

## Ghosting the Tax Authority: Fake Firms and Tax Fraud in Ecuador<sup>†</sup>

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*An important but poorly understood form of firm tax evasion arises from “ghost firms”—fake firms that issue fraudulent receipts so that their clients can claim false deductions. We provide a unique window into this global phenomenon using transaction-level tax data from Ecuador. Five percent of firms use ghost invoices annually. Among these firms, ghost transactions comprise 14 percent of purchases. Ghost transactions are prevalent among large firms and firms with high-income owners and exhibit suspicious patterns, such as bunching below financial system thresholds. An innovative enforcement intervention targeting ghost clients rather than ghosts themselves led to substantial tax recovery. (JEL D22, H25, H26, K34, L25, O14)*

Developing countries rely disproportionately on taxes collected from firms as they strive to build state capacity, fund public goods, and enable redistributive programs in an efficient manner. A widespread scourge on these efforts throughout the world arises when fake firms—often known as “ghost firms,” “invoice mills,” or “missing traders”—issue fraudulent receipts that allow their supposed clients to claim additional tax deductions on value-added and corporate income taxes.<sup>1</sup> Enforcement against ghosts has proven to be a challenging game of whack-a-mole since these ephemeral entities can disappear just as quickly as new ones can open up.

This paper provides a unique window into the ghost economy and the scope for interventions to recoup tax revenues that have been lost due to ghost deductions. Our empirical context is Ecuador, where we can identify ghost clients and transactions by combining firm-to-firm transaction-level tax data with a sample of over 800

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<sup>1</sup>See, for example, OECD (2017) and Keen and Smith (2006). We use the term “ghost firms,” which is the name used by the Ecuadorian Tax Authority (“*empresas fantasma*”).

ghost firms. The sample of ghost firms was identified after an exhaustive process by the tax authority, discussed further in Section I, but it nevertheless represents a lower bound on the universe of ghost firms. The transaction-level data allow us to investigate how ghost transactions—ones for which the seller is a detected ghost firm—facilitate evasion of both VAT and corporate income taxes. We supplement our analysis by drawing on administrative data on the owners of Ecuadorian firms to quantify the extent to which evasion via ghost transactions, and the government’s ability to recoup evaded revenue, are regressive or progressive in nature. The phenomenon of ghost firms is not limited to Ecuador but is prevalent around the world. Online Appendix B describes the importance of ghost firms in other contexts.

Our first contribution is to document new facts about the ghost economy. We begin with the aggregate nature of this form of tax fraud, demonstrating that evasion through ghost deductions is indeed widespread and quantitatively important; that ghost clients are not limited to small, semiformal firms; and that ghost evasion benefits those at the top of the income distribution. In 2015, over 7,000 firms (4.7 percent of potential clients) took deductions from an identified ghost firm. Among these ghost clients, average annual ghost deductions were 14.1 percent of the value of their purchase deductions. Larger firms are more likely to engage in ghost transactions and have larger shares of such transactions in total input costs. Tax evasion via ghost firms has a regressive effect in the sense that ghost deductions are disproportionately used by firms owned by high-income individuals.

We next turn to opening the black box of ghost client behavior, exploiting firm-to-firm transaction data to compare transactions that ghost clients make with ghosts to those they make with regular firms. The observed patterns indicate that ghost activity appears to be a deliberate form of evasion on the part of many clients, with firms utilizing ghost transactions strategically and doing so in a way that avoids transacting through the formal financial sector. Ghost transactions are relatively concentrated at the end of the tax year, a time when firms can more easily determine the level of fake costs needed to offset annual revenues to reduce reported profits. They are more likely to bunch at round numbers, consistent with representing fake flows of nonexistent goods. In addition, ghost transactions disproportionately bunch just below the \$5,000 threshold at which firms are required to make payments via the formal financial system. This avoids the need for ghost firms to have a (traceable) bank account and makes it possible for ghosts to issue receipts without the stated transaction amount actually changing hands.

From a policy perspective, information on the typical characteristics of ghost clients and transactions could be used to help identify ghost firms. However, this leaves open the question of how to recoup lost tax revenue even when ghost firms are successfully identified.

Our second contribution is therefore to provide the first evaluation—to the best of our knowledge—of an enforcement policy against the use of ghost firms. Enforcement efforts targeted directly at ghost firms face unique obstacles. Ghosts are often part of criminal enterprises; “owners” may be shell companies, deceased individuals, or victims of identity theft; and ghosts are often transient, disappearing and reemerging as new entities (see OECD 2006; de la Feria 2020). To deal with these challenges, the Ecuadorian Internal Revenue Service (SRI) began an

innovative enforcement scheme in 2016 that targeted ghost *client* firms rather than chasing the ghosts themselves. Notifications were sent to over 1,500 unique firms, informing them that SRI had detected ghost transactions on previously filed tax returns and requiring that they submit revised returns removing these deductions. Notified firms were selected by SRI primarily on the basis of having made large deductions with ghost receipts in 2010–2015.

We use administrative records of firms' amendments to their corporate income tax filings to evaluate this novel scheme for tackling ghost-enabled evasion. We analyze amendments in the 90 days following the notification that involve a reduction in nonlabor costs and compare amended returns to firms' prenotification returns. The identifying assumption is that, absent notification, firms would not have spontaneously filed amendments that removed deductions taken in prior years. Indeed, the probability that nonnotified firms made such revisions is low.

The policy was highly effective and resulted in a total increase in reported firm income tax of \$20.6 million within three months, despite the fact that a large fraction of firms did not respond (consistent with Carrillo, Pomeranz, and Singhal 2017). Responding firms tend to be somewhat smaller than all notified firms, with 15.4 percent smaller median reported revenues and 30.1 percent smaller median reported tax liability. Among responding firms, the average tax increase was over \$44,000 (81 percent of their original filings), while the administrative cost of issuing notifications—conditional on having identified ghost firms—was close to zero. The tax increases stem mostly from firms owned by high-income individuals. The amount of additional tax reported as a share of owners' income is 170 times higher in the top 1 percent than in the bottom 80 percent of the income distribution. Despite the large additional tax filings, we do not find evidence of client firms going out of business or becoming informal. This is consistent with ghost clients being large, established firms.

This paper adds to the very sparse literature on tax evasion via ghost firms. Waseem (2020) exploits a VAT reduction in Pakistan and demonstrates that this reduced ghost firms identified by the tax authority. He further shows that most ghost deductions are claimed by exporters and used to overclaim refunds. Mittal, Reich, and Mahajan (2018) focus on the problem of identifying ghost firms, developing a machine learning algorithm to detect them, and Mironov (2013) describes a related phenomenon of *spacemen* firms in Russia. As argued in Slemrod and Velayudhan (2022), more evidence is needed on the topic of ghost firms to answer key tax policy questions, such as the overall effectiveness of the VAT.

We advance this literature in two ways. First, we provide the first detailed analysis of the characteristics of ghost client firms, their owners, and their patterns of reported transactions with ghost firms. Second, we provide the first analysis of an enforcement intervention aimed to close the tax gap arising from ghost firms.

## I. Institutional Background and Data

The fabrication and use of falsified invoices is commonly considered an intentional tax offense and regarded as a criminal activity. It is therefore more severe than other types of evasion such as simple revenue underreporting (de la Feria 2020; OECD 2021).

Our data on these activities in Ecuador draw on SRI's 2016 antighost initiative.<sup>2</sup> While the details of these efforts are deliberately secret, they are known to involve four steps. First, candidate ghost firms were identified based on information from audits, whistle-blowers, and tax records. This included, in particular, firms that filed no returns or reported very little income yet were listed as suppliers for large amounts of purchases by other firms. (The suspicious transaction patterns described in this paper were not known to the tax authority at the point of this intervention and where therefore not used in these efforts.) Second, SRI made attempts to contact candidate ghost firms. Firms that were neither found at their registered address nor responsive to emails were taken forward as potential ghosts. Third, the list of potential ghosts was posted on SRI's website. Finally, firms that were wrongly on this list were given an opportunity to prove their existence and be removed. After these steps, a list of 811 identified ghost firms remained (SRI 2017c).<sup>3</sup> This list forms the basis for the policy intervention we study in Section III.

We combine this list of detected ghost firms with administrative tax data (SRI 2015), social security data (SRI 2017a), and firm ownership records (SRI 2017b), using SRI's entity identifier system.<sup>4</sup> Our sample consists of all economically active firms that are required to file purchase annexes, which includes supplying valid invoice numbers. These annexes are needed to support the claiming of nonlabor cost deductions from the VAT and from business income taxes. This sample includes all corporations and all larger sole proprietorships (i.e., annual sales above \$100,000, annual costs above \$80,000, or capital above \$60,000), as well as smaller sole proprietorships who wish to deduct production costs. Corporations make up 88 percent of total firm revenue in our sample, larger sole proprietorships 12 percent, and smaller sole proprietorships 0.2 percent. Robustness checks discussed in Section II show that our results are qualitatively similar for corporations and sole proprietorships.

Smaller sole proprietorships can also choose to file using an abbreviated tax form. This form does not allow us to cleanly separate business and individual income and costs, and these firms are therefore not included in our sample. While it is theoretically possible for these firms to purchase receipts from ghost firms, they do not need to provide receipts in order to justify the claiming of nonitemized deductions. Therefore, their only incentive to transact with ghosts is to have receipts ready in anticipation of a possible audit. We consider the implications of this sample selection after our discussion of the descriptive facts.

We define firms as economically active for each year in which they file revenues or costs, appear as a seller or buyer in a purchase annex, or report payments to employees. We define firms as ghost clients for a given year if they report at least one purchase from an identified ghost. Our analysis focuses on the behavior of these client firms—their characteristics, transactions they make with ghost and nonghost firms, and their response to SRI's antighost intervention.

Lastly, we link firms to administrative ownership records, which allows us to determine each firm's owners and their ownership shares. We also observe individuals'

<sup>2</sup>Online Appendix C provides details on data construction.

<sup>3</sup>Overall, about 7 percent of firms were dropped in the process from candidate firms to the final list.

<sup>4</sup>Anonymized identifiers were created by SRI based on Registro Único de Contribuyentes (RUC) and Cédula de Identidad (SRI 2012). See Carrillo et al. (2023) for further details.

labor income from tax and social security data. This allows us to construct individuals' income from the sum of their salaries, self-employment, and capital income from firm ownership (computed from the annual profit of each firm in which they have a stake, multiplied by their ownership share).

The firm size distribution in our sample is similar to that in other developing countries. Specifically, the firm size distributions in both our sample and other developing countries (see, e.g., Hsieh and Olken 2014) are highly right skewed: there are a large number of small firms accounting for a disproportionately small share of total firm revenue, and the firm distribution features a long, thin upper tail of very large firms.

## II. New Facts about Ghost Clients and Transactions

Ecuador's transaction-level data allow us to shed new light on the nature of the ghost economy. Since these records form the tax authority's basis for cross-checking cost deductions from both VAT and firm income tax filings, our findings expose evasion of both forms of taxation.

We establish six novel descriptive facts. The first three describe overall magnitudes of ghost transactions and the types of firms (and owners) involved as clients. All statistics in this section refer to pooled 2010–2015 data unless stated otherwise.

*Fact 1: Tax deductions based on fake receipts from ghost firms are widespread and large.*—10.4 percent of unique firms file deductions based on receipts from at least one identified ghost firm. Table 1 shows that on average, 3.6 percent of purchases registered by these ghost clients are from ghosts, amounting to 10.4 percent of the value of their purchase deductions. At 4.6 percent and 14.1 percent, respectively, these shares are higher for 2015, the last year before the list of ghost firms was established.

This may result from earlier ghosts having disappeared by the time the list was established. In total, ghost clients reported ghost transactions amounting to \$2.1 billion in value. This represents a substantial share of taxes: 1.7 percent for corporations and 11.5 percent for sole proprietorships.

*Fact 2: Evasion through ghost firms is more prevalent among larger firms.*—Table 1 shows that ghost clients are much bigger than other firms, with higher revenues, costs, and tax liabilities. Consistent with Waseem (2020), their exporter share is also higher (7 percent) than among regular firms (2 percent).<sup>5</sup> Looking at the full size distribution, Figure 1, panel A shows that the probability of engaging in ghost transactions increases monotonically in firm revenue. While this may simply reflect the fact that larger firms have more transactions, panel B shows that the share of ghost deductions out of total deductions also increases throughout much of the size distribution, except at the very top. The sharp drop at the top may result from very large corporations having stronger incentives to avoid illegal

<sup>5</sup>However, as online Appendix Table A1 shows, while exporters are more likely to buy from ghost firms, the share of ghost purchases in exporters' total purchases is smaller.

TABLE 1—DESCRIPTIVE STATISTICS

	2015		2010–2015	
	Ghost clients (1)	Nonghost clients (2)	Ghost clients (3)	Nonghost clients (4)
<i>Panel A. Ghost clients versus nonghost clients</i>				
Revenue (\$000)	4,060 (24,098) [568]	1,023 (28,538) [111]	6,058 (120,767) [568]	952 (30,955) [107]
Cost (\$000)	3,827 (21,928) [538]	967 (26,227) [107]	5,364 (81,360) [536]	875 (22,792) [102]
Tax liability (\$000)	50.68 (395) [3.68]	15.44 (637) [0.01]	153 (10,202) [3.91]	17.20 (2,033) [0.01]
Share exporting firms	0.071	0.023	0.068	0.022
<i>Panel B. Use of ghost firms by ghost clients</i>				
Number of unique ghost suppliers	2 (2) [1]		2 (2) [1]	
Number of identified ghost purchases/ total number of purchases	0.046		0.036	
Value of identified ghost purchases/ value of total purchases	0.141		0.104	
Number of firms	7,118	136,086	22,630	204,186
Number of observations	7,118	136,086	39,982	736,413

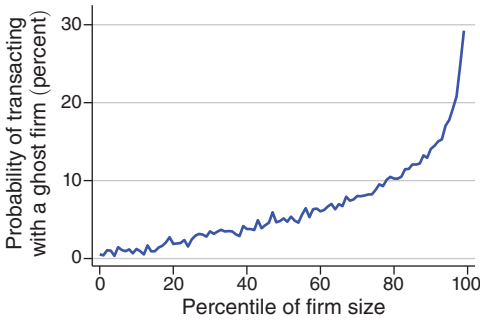
*Notes:* This table shows descriptive statistics by ghost client status for the universe of economically active firms that are required to file a purchase annex for 2015 (columns 1 and 2) and pooled for 2010–2015 (columns 3 and 4). Ghost client status is defined at the firm-year level. Panel A compares ghost client firms to nonghost client firms. Panel B shows how ghost clients transact with ghost firms. All amounts are from filings prior to the start of the policy intervention. Means are reported along with standard deviations in parentheses and medians in brackets. All monetary figures are in thousands of US dollars. Online Appendix Table A10 shows the statistics by year for 2010–2015. Online Appendix Tables A2 and A3 show robustness for incorporated firms and sole proprietorships only. Online Appendix Table A4 includes only firm-year pairs that filed purchase annexes in every month of that year.

behavior or being able to use more sophisticated avenues of tax avoidance (as in, e.g., Bustos et al. 2022).

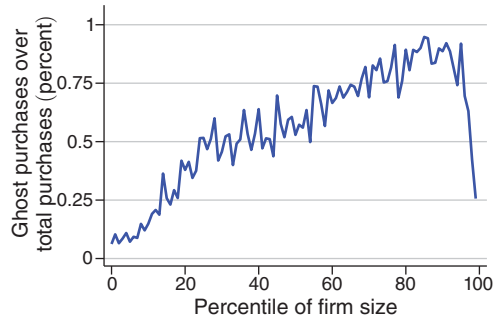
*Fact 3: Ghost deductions are most prevalent in firms owned by high-income individuals.*—Involvement with ghost firms is increasing toward the top of the individual income distribution (Figure 1, panels C–F). Not only does the probability of having ownership of a ghost client increase with individuals' income, but so does the amount of ghost purchases attributed to individuals relative to their income.<sup>6</sup> The ratio of ghost transactions over individuals' income is about 17 times higher in the top 5 percent of the income distribution than in the bottom 80 percent, and almost 36 times higher in the top 1 percent. Zooming in on individuals who have capital income from firm ownership, we also see an increase throughout the income

<sup>6</sup>We attribute ghost purchases to individuals by multiplying individuals' ownership shares by the corresponding firms' ghost purchases.

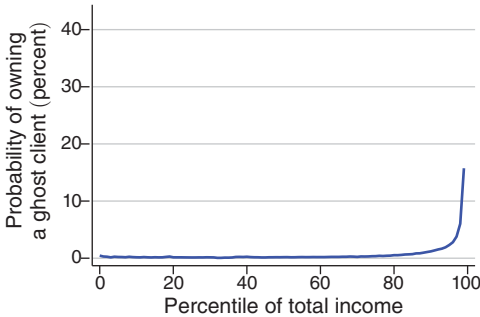
Panel A. Probability of being a ghost client, by firm size



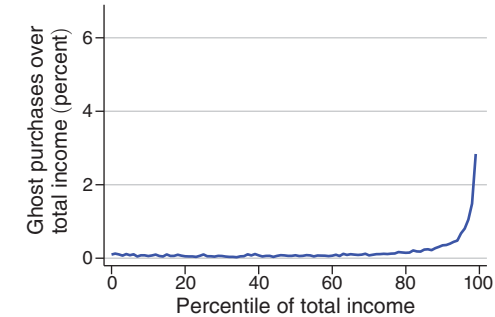
Panel B. Value of reported ghost purchases over firm total purchases, by firm size



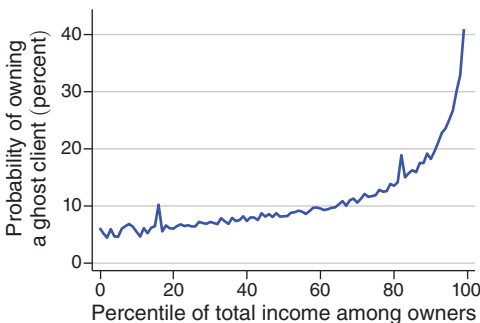
Panel C. Probability of owning a ghost client, by individual total income



Panel D. Value of reported ghost purchases over total individual income, by individual total income



Panel E. Probability of owning a ghost client, by owner total income—owners only



Panel F. Value of reported ghost purchases over total owner income, by owner total income—owners only

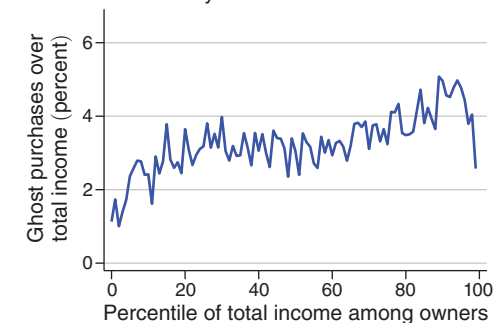


FIGURE 1. DISTRIBUTIONAL RESULTS

*Notes:* This figure provides descriptive results on the use of receipts from ghost firms across the distribution of firm size and individuals' incomes (pooled 2010–2015). Panels A and B show the probability of being a ghost client and the share of firms' reported purchases that are based on receipts from ghost firms, by percentile of firm revenue (for firms that are required to file a purchase annex and have positive revenues). Panels C and D look at individuals and their ownership in ghost client firms, by percentile of individuals' income (for individuals who earn at least \$1 a day and firms with up to 3,000 owners). Panel C shows the probability of having an ownership share in a ghost client. Panel D displays ghost purchases attributed to owners (i.e., individuals' ownership shares multiplied by the corresponding firms' ghost purchases) divided by individuals' total income. Panels E and F show the same as C and D, focusing only on firm owners (i.e., individuals with capital income from a firm in our sample). Outcome variables are trimmed at the top 1 percent of positive values. This figure uses firms' reported profits to calculate their owners' incomes, which can make owners' income appear artificially lower the more ghost deductions a firm takes. Online Appendix Figure A1 shows results when using the profits firms would have without deducting the ghost transactions. Online Appendix Figures A4 and A5 show results separately for ghost purchases by incorporated firms and sole proprietorships, respectively. Online Appendix Figure A7 shows panels A and B for firms that file a purchase annex every month. Online Appendix Figure A8 shows results restricting the sample to the lower two terciles of ghost firms in terms of their size.

distribution.<sup>7</sup> These findings imply that the type of evasion that ghost firms enable tends to reduce taxation of firms owned disproportionately by rich individuals.<sup>8</sup>

These results speak to a growing interest in distributional aspects of corporate tax evasion. While related studies have shown that *individuals'* tax avoidance and evasion are highly skewed toward the top of the distribution (Londoño-Vélez and Ávila-Mahecha 2021; Brounstein 2021; Alstadsæter, Johannesen, and Zucman 2019; Guyton et al. 2021), there are few such studies for firms, as it has been difficult to map corporate evasion to individual owners.

Our next three facts draw on transaction-level data of ghost clients and show that transactions with ghost firms differ in striking ways from those that these same ghost clients make with regular firms.

*Fact 4: Ghost transactions are clustered toward the end of the year.*—Figure 2, panels A and B show that both the number and value of transactions with ghost firms increase strongly toward the end of Ecuador's tax year (which is also the calendar year), while those with other firms do not. In December, there are over twice as many monthly ghost transactions as in the first six months of the year on average, while the number of nonghost transactions (by the same client firms) is only about 6 percent higher in December. This is consistent with firms assessing their annual revenues at the end of the year and then utilizing ghost transactions to achieve a target reported profit level or rate for tax purposes.<sup>9</sup>

*Fact 5: Round number bunching is more prevalent among transactions with ghosts than with nonghost firms.*—Figure 2, panels C and D illustrate the distribution of ghost clients' purchase transaction values (net of VAT) from ghosts and nonghost firms. 6.5 percent of net-of-VAT transaction values for purchases from ghosts are multiples of \$500, far more than for purchases from regular firms (0.7 percent).<sup>10</sup> Such bunching is also observed in Kleven and Waseem (2013) for self-employed individuals' reported taxable income and is consistent with ghost transactions representing false activity (e.g., Klimek et al. 2018; Nigrini 2018).

*Fact 6: Ghost transactions exhibit bunching below the financial system payments threshold.*—A common policy in many countries requires that transactions greater than a cutoff value (\$5,000 gross of VAT in Ecuador) be made through the formal

<sup>7</sup>These findings likely represent a lower bound on the true extent to which ghost deductions increase with income. Since individuals' income includes reported profits of firms they own, their income mechanically looks smaller when firms take more fake deductions. As online Appendix Figure A1 shows, when we calculate individuals' incomes without counting deductions with ghost receipts, ghost deductions increase more monotonically and substantially more steeply with income.

<sup>8</sup>One might be concerned that the higher share of high-income owners is simply a result of the large firm size of ghost clients. However, online Appendix Table A1, panel A shows that the use of ghost firms increases with owner income while controlling for firm size.

<sup>9</sup>This is similar to how US firms have been found to spend more on capital investments toward the end of the fiscal year to reduce tax obligations (Kinney and Trezevant 1993) and public entities spend more at the end of the year to target their budget (Liebman and Mahoney 2017).

<sup>10</sup>Bunching at values net of VAT is consistent with the fact that in Ecuador's tax forms, costs are recorded net of VAT. The bunching statistics are calculated for the full range of transaction amounts. When we exclude transactions below \$400 (which represent a sizeable number of transactions but by construction cannot bunch at multiples of \$500), round number shares are somewhat higher for both ghost and nonghost transactions: 8.1 percent and 2.9 percent, respectively.



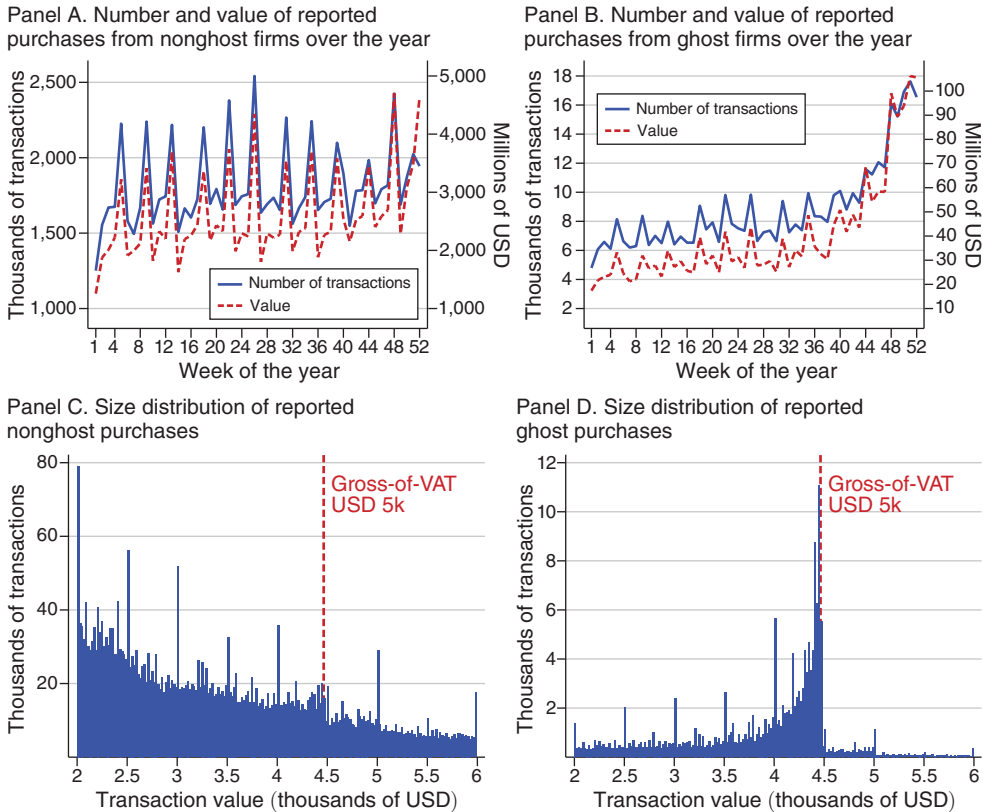


FIGURE 2. PATTERNS OF REPORTED PURCHASES BY GHOST CLIENTS FROM REGULAR FIRMS VERSUS REPORTED PURCHASES FROM GHOST FIRMS

*Note:* Panels A and B show the weekly number and total value of reported purchases over the year, and panels C and D the frequency of values, for reported purchases from nonghost firms and ghost firms, respectively (for all years during 2010–2015) among economically active ghost clients that file a purchase annex. Transaction values are net of VAT. The red dashed lines in panels C and D refer to the corresponding gross-of-VAT amount above which firms are required to make payments via the formal financial system. For ease of visibility, panels C and D include only transactions that are fully subject to VAT. Online Appendix Figure A13 shows the same also including VAT-exempt transactions. Online Appendix Figures A2 and A3 show results separately for corporations and sole proprietorships. Online Appendix Figure A6 shows results for firm-year pairs that filed a purchase annex in all months of that year.

financial sector (i.e., via electronic transfer, check, or credit card). Exceeding this threshold makes ghost transactions more costly, both because payments must be made to a valid—and traceable—bank account, and because real payments must actually take place, even if no goods or services are exchanged. While payments could be reimbursed by the ghost firm, doing so would require coordination and trust. Figure 2, panel D shows strong bunching in ghost transactions just below the transaction value corresponding to \$5,000 gross of VAT and very little density above.<sup>11</sup> By contrast, the distribution of transactions with nonghost firms

<sup>11</sup>In contrast to the round number bunching in Fact 5, which happens at net-of-VAT amounts (as this is the amount used for tax deductions), the \$5,000 requirement is gross of VAT. This value therefore does not coincide with round number bunching. For a small number of ghost clients (4 percent), we observe bunching of ghost transactions at \$1,000 gross of VAT starting in May 2013. We are not aware of any regulatory changes that could explain bunching at this threshold.

(panel C) is relatively smooth through the \$5,000 gross-of-VAT threshold, suggesting that the requirement does not create large economic distortions.<sup>12</sup>

Supplementary analysis in online Appendix A shows how Facts 1–6 are robust across two key subgroups of firms. First, findings are qualitatively similar for incorporated firms and sole proprietorships (online Appendix Figures A2, A3, A4, and A5; online Appendix Tables A2 and A3). Second, we analyze results by firms' filing behavior. Even though firms are required to file purchase annexes to claim deductions, some of this filing is incomplete. Online Appendix Figures A6 and A7 and online Appendix Table A4 show that results look very similar among firms that file purchase annexes every month.<sup>13</sup>

Taken together, these facts shed light on basic, unanswered questions about ghost-enabled tax evasion. The transaction patterns are strongly indicative of deliberate evasion by clients. One would not expect these patterns if apparent ghost transactions simply reflected misclassification of real firms as ghosts by SRI or genuine transactions between ghost clients and informal firms who in turn purchase fake receipts with supplier identification numbers from ghosts.

These descriptive facts capture transactions with detected ghost firms, and it seems plausible that SRI's targeting and detection process may have missed smaller ghosts. However, the production of fake receipts appears highly concentrated: just 10 percent of ghost firms account for over half of all ghost receipts in the sample (both in terms of number and amount) and ten ghost firms alone issue 25 percent of ghost receipts (or 14 percent of total value). The detected sample of ghost firms may therefore capture a large share of total ghost transactions. In addition, in online Appendix Figure A8, we recalculate the distributional analysis of Figure 1 while including only the smaller two terciles of ghost firms (which account for 15.5 percent of the total value of ghost deductions). The results look very similar to the full sample, suggesting limited heterogeneity of transactions by ghost firm size.<sup>14</sup>

A second potential form of selection is into the ghost client sample since smaller sole proprietorships are not required to file purchase annexes. As discussed, these firms have weak incentives to purchase receipts from ghosts: receipts would only be required if they are audited, and they could always purchase fake receipts at that time. The fact that the empirical patterns we observe for corporations and larger sole proprietorships are similar is also reassuring. It is, however, possible that we are missing some ghost clients at the lower end of the full firm size and owner income distributions.

Finally, it is important to note that the sample of ghost firms and clients detected by SRI is the relevant sample for determining the implications of enforcement since tax authorities can only target detected tax fraud. In this respect, Ecuador is unlikely to be unique: tax authorities would generally be more likely to detect larger or more

<sup>12</sup>These results speak more generally to ways in which transacting through the formal financial system limits evasion (Gordon and Li 2009) and to the question of whether outlawing cash can foster tax compliance (Rogoff 2017; Gadenne et al. 2022).

<sup>13</sup>Filing behavior is very similar for corporations and sole proprietorships (online Appendix Table A5).

<sup>14</sup>If there is positive assortative matching (larger ghost firms transacting with larger clients) and SRI is more likely to detect larger ghosts, this could overstate the use of ghosts by larger firms. However, we observe on the contrary that larger ghosts are more likely to transact with smaller clients, but this relationship between ghost size and client size is sensitive to specification.

egregious ghost firms, and size-based thresholds for requiring tax documentation to support deductions are a feature of most tax systems.

### III. Enforcement against Ghost Clients

What can tax authorities do about the sort of widespread evasion via ghost firms that we have documented? Ensuring in real time that all deductions taken by one firm are declared as income by another is extremely challenging in practice, and not even countries with highly developed administrative capacity manage to do so. Many countries—including Ecuador—have made CEOs and accountants personally liable for tax fraud such as the use of ghost-falsified receipts. However, the bar to prove such felonies in court is high. Finally, substantial obstacles arise when agencies pursue ghost firms via direct enforcement since, by their nature, these firms and their true owners are difficult to locate and any success may only be fleeting because new ghost entities can easily reappear.

To address these challenges, in 2016 SRI began an innovative enforcement alternative based on targeting *clients* of ghost firms rather than ghosts themselves. A potential advantage of targeting clients is that unlike ghost firms, client firms have a genuine economic presence that makes them less able to disappear and reemerge, potentially allowing for recovery of evaded taxes. In this section, we evaluate the effectiveness of this approach. SRI sent notification emails to ghost clients, retroactively challenging their deductions from ghost firms on tax returns filed for 2010–2015. The relevant portion of these notifications (with financial details provided as an example)<sup>15</sup> translates as follows:

Dear taxpayer,

Upon reviewing the information available in its registries, the Tax Authority detected that you registered transactions with firms that have been classified, for tax purposes, as nonexistent, ghosts, or individuals and firms that undertake fictitious activities or transactions.

Therefore, you are given a deadline of ten business days to submit your amended corporate income tax and VAT tax forms, in which you must modify the corresponding differences and pay resulting taxes as well as interests and fines:

Fiscal year	Line item	Costs reported by taxpayer	Costs calculated by tax administration	Difference
20XX	799–Total costs and expenditures	\$1,023,686	\$947,166	\$76,520

We focus on notifications sent to incorporated firms regarding their corporate income tax filings because this is the sample for which we have data on firms' amendments (which we will discuss). A total of 2,382 notifications were sent to 1,589 such ghost clients—10.8 percent of all incorporated firms with detected ghost deductions in 2010–2015.<sup>16</sup> SRI selected notified clients primarily based on having

<sup>15</sup> Online Appendix D shows the full notification (Spanish and translated).

<sup>16</sup> SRI also sent 1,288 notifications to sole proprietorships and 329 to incorporated firms about the VAT.

made large deductions with ghost receipts in 2010–2015. While SRI’s methodology is deliberately confidential, the notification sample presumably represents the type of firms tax authorities desire to target.

Notified firms were larger than typical incorporated ghost clients, with 2.4 times higher median tax liability (online Appendix Table A6, panel A). This is consistent with SRI targeting firms with higher potential tax recovery. The median amount of ghost deductions indicated in notifications was around \$181,000 (mean \$338,000), and the median share of ghost deductions out of total purchases was 26 percent (mean 38 percent) among notified firms.

Unsurprisingly, many firms did not respond to the notifications. Within 90 days, 25.4 percent of notifications resulted in the filing of an amendment with a reduction in nonlabor costs. Some firms may not have responded because of failure of the email to reach the firm or the right person within the firm. In addition, as discussed in Carrillo, Pomeranz, and Singhal (2017), firms may choose not to amend, knowing that the tax authority has limited capacity for follow-up enforcement. Adjusting firms tend to be somewhat smaller than all notified firms, with 15.4 percent lower median reported revenues and 30.1 percent lower median tax liability (online Appendix Table A6, panel B).

To estimate the causal effect of these notifications, we compare each firm’s own postnotification filings—after potential amendments—with its original filings for that same tax year. This identification strategy is similar to that used in Carrillo, Pomeranz, and Singhal (2017) and is feasible because we observe the original returns as well as amended returns. We focus on firms that file an amendment within 90 days of receiving a notification that involves a reduction in at least one cost category that could potentially stem from a ghost transaction (i.e., any nonlabor costs). We call this the “adjusting firms” sample. In this sense, firms’ own prenotification filings serve as the counterfactual. This is a different approach from comparing various interventions to each other, as is the case in papers comparing different types of letter messages. The identifying assumption is that absent the notification, firms would not spontaneously file amendments at the time of the notification to lower their cost deductions on filings from previous years.

Two sets of findings in Figure 3 provide support for this assumption. The first relates to the *timing* of amendments. As seen in panel A, there is a stark increase in amendments involving a reduction in cost deductions after notification.<sup>17</sup> Further, panel B shows amendments in calendar time, with zero indicating the start of the campaign in July 2016.<sup>18</sup> Before the campaign, such amendments were rare. After the first notifications were sent, amendments began to increase. This accelerated each time after a large batch was sent—indicated by blue dotted lines. By contrast, there is no increase in amendment rates by nonghost client firms (online Appendix Figure A9).

Second, the pattern of amendment *content*—panel C of Figure 3—provides additional support for the identifying assumption. This figure compares the amount of

<sup>17</sup>The slight increase prior to notification stems from amendments made after the intervention started but before the notification was sent to the specific firm. This likely results from anticipatory spillover effects, as some firms learned that one of their suppliers was detected as a ghost.

<sup>18</sup>See online Appendix Table A7 for notifications sent by month.

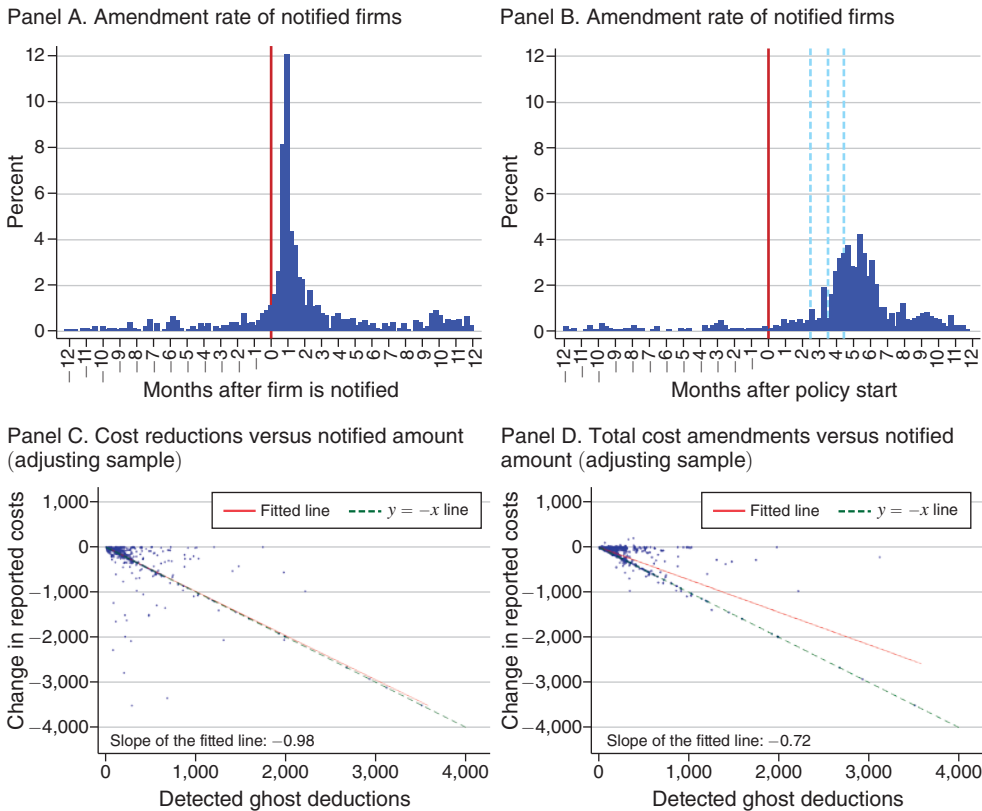


FIGURE 3. AMENDMENT PATTERNS IN RESPONSE TO THE NOTIFICATIONS

*Notes:* This figure shows amendment patterns following the notifications for tax filings from 2010 to 2015. Panels A and B show amendment rates for the universe of notified firms that include reductions to any nonlabor costs. In panel A zero indicates the date on which a given firm was sent its first notification, while in panel B zero indicates the start of the notification intervention by SRI (July 18, 2016). The blue dashed lines in panel B plot the dates on which SRI sent additional sizeable batches of notifications (see online Appendix Table A7 for the number of notifications sent per month). Panels C and D show a firm’s cost amendments compared to the amount of ghost deductions mentioned in the notification. Panel C only includes amendments of nonlabor cost categories that involve a reduction in reported costs, while panel D includes all amendments to any cost categories. The red solid line in panels C and D plots the fitted line of a regression of the change in reported costs on the amount of detected ghost transactions mentioned in the notifications. The green dashed line plots the  $y = -x$  line. All monetary figures are in thousands of US dollars.

ghost deductions mentioned in a firm’s notification (on the  $x$ -axis) to the reduction in reported costs in the amended filing within 90 days of notification (on the  $y$ -axis). The line of best fit shows that on average, adjusting firms made reductions to their claimed nonlabor costs of 98 cents per dollar in the notification. This seems unlikely to have occurred without the intervention. While firms reduced their cost deductions overall, some firms also increased claimed deductions in some cost categories. Such increases appear designed to leave firms with less of an increase in tax liability. Consistent with this notion, the cost categories that were increased are labor, inventory, and financial costs, while the cost categories that were reduced most strongly were domestic purchases, other production costs, and imports. Overall, total costs

TABLE 2—IMPACTS OF NOTIFICATIONS ON REPORTED REVENUE, COST, AND TAX LIABILITY OF ADJUSTING FIRMS

	2015 (1)	2010–2015 (2)
Revenue	–17,733 (21,534)	–10,079 (6,872)
Cost	–228,583 (51,238)	–181,626 (28,680)
Tax liability	40,165 (7,529)	34,003 (5,114)
Number of firms	172	460
Number of firm-year pairs	172	605

*Notes:* This table shows changes to reported revenue, cost, and tax within 90 days after mailing of the notification from SRI, among the adjusting firms. Each coefficient stems from a separate regression showing the average difference in the reported outcome variable across notifications between the original filing from before the notification and the amendment filing after the notification. In column 1 we regress the pre- and postnotification values for filings concerning the tax year 2015 on a postnotification dummy including firm fixed effects. In column 2 we create a pooled sample of all filings (including amendments) for the 2010–2015 tax years. We then regress the reported values (separately for each outcome in question) on a firm–tax year fixed effect and a dummy variable indicating whether the filing was submitted in the 90 days after the firm was sent a notification about the filing from SRI. The coefficient reported here is that on the postnotification dummy variable. Each firm–tax year pair corresponds to a separate notification. Online Appendix Table A8 shows these results for each year separately. Online Appendix Table A9 shows results including all notified firms. Standard errors are clustered at the firm level. All outcomes are in US dollars.

still decreased on average by 72 cents for every dollar contested in the notification (panel D).

The policy intervention had large effects on reported taxes of adjusting firms. Their corporate income tax liabilities increased by about \$40,000 per notification for filings from 2015 and around \$34,000 for the pooled sample across all years (Table 2).<sup>19</sup> Since some firms received notifications for multiple years, the tax increase per firm was over \$44,000. The total amount of additional taxes filed was \$20.6 million. This represents an 81 percent increase on the \$25.4 million filed by adjusting firms in their preamendment returns (13.7 percent of the \$189 million among all notified firms).

These increases in tax liabilities result from the large reductions in reported costs (Figure 3). On average, reported costs were reduced by \$229,000 for 2015 and \$182,000 in the pooled sample (2010–2015) (Table 2). A number of recent studies have found that enforcement strategies aimed at pushing firms to more truthfully report their revenues led many firms to make large offsetting adjustments by increasing reported costs (Asatryan and Peichl 2017; Carrillo, Pomeranz, and Singhal 2017; Slemrod et al. 2017; Almunia and Lopez-Rodriguez 2018; Mascagni, Mengistu, and Woldeyes 2018; Naritomi 2019; Li and Wang 2020). In contrast, we find that this intervention, which pushes firms to reduce reported costs, did not lead to systematic offsetting reductions in reported revenues (Table 2 and online Appendix Figure A10). This points to an important advantage of enforcement focused on cost

<sup>19</sup>Online Appendix Table A8 presents results for each year separately and online Appendix Table A9 for the full notification sample.

overreporting. The third-party reporting system means that in principle, a firm's sales to other firms can be cross-checked with their clients' purchase records. It is plausible that the fear of such actions constrains notified firms' willingness to reduce reported revenues as a way of offsetting cost reductions.

Looking at distributional considerations, the tax increases resulting from this intervention are even more highly concentrated among firms owned by high-income individuals than the overall use of ghost deductions (online Appendix Figure A11). The amount of additional taxes as a share of owners' income is over 56 times higher in the top 5 percent than in the bottom 80 percent of the income distribution and almost 170 times higher in the top 1 percent.<sup>20</sup>

Our estimates likely represent a lower bound on true revenue gains. First, firms may also have filed amended VAT returns with reductions in ghost deductions that we do not observe. Second, the intervention may have disincentivized both targeted and nontargeted firms from using ghost firms in the future. Finally, our definition of adjusting firms, whose amendments we count as resulting from the intervention, is conservative.<sup>21</sup>

In terms of real impacts, we find no evidence that the intervention was followed by firms going out of business or deformalizing. Online Appendix Figure A12 shows these results. There is natural decay over time, as some firms go out of business. However, at 13.1 percent between 2015 and 2017, this rate was very similar for notified and nonnotified ghost clients.<sup>22</sup> These findings are consistent with client firms being large and established. However, it is of course possible that the intervention affected firm development in the longer run. An interesting future research avenue would be to investigate posttreatment impacts over a longer duration and for additional outcomes, such as for investments and employment, as well as potential renewed use of fraudulent deductions from new ghost firms.

In terms of external validity, it is likely that sending similar notifications to a larger number of firms, including smaller ghost clients, would lead to lower returns per notification sent.

#### IV. Conclusion

The phenomenon of tax evasion through ghost firms highlights several broader challenges with building state capacity in the developing world. Third-party reporting is considered central to the ability of modern governments to raise revenue. Ghost firms exploit logistical limits in the ability to cross-check information completely and in real time, thereby undermining the legitimacy of apparently third-party reported firm deductions. While retroactively using information cross-checks can reveal discrepancies, which allows tax authorities to identify potential ghost firms, recovering tax revenue from these firms is often difficult, if not impossible.

<sup>20</sup> Again, the concentration at the top of the income distribution is even stronger when computing individuals' capital incomes without deducting their firms' ghost deductions (online Appendix Figure A11, panels E and F).

<sup>21</sup> Fifty-two additional amendments (filed within 90 days of the notification) reported a change in taxes without updating underlying line items, so these are not included in our adjusting sample. Doing so would raise the total impact of the intervention by \$2.2 million.

<sup>22</sup> Given the different pretreatment evolution, this is of course merely suggestive and not necessarily indicative of the effect of the intervention.

Relatively little is known about the underlying mechanics of firm misreporting of costs.<sup>23</sup> Our paper helps to fill this gap by exploring how ghost firms facilitate cost misreporting and which types of firms engage in this form of evasion. Cost misreporting also has important implications for policy design. It can undermine self-enforcement in VAT systems and may force governments to rely on inefficient tax instruments (Best et al. 2015). For example, high prevalence of cost underreporting would favor retail sales taxes over value-added taxes and turnover taxes (or, generally, broad taxes with limited deductions) over profit taxes.

Our results also highlight the promise of targeting enforcement on ghost clients. One benefit of this type of intervention is that it is quite resistant against attempts at gaming. Traces of the illicit behavior are directly observable by the government (firms issuing a large share of receipts that they do not report as income in their own tax filings), and the generally large, well-established client firms cannot easily disappear. Nevertheless, it is of course possible that firms become more sophisticated if this type of intervention is repeated, for example by retiring ghost firms more frequently in order to change more rapidly who the ghost firms are.

A final important consideration in tax enforcement is its distributional implications. Ghost clients—specifically those likely to be detected and targeted by the tax authority—have ownership that is concentrated at the top of the income distribution. To the extent that the economic incidence of reduced corporate profits falls on firm owners, tax enforcement against ghost clients is therefore likely to be quite progressive.

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<sup>23</sup> Also little studied is the extent to which misreporting in administrative tax data sources may affect researchers’ conclusions about economic phenomena that are measured using such sources. However, one example we can evaluate is our prior work (Adão et al. 2022), in which case we have verified that removing all ghost firms and transactions has only minuscule effects on the paper’s estimates.



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