Working paper UGA-22231

May 2024

You can’t tax what you can’t see: Using fixed cargo scanners to combat tax evasion

Ronald B. Davies
Kyle McNabb
Miroslav Palanský

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You Can't Tax What You Can't See: Using Fixed Cargo Scanners to Combat Tax Evasion*

Ronald B. Davies† Kyle McNabb‡ Miroslav Palanský§

May 15, 2024

Abstract

Taxes and tariffs on imports are a major source of government revenue for many developing countries. This means that tax evasion at the border through understating the quantity and price of imports as well as misclassifying them as lower-taxed goods represents a potentially significant loss to much-needed public funds. In recent years, many countries have implemented non-intrusive fixed cargo scanners at entry points as one way to mitigate such misreporting, providing a quasi-experimental treatment setting. This technology is useful for detecting undercounting of quantities and misclassification but not for identifying underpricing. Using transaction-level customs data for Uganda, we estimate the impact of the introduction of scanners on trade and taxes collected at the border. Our estimates suggest that the scanners reduce undercounting and misrepresentation as intended. However, particularly for the frequent importers who make up the bulk of trade, this appears to have increased underpricing due to potential spillover effects. The net effect was to reduce tax revenues collected at these entry points by 9.8 percent.

JEL classification: F13, H26, O17

Keywords: Tax Evasion; Smuggling; Tax Capacity; Tariffs; VAT.

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*We thank Raymond Ategyeka, Silver Namunane, Nicholas Muganga, Alison Schultz, Mario Cuenda García, and Brian Ahimbisibwe for valuable insights and comments. Thanks also to Gerald Agaba for excellent research assistance. This project has received funding from the International Growth Center under grant UGA-22231. Miroslav Palanský acknowledges additional support from the Czech Science Foundation (CORPTAX, 21-05547M), the Cooperatio Program at Charles University, research area Economics, the Charles University Research Centre program No. 24/SSH/020, and the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 870245. All errors are our own.

†Corresponding author. University College Dublin, School of Economics. Email: ronald.davies@ucd.ie.

‡ODI, London; Center for Tax Analysis in Developing Countries. Email: k.mcnabb@odi.org.uk.

§Institute of Economic Studies, Faculty of Social Sciences, Charles University, Prague, Czechia; Tax Justice Network, London, United Kingdom. Email: miroslav@taxjustice.net.

1 Introduction

Taxes collected at the border are a major source of government revenue for developing countries. In addition to tariffs (which apply only to imports), the scrutiny used at borders aids in the collection of taxes such as excise duties or value-added taxes which apply to both domestically produced and imported goods. For developing countries, difficulty in raising revenues from domestic sources has led to reliance on border-collected taxes. As shown in Figure 2, there is a marked difference in the role trade taxes pay in government revenues for low-income countries as compared to high-income ones. Nevertheless, the same difficulties in collecting from domestic tax bases – namely weak enforcement and high monitoring costs – which lead to a reliance on trade taxes also present a challenge when taxing imports. Importers have incentives to lower their tax burden by under-reporting trade volumes, manipulating prices to reduce ad valorem tariffs, and misclassifying their imports as low-tariff products rather than high-tariff ones. In response, some countries have been modernizing their enforcement methods to reduce the potential for such evasive activities. In this paper, we use transaction-level customs data for Uganda from 2016-2021 to estimate the impact of one such effort – the installation of fixed cargo scanners at the Ugandan border with Kenya.

Fixed cargo scanners essentially act as larger versions of the familiar passenger baggage scanners at airports, i.e. a cargo truck passes through the scanner, an operator examines the images to check if the contents appear amiss relative to the manifest, and the truck is then either waved through or a more detailed inspection is undertaken (see Figure 1 for an example of a fixed cargo scanner at the Malaba border crossing from Kenya to Uganda). If the contents deviate from the manifest, then required duties are re-assessed, a fine may be levied, and goods may be seized. Such scanners were installed in 2018 at two Ugandan entry points on the Kenyan border, namely Busia and Malaba (see Figure 3). These scanners, which cost the Ugandan government 7.5 billion Ugandan Shillings each (approximately EUR 1.5 million at the time), were explicitly intended to stop illegal activities, with import tax evasion being highlighted (Kyatusiimire 2018, Lyatuu 2018). To judge the cost-effectiveness of the scanners, it is then necessary to estimate the changes following their installation.

The natural expectation is that scanners should limit firms from understating the value of a given product that they are bringing in, either by undercounting the quantity of a product and/or misclassifying it as a lower-taxed good. Since scanners make it easier to verify quantities and detect misclassification, all else equal they should increase imports of taxed goods and, to the extent that they limit misclassification, reduce the imports of non-taxed goods. At the same time, however, losing the ability to evade taxes via these methods can lead firms to exploit alternatives that cannot be detected by scanners, including the underpricing of imported goods. This then would yield an ambiguous impact on taxes collected. Furthermore, the increased underpricing on previously undercounted or misclassified products can affect the declared value of goods that had been correctly reported, something we term an "underpricing spillover". This spillover can arise when a given firm initially imports both legally (with correct reporting) and illegally (with undercounting or misclassification), but after the scanners are implemented, the same price must be charged on all its imports. Alternatively, as some firms underprice, this lowers the reference price for other importers, increasing their incentive to underprice as well.[1] Thus, the shift toward underpricing can lead to lower import values and unexpectedly reduced tax collections.

We examine these possibilities using a difference in differences strategy on transaction-level customs data for Uganda. These data, initially drawn from the Automated System for Customs Data (ASYCUDA) contain, among other things, information on the value of each import transaction, including data on the importing firm, product category, and country of origin. When considering the aggregate amount of trade and taxes collected, we find little impact of the scanners. This, however, conceals important granular differences. When operating at the product level to account for different product mixes across entry points, we

[1] Note that these are declared prices on the invoice which need not match those actually paid to the exporter. While such differences could in theory be caught in an audit, the primary reason for relying on trade taxes is inadequate income tax enforcement. Finally, as shown in the model of Davies et al. (2018), if the firm is a multinational and the transactions are intra-firm, then underpricing in order to avoid tariffs factor into the overall transfer pricing decision.

find that the quantity of non-taxed goods fell post-introduction, while their unit value rose. For taxed goods, the reverse is true. These estimates are consistent with a decline in the role of misclassification and undercounting with a simultaneous increase in underpricing. Further, we find that even as misclassification and undercounting decline, there is nevertheless a fall in the imports of taxed goods of 7.7% as compared to the pre-scanner level, something suggestive of underpricing spillovers. This then leads to an estimated 9.8% reduction in tax receipts. Thus, the reduction in misclassification and undercounting is more than offset by more aggressive underpricing maneuvers.

Further granular analysis finds that the results are most clearly seen in products which are frequently imported. Similarly, the effects are strongest for frequently importing firms. We find an increase in taxes paid by moderately frequent importers but a reduction in taxes paid by the most frequent importers. This is consistent with the notion that frequent importers are those most prone to underpricing spillovers. Finally, our results show that the effects are most clearly observed for goods with low tariff levels. These findings suggest that the scanners were most effective in reducing tax evasion by mid-sized firms importing specific types of products. Further, as the underpricing results are clearest for the most frequent importers (which are more likely to be part of multinational corporations), this tariff-induced underpricing may be linked to corporate tax-induced price manipulation.

Our work contributes to two bodies of literature. The first relates to tax evasion, especially that in the context of international trade. Within this, one relevant strand is the trade gap literature. This work relates the difference in reported exports and reported imports between a country pair. When this gap systematically varies with the tax rates faced in the two partner countries, this is suggestive of an effort to misreport in order to avoid tariffs. Examples include Fisman & Wei (2004), Javorcik & Narciso (2008, 2017), Kellenberg & Levinson (2019), and Best et al. (2023). In particular, this work links a larger trade gap to higher tariffs, i.e. the incentive to evade is larger when tariffs are larger. We similarly explore the impact of scanners as a function of the tariff.

The second theme relating trade to tax evasion (or "avoidance" given that this is typically legal) is the work on transfer pricing by multinationals. By manipulating the price of goods traded within the firm, this allows firms to use imports as a means of shifting profits from a high-tax location to a low-tax location, particularly a tax haven. Examples include Davies et al. (2018) and Wier (2020) who use French and South African data, respectively, to show that transfer mispricing is related to the tariff rates specifically for intra-firm transactions. Beer et al. (2020) provide a recent overview of the literature. We borrow from this literature to examine both the impact scanners have on unit values (prices) and how their impact varies between multinationals and domestic Ugandan importers.

The second main literature we contribute to is that considering tax capacity (also known as tax efficiency), i.e. a government's ability to actually collect the taxes it is owed. Recent examples include Best et al. (2015), Besley & Persson (2013), and Carrillo et al. (2017). A significant part of this literature, as reviewed by Okunogbe & Tourek (2024), has focused on the role of technology in improving tax efficiency. Specifically, they focus on the role of information processing – including digitalization of reporting and the capability to cross-check them across multiple parties – in improving the detection of tax evasion. In particular for Uganda, the work of Almunia et al. (2024) compares transactions from the VAT statements of buyers and sellers in Uganda and finds significant discrepancies which led to an underpayment of VAT of approximately $384 million US over 2013-2016. While neither they nor ourselves can repeat this exercise for imports (as we lack the corresponding figures for the exporting firm), they do find that there are fewer missing transactions for imports, something they argue is due to the greater scrutiny of imported goods at border crossings. To our knowledge, ours is the first paper to consider the impact of scanners on imports and tax evasion. In particular, given the relative ease and low-cost of implementing these methods when compared to digitizing the transaction and taxation systems, judging their efficacy is important for cash-strapped governments.

Our results also add a new dimension to the debate on the benefits of switching from tariffs to VAT in a developing country context. Whereas Keen (2008) argues that this will reduce distortions, others such as Emran & Stiglitz (2005) suggest that this can lead to informality. Davies & Paz (2011) use an endogenous entry model and find that tariff reductions reduce informality whereas the VAT need not increase it. Our results suggest that informality – that is, tax evasion – can be relatively mild (where goods at least pass through customs even if they don't pay their full duties) or more aggressive (if firms "drop off the radar" entirely to avoid detection). Furthermore, when border controls work to reduce non-evasive trade (something not occurring in the Davies & Paz (2011) model), this can further limit the benefits of VAT even when tariffs are low.

The rest of the paper proceeds as follows. We begin by developing some expectations for the scanners' impact in Section 2. In Section 3, we discuss the data we use and our estimation strategy. Section 4 presents our results. In Section 5, we provide some final comments and policy recommendations.

2 Hypothesis Development

In this section, we discuss the various methods an importer can use to dodge taxes. We do so in order to develop testable hypotheses. To this end, consider a firm importing a product of type i. On its customs declaration form, it must provide three pieces of information. First, it must declare the quantity imported (q) and total value of the shipment (pq where p is the unit value). Second, it must declare the product's type, i.e. its tariff line. This is then used to assess the applicable tariff duties and VAT. When the firm reports this truthfully, it results in a tax liability

$$(d_i + v_i + d_i v_i)\, pq$$

where the ad valorem duty is d_i and the VAT rate is v_i.

The firm can reduce this tax bill in two ways. First, it can understate the quantity and/or unit value, both of which would result in a lower total value of imports thereby reducing the tax base. Second, it can misclassify the product line by declaring the product as of type j rather than i. If j has a lower effective tax than i, as would occur if $d_j < d_i$ or $v_j < v_i$, then this lowers the tax rate. Thus, to avoid tax, a firm has an incentive to (i) undercount the quantity of imported goods, (ii) underprice the unit value, and (iii) misclassify the product type. Naturally, an importer can use more than one of these approaches with the relative degrees being driven by differences in marginal expected cost of one method compared to another.

When cargo scanners are implemented, this increases the depth of visual inspection of the goods when they cross the border. For firms that undercount quantity, the introduction of scanners would increase the marginal expected cost of undercounting since they are more likely to be caught. Thus, all else equal, the introduction of the scanners would increase the reported quantities. Note that, since there is only an incentive to undercount goods which are taxed, this occurs only for taxed products and we expect no change in the quantity of goods which are VAT- and duty-free.

Similarly, cargo scanners make it more difficult to misclassify product types. As a result, if there is misclassification of taxed goods as non-taxed ones (or more generally as lower-taxed ones), all else equal this will result in a reallocation of a given quantity from non-taxed to taxed product types. As such, misclassification will lead to a reduction in the quantity of non-taxed goods and an increase in the quantity of taxed goods. If there are multiple tax bands, then we would expect this to hold for the lowest and highest tax bands with products taxed at intermediate rates being an ambiguous combination of the two effects.

When misclassification is combined with undercounting, we reach our first hypothesis.

Hypothesis 1: *All else equal, the introduction of scanners will increase the imported quantity of taxed goods. If there is misclassification, scanners will also lower the quantity of non-taxed goods. With multiple tax bands, quantity increases for the highest tax band and decreases for the lowest, with ambiguous effects in between.*

What scanners cannot do, however, is detect underpricing. This does not imply that underpricing cannot be detected, however, since it can be determined by a comparison against "normal" market prices. Indeed, many tax authorities examine unit values in order to identify money laundering and/or transfer pricing by multinationals. Nevertheless, the efficacy of this method of tax avoidance is unlikely to be directly impacted by the introduction of the scanners since visual inspection alone is not enough to determine whether the declared price is appropriate. However, if scanners impede the use of undercounting and misclassification, then it seems plausible that importers will turn to this substitute method of tax evasion instead. Thus, for taxed goods, even as quantities rise, this can lead to a reduction in the unit value. For non-taxed goods, where there is no incentive to underprice, there should be no effect so long as there is no misclassification. If there is misclassification, however, then the effect would depend on whether the misclassified goods were also underpriced relative to their falsely declared type. If this is the case, a reduction in misclassification would move the falsely low-priced goods out of that product category, and the reported unit value would increase. This is our second hypothesis.

Hypothesis 2: *All else equal, the introduction of scanners will reduce the unit value of taxed goods. If there is both misclassification and underpricing in imports, then the unit value for non-taxed goods will rise after scanners become operational. With multiple tax bands, unit values decrease for the highest bands and increase for the lowest, with ambiguous effects in between.*

Finally, we consider what these changes mean for the value of imports and thus the total tax collected. If there is both misclassification and underpricing, then for goods initially labelled non-taxed, the quantity will fall as unit values rise, creating an ambiguous effect. Nevertheless, there should be no change in the tax paid on these imports since they are non-taxed.

Similarly, the impact of scanners on the value of taxed imports is ambiguous because of a rising quantity pitted against a falling unit value. An important potential effect of the unit value reduction is that it may also impact imports which were declared truthfully. This can happen for two reasons. First, comparable to what a multinational can justify when transfer pricing, the ability to underprice is likely linked to a "non-manipulated" reference price. If a firm had been importing the same good both above and below the normal market price prior to the scanners, and started to underprice more aggressively post-scanner, it may need to do so for the previously highly-priced imports as well to avoid raising red flags with the tax authorities. Note that this impact is more likely to be found among frequent importers. Multinationals in particular may find this possible for their intra-firm transactions since they are both the importer and the exporter, meaning that the exporter is more willing to accept this lowered price on its goods.

Second, in addition to affecting the within-firm reference price, increased underpricing would also lower the reference price for other firms. This would then make it easier for them to underprice as well. As a result, even initially non-evaders may begin to do so following the introduction of scanners. Combining these two effects, this highlights the possibility that even when scanners increase the tax base as undercounting and misclassification fall, they can nonetheless result in unanticipted underpricing spillovers which result in a net decline in the tax base and lower tax revenues.

Before turning to our empirical analysis, we wish to make three final points. First, one of the presumed benefits of implementing the scanners was a reduction in waiting time at the border. At the time of their installation, the government indicated that this new technology would greatly speed up inspections at the border with estimates suggesting that scanners would raise capacity from 300 trucks per day to 200 per hour (Kyatusiimire 2018). If true, this might increase total imports of all products, taxed and non-taxed. Second, if these transaction cost savings are partially passed on to consumers, this could result in a reduction in unit prices. Thus, the estimates below will be net of those trade cost changes. That said, if those effects are proportional across the taxed and non-taxed goods, our estimates will provide estimates of the relative change driven by the tax evasion modes as discussed above. Third, it must be remembered that scanners are still operated by people, people who themselves may ignore what the scanners reveal for their own personal gain. While technology may make it harder to avoid taxes, corruption can nevertheless circumvent technology's anti-evasion abilities. Thus, the results must be interpreted with that in mind.

3 Data and Estimation Approach

Our data come from two sources. First, the transaction-level customs data come from the universe of customs declarations submitted to the Uganda Revenue Authority. The data is accessed in person via the URA's secure research lab and is described in detail in (Tieu et al. 2023). We use the data from July (the start of the fiscal year) 2016 through June 2021. This latter date is used both because it represents the end of a fiscal year and because it is a year or more ahead of the installation of scanners at additional entry points. For each import transaction, we have an anonymised importer identification number, the eight-digit harmonised system (HS) product code, the country of origin, the quantity imported, the value imported (in Ugandan Shillings, UGX), and the value of any tariff duties or VAT paid. From the value and quantity we are able to construct the unit price. We combine the duties and VAT into a total tax bill. We use only transactions for private-sector importers for two reasons. First, imports by the government and/or NGOs are often exempt from duties and VAT. Second, the incentives to evade taxes likely differ for those groups as compared to private individuals. Together, this makes such imports poor comparisons to those of private firms.

Critical for our analysis, we have two variables describing the border crossing and where the container was unsealed. For most, these are the same although there are a large number of observations where the container was cleared (at the "station") in Kampala although it crossed the border via a different point (the "front office"). Some of these have a front office for one of the nearby ports (Kibanga for the most part, Entebbe for some). Most, however, entered via Malaba as it is on the main route from the Kenyan port of Mombasa. We therefore use the front office as the entry point for observations where the station was Kampala.[2]

The second data source we use are the East African Community (EAC) Tariff Codebooks and Gazettes which, for each product-origin-year, list the tariff rate applied. The applicable tariff rates fall into eight bands: 0, 10%, 25%, 35%, 50%, 60%, 75%, and 100%. In addition to the tariff, most products are liable for the 18% VAT. For each product, we construct a dummy variable $Taxed$ which equals one if at least 99% of a product's transactions pay a positive tax of some type and zero if no more than 1% of transactions do. These two thresholds are used to keep as many transactions as possible while allowing for occasional errors in the raw data. For products between these, we drop them. We do so for two reasons. First, in visual inspection of the data, this is likely due to a larger number of errors in the raw data (i.e. duty-free products that are subject to VAT yet have a number of transactions that are recorded as paying none). Second, a VAT-free product may be imported from different countries, some of which are duty-free and others of which are not. As including the small number of such products would greatly expand the product space (since we would need to distinguish within a product by country of origin) without adding a great deal of benefit, we omit these to create an easier-to-interpret sample.

In Table 1, we list the total amount of taxed and non-taxed goods imported by entry point. Malaba and Busia are dominant entry points, rivaled in size only by the airport's cargo terminal (Entebbe 1) and Mutukula (which is on the border with Tanzania). Note that we include zeros, that is, when there are no reported imports of a given product via a particular entry point at a specific point of time, the total value, quantity, and taxes paid are counted as zeros, not missing values. Note that in such a case, it is impossible to construct

[2]Note that this is rarely an issue for observations where the station was Entebbe, the airport that serves Kampala. This then suggests that it is primarily an issue for goods arriving into Uganda via land and destined for the capital.

a unit value, thus those observations are omitted in the unit value regressions.

Our approach is to use a difference-in-difference estimation which compares an outcome variable (total imports, quantity, unit value, duties, VAT, or total taxes) before and after treatment (the introduction of a scanner) while controlling for a battery of fixed effects. During the time period covered by our sample, two scanners became operational: one in June 2018 in Busia and one in September 2018 in Malaba. In addition, in line with our hypotheses, we investigate the possibility of differential effects on taxed and non-taxed products coming through these treated entry points. To this end, we estimate variants of:

$$Y_{pst} = f\left(\beta_1 Scanner_{st} + \beta_2 Scanner_{st} \times Taxed_p + \gamma_p + \gamma_s + \gamma_t\right) + \varepsilon_{pst} \tag{1}$$

where the dependent variable Y_{pst} is the relevant outcome for product p entering through entry point s in month-year t. This is constructed by aggregating across transactions. Unit values are constructed by aggregating total imports and total quantities and then dividing the first by the second.

The variables of interest are *Scanner* and its interaction with *Taxed*. The first is a dummy variable equal to one for observations for which a scanner is operational at a given entry point and month-year. The latter is equal to one if the product is taxed. Each of the γs represent fixed effects for product, entry point, and time period (month-year, not month and year). Finally, the robust error term ε_{pst} is clustered at the entry point level. Note that this allows for correlation in the errors across products within a given entry point, something that is necessary if there is misclassification between products at that entry point.[3] This baseline specification is modified to consider different tax levels, to compare imports across firm-products, and more as discussed below.

Following on from our discussion in Section 2, if there is misclassification, then for total imports, quantities, and unit values, we expect different signs for β_1 and β_2. Specifically, we

[3]As discussed above, we do not believe that entry points are reasonable substitutes for one another and thus we do not consider correlations across stations.

hypothesize that the introduction of scanners will reduce imported values and quantities of non-taxed goods, so that $\beta_1 < 0$ and increase them for taxed goods, so that $\beta_2 > 0$. If there is both misclassification and underpricing, then we anticipate the opposite for unit values, so that $\beta_1 > 0 > \beta_2$. Since, by definition, non-taxed goods do not pay duties or VAT, we cannot estimate both of these when considering duties, VAT, or total taxes.

When choosing an estimator, two features of the data drive our choice: the prevalence of zeros and the skewed distribution of values. Looking at the first, there are a large number of zeros in the data since some products do not come through a given entry point every month. Indeed, some products never come through a given entry point, something we account for in a robustness check. To illustrate this, in Figure 4, we plot the histogram of the number of months a product is imported via any entry point. As can be seen, many products are imported only a few times during the sample period. That said, as shown in Figure 5, a large share of the total trade value is made up of those products which are frequently imported, indicating a highly skewed distribution. This figure also illustrates the relative amounts of taxed and non-taxed products in those categories. Similarly, as illustrated in Figure 6, many firms import infrequently with a fairly small number importing every month. Nevertheless, Figure 7 shows that again these frequently importing firms make up the bulk of trade. Because of the skewed nature of the data and the significant number of zeros when operating at the product and/or firm level, we follow the recommendation of Santos Silva & Tenreyro (2006) and use the PPML estimator.

4 Results

We begin our analysis in Table 2 where we aggregate across firms and products to consider total imports and government revenues by entry point and month-year. Note that as we are aggregating across products, it is inappropriate to aggregate quantities and then generate unit values as different goods' quantities are measured in different ways. In column 1, we examine the total value of imports where the estimate suggests that the implementation of scanners is associated with a significant decline in the value of imports of 6.8% as compared to the pre-scanner level.[4] This is suggestive of underpricing spillovers eroding the value of taxed imports. We acknowledge that one potential concern with this estimate is that tax dodgers may shift their imports from the treated entry stations to those in the control group. In our case, however, this is somewhat unlikely as their is not a reasonable alternative for using the treated stations.[5]

In column 2, we split imports between those that are taxed and those that are not.[6] Based on our hypotheses, if there is misclassification, the impact on imports of non-taxed goods is ambiguous as quantities would fall even as unit values rise following the introduction of the scanners.[7] If the quantity effect dominates, then the net impact should be to lower non-taxed imports. For taxed goods, we expect the opposite, i.e. if the quantity effect dominates we should find a positive coefficient on the interaction. Finally, note that the net effect for taxed goods is the sum of the two. Although the coefficients are insignificant, their signs are consistent with the dominance of the quantity effect from misclassification. This insignificance may be due to aggregation across products; when different entry points tend to different sets of products, this can cloud clear effects. We explore this more momentarily.

Finally, in columns 3-5, we examine what happens to the duties, tariffs, and total taxes collected.[8] This suggests that there is a rise in the taxes collected although, consistent with

[4]Recall that when the coefficient on a binary control variable is β, the percentage change is calculated as $100\left(e^{\beta}-1\right)$.

[5]The bulk of imports via Malaba and Busia come from the Kenyan port of Mombasa. The best alternative from there would be to divert north to the border crossing in Suam and then return south skirting the mountain range. According to Google Maps, this roughly 400km detour is along winding, poorly maintained roads and would optimistically add more than a day to transport times. In any case, as shown in Table 1, Suam is a small entry point and unable to handle significant diverted trade. Likewise, to arrive at the second biggest entry point – Entebbe – would mean travelling by air rather than land. Finally, to reach Mutukula on the Tanzanian border, a truck would need to add 1,200km to its trip just to reach the Ugandan border. Therefore we feel that redirecting imports to non-scanned stations is unlikely. This notion is confirmed by interviews with various Uganda Revenue Authority's staff.

[6]Note that the size of the sample does not quite double because, as reported in Table 1 some entry points only import taxed goods.

[7]Recall that when aggregating across products, it is inappropriate to combine quantities and thus construct aggregate unit values.

[8]When doing so, we only used the taxed category as, by definition, the revenues from non-taxed goods

column 2, this change is statistically insignificant.

4.1 Product-level Results

As noted above, different entry points may import different products. Indeed, this is what one might expect given the different levels of activity (Table 1) and the fact that some goods are imported infrequently (Figure 4). With this in mind, we aggregate across transactions at the product, entry point, and time level. Note that as we include product fixed effects, this absorbs the taxed coefficient shown in Table 2.

In Table 3, we begin by again looking at the total level of imports in column 1. What we see is a highly significant decline in imports for non-taxed goods following the introduction of scanners. Translating this coefficient to a percentage change, this is equivalent to a 89.4% decline in the value of imports for an non-taxed good in a treated station relative to the same good in an untreated station. Although this may seem large, recall that there are a significant number of zeros in the data, i.e. that this can result from some non-taxed products no longer being recorded post-scanner. Looking to the interaction term, we find a strongly positive coefficient, suggesting a clear difference for taxed goods. Here, the net effect (sum of the two coefficients) translates to a net decline of 7.7%. Taking into account our hypotheses, this would either suggest that the unit value effect dominates and/or that there are underpricing spillovers.

To investigate this further, we turn to columns 2 and 3 where we examine the quantity and unit value changes. When looking at the quantity changes, see results consistent with scanners making it more difficult to misclassify taxed as non-taxed goods. Notably, the net impact on taxed goods is positive, with an estimated rise of 38.8%. The unit value estimates similarly support our second hypothesis. Critically, the unit value for taxed goods is estimated to fall by 49.2%. This then suggests that the decline in total imports may well be the result of underpricing spillovers.

are zero.

In columns 3 to 5, we estimate the change in taxes collected on a given product following the introduction of scanners. Note that when doing so, we again omit non-taxed goods. Although we find a negative, albeit insignificant decline in tariff duties, there is a significant reduction in VAT receipts that then drives a 9.8% decline in total taxes collected. Given that quantities are expected to rise, this is potentially the result of the declining unit values as imports shift towards this method of evasion. An important thing to note here is that this does not account for differences in the tax rates applied to different goods. We explore this issue below.

The last two columns repeat the first two but omit those product-entry point pairs where there are never any positive imports. As expected, this greatly reduces the sample size. Nevertheless, it does not change the overall flavour of the results, with an expected decline in overall taxed imports of 12.4% and an expected rise in taxed quantities of 37.2%.

As discussed in Figures 4 and 5, many products are imported infrequently yet those that are frequently imported account for the bulk of total imports. With this in mind, Tables 4 and 5 split the sample into those products which are imported less than half the time (i.e. 30 months or less) or more than half the time. For the infrequent product results in Table 4, we see results similar to what was found in the combined results. That said, there is somewhat less significance, something potentially driven by the fact that at least half of the observations are zero by definition. In addition, the point estimates tend to be smaller. The frequent product estimates in Table 5, again paint a similar picture with the primary difference being both higher point estimates and stronger significance. For the frequent goods (which again make up the bulk of imports), we estimate a 86.5% decline in imported tax-free products and a 5.8% drop in taxed imports. This latter decline is again the result of the unit value decline and leads to an estimated tax loss of 8.6%.

4.2 Firm-level Results

One feature of the data shown in Figures 6 and 7 that there is significant variation into how often an importer does so with the more frequent importers driving the bulk of trade. The incentive to dodge taxes may well vary across those groups. For example, infrequent importers may lack the knowledge of how to falsify customs declarations in order to reduce their tax burden. In addition, frequent importers may be able to better work around the system and misclassify goods because they import multiple products.[9] With this in mind, we now disaggregate further to the firm-product-entry point-time period level.[10] In addition, we split the sample into four frequency groups: low (firms who import in 1-15 months), mid-low (16-30 months), mid-high (31-45 months), and high (46-60). In order to reduce the size of the dataset, we restrict attention to frequently imported goods (those imported 31 or more months). Recall that these products made up a large share of total imports.

As before, we start by examining the level of imports, with the results found in Table 6. In the first four columns, we see a consistent pattern that once again reveals a significant decline in non-taxed imports and a smaller decline in taxed imports. In terms of the size estimated changes, for non-taxed goods, the effects are fairly similar for the low to mid-high group, with a significantly smaller impact in the high-frequency group. When looking to non-taxed goods, the net effect is a 2.9% drop for the low group and a 3.8% decline for the high group. Those in the middle, however, are quite different with a 47% decline for mid-low importers and a 50% *increase* for the mid-high group. Thus, there seems to be some significant differences across the frequency groups. In columns 5 to 8, we repeat this but omit the entry point-product combinations for which there are never any imports. This does not greatly impact the estimates.

Table 7, we repeat this approach but using quantity as the dependent variable. Across all groups, we see a decline in the quantity of non-taxed goods with the effect markedly

[9] In a very different context, Davies et al. (2018) find that large firms are more apt to dodge taxes – including tariffs – via manipulating prices.

[10] Firm here refers to the importer, not the exporter or the transport firm.

higher for the mid-high group. For taxed goods, we see a net quantity increase for mid-low (93.3%), mid-high (17.6%), and high (42.6%) categories. Low frequency importers, however, buck the trend with a decline of just over 25%. This may suggest that scanners drive such firms from the market entirely. As before, we repeat these estimations in columns 5 to 8 but omit entry point-product pairs for which there are never positive imports. We find broadly similar results.

In Table 8, we use unit value as the dependent variable. Perhaps unsurprisingly given how unit value is constructed, we find differences across groups with only the high-frequency importers matching our expectations. Consistent with the fact that this group makes up such a major fraction of importing activity, they appear to be driving the product-level estimates.

Finally, in Tables 9 and 10 we report estimates of the revenue changes using just taxed goods. This reveals some differences across the groups. For infrequent importers, there is no significant change in taxes collected. Mid-low and mid-high importers, however, pay more in VAT with the latter also paying more in tariff duties. This then seems to lead to more taxes collected from this set of importers, with the total taxes collected from mid-high firms increasing by an estimated 64.4%. Nevertheless, the high-frequency firms appear to pay 21.4% less in tax. If these frequent importers are those more likely to have been importing the same product legitimately sometimes and illegitimately others, then they may be more subject to the underpricing spillovers which would explain this difference.

Taken together, these estimates suggest that the impact of the scanners on tax evasion may vary significantly across firm types with mid-size firms (those importing fairly often) seeing an increase in their tax liabilities. Large firms, however, appear to be able to avoid these burdens by adjusting the declare unit values across all imports. Further, to the extent that these firms may be multinationals, this incentive can align with corporate tax-driven transfer pricing.

4.3 Differential Tax Rates

To this point, we have assumed that the change in the variables following the introduction of the scanners was the same across all taxed goods. Since the tax applied differs, however, this may not be appropriate. Further, this assumption may conceal misclassification across different tax levels. With this in mind, we return to the product-level approach but distinguish products according to their tariff level (0, 10, 25, 35, 50, 60, 100). To simplify the comparison, we also separate the sample according to whether or not products are liable for VAT.

In Table 11, we carry out the above set of regressions but for VAT-liable products. Note that all of these fall in the *Taxed* category previously used since all are subject to VAT. In column 1, we consider the amount of imports following the introduction of the scanners. For tariff-free goods, only the first estimated coefficient applies. As can be seen, duty-free imports significantly decline, with an estimated reduction of 73.6%. For other products, this reduction is smaller and significantly so for the lower tariff rates. In particular, the decline is closest to zero for the 10% tariff rate, with the point estimate and significance of the difference fading as the tariff grows. This suggests that misclassification may be strongest between duty-free goods and those with fairly low tariffs.

Turning to the quantities, we see a similar pattern. Note that, unlike the baseline results in Table 3, we no longer find an increase in the quantity for any product, regardless of its tariff rate (more on this momentarily). For unit values, although we again see a sign pattern suggestive of misclassification combined with underpricing, the coefficients are insignificant. Finally, in terms of taxes, we see that although misclassification seems to decline, this does not lead to increases in tax collection.

In Table 12, we omit those entry point-product pairs which are always zero and repeat this exercise. This results in two notable changes compared to Table 11. First, we now estimate significant increases in quantity for the low-tariff goods. Second, we now see little change in the duties collected. This suggests that the surprising decline in quantities observed above were due to the inclusion of these inactive entry point-good combinations.

Finally, in Table 11 we repeat this exercise using the VAT-exempt goods. In comparison to the baseline results and those for VATted goods, the findings are largely similar, with the primary difference that we predict a rise in imports of VAT-free goods tariffed at the 10% rate. This is true when we include entry point-product combinations that are all zeros (columns 1 and 2) and when we do not (columns 5 and 6).

5 Conclusions and Policy Recommendations

Tax evasion in its many forms is a problem for high- and low-income countries alike. Due to weak enforcement and costly monitoring of domestic activity, developing countries continue to rely heavily on taxes collected at the border in the form of tariffs and VAT. Nevertheless, efforts have been made to improve tax capacity with technological innovations leading this drive. Since such moves are costly, it is necessary to derive estimates of their efficacy.

Here, we use one such effort – the installation of fixed cargo scanners at two Ugandan border crossings with Kenya – to estimate their effect on trade and tax revenues. We find that the scanners are associated with a drop in imports for taxed goods, a result which is the combination of a rise in quantity and a dominating decline in unit values. This is consistent with importers shying away from undercounting or misclassifying their imports but resorting to manipulating prices instead. The net effect is a decrease in the overall level of taxed imports, with the evidence suggesting this may be due to underpricing spillovers. This drop in imports then lowered the total tax revenues, a result especially clear in VAT receipts since even duty-free imports incur VAT. Importantly, these effects vary widely across firms, with the ability to resort to underpricing the domain of the most frequent importers, a group perhaps most susceptible to underpricing spillovers. As these larger firms account for the bulk of trade, this then feeds into the aggregate tax loss.

These results suggest that it is not sufficient to consider how improvements in enforcement and tax capacity operate in the border tax sphere alone. Further, when the ability to work around additional enforcement varies across firms, this introduces an inequality reminiscent of the other tax differences found between small and large companies. This then lends a new angle to long-standing debates on the optimal tax policy, especially in a developing country context where border taxes are a critical feature. It also highlights the growing role of multinational corporations and points to their ability to shift profits to low-tax jurisdictions via transfer mispricing. This underlines the importance of the ongoing efforts to curb corporate tax avoidance via profit shifting to tax havens.

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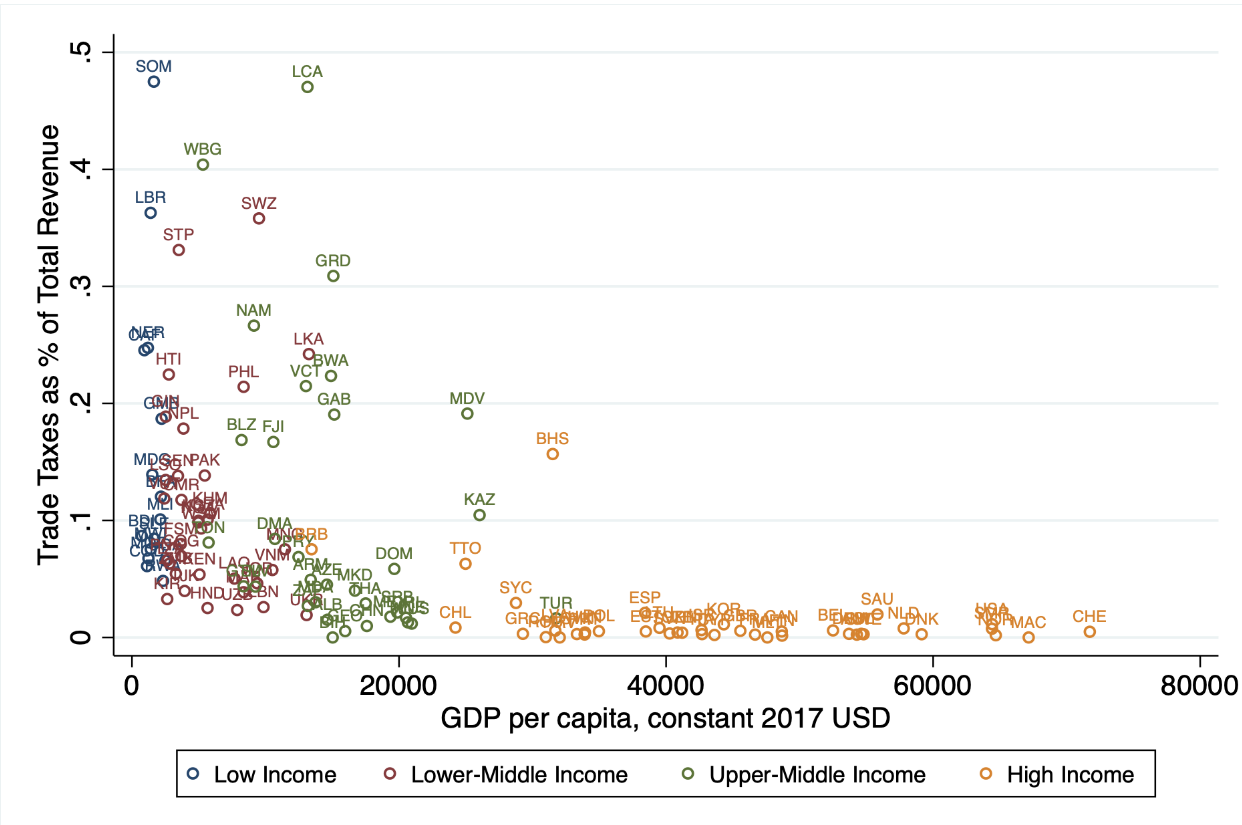
Figure 1: Truck headed towards the fixed cargo scanner at the Malaba border crossing from Kenya to Uganda

Source: Google Street View (GPS coordinates: 0.63710208340666, 34.268862013624805)

Figure 2: Trade Taxes Across Countries (2021)

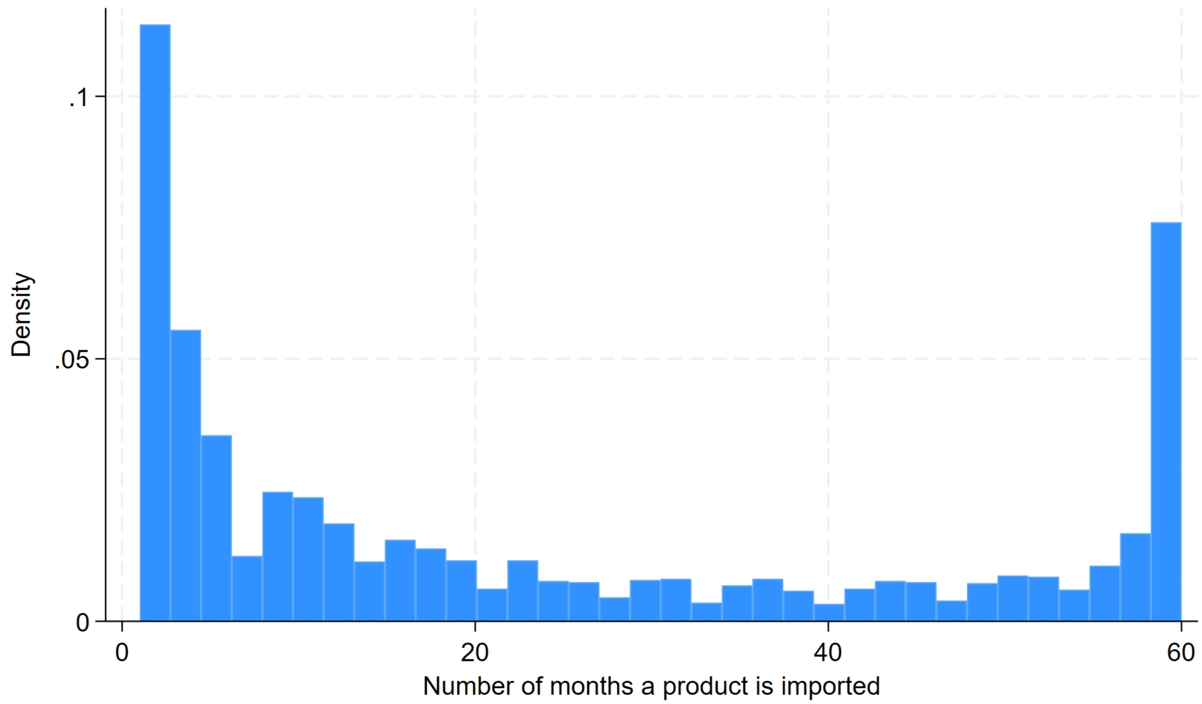


Source: Authors. Data come from UNU-WIDER (2023) and IMF World Economic Outlook Database (April 2024 version).

Figure 3: Map of Uganda with the two major border crossings with Kenya

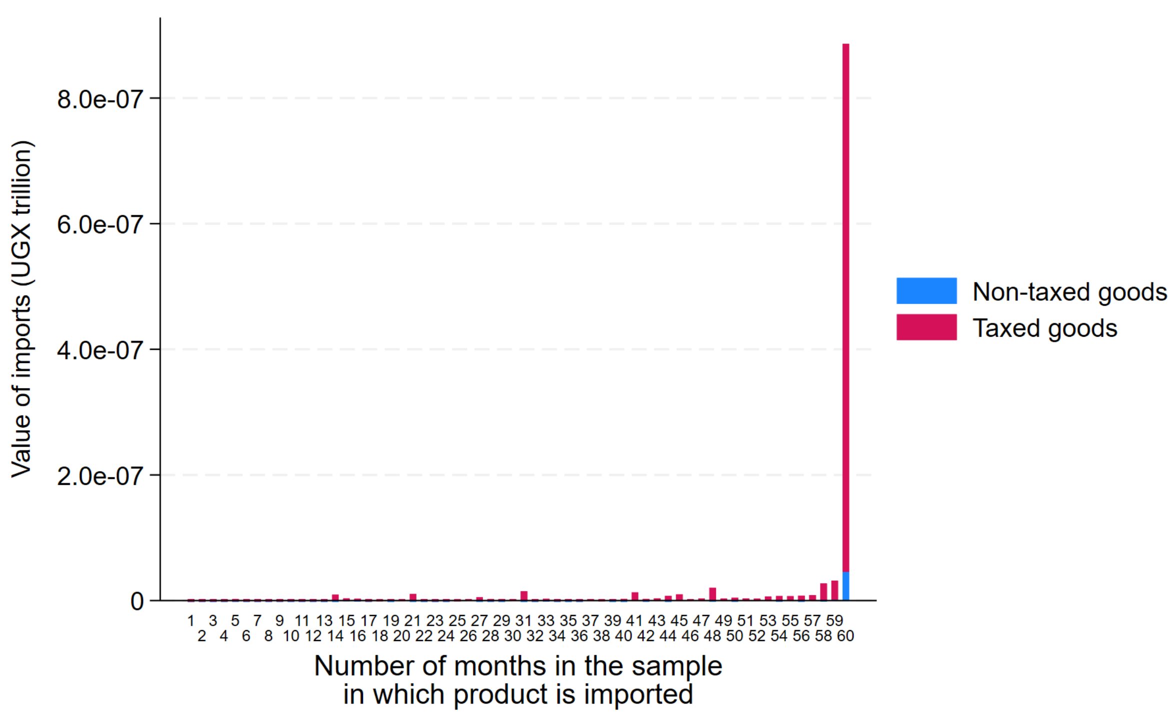
Source: Centers for Disease Control and Prevention (https://wwwnc.cdc.gov/travel/destinations/traveler/none/uganda); Malaba and Busia markers added by authors.

Figure 4: Frequency of Imports - Products



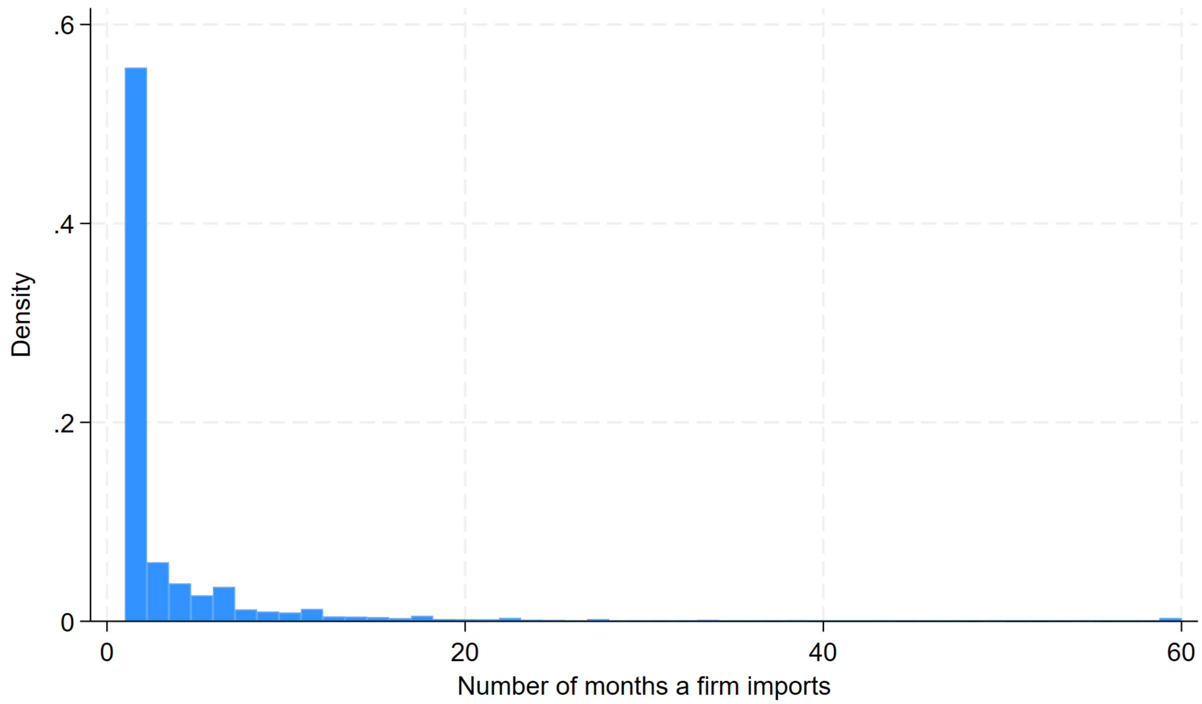
Source: Authors.

Figure 5: Value of Imports by Product Frequency



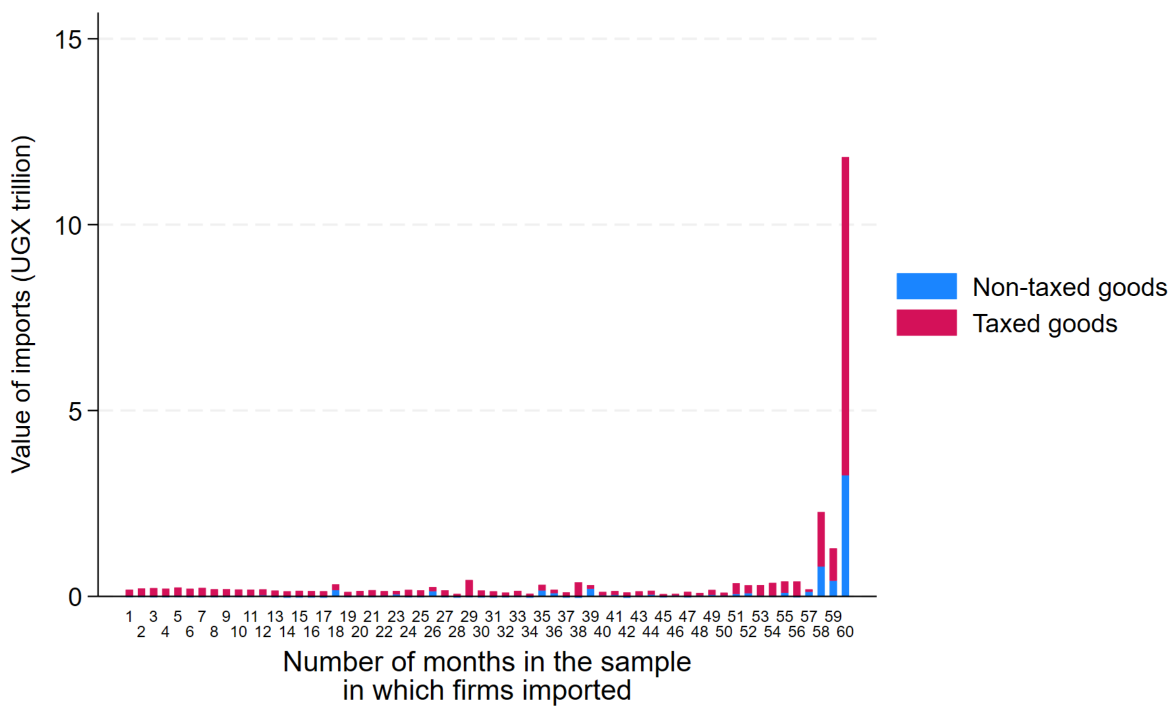
Source: Authors.

Figure 6: Frequency of Imports - Firms



Source: Authors.

Figure 7: Value of Imports by Firm Frequency



Source: Authors.

Table 1: Imports by Entry Point

Station	Abbreviation	Non-taxed	Taxed
Malaba	**UGMAL**	**16,635.080**	**33,530.200**
Busia	**UGBUS**	**727.678**	**1,818.094**
Busunga	UGBGA	0.018	0.178
Bugango Isingiro	UGBGG	0	0.077
Bunagana	UGBUN	0.179	1.116
Kampala	UGCBT	0.092	0.245
Kisoro	UGCNK	0.121	8.710
Kampala	UGCWH	51.780	67.703
Entebbe 1	UGEB1	7,246.164	4,516.583
Entebbe 2	UGEB2	0.303	0.486
Entebbe 3	UGEB3	69.952	58.705
Gulu	UGELE	6.757	67.035
Kisoro	UGISH	0	0.180
Jina	UGJJA	5.212	16.956
Jina	UGJJP	10.873	0.000
Kabale	UGKAT	16.033	46.614
Mbarara	UGKIK	18.623	38.478
Lia	UGLIA	0	0.475
Mbale	UGLKK	28.178	8.103
Kitgum	UGMAD	1.789	7.017
Ntungamo	UGMHL	12.417	12.799
Moyo	UGMOY	0.063	0.627
Mpondwe	UGMPO	0.270	11.161
Mutukula	UGMUT	676.645	593.595
Ntoroko	UGNTO	0	0.091
Arua	UGOLI	16.352	14.208
Arua	UGORA	7.341	5.443
Padea	UGPAD	0.158	22.175
Portbell	UGPBL	164.042	16.313
Kampala	UGPOP	0	0.047
Suam	UGSWR	0.325	0.016
Vurra	UGVUR	4.730	20.668

Notes: Import values are the sum of all imports by entry point during the sample period expressed in billions of Ugandan shillings.

Table 2: Aggregate Imports and Revenues

Dependent Variable	(1) Imports	(2) Imports	(3) Duties	(4) VAT	(5) Tax
Scanner	-0.0661**	-0.753	0.101	0.0718	0.0823
	(0.0314)	(0.557)	(0.295)	(0.206)	(0.225)
Scanner∗Taxed		0.969			
		(0.774)			
Taxed		0.755			
		(0.783)			
Constant	26.97***	24.93***	23.67***	24.32***	24.73***
	(0.0147)	(0.547)	(0.166)	(0.110)	(0.123)
Observations	1,860	3,600	1,620	1,800	1,800

Notes: The unit of observation is station and month-year. All specifications include entry point and month-year fixed effects. Robust standard errors clustered by station in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Product-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	Imports	Quantity	Unit Value	Duties	VAT	Tax	Imports	Quantity
Scanner	-2.249***	-4.004***	0.901***	-0.00633	-0.103***	-0.0772**	-1.947***	-3.946***
	(0.298)	(0.135)	(0.167)	(0.106)	(0.0262)	(0.0309)	(0.309)	(0.157)
Scanner∗Taxed	2.169***	4.332***	-1.578***				1.815***	4.262***
	(0.666)	(0.197)	(0.160)				(0.518)	(0.188)
Constant	21.82***	13.98***	18.70***	18.93***	19.85***	20.02***	21.92***	14.10***
	(0.173)	(0.126)	(0.0318)	(0.0598)	(0.0141)	(0.0169)	(0.149)	(0.126)
Observations	5,009,400	5,000,400	108,054	89,623	101,813	104,412	505,440	505,140

Notes: The unit of observation is product, entry point, and month-year. All specifications include HS8 product, entry point, and month-year fixed effects. Columns 7 and 8 omit entry point-product pairs where no imports are recorded in any month. Robust standard errors clustered by entry point in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Product-level Analysis: Infrequently Imported Products

Dependent Variable:	(1) Imports	(2) Quantity	(3) Unit Value	(4) Duties	(5) VAT	(6) Tax
Treated	-4.873***	-4.908***	0.406	0.0481	0.0393	0.0510
	(0.675)	(0.812)	(0.349)	(0.131)	(0.171)	(0.150)
Taxed∗Treated	4.795***	6.279***	-1.080**			
	(0.550)	(1.291)	(0.504)			
Constant	20.29***	13.69***	20.57***	17.49***	18.93***	18.97***
	(0.221)	(0.365)	(0.170)	(0.0397)	(0.0701)	(0.0577)
Observations	2,543,340	2,426,160	16,981	11,446	15,159	16,369

Notes: The unit of observation is product, entry point, and month-year. All specifications include HS8 product, entry point, and month-year fixed effects. Robust standard errors clustered by entry point in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Product-level Analysis: Frequently Imported Products

Dependent Variable:	(1) Imports	(2) Quantity	(3) Unit Value	(4) Duties	(5) VAT	(6) Tax
Scanner	-2.005***	-3.677***	1.143***	-0.0172	-0.117***	-0.0899***
	(0.456)	(0.448)	(0.199)	(0.113)	(0.0273)	(0.0262)
Scanner∗Taxed	1.945**	3.919***	-1.848***			
	(0.831)	(0.547)	(0.227)			
Constant	21.91***	14.05***	15.36***	18.99***	19.90***	20.08***
	(0.155)	(0.120)	(0.0314)	(0.0648)	(0.0148)	(0.0145)
Observations	1,692,000	1,692,000	91,070	78,174	86,651	88,040

Notes: The unit of observation is product, entry point, and month-year. All specifications include HS8 product, entry point, and month-year fixed effects. Robust standard errors clustered by entry point in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 6: Firm-Product-level Analysis: Imports by Firm Frequency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Scanner	-3.221***	-3.290***	-3.736***	-2.285***	-3.139***	-3.188***	-3.628***	-1.890***
	(0.186)	(0.310)	(0.241)	(0.556)	(0.186)	(0.327)	(0.267)	(0.580)
Scanner∗Taxed	3.192***	2.656***	4.141***	2.246**	3.110***	2.561***	3.972***	1.762**
	(0.520)	(0.486)	(0.650)	(0.928)	(0.541)	(0.451)	(0.600)	(0.751)
Constant	19.27***	20.26***	19.88***	22.19***	19.31***	20.32***	19.94***	22.31***
	(0.215)	(0.192)	(0.233)	(0.181)	(0.213)	(0.196)	(0.203)	(0.151)
Observations	1,509,840	1,432,080	1,024,860	1,498,500	278,520	275,280	267,360	276,240

Notes: The unit of observation is firm, product, entry point, and month-year. All specifications include firm, HS8 product, entry point, and month-year fixed effects. Columns 5-8 omit entry point-product pairs where no imports are recorded in any month. Robust standard errors clustered by entry point in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7: Firm-Product-level Analysis: Quantity by Firm Frequency

Frequency	(1) Low	(2) Mid-Low	(3) Mid-High	(4) High	(5) Low	(6) Mid-Low	(7) Mid-High	(8) High
Scanner	-4.829***	-4.101***	-8.160***	-4.425***	-4.614***	-4.091***	-6.915***	-4.316***
	(0.394)	(0.507)	(1.243)	(0.678)	(0.349)	(0.527)	(0.786)	(0.757)
Scanner∗Taxed	4.541***	4.760***	8.322***	4.780***	4.326***	4.743***	7.092***	4.661***
	(0.449)	(0.514)	(1.129)	(0.740)	(0.477)	(0.532)	(0.672)	(0.804)
Constant	12.38***	12.23***	13.66***	14.42***	12.42***	12.32***	13.69***	14.52***
	(0.142)	(0.501)	(0.0872)	(0.185)	(0.141)	(0.497)	(0.0857)	(0.179)
Observations	1,508,220	1,432,080	1,023,720	1,498,500	278,400	275,280	266,940	276,240

Notes: The unit of observation is firm, product, entry point, and month-year. All specifications include firm, HS8 product, entry point, and month-year fixed effects. Columns 5-8 omit entry point-product pairs where no imports are recorded in any month. Robust standard errors clustered by entry point in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Firm-Product-level Analysis: Unit Value by Firm Frequency

	(1)	(2)	(3)	(4)
Scanner	1.022***	-1.079**	0.384**	-2.829***
	(0.258)	(0.524)	(0.189)	(0.193)
Scanner∗Taxed	-1.460***	-0.365	-0.480	1.832***
	(0.252)	(0.562)	(0.356)	(0.157)
Constant	14.74***	16.65***	16.20***	16.88***
	(0.0285)	(0.0631)	(0.0666)	(0.00422)
Observations	61,726	35,825	25,291	44,063

Notes: The unit of observation is firm, product, entry point, and month-year. All specifications include firm, HS8 product, entry point, and month-year fixed effects. Robust standard errors clustered by entry point in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Firm-Product-level Analysis: Duties and VAT by Firm Frequency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable		Duties					VAT	
Scanner	0.0160	0.123	0.521***	-0.158**	0.0756	0.214**	0.498***	-0.267***
	(0.229)	(0.245)	(0.0757)	(0.0719)	(0.170)	(0.104)	(0.0854)	(0.0894)
Constant	18.22***	17.70***	17.38***	18.86***	18.00***	18.23***	17.84***	20.31***
	(0.132)	(0.138)	(0.0457)	(0.0407)	(0.0926)	(0.0478)	(0.0513)	(0.0492)
Observations	56,308	31,762	21,798	35,903	59,700	34,318	24,149	41,418

Notes: The unit of observation is firm, product, entry point, and month-year. All specifications include firm, HS8 product, entry point, and month-year fixed effects. Robust standard errors clustered by entry point in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 10: Firm-Product-level Analysis: Taxes by Firm Frequency

	(1)	(2)	(3)	(4)
Scanner	0.0597	0.198	0.497***	-0.241***
	(0.191)	(0.148)	(0.0814)	(0.0748)
Constant	18.75***	18.55***	18.22***	20.35***
	(0.107)	(0.0742)	(0.0490)	(0.0415)
Observations	60,142	34,698	24,313	42,373

Notes: The unit of observation is firm, product, entry point, and month-year. All specifications include firm, HS8 product, entry point, and month-year fixed effects. Robust standard errors clustered by entry point in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11: Product-level Analysis: By Tariff Rate, VAT Only

Dependent Variable	(1) Imports	(2) Quantity	(3) Unit Values	(4) Duties	(5) VAT	(6) Tax
Scanner	-1.330***	-1.312***	0.455	-2.255***	-1.298***	-1.367***
	(0.406)	(0.360)	(0.555)	(0.340)	(0.373)	(0.323)
Scanner*$Tariff_{10}$	0.429***	0.599**	-0.352	1.111***	0.502***	0.542***
	(0.144)	(0.235)	(0.352)	(0.239)	(0.147)	(0.152)
Scanner*$Tariff_{25}$	0.231**	0.274**	-0.216	0.710***	0.266**	0.310**
	(0.110)	(0.126)	(0.166)	(0.191)	(0.120)	(0.126)
Scanner*$Tariff_{35}$	0.133**	0.190***	-0.195	0.508***	0.154**	0.193**
	(0.0624)	(0.0671)	(0.159)	(0.137)	(0.0704)	(0.0812)
Scanner*$Tariff_{50}$	0.0114	0.0128	0.0731	0.414***	0.0650	0.146*
	(0.132)	(0.129)	(0.0701)	(0.0971)	(0.106)	(0.0747)
Scanner*$Tariff_{60}$	0.0124	0.0124	-0.0899	0.303***	0.0515**	0.101***
	(0.0146)	(0.0290)	(0.156)	(0.0632)	(0.0219)	(0.0347)
Scanner*$Tariff_{100}$	0.0998	0.121*	-0.0855	0.266***	0.106*	0.118*
	(0.0614)	(0.0675)	(0.0785)	(0.0836)	(0.0637)	(0.0644)
Constant	21.83***	14.55***	14.10***	19.00***	20.01***	20.21***
	(0.233)	(0.258)	(0.0151)	(0.173)	(0.225)	(0.218)
Observations	1,584,000	1,584,000	86,309	1,221,480	1,584,000	1,584,000

Notes: The unit of observation is product, entry point, and month-year. All specifications include HS8 product, entry point, and month-year fixed effects. Robust standard errors clustered by entry point in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 12: Product-level Analysis: By Tariff Rate, VAT Only; Trimmed Sample

Dependent Variable	(1) Imports	(2) Quantity	(3) Unit Values	(4) Duties	(5) VAT	(6) Tax
Scanner	-0.464***	0.0831	0.455	-0.714	-0.451***	-0.486***
	(0.0809)	(0.293)	(0.567)	(0.626)	(0.102)	(0.160)
Scanner∗$Tariff_{10}$	0.250***	0.270***	-0.351	0.355*	0.307***	0.295***
	(0.0377)	(0.0536)	(0.356)	(0.202)	(0.0369)	(0.0390)
Scanner∗$Tariff_{25}$	0.198	0.124*	-0.217	0.251	0.209*	0.204*
	(0.122)	(0.0671)	(0.170)	(0.207)	(0.122)	(0.116)
Scanner∗$Tariff_{35}$	0.205**	0.165**	-0.164	0.140	0.184**	0.139*
	(0.0932)	(0.0774)	(0.162)	(0.146)	(0.0896)	(0.0830)
Scanner∗$Tariff_{50}$	0.0799	0.0205	0.0722	0.121	0.0818	0.0822
	(0.0508)	(0.0456)	(0.0762)	(0.111)	(0.0498)	(0.0514)
Scanner∗$Tariff_{60}$	0.0226***	-0.0390	-0.0901	0.0153	0.0191***	0.00521
	(0.00604)	(0.0704)	(0.159)	(0.0353)	(0.00516)	(0.00515)
Scanner∗$Tariff_{100}$	0.0463**	0.0404**	-0.0856	0.0716	0.0469**	0.0482*
	(0.0227)	(0.0159)	(0.0798)	(0.0697)	(0.0234)	(0.0259)
Constant	21.72***	14.20***	14.10***	19.00***	19.91***	20.09***
	(0.0254)	(0.178)	(0.0154)	(0.0628)	(0.0197)	(0.0146)
Observations	86,424	86,424	86,309	76,558	86,424	86,424

Notes: The unit of observation is product, entry point, and month-year. Product-entry point combinations for which there are no imports in any month are omited. All specifications include HS8 product, entry point, and month-year fixed effects. Robust standard errors clustered by entry point in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 13: Product-level Analysis: By Tariff Rate, non-VAT Only

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Imports	Quantity	Unit Value	Duties	Imports	Quantity
Scanner	-0.623***	-2.068***	-0.319**	-3.075***	-0.304***	-2.114***
	(0.102)	(0.661)	(0.139)	(0.478)	(0.0914)	(0.648)
Scanner∗$Tariff_{10}$	1.115**	1.431**	-0.259		0.980**	0.807**
	(0.510)	(0.677)	(0.273)		(0.439)	(0.393)
Scanner∗$Tariff_{25}$	0.379	0.567**	-0.429***	0.997***	0.294	0.205***
	(0.235)	(0.258)	(0.0673)	(0.131)	(0.190)	(0.0684)
Constant	23.35***	14.75***	17.77***	17.68***	23.34***	15.06***
	(0.0293)	(0.110)	(0.0478)	(0.0433)	(0.0266)	(0.110)
Observations	55,680	55,680	4,530	1,387	13,380	13,380

Notes: The unit of observation is product, entry point, and month-year. All specifications include HS8 product, entry point, and month-year fixed effects. Columns 5 and 6 omit product-entry point combinations where there are no imports in any month. Robust standard errors clustered by entry point in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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