authorities significantly increase tax filing and payment among these firms.

5 Previous 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, Almuni & Rodriguez 2015 for an enforcement notch in the Spanish corporation tax).

6 These estimates are lower than similar estimates for firms in Ecuador from Carrillo et al. (2014). However, given the incompleteness of third-party records, our estimates are weak lower bounds on evasion, and weaker compared to Carrillo et al. (2014) who also used customs data.
We turn to analyze the impact of withholding in the second part. We begin by showing that coverage by a withholding scheme is strongly correlated with higher reported taxable income across firms and within firms across time. Across firms, we find that bunching is significantly smaller among firms covered by third-party information reporting and even smaller among firms subject to withholding, either by a state institution or by their credit/debit card provider. Across time, we find that firms that become subject to withholding exhibit a significant increase in reported taxable income precisely in the year in which they are subject to withholding for the first time.

We then exploit a sales tax withholding reform in a difference-in-difference design, finding that a doubling of the withholding rate leads to an approximately 40% increase in total tax payment among taxpayers subject to withholding. In aggregate, the withholding rate reform increased sales tax payments by about 10%. This response is driven by incomplete reclaim of the tax withheld, and an increase in reported taxable income among firms subject to withholding. This confirms the impact mechanisms predicted by our conceptual framework. We also confirm that only a tiny fraction of taxpayers reclaim through other channels, for instance on another tax declaration or by requesting a cash refund. We conclude that withholding increases tax payments by establishing a compliance default.

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 explain the prevalence of withholding schemes for firms as an enforcement tool in low-compliance environments. They also highlight the important role of firms in enforcing taxes (here as withholding agents), as suggested theoretically by Kopczuk & Slemrod [2006] and Kleven et al. [2015], 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 (Carrillo et al. [2014], Slemrod et al. [2015], Pomeranz [2015], Naritomi [2015]). Consistent with Carrillo et al. [2014], we find under-reporting of sales as well as costs. We also find that the presence of third-party information is correlated with compliance on the intensive margin, and on the extensive margin among registered firms. Finally, our paper provides novel estimates of extensive margin compliance gaps and payment compliance. Shedding light on substantial payment delays, we highlight the importance of analyzing payment data in addition to tax liability data, which previous studies have focused on.

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7 Overall, withholding agents collected 10% of corporate income tax revenue and 20% of sales tax revenue in 2014.
8 Results available upon request.
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 that even rational agents do not display. To the extent that there might be a behavioral interpretation of some of our findings, our paper also relates to the study of optimal taxation with behavioral agents in Farhi & Gabaix (2015).

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). 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. Sections 3 and 4 present the Costa Rican tax system and data. Sections 5 and 6 present the anatomy of compliance and the impact of withholding, and 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. (2014) 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 finally consider a model of withholding with costly reclaim.
2.1 A Simple Tax Evasion Model

The basic setup of our model follows Carrillo et al. (2014). 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 \( \tau \) 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 \( \theta \) which is proportional to the evaded liability. Firms maximize expected utility over after-tax income in the audited and non-audited state of the world, \( Y_A \) and \( Y_N \):

\[
EU = (1 - p)U(Y_N) + pU(Y_A) = (1 - p)U(\pi - \tau \hat{\pi}) + pU(\pi - \tau \pi - \theta \tau (\pi - \hat{\pi})).
\]

To take into account the tax authorities’ use of risk scores to target audits, we further follow Carrillo et al. (2014) by assuming that the audit probability is decreasing in the reported profit rate, \( p = p((\hat{\pi} + \epsilon)/\hat{R}) \) with \( p' < 0 \), and mis-reporting against third-party information leads to certain detection: \( p = 1 \) if \( \hat{R} < R_T \). With these assumption, firms choose to report \( \hat{R}^* \geq R_T \), and choose \( \hat{C}^* \geq C \) to satisfy the first-order condition.

To ensure that the government always prefers less evasion, i.e. \( \partial R/\partial \hat{\pi} > 0 \), we assume that \( \theta \) and \( p' \) are small, which are reasonable assumptions in a middle-income country. As is also standard in the literature, we ensure 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 witheld at a rate \( \mu \) 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

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9 As Carrillo et al. (2014), 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.

10 The inclusion of \( \epsilon \), 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 \( \hat{\pi} = 0 \).
 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

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

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

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.

### 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 $\mu R_T$. This fixed cost can represent the cost of collecting withholding receipts for each transaction and adding up the amounts when preparing the tax return. It 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 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. 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 $f_i < \mu R_T$ and non-reclaimers experience a decrease of their after-tax income of $\mu R_T$. For both types of firms, the absolute decrease is the same in the audited and non-audited state. 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 $\hat{\pi}_1$ and non-reclaimers declare $\hat{\pi}_2$ with $\hat{\pi}_2 > \hat{\pi}_1 > \hat{\pi}^*$, where $\hat{\pi}^*$ is the taxpayers’ optimum in the baseline model without withholding. Intuitively, the decrease in after-tax income hurts firms 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

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11 Other non-innocuous assumptions of the model are the absence of an extensive margin decision and the full payment of declared net liabilities $P$.

12 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).

13 We assume that non-reclaimers lose the amount of tax withheld also when they are audited. This is true if they did not keep receipts recording the amounts withheld.
of detection. As the decrease in after-tax income is larger for non-reclaimers, they respond more strongly to the withholding scheme.\textsuperscript{14} It is trivial to see that $\partial \hat{\pi}_1 / \partial f > 0$ for reclaimers, with $\mu$ being irrelevant, and $\partial \hat{\pi}_2 / \partial \mu > 0$ for non-reclaimers. The second testable prediction of the model is thus that an increase in the withholding rate increases reported taxable income, $\partial \hat{\pi} / \partial \mu > 0$.\textsuperscript{15}

**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 a higher tax liability in addition to the tax withheld:

$$
G = (1 - p) \left[ H(\bar{f})[\tau \hat{\pi}_1] + (1 - H(\bar{f}))[\tau \hat{\pi}_2 + \mu R_T] \right] 
+ p \left[ H(\bar{f})[\tau \pi + \theta \tau (\pi - \hat{\pi}_1)] + (1 - H(\bar{f}))[\tau \pi + \mu R_T + \theta \tau (\pi - \hat{\pi}_2)] \right].
$$

The introduction of withholding thus increases government revenue both mechanically, through the collection of tax withheld, and through the increase in reported tax liabilities.\textsuperscript{16} However, the setting of the revenue maximizing withholding rate $\mu$ involves a trade-off, so that revenue may increase or decrease in $\mu$, $\partial G / \partial \mu \geq 0$. On the one hand, a higher withholding rate allows the government to collect more revenue from non-reclaimers. On the other hand, the higher rate induces more firms to incur the fixed cost and become reclaimers, which reduces government revenue as $\partial G / \partial H(\bar{f}) < 0$. The effect of a withholding rate increase on government revenue is thus theoretically ambiguous. We proceed to estimate this effect empirically using policy variation in Costa Rica.

### 3 Tax System

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

\textsuperscript{14} As has been shown in the referenced papers, $\hat{\pi}$ also increases in $p$, $\theta$ and $R_T$.

\textsuperscript{15} An increase in the withholding rate from $\mu_1$ to $\mu_2 > \mu_1$ will also induce some non-reclaimers to become reclaimers. However, these firms will still experience a decrease in their after-tax income by $f_i - \mu_1 R_T$, as $\mu_1 R_T < f_i < \mu_2 R_T$ for them, so that they will also chose to increase reported taxable income.

\textsuperscript{16} This result would be strengthened in a context of extensive compliance gaps or under-payment of liabilities.
and income tax schedule for the two firm types differ.\footnote{Wage 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.} This section presents first the income and sales tax system in Costa Rica, and then the compliance mechanisms used to enforce taxes, information reporting by third parties and withholding.

### 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.\footnote{Fiscal 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.} 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 obligation. 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.\footnote{Corporations also claim a different set of deductions than unincorporated firms.} 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.

### 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 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.\textsuperscript{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

\textsuperscript{20} In 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.
purchases at the auction. Each transaction must be reported only once, either by the seller or the buyer.

### 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. 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, or in future fiscal periods.

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, or in case the firm colludes with the withholding agent to apply a lower withholding rate, the actual withholding rate may differ from the rate predicted by value-added or share of local sales in semester \( t - 2 \).

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.

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.

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

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21 Only 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 11.2% of corporations respectively. 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. The picture is currently incomplete, as we still work on incorporating the simplified regime declarations D105 into this analysis. However, given the small number of firms in this regime (20,000-30,000 returns filed per quarter) their absence from our analysis cannot fully explain the discrepancies between the presence of third-party reports and tax declarations.

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 oficio, which happens if a firm has not filed taxes for at least three years, a D141 form is used.

5 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, matching tax declarations filed and the set of tax liable firms as constructed from the tax register and available third-party reports. We then consider the intensive margin, comparing third-party reported and self-reported sales and analyzing bunching around tax bracket thresholds. Finally, we estimate compliance with the payment obligation, comparing tax returns with payment returns. To the extent possible, we compare compliance by the self-employed and by corporations.

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22 As 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.

23 Retailers 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).
5.1 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 year $t$, (iii) is covered by at least one third-party informative declaration in year $t$, (iv) has filed income tax at least once in the previous three fiscal years and has not deregistered since, or (v) has registered within the previous three fiscal years and has not deregistered since. The three-year window reflects the tax authorities’ practice of deregistering a firm de oficio if it has not filed for three years. For the sales tax, we consider only firms that are registered as liable for the sales tax and have not changed their registration status since, or are covered by information reporting by credit/debit card providers for the purpose of sales tax compliance.

The algorithm allows us to estimate the share of non-filers, i.e. tax-liable firms that failed to submit their self-assessment declaration, for different taxes, subsamples and firm types. For demonstration purposes, we consider filing in fiscal year 2014 and December 2014 for the income tax and the sales tax respectively. However, the results are similar for years 2009-2012 (figures available upon request). We are currently studying late filing behavior, and updating the results to take into account the tax returns filed under the simplified regime.

The first panel of Figure II shows that the share of non-filers is substantial, ranging from 34% for the income tax to 45% for the sales tax. The share is equally high (and even higher for the sales tax) among firms covered by third-party information. 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. The high share of non-filers among third-party reported sales-tax-liable firms could be due to the fact that credit/debit card companies report transactions even for firms that are not liable for the sales tax, an explanation we are currently investigating. For the income tax, an average of 10% of total third-party reported sales remain unreported for 2009-2013, and 30% are still unreported for 2014.

To analyze filing behavior across firm types, we focus on the subsample of registered firms,

\footnote{We exclude information on D151 cost reports, which could pertain to wage-earning individuals who purchased goods from a firm.}

\footnote{This algorithm will be described in more detail in a forthcoming data appendix.}

\footnote{According to the \textit{código de normas y procedimientos tributarios}, the period until a taxpayer gets deregistered \textit{de oficio} is three years until September 2012 (when the relevant article was amended), and four years from then on. A resolution in September 2014 emphasized that non-filers should be deregistered after four years, so the tax authorities' implementation of the rule may have strengthened thereafter.}
which are identified as either self-employed or corporation. The second panel in Figure II shows that compliance is generally higher among registered firms. Besides, we now observe a positive correlation between information-coverage and filing, as theory would predict. The fact that third-party information is correlated with filing only for registered firms could be due to the fact that the authorities have contact information for registered firms, and can thus follow up on non-filers. This is more difficult for firms that are identified by third-party information but not registered, for whom the authorities have only incomplete contact information. Consistent with the self-enforcing nature of the VAT, compliance is higher for the sales tax than for the income tax. However, whether firm type is correlated with filing is unclear and warrants further analysis. Corporations exhibit higher compliance for the income tax, while the self-employed exhibit higher compliance for the sales tax.

Given the incomplete nature of the third-party information trail, these estimates are a weak lower bound of extensive margin compliance gaps. The estimates do not capture firms that are fully informal and do not trade with institutions or firms that are 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 in the sample captured in Figure II can be increased significantly through low-cost deterrence emails.

5.2 Intensive Margin Compliance

5.2.1 Self-Reports vs. Third-Party Reports

To examine compliance on the intensive margin, we first compare self-reports and third-party reports, for sales and costs respectively. More specifically, we follow Carrillo et al. (2014) by plotting the distribution of the log difference of self-reports and third-party reports, and extend the analysis to the sales tax. The tax authorities in Costa Rica systematically cross-check all tax returns against third-party information and notify firms with substantial discrepancies, or invite them for an interview with a tax official. To take into account that firms may revise their return to correct discrepancies, we consider the tax year 2012 rather than more recent years. However, the results for other years are similar and are available upon request.

The first panel in Figure III compares sales reports for the income tax to third-party reports. Third-party reported sales is either the sum of sales reported under D150, D151 and D158, or sales reported under D153, whichever is larger. The figure shows that the majority of firms report

27While the D150, D151 and D158 declarations are mutually exclusive and the sales amounts can be summed, as
sales higher than third-party reports and few firms bunch at the point where the self-report equals
the third-party report. Yet, 18% of the self-employed and 9% of corporations report sales lower
than third-party reports. Overall, among the under-reporters, the self-employed declare only 52%
and corporations declare 54% of third-party reported sales. Of course, these estimates are again
lower bounds to the true compliance gaps, given the incompleteness of the information trail. It
is striking that these substantial discrepancies persist even three years after the filing period, after
revisions were requested by the authorities, and in an environment with a relatively high capacity tax
administration. This confirms that there are limits to the extent to which third-party information
can help to enhance tax compliance, especially among the self-employed.

The second panel repeats the exercise of the first panel, focusing on cost reports. Third-party
reported costs for the income tax is the sum of costs reported under D151 and D158. Surprisingly,
a large share of firms declares costs lower than third-party reported costs, and this behavior is
much more pronounced among the self-employed. 60% of the self-employed and 28% of corporations
under-utilize costs. For the self-employed, profits below the first kink are tax exempt, so a firm has
an incentive to under-report only until its profit is below the first kink. For corporations, there is no
exemption, so the under-utilization of costs is all the more surprising. Among the under-reporters,
the self-employed declare 59% and corporations declare 76% of third-party reported costs. These
findings are in line with Carrillo et al. (2014), who show evidence for cost under-reporting among
firms in Ecuador, arguing that firms have an incentive to appear small by under-reporting both costs
and sales.

The third panel compares self-reported and third-party reported sales for the sales tax, using the
credit/debit card reports as third-party information. Compared to the first panel, we find a similar
share of under-reporters among corporations (10%), but a smaller share among the self-employed
(12%)\footnote{they refer to transactions conducted with three different types of agents, a transaction could potentially be reported both in a D153 and a D150/D151/D158 form.}. However, interpreting the discrepancy as a compliance gap is more complicated for the sales
tax than for the income tax. The D153 reports cover all transactions that a sales taxpayer conducts,
including transactions not liable for the sales tax. Firms also report both taxed and non-taxed sales
on their tax return, but they might under-report the non-taxed sales as those are irrelevant to their
tax liability. Interpreting under-reporting as a compliance gap thus requires assuming that firms do
not selectively under-report non-taxed sales.

\footnote{Note that both sales reported on the D153 informative declaration and on the D104 sales tax return should be inclusive of sales tax. However, the spike in the histogram at $-0.122 \approx \log(X) - \log(1.13 \times X)$ for a large $X$ suggests that some firms erroneously report their sales net of sales tax.}
This seems to be a strong assumption, as the final panel suggests. The figure shows that firms which file both sales tax and income tax exhibit a high degree of internal consistency. The share of bunchers, reporting the same amount of sales for the income tax as for the sales tax is 67% and 60% among the self-employed and corporations respectively. However, the non-bunchers are more likely to report higher sales on the income tax declaration compared to the sales tax declaration than vice-versa.

5.2.2 Bunching

While the comparison of self-reports to third-party reports has uncovered significant compliance gaps, at least for the income tax, this approach can identify misreporting only for firms which are covered by third-party information. Besides, it constitutes only a weak lower bound of misreporting, given the incomplete nature of the information trail. To identify misreporting in the full sample, including firms not covered by information reports, we analyze bunching of taxpayers around the first threshold in the income tax schedule. In theory, bunching can be driven by a real response or by evasion or avoidance. In practice, however, most studies have found that bunching is largely driven by misreporting rather than real response (e.g. Almunia & Rodriguez 2015, Seim 2015). This section demonstrates that the nature of bunching in Costa Rica is consistent with bunching through misreporting, but difficult to reconcile with a real response.

Instead of comparing the bunching behavior for self-employed and corporations, which is complicated by the fact that the relevant thresholds are kinks in one case and notches in the other and also located at different points in the income distribution, we focus in this section on bunching among the self-employed at the first income tax kink. Bunching among corporations at the first revenue notch behaves in qualitatively similar ways and will be used in Section 6.1 to examine the correlation between misreporting and withholding.\footnote{See also Bachas (2015) who uses the notches in the corporate income tax to estimate the elasticity of corporate revenue, costs and profits.} We focus on the first kink in the self-employed tax schedule, which is the largest and most salient, featuring a marginal tax rate jump from 0% to 10%. Bunching at the second kink is qualitatively similar but smaller, consistent with the fact that the tax incentive is smaller and the second kink is less salient as a reference point. Bunching at the third and fourth kinks is difficult to estimate as the density distribution around these kinks is lower and more noisy, making it more difficult to distinguish bunching behavior from noise.\footnote{Results available upon request.}

Figure V plots the frequency distribution of taxable income for the self-employed around the first kink, in income bins of CRC 20,000, for each year from 2006 to 2014. The solid vertical line marks the
kink location in year $t$, corresponding to the figure title, and the dotted vertical line marks the kink location in year $t-1$. The income distribution is characterized by a large and sharp excess mass at the kink in every single year. The movement of bunching with the kink location over time supports the interpretation of bunching as a behavioral response to the kink rather than a feature of the income distribution which coincides with the kink location. Except in two years (2010 and 2014), there is no 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 corroborates our interpretation of bunching as a reporting response rather than a real production change. If bunchers moved to the kink by adjusting their production level, this adjustment would likely take longer to materialize and would yield less precise bunching.

Strikingly, 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 warrants 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.

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31 Kink are thresholds at which the marginal tax rate jumps discontinuously. Notches are thresholds at which the average tax rate jumps discontinuously. Kinks imply a marginal change in tax liability, and hence generate bunching which is symmetric around the threshold. Taxpayers are equally well-off just below and just above the kink. Notches, on the contrary, imply an increase in the tax rate on all units of income, and hence a discrete jump in the tax liability. Notches therefore create a strictly dominated area above the threshold, where firms would not locate unless optimization frictions prevent them from responding to the tax incentive. This generates bunching below the threshold and a missing mass (hole) above the threshold.

32 See for instance Devereux et al. 2014 and Brockmeyer 2014 for evidence on this from the United Kingdom.
5.3 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 returns. 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. 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.\textsuperscript{33}\textsuperscript{34} 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.\textsuperscript{35} We take the share of payment over liability and average this share across all taxpayers in each fiscal period.

The results are displayed in Figure VI for the income tax (top panel) and for the sales tax (bottom panel). In both figures, the average payment share is below 100% in all fiscal periods, and decreases as we consider more recent years, dropping to 70% for the income tax and 85% for the sales tax in 2014. This is despite the fact that we consider payments made until June 2015 for the income tax and until October 2015 for the sales tax. Thus, although the payment rate reaches an average of approximately 95% within four years of the filing period, a non-negligible share of payments are made with several years of delay. 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 and legally enforcing outstanding payments is costly for the tax authorities.

However, the total payment share, meaning the sum of payments as a share of the sum of net liabilities for all firms, is higher than the average payment share for the self-employed and reaches almost 100% even in recent years, suggesting that the late payments are predominantly small amounts. This is again consistent with the fact that smaller firms are more likely to be cash constrained. For corporations, however, the total payment share is substantially below 100%, driven by a small number of taxpayers with large liabilities and zero payment. This is likely due to missing payment records and may also explain why the average payment rates are lower for corporations than for the self-employed, at least for the sales tax. We show this result in appendix Figure XIII.

To ensure that our main results on the causal impact of withholding are not driven by gaps in

\textsuperscript{33} Del Carpio (2014) provides estimates of property tax compliance in Peru.
\textsuperscript{34} Note 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. As the advance payments for the income tax constitute three quarters of the total tax liability, the remaining tax to be paid at the end of the fiscal year is relatively small.
\textsuperscript{35} Including payments that are enforced retroactively by the tax authorities through administrative or judicial procedures makes little difference to the results.
the payment data, we conduct a series of robustness checks explained below and displayed in the appendix.

To summarize, the anatomy of compliance allows the following preliminary 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. The share of non-filers is similarly large in the full sample of tax liable firms and in the subsample of firms covered by third-party information. Second, a substantial share of firms under-report sales compared to third-party reports, and misreport taxable income to bunch below kink points, despite the fact that the authorities systematically cross-check tax returns and informative declarations and request corrections of discrepancies. Finally, a non-negligible share of small firms pay their outstanding liabilities with several years of delay. The fact that these compliance gaps are present despite the use of third-party information, and are particularly prevalent among small firms which are costly to follow up on for the authorities, provide a rationale for the use of withholding as an additional compliance mechanism, which comes at a low implementation cost for the authorities.

6 Impact of Withholding

This section analyzes the compliance impact of withholding. We start by examining the correlation between coverage by withholding and tax compliance, across firms and across time. Heterogeneity in bunching across subsamples of firms provides for cross-sectional correlations. An event study around the timing of the receipt of the first withholding declaration provides for correlations within firm across time. We then exploit the 2011 reform of sales tax withholding to estimate the causal impact of the withholding rate increase in a difference-in-difference design, and investigate the mechanisms driving the impact.

6.1 Correlations across Firms: Heterogeneity in Bunching

To examine the heterogeneity of bunching across subsamples of firms, we pool the data for all years and display the distribution as percentage difference from the year-specific 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, Klevén & 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. 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 VII displays the observed distribution (dotted blue line), the estimated counterfactual (solid red line) and excess/missing mass estimates for three different subsamples. The top row shows the distribution of taxable income for the self-employed around the first kink, the bottom row shows the distribution of revenue for corporations around the first notch. The figures on the far left reflect the sample of firms not covered by any information reporting or withholding declaration. The figures in the middle reflect the sample of firms covered only by information reporting through the D151 or D158 declarations. Whereas several papers have analyzed the heterogeneity in bunching by proxies of evasion propensity [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. The subsample of information-covered firms 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 covered by 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. 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 is incomplete, covering only large transactions. Firms can still manipulate their taxable income by misreporting small and cash transactions, inflating costs, and using deductions and exemptions.

Comparing the figures in the center to the far right figures, which reflect the sample of firms covered by withholding by either state institutions (D150) or credit/debit cards (D153), it becomes clear that withholding further reduces firms’ ability to misreport. The excess mass drops to 1.19 for the self-employed and to 1.33 for corporations, estimates which are statistically significantly different from the estimates in the corresponding middle panels, and the missing mass also decreases in both

36 The 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.

37 Note 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 the middle and far right figures. This suggests that the threshold may still be perceived as a kink by some firms in the subsample not covered by information reporting.

38 Bunching is also present in all economic sectors and relatively homogenous across sectors.
samples.\textsuperscript{39}

Although the heterogeneity of bunching across subsamples is consistent with a compliance impact of information reporting and withholding, these results are based on correlations. Subsamples of firms covered by information reporting are different from non-covered subsamples in many aspects. It is possible that characteristics other than coverage by informative declarations explain the weaker bunching in covered subsamples. Similarly, the results are consistent with the notion that withholding may be a more effective compliance instrument than mere information reporting, but do not constitute causal evidence for this.\textsuperscript{40} The D151/D158, D150 and D153 declarations apply to different types of transactions, firm-to-firm, firm-to-state transactions and card transactions respectively, so that the declarations and the firms covered by them are not strictly comparable.\textsuperscript{41}

### 6.2 Correlations across Time: Event Study

To hold at least firm characteristics constant, we exploit the panel dimension of the data set and estimate within firm correlations across time between information reporting/withholding coverage and reported taxable income. Each year, over a thousand firms switch into being covered by information reporting and/or withholding. This can happen for several reasons. A firm becomes covered by D151 information reporting from other firms once the transaction volume with a transaction partner passes the annual threshold for D151 reporting, if an agreement with a transaction partner to not report the transaction breaks down, or if the firm gains a new (reporting compliant) transaction partner. A firm becomes covered by D150 withholding by state institutions once it sells to a state institution, and a firm becomes covered by D153 withholding by credit/debt card companies when it starts conducting sales through card transactions.\textsuperscript{42}

To assess whether becoming covered by information reporting or withholding increases firms’ reported taxable income, we conduct an event study around the time of switching into coverage by one of these compliance mechanisms. As in in Hilger (2014) and Naritomi (2015), we construct an event control group, that is the propensity-score weighted average of the control firms, the propensity-score

\textsuperscript{39}The results are similar when considering separately firms subject to withholding by state institutions and by credit/debit card companies.

\textsuperscript{40}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.\textsuperscript{IRS2012}.

\textsuperscript{41}For 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. Similarly, transactions conducted by credit card have different characteristics than transactions conducted in cash.

\textsuperscript{42}Given the structure of reporting requirements, each firm should be aware of the informative declarations held by the tax authorities about its business activities. When subject to withholding, firms also receive a receipt from the withholding agent stating the amount of tax withheld.
capturing each control firm’s likelihood of becoming covered by the relevant compliance mechanism (receiving the relevant informative declaration for the first time). However, as firms have control over the conditions which lead to information reporting and withholding (e.g. sales volume, transaction partners, accepted payment methods), the event study cannot be interpreted as a causal estimation. Firms that become information/withholding covered might be firms that experienced an increase in their true profits, or were already planning to become more tax compliant.

With these caveats in mind, we consider the event group $E$ of firms that switch into information/withholding coverage for the first time in event year $k = 0$, and the event control group $C$ of firms which have not switched into coverage by $k = 0$. For each event year, we estimate the firms’ propensity score of switching into information/withholding coverage. Following DiNardo et al. (1996), we re-weight the control group by percentile bins of the propensity score to match the distribution of the event group. To examine pre-event trends, we restrict the estimation to firms in the balanced sample for 2006-2014 and events happening in 2010 and 2011. The estimation thus covers event years $k \in [-4, 3]$.

Each panel in Figure VIII displays the change in reported taxable income for the event group (orange dots) and the control group (blue crosses), compared to the pre-event average, along with the DD coefficient obtained from estimating

$$y_{gk} = \alpha_g + \gamma_k + \beta \cdot I\{k \geq 0, g = E\} + u_{gk},$$

where $y_{gk}$ is log taxable income reported by event group $g$ in event year $k$, $\alpha_g$ and $\gamma_k$ are group and year fixed effects, and $u_{gk}$ is the error term. Panels on the left side of the figure correspond to the self-employed, and panels on the right side correspond to corporations.

The first panel shows that becoming covered by information reporting is associated with an 18% increase in reported taxable income for the self-employed. For corporations, the control group displays a different trend, so that it is difficult to draw a conclusion from the evidence. The middle and bottom panels on the left side show that becoming covered by withholding, either by a state institution or by a credit/debit card company, is associated with a larger 42-44% increase in reported taxable income for the self-employed. For corporations, becoming covered by withholding is associated with a 21-25% increase in taxable income.

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43 See also the appendix in Yagan (2015).

44 The propensity score of a firm receiving its first informative declaration is estimated separately for each declaration type, using fixed effects for year, firm type, sector, tax administration, and the two lags of a third-order polynomial of total income and taxable income.

45 Results are robust to considering a shorter balanced sample, or fewer or more event years.
These correlations across time are consistent with the correlations across firms, suggesting that withholding is more strongly associated with increases in reported taxable income than pure information reporting, at least for the self-employed. However, it remains unclear whether the association is causal. The income increase associated with receiving a D150 or D153 declaration could be stronger than the increase associated with receiving a D151 reporting declaration, either because because the former are submitted by state and financial institutions rather than other firms, or because they are accompanied by withholding, or both. The next section therefore attempts to isolate the impact of withholding on compliance causally.

6.3 Causal Impact of Withholding: Difference-in-Difference Study

To examine the causal impact of withholding on tax compliance, we exploit the August 2011 reform which increased the withholding rate for a large share of sales taxpayers under reporting by credit/debit card companies. The first panel in Figure IX shows that the reform lead to a doubling of the average withholding rate but was not accompanied by a discontinuous change in the tax base, or in the number of sales tax or withholding declarations filed.\footnote{There is a reduction in credit/debit card reporting on small transactions, but these transactions are too marginal in size to affect the overall average withholding base.} This is consistent with the reform design, which affected only the withholding rate but not the reporting requirements. It also conforms with the notion that credit/debit card providers are highly compliant with their reporting and withholding obligations, and that most firms do not have the market power to refuse card transactions, thus preventing an extensive margin response to the rate increase.\footnote{There is only a weak behavioral response to the withholding rate notches, suggesting that few firms, if any, can manipulate the withholding rates they are subject to.}

This confirms that the reform changed only the rate of withholding, but not firms’ coverage by information reporting, allowing us to isolate the effect of withholding. Our estimation focuses on the balanced panel of firms which submitted sales tax declarations within a 30-months window around the reform, and compares a treatment group to a control group in a difference-in-difference design. Treated firms experience an increase in the \textit{predicted} withholding rate between July and August 2011. Firms in the control group experience no rate increase or are not subject to withholding.\footnote{Results are robust to excluding the latter subsamples of firms.}

Note that we condition on the predicted rather than the realized increase in the withholding rate (although the two closely track each other), as the latter may be affected by collusion between firms and withholding agents, or a firm-specific connection to the tax authority which allowed the firm to obtain a lower withholding rate. As the predicted rate change depends on value added and the share

\[ \text{predicted withholding rate} = \beta \times \text{value added} + \epsilon \]
of local sales in the second semester of 2010, long before the reform decree was designed, it is not possible that firms could have gained the system to avoid an increase in the predicted withholding rate. We estimate the effect of the rate increase using the model

\[ y_{it} = \alpha_i + \gamma_t + \mu_i \cdot t + \beta \cdot \text{Treat}_i \cdot \text{Post}_t + \epsilon_{it}, \]  

(2)

where \( y_{it} \) is the outcome reported by firm \( i \) in month \( t \); \( \alpha_i \) and \( \gamma_t \) are firm and month fixed effects and \( \mu_i \) is a firm-specific linear time trend; and \( \text{Treat}_i \) and \( \text{Post}_t \) are dummies indicating the treatment group and post-reform period. \( \epsilon_{it} \) is the error term. We consider as outcomes all main line items on the tax return, as shown in Table IV. The table reports the pre-reform mean in the treatment group, and the coefficient \( \beta \) for different specifications, either using the raw data, or winsorizing by the 99.9th, 99th and 95th percentile. As several outcome variables take value zero for a larger 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(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, the top panel in Figure X 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).\footnote{For the purpose of this figure, the data is winsorized by the 99th percentile.} Despite seasonal fluctuations, 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 40% and remain at this higher level for the next 15 months.\footnote{To ascertain that this result is not driven by the missing payment data for corporations, discussed in Section 5.3, we replicate the estimation in Appendix Figure XIV for the following subsamples: the self-employed (for whom the payment data is complete), firms with zero net liability or non-zero (own) tax payment, and firms making a non-zero (own) tax payment. The results are qualitatively similar and statistically significant in all subsamples. Only the very small subsample of firms making a non-zero payment in each month exhibits a relatively smaller treatment effect of 35%.}

A possible interpretation for this large effect is that the reform sends treated firms a signal about increased tax enforcement. However, the bottom panel shows that the treatment effect varies significantly by treatment strength, suggesting that it is not just the enactment of the reform, but the amount of tax withheld that generates the effect. The figure shows the treatment effect for three treatment groups, distinguishing firms experiencing a 1-2, 3-4 and 5-6 percentage point increase in the withholding rate respectively. The reform generates a 29% increase in tax payment among firms experiencing the smallest rate increase, a 38% increase among firms experiencing a rate increase of 3-4 percentage points (and this point estimate is statistically significantly different from
the previous one), and a 90% increase in tax payment among firms experiencing the largest increase in withholding. Although the three treatment groups may also differ along other dimension, the results are consistent with the interpretation that it is the amount of tax withheld that affects total tax payment.

6.4 Mechanisms of Withholding Impact

Figure XI analyzes the mechanisms through which the withholding rate reform affects tax payment. The first prediction of our conceptual framework is that reclaim of the tax withheld is incomplete, but increases as the withholding rate increases. The first panels of Figure XI support this prediction. The share of withholdees making a reclaim on their sales tax declaration is only around 60% before the reform, and drops close to 50% 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 7 percentage points. The average share of withheld tax reclaimed, as displayed in the second panel, follows a similar pattern. The share fluctuates between 65% and 80% before the reform, then drops sharply at the time of the reform, and recovers gradually. This provides evidence that incomplete reclaim is indeed a mechanism through which withholding increases total tax payment.

However, while the increase in total tax payment arises sharply at the time of the reform and then remains constant over time, the share of reclaimers rises over time. This suggests that a second mechanism is at play. The second prediction of our conceptual framework is that the withholding rate increase leads to an increase in reported taxable income. The bottom panels of Figure XI support this prediction. The figures display results from estimating Equation X as in Figure X with different outcome variables, as indicated in the panel titles. The figures show that the reform led to a 2% reduction in reported input tax credits in the treatment group, but to no change in sales tax collected. Combining these two results means that the reported gross tax liability in the treatment group increased by about 12%. The figure also suggests that the impact on input tax credits emerges gradually over time. The reduction input tax credits and accompanying increase in gross tax liability thus compensates for the increase in reclaims, so that net liability changes little. The finding suggests that firms generally evade tax by over-reporting input tax credits, but report more accurately after the withholding rate is increased. In the conceptual framework, the increase in reported tax liability is driven by the non-reclaimers. Given the small effect size and noisy data,
it is difficult to test whether this is the case in Costa Rica. The results do not rule out the possibility that the tax liability increase could be driven by reclaimers, who reduce evasion in anticipation of possible audits.

7 Conclusion

Although withholding schemes for firms are widespread in developing countries and collect a significant share of tax revenue, 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, withholding creates a compliance default if reclaiming the tax withheld is costly.

Exploiting a unique nine-year panel of tax declarations and third-party information and withholding reports for the universe of firms in Costa Rica, we identify significant compliance gaps on the extensive and intensive margins, and to a lesser extent on the payment margin, providing a rationale for the use of withholding. We then show that coverage by withholding is associated with higher reported taxable income across firms and across time, and more strongly so than coverage by pure information reporting. Finally, we demonstrate that a doubling in the withholding rate increases tax payments among firms subject to withholding by about 40%. This effect is driven by incomplete reclaim of the tax withheld, and reduced misreporting. Overall, the results show that withholding indeed establishes a compliance default, providing the government with a larger and more foreseeable stream of revenue.

However, even if withholding increases tax revenue, its welfare impact remains ambiguous. Withholding shifts administrative costs from the tax authorities to the withholding agent, and generates administrative costs for the withholdee who needs to track the tax withheld. In addition, withholding transfers liquidity from the taxpayer to the government by advancing the timing of payment. Analyzing the welfare implications of withholding is thus an important next step in this research project.
### Table I: Income Tax Schedule

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

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/contento/12994-regimen-tradicional](http://www.hacienda.go.cr/contento/12994-regimen-tradicional).

### Table II: Withholding Rate Schedule for Sales Tax

<table>
<thead>
<tr>
<th>Withholding Rate</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base before 08/2011: Value-Added Rate</strong> ≤ 5</td>
<td>20</td>
<td>30</td>
<td>40</td>
<td>55</td>
<td>75</td>
<td>∞</td>
<td></td>
</tr>
<tr>
<td><strong>Base since 08/2011: Share of Local Sales</strong> ≤ 0</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Form</th>
<th>Purpose</th>
<th>Record Type</th>
<th>Coverage of Corporations</th>
<th>Coverage of Self-Employed</th>
<th>% Matched With Income Tax Records</th>
</tr>
</thead>
<tbody>
<tr>
<td>D151</td>
<td>Reporting of firm-firm transactions</td>
<td>Sales</td>
<td>46.5</td>
<td>38.9</td>
<td>37.0</td>
</tr>
<tr>
<td></td>
<td>N=17,125,017 (54.3% sales)</td>
<td>Purchases</td>
<td>49.3</td>
<td>54.1</td>
<td>65.5</td>
</tr>
<tr>
<td>D158</td>
<td>Reporting of transactions at auctions</td>
<td>Sales</td>
<td>0.5</td>
<td>1.7</td>
<td>16.4</td>
</tr>
<tr>
<td></td>
<td>N=369,002 (71.0% sales)</td>
<td>Purchases</td>
<td>0.3</td>
<td>0.9</td>
<td>23.5</td>
</tr>
<tr>
<td>D150</td>
<td>Withholding on purchases</td>
<td>State purchases</td>
<td>8.4</td>
<td>5.0</td>
<td>78.7</td>
</tr>
<tr>
<td></td>
<td>N=759,391 (98.5% state purchase)</td>
<td>Private purchases</td>
<td>0.22</td>
<td>0.08</td>
<td>39.9</td>
</tr>
<tr>
<td></td>
<td>N=4,198,384</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 Codigo 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](http://www.hacienda.go.cr/contenido/12997-declaraciones-informativas).
Table IV: Intensive Margin Misreporting

<table>
<thead>
<tr>
<th>Panel A: Underreporting IT</th>
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</thead>
<tbody>
<tr>
<td>1) % Underreporters IT vs TPI</td>
<td>16.9</td>
<td>14.2</td>
<td>50.6</td>
</tr>
<tr>
<td>2) Unreported Amount</td>
<td>270.6</td>
<td>2799.7</td>
<td>271.1</td>
</tr>
<tr>
<td>3) Underreporters’ TPI</td>
<td>652.9</td>
<td>7010.6</td>
<td>953.2</td>
</tr>
<tr>
<td>4) Total TPI</td>
<td>1859.8</td>
<td>20664.1</td>
<td>1507.5</td>
</tr>
<tr>
<td>5) Unreported Amount (% UR TPI)</td>
<td>41.4</td>
<td>39.9</td>
<td>28.4</td>
</tr>
<tr>
<td>6) Unreported Amount (% TPI)</td>
<td>14.5</td>
<td>13.5</td>
<td>18</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Panel B: Underreported Liability</th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7) Unreported Tax IT</td>
<td>12.7</td>
<td>71.1</td>
<td></td>
</tr>
<tr>
<td>8) Underreporters’ Reported Tax</td>
<td>3.3</td>
<td>51.8</td>
<td></td>
</tr>
<tr>
<td>9) Total Reported Tax</td>
<td>26.6</td>
<td>800.1</td>
<td></td>
</tr>
<tr>
<td>10) Unreported Tax (% UR Tax)</td>
<td>385.6</td>
<td>137.4</td>
<td></td>
</tr>
<tr>
<td>11) Unreported Tax (% Tax)</td>
<td>47.7</td>
<td>8.9</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C: Internal Consistency</th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>12) % Underreporters IT vs OTPI</td>
<td>3.6</td>
<td>5.3</td>
<td>17</td>
</tr>
<tr>
<td>13) % Overreporters IT vs OTPI</td>
<td>43.5</td>
<td>62.9</td>
<td>81.1</td>
</tr>
<tr>
<td>14) % Underreporters IT vs ST</td>
<td>9.4</td>
<td>9.6</td>
<td>14</td>
</tr>
<tr>
<td>15) % Overreporters IT vs ST</td>
<td>53.8</td>
<td>61.6</td>
<td>83.5</td>
</tr>
</tbody>
</table>

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 V: Impact of Withholding Rate Increase

<table>
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<tr>
<th></th>
<th>(1)</th>
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<tbody>
<tr>
<td></td>
<td>Pre-Reform Mean</td>
<td>Pre-Reform Mean</td>
<td>Baseline</td>
<td>Winsorized</td>
<td>Winsorized</td>
<td>Winsorized</td>
</tr>
<tr>
<td></td>
<td>Treated, Raw Data</td>
<td>Treated, 99.9th pctile</td>
<td>Raw Data</td>
<td>99th pctile</td>
<td>95th pctile</td>
<td>99th pctile</td>
</tr>
<tr>
<td>Sales Tax Collected</td>
<td>3079.697</td>
<td>3077.173</td>
<td>0.031</td>
<td>-0.000</td>
<td>-0.002</td>
<td>0.015*</td>
</tr>
<tr>
<td></td>
<td>(36.814)</td>
<td>(21.050)</td>
<td>(0.041)</td>
<td>(0.020)</td>
<td>(0.009)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Input Tax Credits</td>
<td>2657.075</td>
<td>2657.075</td>
<td>-0.038</td>
<td>-0.043</td>
<td>-0.032**</td>
<td>-0.034***</td>
</tr>
<tr>
<td></td>
<td>(20.749)</td>
<td>(17.332)</td>
<td>(0.033)</td>
<td>(0.023)</td>
<td>(0.011)</td>
<td>(0.007)</td>
</tr>
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<td>Import Credits</td>
<td>680.918</td>
<td>680.918</td>
<td>-0.092</td>
<td>-0.085</td>
<td>-0.015</td>
<td>-0.076***</td>
</tr>
<tr>
<td></td>
<td>(12.184)</td>
<td>(9.884)</td>
<td>(0.062)</td>
<td>(0.045)</td>
<td>(0.027)</td>
<td>(0.019)</td>
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<tr>
<td>Local Purchase Credits</td>
<td>1976.060</td>
<td>1975.925</td>
<td>-1.015</td>
<td>-0.023</td>
<td>-0.030**</td>
<td>-0.029***</td>
</tr>
<tr>
<td></td>
<td>(200.210)</td>
<td>(11.026)</td>
<td>(0.978)</td>
<td>(0.022)</td>
<td>(0.010)</td>
<td>(0.007)</td>
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<tr>
<td>Pre-Gross Tax Liability</td>
<td>580.168</td>
<td>580.055</td>
<td>0.154***</td>
<td>0.163***</td>
<td>0.180***</td>
<td>0.193***</td>
</tr>
<tr>
<td></td>
<td>(8.387)</td>
<td>(7.662)</td>
<td>(0.033)</td>
<td>(0.029)</td>
<td>(0.021)</td>
<td>(0.013)</td>
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<tr>
<td>Pre-Gross Tax Balance</td>
<td>155.477</td>
<td>148.291</td>
<td>-0.144</td>
<td>0.118</td>
<td>0.090*</td>
<td>-0.050*</td>
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<tr>
<td></td>
<td>(7.824)</td>
<td>(2.464)</td>
<td>(0.182)</td>
<td>(0.078)</td>
<td>(0.044)</td>
<td>(0.025)</td>
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<tr>
<td>Previous Gross Tax Balance</td>
<td>19631.301</td>
<td>223.293</td>
<td>-3.965</td>
<td>0.063</td>
<td>0.117***</td>
<td>0.232***</td>
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<tr>
<td></td>
<td>(9468.210)</td>
<td>(3.678)</td>
<td>(0.072)</td>
<td>(0.043)</td>
<td>(0.027)</td>
<td></td>
</tr>
<tr>
<td>Gross Tax Liability</td>
<td>464.368</td>
<td>460.498</td>
<td>0.184***</td>
<td>0.182***</td>
<td>0.196***</td>
<td>0.227***</td>
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<tr>
<td></td>
<td>(7.593)</td>
<td>(7.021)</td>
<td>(0.037)</td>
<td>(0.035)</td>
<td>(0.024)</td>
<td>(0.016)</td>
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<td>Withholding Base</td>
<td>7541.377</td>
<td>7502.520</td>
<td>-0.024</td>
<td>0.005</td>
<td>0.009</td>
<td>-0.009</td>
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<tr>
<td></td>
<td>(67.197)</td>
<td>(61.485)</td>
<td>(0.031)</td>
<td>(0.017)</td>
<td>(0.012)</td>
<td>(0.009)</td>
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<tr>
<td>Withheld Tax</td>
<td>90.552</td>
<td>90.302</td>
<td>2.159***</td>
<td>2.180***</td>
<td>2.633***</td>
<td>2.927***</td>
</tr>
<tr>
<td></td>
<td>(2.391)</td>
<td>(2.148)</td>
<td>(0.132)</td>
<td>(0.127)</td>
<td>(0.101)</td>
<td>(0.071)</td>
</tr>
<tr>
<td>Withheld Tax Reclaims</td>
<td>79.953</td>
<td>79.665</td>
<td>1.607***</td>
<td>1.676***</td>
<td>2.099***</td>
<td>2.367***</td>
</tr>
<tr>
<td></td>
<td>(2.834)</td>
<td>(2.145)</td>
<td>(0.140)</td>
<td>(0.133)</td>
<td>(0.109)</td>
<td>(0.078)</td>
</tr>
<tr>
<td>Net Tax Liability</td>
<td>378.400</td>
<td>378.186</td>
<td>-0.041</td>
<td>-0.037</td>
<td>-0.029</td>
<td>-0.048**</td>
</tr>
<tr>
<td></td>
<td>(6.348)</td>
<td>(5.827)</td>
<td>(0.037)</td>
<td>(0.036)</td>
<td>(0.026)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Compensation Requests</td>
<td>22.580</td>
<td>16.018</td>
<td>0.729**</td>
<td>0.531*</td>
<td>0.154</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(2.151)</td>
<td>(0.509)</td>
<td>(0.280)</td>
<td>(0.207)</td>
<td>(0.163)</td>
<td>(.)</td>
</tr>
<tr>
<td>Final Tax To Pay</td>
<td>418.517</td>
<td>366.641</td>
<td>-0.046</td>
<td>-0.092*</td>
<td>-0.093***</td>
<td>-0.107***</td>
</tr>
<tr>
<td></td>
<td>(14.260)</td>
<td>(5.551)</td>
<td>(0.133)</td>
<td>(0.036)</td>
<td>(0.025)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Final Tax To Pay (Constructed)</td>
<td>361.288</td>
<td>361.177</td>
<td>-0.088*</td>
<td>-0.085*</td>
<td>-0.068**</td>
<td>-0.079***</td>
</tr>
<tr>
<td></td>
<td>(5.991)</td>
<td>(5.477)</td>
<td>(0.035)</td>
<td>(0.034)</td>
<td>(0.025)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Taxpayer Payment</td>
<td>290.444</td>
<td>280.948</td>
<td>-0.070</td>
<td>-0.048</td>
<td>-0.068**</td>
<td>-0.079***</td>
</tr>
<tr>
<td></td>
<td>(4.455)</td>
<td>(2.911)</td>
<td>(0.037)</td>
<td>(0.027)</td>
<td>(0.021)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Total Payment</td>
<td>350.996</td>
<td>378.150</td>
<td>0.471***</td>
<td>0.476***</td>
<td>0.571***</td>
<td>0.680***</td>
</tr>
<tr>
<td></td>
<td>(5.516)</td>
<td>(4.376)</td>
<td>(0.038)</td>
<td>(0.036)</td>
<td>(0.029)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Total Payment (Constructed)</td>
<td>509.068</td>
<td>458.060</td>
<td>0.351***</td>
<td>0.368***</td>
<td>0.412***</td>
<td>0.568***</td>
</tr>
<tr>
<td></td>
<td>(14.743)</td>
<td>(6.712)</td>
<td>(0.113)</td>
<td>(0.036)</td>
<td>(0.025)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Observations</td>
<td>1061280</td>
<td>1061280</td>
<td>1061280</td>
<td>1061280</td>
<td>1061280</td>
<td>1061280</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.001</td>
<td>0.004</td>
<td>0.265</td>
<td>0.645</td>
<td>0.770</td>
<td>0.816</td>
</tr>
</tbody>
</table>

OLS estimation. Point estimates are marginal effects compared to pre-reform average.

Columns 3-6 allow for year and firm FE and a firm-specific linear time trend.

Standard errors in parentheses, clustered at the taxpayer level in parentheses.

All amounts are in '000 CRC, deflated with base in 06/2015 (1USD=530CRC).

(W) indicates that outcome variables are winsorized at the 99th percentile.
Figure I: Withholding Systems and GDP per capita

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>Mean GDP pc</th>
<th>Median GDP pc</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Countries</td>
<td>175</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Countries with WH</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Broad WH</td>
<td>27</td>
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<tr>
<td>Targeted WH</td>
<td>20</td>
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<td></td>
<td></td>
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<tr>
<td>TADAT: WH</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TADAT: no WH</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: This figure displays the mean and median GDP per capita, and the 95% confidence interval on the mean, for different subsamples of countries. GDP per capita is measured in thousands of current international dollars (purchasing-power parity) from the World Development Indicators for 2012. The year 2012 is chosen as it provides GDP data for the largest number of countries. The number below each bar provides the sample size. The first bar refers to all countries captured in the dataset. The second bar refers to the subsample of countries that use withholding on business sales, as per the above-mentioned secondary sources (some of which are outdated and are currently being updated) and the confidential TADAT (Tax Administration Diagnostic Assessment Tool) reports. The third and fourth bar further divide this subsample into countries that use a broad withholding regime (in which withholding may be limited to certain types of firms or transactions, but not to specific sectors), and those that use a specialized withholding regime, applicable only to certain sectors (e.g. construction, fishing). The fifth and sixth bar focus on the sample of countries covered by the first TADAT round (excluding one OECD country), comparing countries that do not use withholding on business sales to countries that use withholding (combining both broad and specialized schemes).
**Figure II: Filing Behavior**

Notes: The figure shows the share of non-filers, i.e. tax-liable firms which have not submitted their own tax declaration for the relevant fiscal period. The first panel focuses on all tax liable firms, identified from the tax register, previous tax declarations and informative declarations, as per the algorithm explained in Section 5.1. The bottom panel focuses on the subset of registered firms, for which we can identify the firm type (self-employed or corporation). In the top panel, the orange bars pertain to the income tax and the green bars pertain to the sales tax. The dark bars are for the full sample, and the light bars are for the subsample of firms covered by third-party information. In the lower panel, the red bars are for all tax liable firms, the blue bars are for the subsample of tax liable firms which are covered by third-party information. The dark bars are for the self-employed, the light bars for corporations. In both figures, the income tax data is for fiscal year 2014, the sales tax data is for December 2014.
Figure III: Self-Reports vs Third-Party Reports

Notes: The figure shows the distribution of the log difference between firms’ self-reported and third-party reported sales and costs, for firms with non-zero amounts of third-party reports and filing taxes for fiscal year 2012. As the third-party reported data is always reported for the regular fiscal year (October to September), we focus on firms that file their tax declaration according to the same period, dropping the 32% of firms that file outside of a 10-day interval around the filing deadline for the regular fiscal period, December 15. Third-party reported sales for the income tax is either the sum of sales reported under D150, D151 and D158, or D153, whichever is larger. 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. Bunchers are firms that exactly match third-party reports (within a 1% error margin). Under-reporters are firms with a difference between log self-reports and log third-party reports of more than -0.05. The bin size is 0.01 for all figures, except the bottom right one, for which the bin size is 0.005.
**Figure IV: Impact of Desk Audits**

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.
Notes: The figures show the frequency distribution of taxable income of the self-employed (personas fisicas 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 $t - 1$. 
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.
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), and the density distribution of total revenue for corporations around the first notch in the corporation tax schedule (bottom row). The data is pooled for years 2006-2014, represented as percentage distance from the kink, and aggregated in taxable income bins of 1%. The panels show the distribution for different subsamples, as indicated by the panel titles. 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 an eighth-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 VIII: Event Study of Reporting Behavior

Notes: The figures display the change in tax liability, compared to the pre-event average of the event and control group, for event years -4 to 3. The event group includes firms that receive a first informative declaration in event year 0. Event years considered in this estimation are 2010 and 2011, and control firms are all firms that have not received a first informative declaration by the event year. The left column is for the self-employed, the right column is for corporations. Panel A considers the receipt of a first informative declaration from another firm (information reporting only), panel B considers the receipt of a first informative declaration from a state institution (information reporting and withholding), and panel C considers the receipt of a first informative declaration from a credit/debit card company (information reporting and withholding). The text displays the difference-in-difference estimate from equation 1.
Figure IX: Withholding Rate Reform

Notes: The figure displays the average withholding rate among firms subject to withholding (panel A), the average withholding base (credit/debit card sales) among those firms (panel B), the total number of sales tax and withholding declarations per month (panel C), and the share of sales tax declarations matched with at least one withholding declaration, and vice versa (panel D). The black solid line marks 08/2011, when the increase in withholding rates entered into effect. The figures show that the withholding rate increase was not accompanied by a discontinuous change in the average withholding base, the number of sales tax or withholding declarations, and only a modest increase in the likelihood that a taxpayer covered by withholding files her sales tax declaration.
Figure X: 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. The first panel considers the overall impact of the reform, pooling all firms with a predicted rate increase in the treatment group. The second panel considers the impact of the reform by treatment strength, distinguishing firms with a predicted rate increase of 1-2, 3-4 and 5-6 percentage points. 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 $\beta$ (marginal effect compared to pre-reform average) from estimating Equation 2.
**Figure XI: Mechanisms of Withholding Rate Impact**

**Mechanism 1: Incomplete Reclaim**

- **Reclaimers over Withholdees**
- **Share of Withheld Tax Reclaimed**

**Mechanism 2: Reduced Mis-Reporting**

- **Input Tax Credits**
  - DD = 0.02 (0.009)

- **Sales Tax Collected**
  - DD = 0.007 (0.007)

- **Gross Tax Liability**
  - DD = 0.116 (0.017)

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 $\beta$ (marginal effect compared to pre-reform average) from estimating Equation 2.
Figure XII: Aggregate Impact

Notes: This figure shows the impact of the withholding rate reform in August 2011 on aggregate sales tax revenue. The dots represent monthly sales tax revenue in billions of Costa Rican colones, as per the official statistics. The red line is a linear fit, allowing for a discontinuity at the time of the reform. The text displays the coefficient and standard error on the post-reform dummy. The results are robust to omitting or controlling for the outlier months of December and January.
Appendix

Figure XIII: Payment of Tax Liabilities

Notes: This figure extends Figure VI, displaying additionally the share of total tax payments made by the taxpayers over the total final tax liability. All variable definitions are as in the notes to Figure VI. See Section 5.3 for a discussion of these results.
Figure XIV: Robustness of Withholding Impact

Panel A: Self-Employed

<table>
<thead>
<tr>
<th>Date</th>
<th>Treatment Group (Rate Increase)</th>
<th>Control Group</th>
</tr>
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<tbody>
<tr>
<td>2010m1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011m1</td>
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<tr>
<td>2012m1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013m1</td>
<td></td>
<td></td>
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</table>

DD = .857 (.045)

Panel B: Payers and Zero-Liability Firms

<table>
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</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>2011m1</td>
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<td>2012m1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013m1</td>
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<td></td>
</tr>
</tbody>
</table>

DD = .465 (.025)

Panel C: Payers Only

<table>
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</thead>
<tbody>
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<td>2012m1</td>
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</tr>
<tr>
<td>2013m1</td>
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<td></td>
</tr>
</tbody>
</table>

DD = .353 (.039)

Notes: This figure replicates Figure X, limiting the sample to the self-employed (panel A), firms with zero net liability or non-zero (own) tax payment (panel B), and firms making a non-zero (own) tax payment (panel C).
Figure XV: Impact if 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.
**Figure XVI: Audit Rates**

Notes: This figure shows the evolution over time of the number of planned audits, planned audits for firms that are not part of the large taxpayer unit, and the audit rate (total number of executed audits over number of tax-filing firms).
References


OECD. 2009. Withholding and information reporting regimes for small or medium-sized businesses and self-employed taxpayers, Information Note. Tech. rept. OECD.


