Formalising informal cross-border trade: Evidence from One-Stop-Border-Posts in Uganda

Jade Siu

Abstract

Informal trade is pervasive between sub-Saharan African countries. This study examines the elasticity of trade informality with respect to trade costs. More specifically, I exploit time and custom point variation in the introduction of border facilities that reduce trade costs through reduced border delays and corruption to estimate the effect on formalisation of trade. I find that the informal-total trade ratio between Uganda and its neighbours reduced only in the quarter when the border facilities were introduced. I examine whether this result can be explained by formalisation of cross-border traders by using an original data set collected at two border towns between Kenya and Uganda. I find that few traders formalise despite the reduced costs associated with trading formally, and that trade costs and border crossing choices are not only associated with export restrictions, but are also gendered.

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1 Introduction

Sub-Saharan African economies continue to suffer from the highest trade costs in the world (World Bank, 2017). These costs are particularly pronounced when trading with other countries in the region. High trade costs have been suggested as a factor which contributes to the persistently low recorded levels of intra-African trade, and a factor which encourages unrecorded informal trade (Lesser and Moisé-Leeman, 2009; Golub, 2015; FAO, 2017).

Under- and unreported trade flows between neighbouring countries – also known as informal cross-border trade (ICBT) – are especially pronounced in sub-Saharan Africa. Between Uganda and its neighbours alone, informal exports were estimated to be USD 538 million in 2018 (38 percent of formal exports to its neighbours). Informal trade can offer lower trade costs, incentivising individuals to trade through this channel, some of whom would otherwise not engage in cross-border trade at all (Little et al., 2010; Golub, 2015).

This paper examines the effect of a change in trade costs – through trade facilitation – on the (in)formality of trade flows, measured by the ratio of informal trade to total trade, and the factors associated with informality. In theory, traders choose to trade formally or informally by evaluating their relative costs (Bhagwati and Srinivasan, 1974; Deardorff and Stolper, 1990; Golub, 2015; Bensassi et al., 2018). Whether traders formalise depends upon whether a reduction in trade costs at the customs is sufficiently larger than the benefit of trading informally.

I test this relationship empirically in two steps, with two data sets. Firstly, I use the existing ICBT survey data collected by the Ugandan Bureau of Statistics and the Bank of Uganda, and exploit the spatial and time variation across custom points of the introduction of One-Stop-Border-Posts (OSBPs) – a border facility which aims to reduce delays and corruption at the customs. Guided by an augmented gravity model, in which I include informal trade, I use a Poisson pseudo-maximum likelihood estimation to examine whether quarterly informal trade-to-total cross-border trade ratios between Uganda and its neighbours at a certain border post change when an OSBP has been introduced. I discuss and attempt to overcome potential threats to identification: by comparing data with Kenyan ICBT survey data, by using comparable custom points and by using country-pair-time fixed effects. The latter is a method that is usually not feasible in existing studies as variables of interest are commonly varying across time and country-pair.

I find that the introduction of an OSBP has reduced the informal-total trade ratio by 68 percent, driven mainly by a boost in formal trade in industrial products. I cannot find evidence of lagged effects, suggesting that this effect could be one-off. I also examine whether the reduction of the proportion of trade that is traded informally is due to informal traders formalising by collecting trader-level data at two major border crossings between Uganda and Kenya, both of which have recently constructed an OSBP.

A random sample is drawn from the census of 4757 shops and stalls, conducted immediately before the survey was undertaken. Using responses from 876 traders, I find that since the OSBP came into operation, hardly any traders have decided to switch their main border crossing routes. Only five percent reported switching route, and of that less than three quarters switched from an informal border crossing to the customs. A quarter of them declared that they would cease trading if they can only trade through the customs. These observations point to the challenges in formalising existing informal traders, which I investigate by comparing the characteristics of the cross-border traders who cross through the OSBP and

those that use an informal border crossing.

By using a probit estimation with sample selection, I find that informal cross-border traders tend to be male, trade perishable goods and are more likely to experience demands for bribes. Results also suggest that export restrictions play a role in determining the prevalence of informal trade. This is consistent with the relationship between traders' characteristics and their self-reported border payments. Women cross-border traders tend to pay more informal payments per transaction compared to males.

This study contributes to the trade and development literature in three ways. Firstly, by examining a type of trade facilitation implemented at customs, I contribute to the understanding of policies which are aimed at reducing trade costs through measures other than trade liberalisation. This is particularly important in a context where there are high levels of tax evasion and informality at customs – Sequeira (2016) found that tariff reduction has not led to large gains from trade due to the prevalence of bribery to evade tariffs occurring in the ports of Mozambique. While studies have found a positive impact of trade facilitation on formal trade (Wilson et al., 2003; Portugal-Perez and Wilson, 2012), such as through custom and port efficiency (Clark et al., 2004; Feenstra and Ma, 2014; SantâĂŹAnna and Kannebley Júnior, 2018), I find that trade facilitation does not guarantee that there will be a formalisation of trade due to factors beyond compliance costs which influence traders' decisions of whether to trade via formal or informal channels. This finding provides an alternative perspective of the possible trade offs in boosting trade and reducing tax evasion which were discussed in previous studies (e.g. Raballand et al. (2017); Cariolle et al. (2019) and Laajaj et al. (2019)).

Secondly, this paper contributes to the literature examining informality and tax evasion in cross-border trade. Existing studies with econometric analysis mainly use statistical discrepancies between reported trade flows by the importer and exporter to proxy for tax evasion at customs (Bhagwati and Srinivasan, 1974; Fisman and Wei, 2009; Bouet and Roy, 2012), but this method has been criticised for its misuse and misinterpretation (Forstater, 2018) and ignores trade flows at informal border crossings, analysis of which has been dominated by ethnographic studies (e.g. Little et al. (2010), Titeca (2012) and Gallien (2018)). There is a growing literature studying activities at informal border crossings quantitatively, such as analysing informal traders' networks in West Africa (Trémolières and Walther, 2017; Walther, 2015), capturing challenges in traders' lives through surveys (Titeca and Kimanuka, 2012; Brenton et al., 2013; Van den Boogaard et al., 2018a,b; Tyson, 2018). There have only been a couple of econometric studies, namely Burke and Myers (2014) on price transmission and Bensassi et al. (2018) on official trade taxes and ICBT, focused on this topic. I apply econometric analysis to understand causal linkages between trade informality and trade costs as a result of a policy – both at official customs and at informal border crossings.

Lastly, this study contributes to the body of research examining efforts to formalise firms. There have been a number of studies evaluating interventions aimed at reducing the extensive margin of informality (Ulyssea, 2018), both by incentivising businesses (via a reduction in monetary and non-monetary costs) to formalise (Monteiro and Assunção, 2012; De Mel et al., 2013; Rocha et al., 2018), by increasing the benefits of being a registered firm (Benhassine et al., 2018) and by enforcement (De Giorgi et al., 2018). I depart from this literature by focusing on trade activities at the border. Many African countries depend heavily on trade-related taxes as sources of government revenue, in some cases accounting for half of total revenue (Cantens and Raballand, 2017). My results echo the stickiness of informality found in previous studies in other contexts (as summarised in La Porta and Shleifer (2014)) and that effects are short term (e.g. as found in Rocha et al. (2018)).

The rest of this paper is structured as follows: in Section 2, I provide some context to this study and describe the two datasets which I will be using in my analysis. In Section 3, I describe the conceptual framework which is used to guide my empirical analysis. In Section 4, I describe the empirical strategy, discuss threats to identification and the results of the effect of OSBPs on the ratio of informal-to-total trade between Uganda and its neighbours. In Section 5, I conduct traders' level analysis to understand choices of border crossing and the associated border costs. In Section 6, I conclude.

2 Context and data

Informal cross-border trade (ICBT) in this paper refers to 'trade in legitimately produced goods and services, which escapes the regulatory framework set by the government, as such avoiding certain tax and regulatory burdens' (Lesser and Moisé-Leeman, 2009)[1]. Under this definition, trade in illicit goods, such as narcotics, is not included, and is also outside the scope of this paper[2]. ICBT does include trade which does not pass through the customs, as well as trade which passes through the customs but traders do not pay the required amount of taxes or comply fully (if at all) with the regulations. These traders may or may not be registered firms (Lesser and Moisé-Leeman, 2009)[3]. Traders who are not registered, but pay full taxes at the customs, are referred to as formal traders[4].

2.1 Informal cross-border trade data

2.1.1 Aggregate informal trade flows

I use the quarterly informal cross-border trade flow data from 2015 to 2017 collected by the Bank of Uganda (BoU) and the UBOS. Enumerators monitored informal trade flows for 14 days each month and created estimates for the rest of the days, taking seasonality effects into account. These surveys cover 19 official custom points along Uganda's borders with the DRC, Kenya, Rwanda, South Sudan and Tanzania. The survey points are chosen according to existing knowledge of the intensity of ICBT, as well as adequate infrastructure and government support to implement the field study.

This survey captures two types of informal trade flows (but cannot be separated with the data at hand)[5]:

- Goods which are crossed through informal trading routes, which are near, but not at, the customs. These informal trading routes are widely used by cross-border traders and are known by the officials. Enumerators are stationed at strategic points to record the goods that have been carried or

[1]The distinction between 'informal trade' and 'smuggling' is discussed in Cantens et al. (2015). In this study, I prefer the term 'informal trade' to broaden the perspective that the activities may not always be conducted with the intent to evade tax and to recognise that some of the 'informal' trading routes have been established before borders were drawn. Other studies especially those in economics, such as Yang (2008), have used the term 'smuggling' instead of 'informal trade'.

[2]By excluding illicit products, I can focus on formalisation of the trading activity rather than the legality of the actual product, as pointed out by Cantens et al. (2015).

[3]This is different from existing studies examining formalisation of firms, e.g. La Porta and Shleifer (2014); Ulyssea (2018); Benhassine et al. (2018); De Mel et al. (2013). Unlike these papers, this study focuses on border taxes and border crossing routes rather than other types of taxation such as income tax that require business registration. Cross-border traders are able to pay border taxes at the customs without business registration.

[4]When referring to the trade flow (as oppose to traders), any trade flow which is not officially recorded at the customs is defined as informal.

[5]I confirmed the coverage of this survey and data collection method by observing the enumerators in the field.

transported across the border. This informal trade flow is represented by the dotted line labelled as I1 in Figure 1. In the same diagram, the yellow triangles represent the established informal border crossing.

- Under-declaration of goods at custom offices. This is done by comparing the volume inside the vehicle against the paper work completed. The enumerators count what is inside the vehicle and match the paper work through the car plate. They record the discrepency between what they counted and the paper work. This informal cross-border trade flow is represented by the dotted line labelled as I2 in Figure 1. In that diagram, the orange rectangle represents the official customs office.

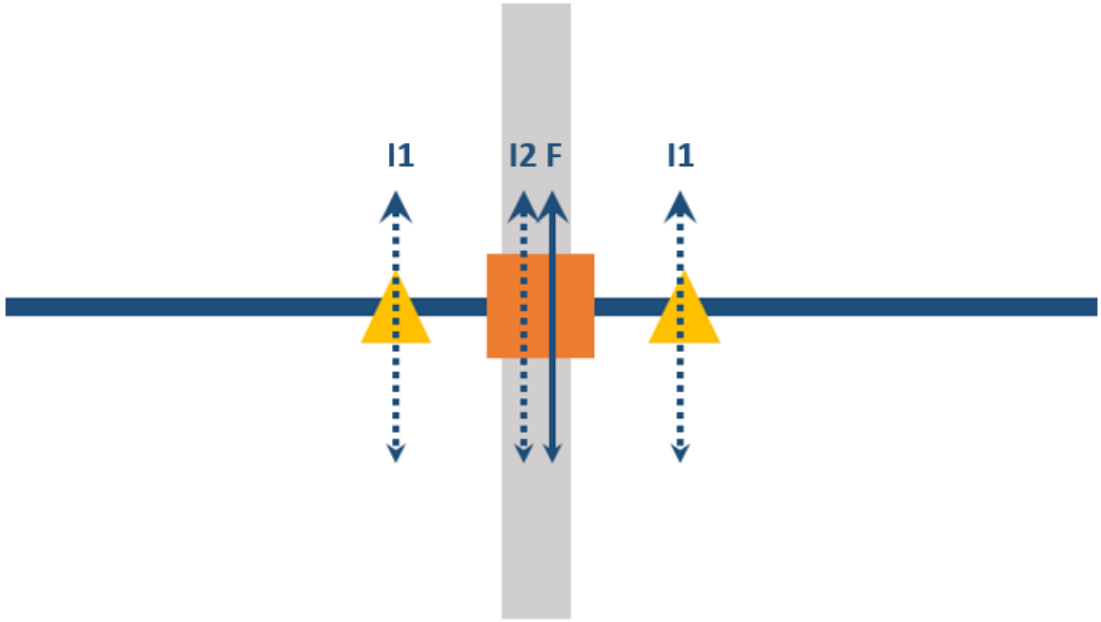

Figure 1: Types of informal cross-border trade

Enumeration depends mostly on observation of packaging, which is generally uniform across border posts around Uganda[6]. Through experience, enumerators are trained to note down packaging which is of higher value than its stated amount. When needed, enumerators verify by inquiring the traders, custom, security and revenue officers. They also weigh selected goods for further verification.

Monitoring is only conducted from 7am to 6pm, which means night activities are not captured, but UBOS notes that underestimation due to this is minimal.

This survey only captures informal trade flows which take place at established informal border crossings and are located close to the customs. For example, in Busia, a border town between Kenya and Uganda, there exists two established informal border crossings, where both are within 500 meters from the customs office.

The rationale for focusing on established informal border crossings is beyond data limitations. Firstly, they are routes which are common across Uganda (BoU, 2006) and other parts of sub-Saharan Africa.

[6]Although each record represents an observation of a trader, I only have access to the aggregated trade flow.

More importantly, it is a set-up where I can investigate trade costs beyond distances, since the two routes are in such close proximity. Secondly, the sheer volume of trade flowing through these crossings is highly visible. Figure 2 shows that between 2014 to 2017, informal trade is comparable to formal trade, in particular when looking at the trade flows with the DRC. The ratio between informal and formal trade differs across country pairs.

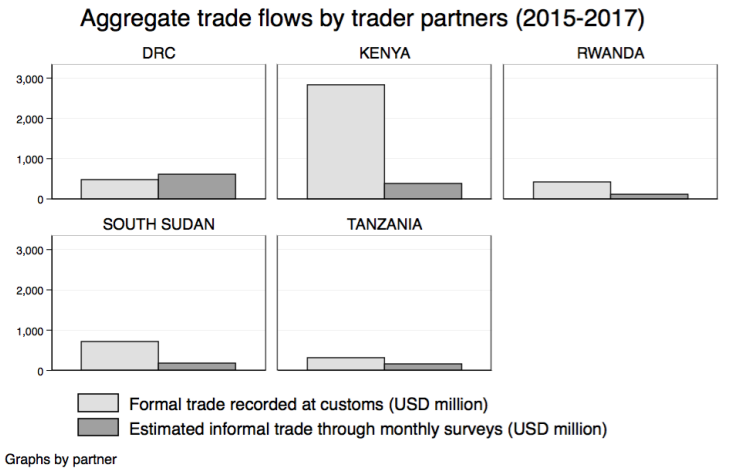

Figure 2: Formal and informal trade between Uganda and its neighbours (USD) by country. Aggregated from monthly ICBT survey data collected by the Bank of Uganda and Ugandan Bureau of Statistics.

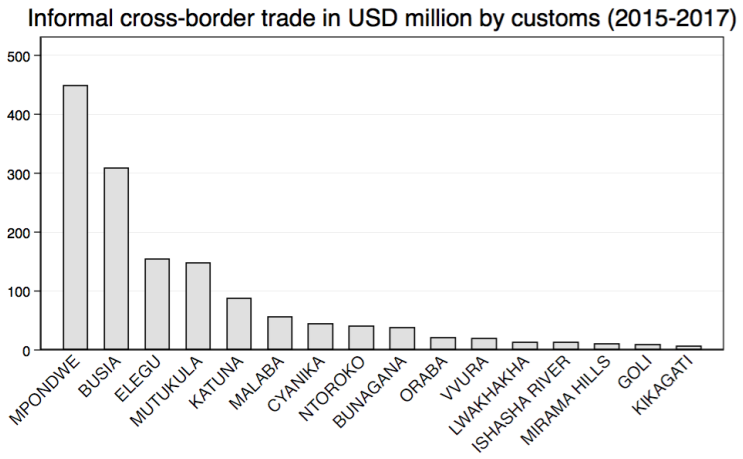

Figure 3: Informal cross-border trade between Uganda and its neighbours (USD) by customs. Aggregated from monthly ICBT survey data collected by the Bank of Uganda and Ugandan Bureau of Statistics.

2.1.2 Cross-border traders data

To analyse traders' border crossing choices and their border costs, I conducted a cross-border traders survey with traders operating in Busia and Malaba, two border towns between Uganda and Kenya. Busia, in particular, is known for its porous border (see Figure 3), partly due to its lack of natural barriers (e.g.

a river) (Bhan and Kimani, 2016; Soi and Nugent, 2017; Tyson, 2018). Both border towns have a recently constructed OSBP. Data collection took place from late August 2018 to early October 2018.

The data collection is conducted in two steps. Firstly, I, together with enumerators, conducted a census of all the shops and stalls situated within the 1.5 km radius centred at the customs. In this census, we captured both local and regional traders; one of the largest grains market in East Africa is situated in Busia, Uganda. We recorded basic characteristics of 4757 shops and stalls: shopkeeper's gender, size of the shop/stall (small/medium/large/permanent) and broad categorisation of what was being sold. GPS locations were also recorded.

From the census, I randomly selected shops or stalls within specified strata[7]. The strata were constructed according to non-market areas and markets. In Busia Uganda and Busia Kenya, I created five strata each, with four markets for each side of the border. For Malaba, the strata are only according to which country (Uganda or Kenya). 876 surveys are completed and usable for analysis[8].

Referring back to Figure 1, this traders' survey captures who crosses the border through I1 (informal border crossing) and who crosses through the customs (I2 and/or F), as well as the payments which traders made as they were crossing the border. This includes both official taxes and informal payments to other agents.

2.2 Formal cross-border trade flow data

I match the ICBT flows with formal trade by country-pair, customs and time[9]. This data set of aggregated customs transactions was provided by the Bank of Uganda. It is important to note that the under-invoiced trade flows I will be analysing are only those occurring across the land regional borders (i.e. excluding international trade customs such as Entebbe). In addition, while I do make direct comparisons between formal and informal trade flows, it is crucial to note that the data for formal trade flows cover all transactions recorded at customs, while the data for informal trade flows are based on surveys.

2.3 Border trade costs

This paper focuses on border-related trade barriers, which include tariff and non-tariff barriers [10].

2.3.1 Border costs

The Custom Union of the East African Community (EAC) became operational in 2005. Initially consisting of only Kenya, Uganda and Tanzania, Rwanda and Burundi joined the EAC in 2007 and the Custom Union in 2009. In July 2010, the EAC Common Market entered into force with internal tariffs eliminated (Kiuluku and Chekwoti, 2013). Nevertheless, there remains ad-hoc tariff rates and a certificate of origin needs to be presented at the customs in order for these favourable tax rates to be applicable.

[7] If the shopkeeper was not present, the enumerator is asked to approach the neighbouring shop.

[8] 21 percent refused to respond or did not complete most of the survey

[9] There is no overlap between ICBT flows and formal trade flows as enumerators from the BoU and UBOS only record the under-invoiced amount for the ICBT survey.

[10] Anderson and Van Wincoop (2004) categorised trade costs into three groups: 1) transportation costs, 2) distribution costs for wholesalers and retailers and 3) border-related trade barriers

There is a three-band Common External Tariff (CET) in place but 'sensitive products' are excluded from these bands. 66 products (HS8 level) are included in this list of 'sensitive products', and have tariffs which are substantially higher than the maximum 25 percent rate for non-sensitive product (EAC, 2017).

Payments at borders extend beyond tariffs. Although some goods are subject to zero import duty, traders are still required to pay VAT, withholding taxes, excise duties and infrastructure levies when bringing their goods across the border. I rely on border tax data collected by Sauti Africa at the Busia customs from the Ugandan Revenue Authority. Sauti Africa is a social enterprise set up to provide timely and accurate border and price information for traders through a mobile platform. Their information about border taxes are more up-to-date and comprehensive compared to those available in UNCTAD, which only has information about tariffs and in many cases the data are missing.

Cross-border traders also face non-tariff barriers (NTBs) which include inefficient customs procedures, bribery and corruption. According to the NTB tracker (COMESA, EAC and SADC, 2017), 'lengthy and costly customs clearance procedures' is the most common complaint filed by traders. Indeed, the average time for 'border compliance to export' in sub-Saharan Africa was 103 hours in 2016. In addition to delays at customs, surveys have found that a large proportion of respondents have reported high incidences of bribery and/or harassment by custom officers at borders (e.g. at the Kenya-Uganda border (Tyson, 2018) and at the DRC-Rwanda border (Brenton et al., 2011; Mora and Roshan, 2011)).

2.4 Role of trade facilitation

Trade facilitation, broadly defined as 'steps that can be taken to smooth and facilitate the flow of trade' (OECD, 2005), has been a direction to implement policies and programmes to formalise informal trade (e.g. AfDB (2012), FAO (2017), Lesser and Moisé-Leeman (2009)).

OSBPs have been a key instrument adopted by the EAC to facilitate trade (JICA, 2017). The main objective of the establishment of OSBPs is to 'enhance trade through the efficient movement of goods, persons and services within the Community' (EAC, 2016). In the EAC, the operation of OSBPs in Uganda is regulated under the East African Community One Stop Border Posts Act (2016) and the East African Community One Stop Border Posts Regulations (2017), as well as bilateral agreements between Uganda and its neighbours. An increasing number of OSBPs have been planned and constructed over the past five years. Within the EAC, 15 border crossings are designated to be converted or have already been converted into OSBPs (EAC, 2016), while 80 OSBPs are being planned, built or are in operation across sub-Saharan Africa (Tralac, 2016). In Uganda, the currently operational OSBPs are listed in Table 1.

Although OSBPs around the world can be set up differently, the OSBPs in Uganda are set up such that there are two offices on either side of the border, and the trader only needs to enter the office of the destination country. Prior to the operation of an OSBP, a trader would have to enter both offices. In addition, the OSBP offices are designed as open offices, aimed at reducing incidences of bribery. All border-related services are housed inside the OSBP, including various certifications, a revenue office to pay taxes and information desks. The OSBPs operate for 24 hours - this is aimed at providing flexibility to traders crossing the border, as well as providing a secure place for traders to cross.

The OSBP which has been constructed in Busia, a border crossing between Uganda and Kenya, has become a success story for aid for trade (TMEA, 2018, 2017). Since the operation of the OSBP at Busia, the average border-crossing time has been reported to have been reduced by 80 percent. For example, before

the OSBP, a truck took an average of one hour and 26 minutes to cross the border, compared to only 17 minutes now (TMEA, 2017). This reduction in delays is especially relevant to those who trade in perishable goods – Bensassi et al. (2018) found that trade in perishable goods is associated with informality. From my traders level data, more than half of the respondents chose 'faster border crossing' as one of the benefits of the OSBP. Other benefits include 'clearer instructions' and 'less harrassment'.

OSBP	Completed infrastructure	Fully introduced	Border
Mutukula	Q1 2016	Q3 2016	Tanzania
Busia	Q2 2016	Q2 2016	Kenya
Mirama Hills	Q2 2015	Q4 2015	Rwanda
Malaba	Q1 2015	Q2 2016	Kenya

Table 1: The dates when the OSBPs are fully introduced at the custom points.

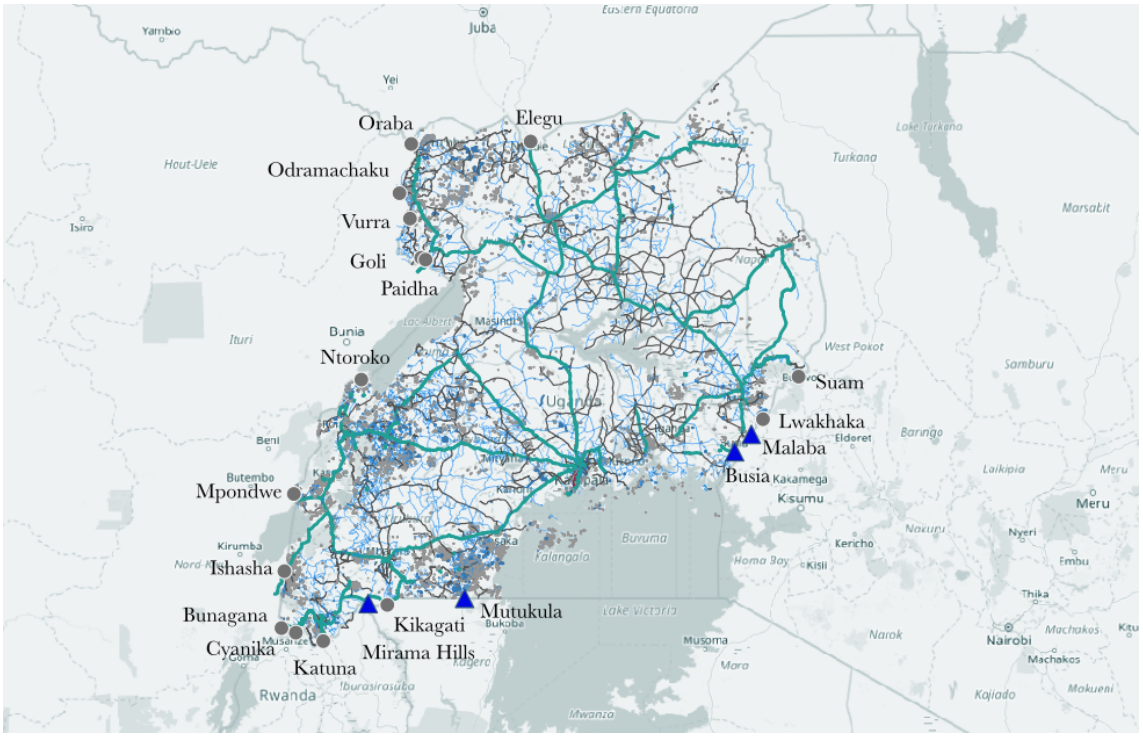

Figure 4: A map of Uganda and its neighbours, with each customs point surveyed by BoU and UBOS labelled. Triangle points are custom points with OSBPs. Lines are roads, including primary, secondary and paths

3 Conceptual framework

My empirical strategy is guided by the structural gravity model augmented by Dutt and Traca (2010), in which they include the possibility of bribery extortion by officials and tax evasion by traders at customs. I make some slight changes to Dutt and Traca (2010)'s derivation of their augmented gravity model and allow for variation across border points, as well as adjusting border costs in line with the profit functions faced by informal traders proposed in Yang (2008) and Bensassi et al. (2018).

Trader in country i exporting x_v in sector v face some exogenous bilateral trade costs (iceberg cost) τ and unit production cost w_i. This iceberg cost τ does not vary depending whether or not the trader decides to cross the border formally or informally. Both formal and informal exporters receive the following profit:

$$\Omega = \pi - \tau w_i x_v \tag{1}$$

where π differs between the three types of traders (see Figure 1).

The formal trader (labelled as F in Figure 1) who passes through the customs and does not evade taxes face the following profit function (Equation 2), where p_v is the unit price of the good, υ^F is variable cost of exporting, which include taxes, time taken to clear goods and harassment by officials, and fixed cost f^F which include costs required for business registration and permits.

$$\pi^F = p_v x_v (1 - \upsilon^F) - f^F \tag{2}$$

A trader who crosses through an informal border crossing (I1 in Figure 1) has the following profit function (Equation 3), where c^{I1} are variable costs and f^{I1} are fixed costs to cross through the informal border crossing. Variable costs include efforts from repackaging (as in Bhagwati and Hansen (1973) and Pitt (1981)) and hiring specific 'transporters' to carry the goods, as well as the possibility that some goods may be lost or stolen on the way due to poor security and poorly paved roads. Fixed costs include the need to establish networks with the officials monitoring those crossings, and efforts needed to gather information regarding the 'way of working' when crossing these informal border crossings[11]. As shown, official taxes and costs of compliance are no longer relevant for these traders' profit function.

$$\pi^{I1} = p_v x_v (1 - c^{I1}) - f^{I1} \tag{3}$$

For a trader who crosses through the customs but evades taxes faces profit function of Equation 4. The trader has an opportunity to evade a portion h of the fixed (F^F) and variable cost of compliance (υ^F), as in Equation 2 for formal traders. h depends on the honesty of the official – lower h (honesty) means the exporter can evade costs. There is also a cost of evasion, denoted by c^{I2}, such as bribery, and fixed cost, such as establishing networks with brokers and custom officers.

$$\pi^{I2} = p_v x_v (1 - h\upsilon^F - c^{I2}) - hf^F - f^{I2} \tag{4}$$

An informal trader who crosses through the informal border crossing (denoted as I1 in Figure 1) will only switch to crossing through the customs and not evade tax if the cost of evasion has outweigh the benefits (comparing π^{I1} in Equation 3 and π^F in Equation 2), satisfying the inequality in Equation 5[12].

$$\underbrace{p_v x_v c^{I1} + F^{I1}}_{\text{Cost of evasion via I1}} > \underbrace{p_v x_v \upsilon^F + f^F}_{\text{Benefit of evasion}} \tag{5}$$

An operating OSBP should reduce the benefit of evasion by reducing the variable and fixed cost of compliance (υ^F and f^F). Assuming that monitoring of informal border crossings has not changed as a result

[11] In several in-depth interviews, traders revealed to me that during the first time they cross the border to trade, they were accompanied by another friend who was more experienced in cross-border trade activities.

[12] This is similar to Yang (2008) which evalutes the net benefit of a smuggling route over another.

of the OSBP, an operating OSBP could lead to a trader crossing through informal route to formalise if the benefit of evasion reduces sufficiently.

Similarly, an informal trader who crosses through the customs but evades taxes (I2 in Figure 1) will only formalise if the cost of evasion has outweigh the benefits (comparing π^{I2} in Equation 4 and π^{F} in Equation 2, satisfying the inequality in Equation 6.

$$\underbrace{p_v x_v c^{I2} + F^{I2}}_{\text{Cost of evasion via I2}} > \underbrace{p_v x_v v^F (1-h) + f^F (1-h)}_{\text{Benefit of evasion}} \tag{6}$$

In this case, the OSBP not only reduces the benefit of evasion by reducing variable and fixed costs of compliance (v^F and f^F), but also increases the honesty of officials through training and open offices. Strengthening tax enforcement might also mean that variable (c^{I2})and fixed costs (F^{I2}) of evasion at the customs (I2) increase. For example, the trader who wish to evade taxes at the customs may need to pay higher bribes and/or make new connections with officials. An operating OSBP could lead to formalisation of traders who have been evading tax at customs (I2) if there is a sufficient increase in cost of evasion and decrease in benefit of evasion.

$$\underbrace{p_v x_v c^{I1} + F^{I1}}_{\text{Cost of evasion via I1}} > \underbrace{p_v x_v c^{I2} + F^{I2}}_{\text{Cost of evasion via I2}} + \underbrace{p_v x_v h v^F + h f^F}_{\text{Additional benefit of evasion via I1 compared to I2}} \tag{7}$$

The effect of an operating OSBP is less clear in this case. An OSBP is expected to increase the variable and fixed costs of evading at customs (c^{I2} and F^{I2}). While the costs of compliance is expected to reduce (v^F and f^F), OSBP is expected to increase honesty of officials (h). The effect of OSBP on the additional benefit of evasion via crossing through the informal crossing (I1) compared to through the customs (I2) is ambiguous.

The three types of traders maximise their respective profit functions (substituting into Equation 1) by choosing the amount to export (x^{I1}, x^{I2} and x^F) subject to a constant elasticity of substitution (CES) demand function (elasticity denoted as $\epsilon > 1$). The individual amounts of exports and the number of exports from country i are then aggregated into global output by following Dutt and Traca (2010)'s procedures.

This results in an augmented gravity model (Equation 8). As in Anderson and Van Wincoop (2003), the price indices Π_i and P_j are the multilateral resistant terms; Y_i and Y_j are the size of markets in country i and j; Y_w is the global income. As in Bensassi et al. (2018), Θ_{vijn} is the proportion of total trade which has been conducted informally and X^I_{vijn} is the amount of informal trade flow of sector v between country i and j through custom n. In this case, informal trade includes trade through informal border crossing (I1) and through customs (I2).

$$\Theta_{vijn} = \Big[\tau_{vijn}(1+\Delta_{vijn})\Big]^{1-\epsilon} P_j^{\epsilon-1} Y_j \frac{Y_i}{\Pi_i^{1-\epsilon} Y_w} X^I_{vijn} \tag{8}$$

where

$$1 + \Delta_{vijn} = \frac{1}{1 - c^{I1}_{vijn}} + \frac{1}{1 - h_n v^F_{vijn} - c^{I2}_{vijn}} + \frac{1}{1 - v^F_{vijn}} \tag{9}$$

From Equation 8 and 9, it is obvious that bilateral trade flows and its degree of informality are affected by

variable costs incurred at customs, faced by both traders who pay full taxes (υ^F_{vijn}) and evade some tax (c^{I2}_{vijn}), but also variable costs which incurr at informal border crossings (c^{I1}_{vijn}). As mentioned during the discussion of the inequalities (Equations 5, 6 and 7), an operating OSBP is expected to reduce variable costs υ^F_{vijn} and c^{I2}_{vijn}, and increase honesty of officials h_n.

4 OSBP and trade flow

4.1 Identification strategy

Log-linearalisation of Equation 8 will yield a similar estimable equation as in Dutt and Traca (2010). Instead, I kept Equation 8 in its multiplicative form and estimate using Poisson pseudo-maximum likelihood (PPML) which was first proposed by Silva and Tenreyro (2006). This method addresses selection bias when ignoring zero trade flows and to avoid Jensen's inequality problem when taking logs of the gravity model[13].

I capture variables in Equation 8 which are traditionally explicitly estimated (such as market size) by using a combination of fixed effects. The resulting equation to be estimated is Equation 10[14].

$$\Theta_{vijnt} = \exp(\beta_0 + \beta_1 OSBP1_{vijnt} + z_{vijnt}\beta_2 + \alpha_i + \gamma_j + \delta_{it} + \zeta_{jt} + \eta_{ij} + \theta_{ijt} + \iota_n + \kappa_{nt} + \lambda_v + \mu_t) + e_{vijnt} \quad (10)$$

where variable $OSBP1_{vijnt}$ is a dummy variable which is valued at 1 if the border crossing n at time t has an OSBP in full operation, and valued at 0 if otherwise. The parameter of interest is β_1, where $(e^{\beta} - 1) * 100$ provides the percentage change of informal-total trade (Θ_{vijnt}) between country i and j as a result of the OSBP. If β_1 is smaller than zero, informal trade has fallen in relation to total regional trade between Uganda and its neighbours.

z_{vijnt} captures other time-varying customs point-specific factors. I include here precipitation levels[15] which can affect whether or not a border post is open or not and how easy it is to transport goods in less well paved roads. I also include a dummy which indicates when the physical building of the OSBP has been constructed. This is distinct from when the OSBP is in full operation, only after then when traders can clear their goods only once, instead of twice when crossing the border.

α_i and γ_j are country fixed-effects capturing the multilateral resistance terms Π_i and P_j in Equation 8. δ_{it} and ζ_{jt} are exporter and importer time-varying fixed effect, which captures the sizes of exporter and importer markets. η_{ij} is country-pair time invariant fixed effect which captures time-invariant trade costs between the exporter and importer (e.g. language barriers). ι_v and κ_{vt} captures sector specific effects, such as seasonality of agricultural trade. The custom time-invariant fixed effect (λ_n) captures customs-specific effects, such as whether or not the border point where the customs is situated has a natural barrier, such as a river. The country-pair-time fixed effect (θ_{ijt}) captures time-varying policies which include changes in tariffs and border regulations across time.

[13]Fally (2015) has shown that including fixed effects using Silva and Tenreyro (2006)'s remains consistent with Anderson and Van Wincoop (2003)'s theoretical gravity.

[14]By using fixed effects beyond two-ways (exporter and importer), the estimation Equation 10 is most similar to Larch et al. (2018), which used PPML method to estimate the effect of currency unions on bilateral trade flows, and Álvarez et al. (2018) which also used PPML method to estimate the effect of institutions on bilateral trade.

[15]Location-specific quarterly median precipitation level is obtained from NASA Power. Where exact longitudes and latitudes of a border post is not available, I approximate a location and obtain its longitude and latitude using Google Earth.

This set of fixed effects, and notably the country-pair-time fixed effect, are used to reduce possible bias arising from potentially omitted variables as well as from statistical discrepancies, which is non-trivial when using macroeconomic statistics of African economies, as highlighted in Jerven (2013). More generally, analysis on bilateral trade often suffer from the lack of available up-to-date data on tariffs and NTBs (Anderson and Van Wincoop, 2004; Goldberg and Pavcnik, 2016). As our variable of interest varies with customs and across time, country-pair-time fixed effect can be included in the estimation.

I report summary statistics of the variables in Table A.1.

4.2 Results

I find that the OSBP has a negative and significant effect on the informal-total trade flow ratio (column 1, Table 2). The average treatment effect of the operation of OSBP on informal-total trade ratio is a reduction of 68 percent ($e^{0.484} - 1$). This result indicates that the OSBP has been effective in reducing the proportion of trade that is traded informally. It is clear that the operation of the OSBP is more than constructing a modern building – I find no effect of the completion of the customs building construction on informal-total trade ratio.

By splitting the data set into trade in agricultural and industrial goods, I find that the OSBP has a stronger effect on trade in industrial goods (column 5, Table 2). The average treatment effect on informal-total trade in industrial goods is a reduction of 77 percent, while the effect is only marginally statistically insignificant for agricultural goods, and the magnitude is much lower.

It is plausible that by just looking at the contemporaneous effect, I am underestimating the average treatment effect of the OSBP. For example, traders may take time to decide whether or not to change their behaviour according to what they observe, and the staff working in the OSBP might still be adjusting to the new functions of the OSBP.

Following Baier and Bergstrand (2007), I modify the main specification to account for lagged effects. Specifically, I include one lagged variable (column 2, Table 2), and two lagged variables (column 3, Table 2) to examine further effects that might have happened beyond the quarter when the OSBP was first introduced. Results show that this is not the case. There is no evidence that the OSBP further reduces informality beyond the quarter when it was introduced, although admittedly there is low power for estimating the second lagged effect. This suggests that the effect might only be one-off.

	(1)	(2)	(3)	(4)	(5)	(6)
	No lag	1 quarter lag	2 quarters lag	1 lead	Agriculture	Industrial
OSBP in operation	-0.484***	-0.375***	-0.329**	-0.224	-0.409*	-0.571***
	(0.146)	(0.127)	(0.160)	(0.200)	(0.214)	(0.157)
OSBP in full operation (t-1)		-0.0888	0.0252			
		(0.166)	(0.141)			
OSBP in full operation (t-2)			-0.134			
			(0.109)			
OSBP in full operation (t+1)				-0.167		
				(0.189)		
OSBP construction completed	0.293	0.288	0.268		0.323*	0.369*
	(0.182)	(0.228)	(0.209)		(0.178)	(0.211)
Precipitation	-0.0308*	-0.0142	-0.00762	-0.0325	-0.0528**	-0.00923
	(0.0176)	(0.0127)	(0.0134)	(0.0200)	(0.0263)	(0.0240)
R-squared	0.591	0.571	0.566	0.591	0.738	0.704
N	864	751	683	792	432	410
Degrees of freedom	34	33	33	34	35	33

Standard errors clustered by country-pair-customs in parentheses

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

Table 2: Effect of an introduction of an OSBP on quarterly informal-total trade ratio with neighbouring countries. Includes the following fixed effects: exporter, importer, exporter-time, importer-time, country-pair, country-pair-time, customs, sector, sector-time, time.

The informal-total trade ratio is a measure of informality, which can be driven by several mechanisms: 1) informal traders formalising, leaving total trade the same, 2) total trade has increased, with the increase in formal trade larger than informal trade, 3) total trade has decreased, with the reduction in informal trade larger than formal trade.

To explore these mechanisms, I modify the main specification such that the dependent variable is total trade values (informal plus formal trade), formal trade values and informal trade values in USD. I find weak evidence that the OSBP has increased total trade (Table A.2: the estimates for the average treatment effects of the OSBP on total trade are positive, and the estimates for treatment effects on industry trade is marginally statistically significant and economically significant. The estimates for the positive average treatment effects on formal trade (Table A.3) reveal that the negative effect of the OSBP on informality is possibly driven by an increase in formal trade in industrial goods. I do not find strong evidence that informal trade, both in agricultural and industrial goods, has decreased as a result of OSBP – the estimates for the average treatment effects are negative, but are all statistically insignificant (Table A.4). The lack of significant change in informal trade indicates that the OSBP has limited effect in switching traders from trading in informal channels to the formal channel.

While the estimations have provided a broad picture of the effect of the OSBP on informality of trade, it is still unclear the specific behavioural changes of the traders (if any) and changes in trade costs as a result of the OSBP. To explore this, I use trader-level data which my enumerators and I have collected in two of the major border towns between Kenya and Uganda to understand which traders have formalised (or in-formalised) after the OSBP has been operation, their reasons behind formalising (or not) and the costs associated with cross-border trading in both the formal and informal channel. I shall describe

the findings in Section 5, after detailing the assumptions of the above estimations, and cautions when interpreting the estimates.

4.2.1 Threats to identification and robustness checks

The causal interpretation of the results hinges upon on several identification assumptions. First is the parallel trends assumption – the customs which have an OSBP introduced and customs which never have OSBPs follow a common trend in informal-total trade ratio if no OSBP has been introduced. This is an untestable assumption, but I do not find evidence of anticipatory effects which provide support to this assumption (see column 5 Table 2).

I include heteroskedasticity-robust RESET tests for all of the estimations. For the main specification (column 1, Table 2), the test is passed, i.e. not being able to reject the null hypothesis that the model is not misspecified. Some of the modified specifications need to be interpreted with caution: for the models which have formal trade flows (Table A.3) and informal trade flows (Table A.4), the null is rejected at 1 percent [16].

I also modify the comparison group by excluding all trade flows which were exporting or importing to and from the DRC and South Sudan. The DRC and South Sudan are not members of the EAC, and so their trade agreement with Uganda is legally different from Kenya, Rwanda and Tanzania. Results remain consistent (see Table A.5).

Some assumptions are made with regards to the ICBT flow survey data. Firstly, as enumeration only takes place two weeks each month, I assume that the up-rating model employed by UBOS and Bank of Uganda is reflective of the reality. Any systematic underestimation or overestimation of ICBT flows is assumed to be uncorrelated with the introduction of the OSBP. Secondly, any observations not captured by the enumerators during that period of data collection is missing at random, and that measurement error is not correlated with the introduction of the OSBP. I argue this assumption is strong, but reasonable. Some enumerators have reported that it is harder to enumerate at some customs compared to others due to the physical condition of border crossing, but this difference should be constant across time. In addition, the enumerators have been assigned to different border posts each month; enumerators are only told which custom post they will be fielded at a week or so before the assignment. To validate the quality of the Ugandan ICBT survey data, I compare the ICBT survey data gathered by the Kenyan Bureau of Statistics. As the two countries share the border, I compare the goods traded and the values of the border posts which they have in common. I find that the composition of goods and the value of goods recorded by the two statistics offices are generally consistent and highly correlated.

For inference, while the main results use clustered standard errors by country-pair and customs, I also find estimation using clustered standard errors by country-pair, which is the standard practice for gravity model estimations, to be consistent (see Table A.6).

[16] Note that most gravity models which use OLS instead of PPML do not pass the RESET test (Silva and Tenreyro, 2006).

5 Traders-level analysis

I explore whether the contemporaneous negative effect of an OSBP on informal-total trade ratio (see Section 4.2) is due to formalisation of traders by using traders-level data collected two locations where an OSBP has already been implemented. I also examine the drivers behind informality amongst cross-border traders by turning back to the micro-foundations of the augmented gravity model (i.e. referring to the inequalities in Equations 5, 6 and 7).

5.1 Did informal traders formalise?

Survey responses provide evidence that there is a lack of switching between formal and informal trade. Only 5 percent of cross-border traders said that they had switched their main border-crossing route since 2016, the operating year of the OSBP in Busia and Malaba. Amongst those that switched, 73 percent changed their main border crossing route from an informal channel to the official customs crossing; 18 percent changed from official crossing to informal crossing; 9 percent changed between different informal border crossings. For those that have switched to the official customs crossing, a majority (63 percent) of them stated that the previous route was too dangerous, and the remainder attributed the change to the official route being safer (13 percent), having better facilities (13 percent) and being less costly (13 percent). None of these traders who switched to the official crossing have changed the products that they trade, but most of them have increased their sales since switching.

I then investigate to what extent those traders who did not change their routes would need to be paid to switch. By using a hypothetical scenario[17], 19 percent of those who cross informally said that they would not change to crossing through the customs for any amount of money, while 55 percent of those who cross formally said that they would not change to an informal border crossing for any fee. The responses are different between traders surveyed in the Kenyan side of the towns and Ugandan side of the towns: only 6 percent of the Ugandan cross-border traders said that they are not willing to change their border crossing route at any price, while this percentage is 42 percent for responses in the Kenyan side of the towns. Even among those who responded in Uganda and are willing to switch, the price they would require is high: 52 percent chose 'More than UGX 1,000,000' (approximately USD 270). When faced with the question of whether they would cease trading entirely if the option of an informal border crossing no longer existed[18], a quarter of the informal cross-border traders stated that they would stop trading.

[17]The question was asked to the cross-border traders whose main border crossing route is informal: 'If I pay you [X] will you change your route to the gazette crossing?'. The question was asked to the cross-border traders whose main border crossing route is formal: 'If I pay you [X] will you change your route to the Sofia or Marachi crossing?'. The enumerator only reveals the next choice if respondent says no. For surveys implemented in the Ugandan side of the towns, the choices were 1) UGX 100,000 2) UGX 200,000 3) UGX 500,000 4) UGX 1,000,000 5) More than UGX1,000,000 6) I will not change for any price. For surveys implemented in the Kenyan side of the towns, the choices were: 1) KES 3000 2) KES 5000 3) KES 10,000 4) KES 20,000 5) More than 20,000 6) I will not change for any price. The options are chosen through an initial round of focus group testing.

[18]Survey question is 'If you can only go through the gazette crossing, will you continue to trade?'

5.2 Who chooses to cross informally?

5.2.1 Identification strategy

I use a probit estimation with sample selection to examine the factors behind the persistence of informality amongst cross-border traders[19]. Sample selection is needed as not all traders are cross-border traders and these cross-border traders are not randomly selected. In order to estimate the two equations simultaneously, there must be a variable which exists in the selection equation (Equation 11) and not the outcome equation (Equation 12).

The selection equation is similar to the specification used by Sequeira (2016) in her firm level analysis of the effect of bribery on the extensive margin of trade. Here, the decision to conduct cross-border trade is captured in D_i, which is valued as one if a trader bought goods across the border, and zero otherwise. In this selection equation, there are factors which influence exporting/importing decisions but not the border crossing path z_i. There must be at least one element in this vector.

The border-crossing decision is captured by Θ_i, which is valued as one if the main border crossing route chosen by trader i is through the customs and zero otherwise. This decision depends on the official taxes T_v imposed at the border for product v[20], traders' characteristics (captured in the vector X_i), such as traders' age, gender, education level, size of business and information access. I report summary statistics of the variables in Table B.2.

$$D_i = (T_v\beta_1 + X_i\gamma_1 + z_i\delta + u_i > 0) \tag{11}$$

$$\Theta_i = \alpha + T_v\beta_2 + X_i\gamma_2 + \epsilon_i \tag{12}$$

5.2.2 Selecting exclusion restriction

I identify the exclusion variable by examining the reasons behind being an importer or exporter, and the reasons behind choosing the specific border crossing (Table B.1). My cross-border traders' survey results show that the reasons for these two decisions are distinct. The reasons for importing are directly related to the profit of a trader's business, such as the price of the goods across the border compared to the domestic market and quality of the goods. The choice of border crossing channel is mainly driven by the security of the route. From informal interviews, traders frequently voice their concerns about crossing the border at night (for example when they have travelled from the capitals and reached the border at night).

The variable which I use is the method of gathering price information. The ability to gather accurate, timely price information can improve firm profitability. I use a dummy variable which captures whether or not the trader uses a mobile platform, internet or calling other people to gather price information.

[19] I define the respondent as a cross-border trade if he/she bought or sold a good across the border in the past seven days. This underestimates the number of cross-border traders, but asking respondents to recall trading activities, such as specific amount bought and sold, is highly inaccurate for duration beyond a week. Most respondents reveal that they do not keep a monthly record of their sales and purchases

[20] This tax vector (T_v) includes a dummy variable which is valued as one if the product traded is subject to VAT, and zero otherwise. Ugandan government imposes VAT rate of 18 percent on certain goods and the Kenyan government imposes VAT rate of 16 percent on certain goods. The tax vector (T_v) also includes a dummy variable to indicate which goods are highly restricted. Tax information is collected by Sauti Africa (http://sautiafrica.org/) from the Ugandan Revenue Authority and Kenyan Revenue Authority. Import duty and VAT are highly correlated with each other; VAT is used because I can match VAT more accurately than import duty.

Mobile platforms should in theory provide more timely and accurate price information and thus affect the ability of traders to source and sell goods at more competitive prices (Jensen, 2007; Aker and Mbiti, 2010; Aker and Fafchamps, 2014). I assume that the method of gathering price information does not have a role in influencing a traders' choice of whether or not to cross the border formally or informally, except through the channel of increased profitability.

5.3 Results

I find that export restrictions and taxes play a role in determining whether the trader uses the customs or informal border crossing as their main trading route (see Table 3). VAT and export restrictions have a negative and significant association on whether a trader crosses the border through the customs. This provides support to Porteous (2017)'s finding that informal trade is related to the ineffectiveness of export bans of grains in Tanzania. However, after accounting for enumerator and strata specific effects, the values of the two coefficients are lower and no longer statistically significant.

Moving beyond official taxes, gender also plays an important role in determining the choice of border crossing. Male traders are less likely to use the customs compared with female traders. The fact that the gender of the trader matters reflect the persistence of informality in border crossing choices. Even with smoother border crossing at customs, and even if taxes are lowered, the gendered aspect of trade costs remains. There are various reasons as to why male traders might be more likely to use the informal border crossing, such as better networks and higher bargaining power. The gendered nature of cross-border trade is also observed in West African networks (Walther and Tremolieres, 2018).

Consistent with Bensassi et al. (2018)'s findings in Benin, those who trade in perishable products, such as fruits and vegetables, are more likely to use the informal border crossing. Due to the time-sensitivity of these products, the reduction in delays may need to be much lower for these traders to switch to a formal crossing.

There is also a significant and positive association between those who choose to use the informal border crossing and those who have encountered officials threatening to confiscate their goods to obtain a bribe in the past three months[21]. Since survey responses suggest that there is hardly any switching between border crossings since the operation of the OSBP, these results can imply that those who experience these threats are more likely to be using the informal crossings. In addition, informal interviews with traders has informed me that there are individuals who pretend to be officials at informal border crossings to extract bribes. This cannot be the case in the formal border crossing where officials are behind window counters. These findings are consistent with the findings in Tyson (2018).[22]

Training also have a positive association with the likelihood that the trader chooses to cross the border formally. Training sessions have been conducted in Busia and Malaba through various bodies, from the Ministry of Trade to international organisations, such as TradeMark East Africa, the World Bank and USAID, and charities and social enterprises, such as Sauti Africa, World Vision and EASSI. There are also several accounts of those who received training from banks such as the Equity Bank and DFC bank.

[21] Exact wording of the question is 'Have officials threatened to confiscate your good to obtain a bribe in the past 3 months?'

[22] In Tyson (2018)'s sample of 116 informal cross-border traders, 48 percent report being asked to pay bribes and paid to avoid confiscation of goods, delays at the border, and consequences of not providing ID and carrying illegal goods. Bribes normally range from KSH 20 to KSH 200, but higher valued goods require larger amounts. Similar to Brenton et al. (2011), (Tyson, 2018) finds that there are individuals hired by officials to intimidate traders to extract bribes.

Almost all responses find these training sessions beneficial for their businesses.

While it is to be expected that those who have knowledge about the Simplified Certificate of Origin (SCOO)[23] are positively and significantly associated with crossing through the customs, not all cross-border traders who know about the SCOO will always use it – some never use it and some only use it occasionally. Over half of those who know about the SCOO continue to use the informal border crossings as their main trading route. While it could theoretically be the case that officials do not always accept the SCOO or require further payments, this does not appear to be true in Busia and Malaba. Nearly all traders (93 percent) report that custom officers have accepted their SCOO without any problems.[24].

[23]This is a simplified clearance form which can be used by traders who are trading goods originated from EAC partner states and the value of traded goods is USD 2000 or below.

[24]Question was asked to the respondent 'During the last time you crossed the border, did the custom officer accept the Simplified Certificate of Origin?' The choices are: 1) Yes without any problems 2) Yes, but need to pay 3) No, not accept.

	(1) Naive	(2) With strata, enumerator dummies
Channel		
Age	-0.0159	-0.00770
	(0.00998)	(0.00699)
Male	-0.403***	-0.243**
	(0.150)	(0.114)
Education	-0.0536***	0.0638
	(0.0193)	(0.0886)
kiswahili	0.302*	0.0906
	(0.162)	(0.195)
Perishability	-0.736**	-0.343
	(0.355)	(0.234)
VAT dummy	-0.723*	-0.0906
	(0.372)	(0.469)
Export restricted	-0.878**	-0.390
	(0.416)	(0.333)
Received training	0.429**	0.444**
	(0.197)	(0.175)
Know SCOO	0.608***	0.366***
	(0.189)	(0.129)
Threatened to confiscate good, pay bribe	-0.238***	-0.199
	(0.0825)	(0.148)
select		
Age	-0.00224	-0.00246
	(0.00353)	(0.00388)
Male	0.0613	0.0672
	(0.142)	(0.144)
Education	0.0123	0.0204
	(0.0567)	(0.0409)
kiswahili	-0.0922	-0.128
	(0.212)	(0.218)
Perishability	0.886***	0.888***
	(0.0981)	(0.0936)
VAT dummy	1.016**	1.039***
	(0.405)	(0.392)
Export restricted	0.198**	0.194**
	(0.0819)	(0.0862)
Received training	0.413*	0.454**
	(0.211)	(0.226)
Info price source: digital	-0.108	-0.194**
	(0.0715)	(0.0982)
Strata dummies	No	Yes
Enumerator dummies	No	Yes
Rho	0.452	1.000
Test indept Chi-squared	1.176	2075.7
Test indept p-value	0.278	0
N	731	731

Clustered standard errors by strata in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Cross border traders' border crossing decision: formal or informal? Top panel is the outcome equation of interest with a binary dependent variable which equals to one if the cross-border trader uses the official customs as his/her main border crossing route, and zero otherwise. The bottom panel shows the results of the selection equation which account for the endogenous selection into being a cross-border trader.

5.4 Threats to identification and robustness checks

I reduce the potential threat of omitted variable bias by including behavioural variables. Specifically, I elicited risk aversion and recall ability following De Mel et al. (2013)'s method[25]. These behavioural variables are statistically insignificant for the decision to cross the border via the customs (see Table B.3, column 1).

The results remain generally consistent when regressing using survey weights, providing support for the current specification (see Table B.4).

It is a concern that the assumption for the exclusion restriction – using digital means to source price information affects only the decision of whether to trade across the border or not, and does not affect the decision of whether or not to cross formally – is too strong. To test whether the direction and statistical significance of the associations are robust, I estimate using Lee bounds to find a range where the effects could lie. I estimate firstly without tightening the bounds (columns 1, 3, 5 in Table 4), and then tightened the bounds using a dummy variable which indicates whether the trader's main language is Kiswahili (columns 2, 4, 6 in Table 4). Kiswahili is the main language used in Kenya, but is not as common in Uganda where it is more a language for trading and business.

The Lee bounds estimates show that the direction of relationship between the sex of the trader, whether the product is restricted and whether the trader knows SCOO are generally consistent with the estimates using the probit estimation with sample selection (Table 4).

	(1) Male	(2) Male (tight-kiswahili)	(3) Restricted	(4) Restricted (tight-kiswahili)	(5) Know SCOO	(6) Know SCOO (tight-kiswahili)
lower	-0.0925*	-0.107*	-0.302***	-0.302***	0.227***	0.172**
	(0.0531)	(0.0564)	(0.0246)	(0.0246)	(0.0717)	(0.0877)
upper	-0.0870	-0.0775	-0.177**	-0.214***	0.233***	0.134
	(0.0711)	(0.0749)	(0.0742)	(0.0603)	(0.0689)	(0.0935)
Observations	818	818	818	818	593	593

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Lee bounds estimates to examine the relationship between the decision to cross the border (in)formally and 1) sex of the trader, 2) whether the product traded is restricted and 3) whether the trader knows the SCOO. The estimated bounds shown in Column 2, 4 and 6 are tightened with the variable 'Kiswahili' which indicates 1 if the main language of the trader is Kiswahili and 0 otherwise.

[25]De Mel et al. (2013) examined formalisation of firms in Sri Lanka. To elicit risk, they asked the respondent 'are you generally a person who is fully prepared to take risks or do you try and avoid taking risks' with a scale from 0 to 10. Although in my survey the question and the scale were the same, I found that many respondents answered 10 as if the question was a binary one (prepared to take risks or not). As in De Mel et al. (2013), the respondents were not financially incentivised for this question. As such I coded the risk aversion variable as binary. For eliciting recall ability, I followed De Mel et al. (2013)'s survey in providing numbers for the respondent to recall. I also included one example (four digits to recall) then for the actual enumeration respondent are tested up to eight digits. The enumeration is according to when the respondent made a mistake, i.e. 1 is enumerated if the respondent was incorrect in recalling the five digits of the first test. If the respondent was correct, the respondent was asked to recall six digits.

5.5 Taxes and border payments

The results reported in Section 5.3 reveal certain factors which may explain some of the challenges in formalising existing informal traders. Here, I further explore the extent to which the significant factors identified to be associated with a trader's choice of border crossing are actually related to border costs.

There are a number of different agents that traders may need to pay when they conduct informal cross-border trade[26]. These payments (which are per one dollar traded) are plotted against VAT rates (Figure 5).

The first observation is that, for all payments, they are on average low in value compared to the traded value (less than 1 percent of value of good). They are however paid each time that the trader crosses the border, meaning that these low-value payments add up (almost a third of the cross-border traders in the survey cross daily, and 56 percent of them cross weekly). Informal payment (kitu kidogo, literal translated as 'little something') is usually given to the officials outside custom offices and in the case of informal routes, officials are stationed to collect these payments at established paths. At zero rate, informal payment varies considerably – in some instances, the value is higher than for those who trade goods with higher import duties.

The second type of payment is to the transporter. These transporters are specifically hired to carry goods to cross the border on behalf of the trader. The trader usually waits on the other side of the border. The total payment therefore includes any extra payment that the transporter has to pay at the border, as well as the wage of the transporter and fuel expenses. It is not possible to separate the three – respondents will not know how much of their payment to the transporter is ultimately used for paying the officials and fuel, and how much the transporter takes home.

Brokers are usually hired to assist in buying and selling in markets. For example, a buyer of grains may not know which seller has better value or quality. A broker can help the buyer or seller to execute the transaction and can even load the goods directly to the transporter's vehicle.

Trade information help desks were set up by COMESA and the EAC to assist traders in crossing the border formally. Situated inside the OSBP, the trade information help desks are where traders obtain the SCOO. Most traders who do use the SCOO do not complete the forms themselves, but go to the help desk where the officer helps them to fill it in. These services are supposed to be free, but the survey data suggests that this is not always the case.

[26]The different types of informal payments faced by cross-border traders are also documented in Sierre Leone by Van den Boogaard et al. (2018a).

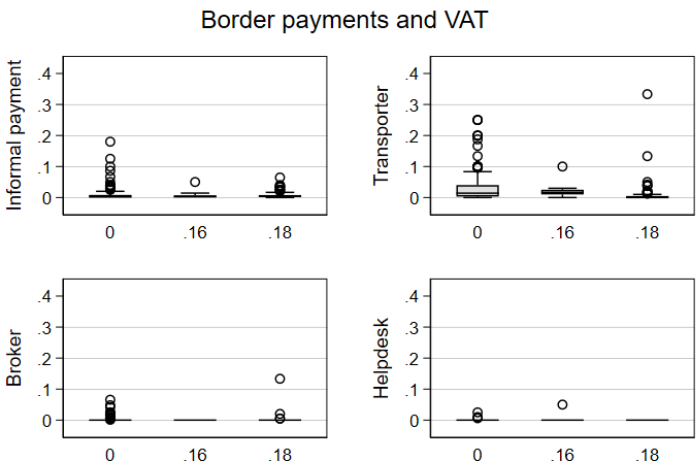

Figure 5: Border payments per unit in USD against VAT. Excluded three outliers: two data points of transporter payment which are higher than 0.6 and one data point of broker payment which is higher than 0.4.

To understand the factors which determine these border payments, I regress the following using an OLS estimation.

$$payment_i = \alpha + \beta T_v + X_i\gamma + u_i \tag{13}$$

where $payment_i$ is the amount paid at the border during the most recent time that the trader i crossed the border, T_v is the tax imposed on good v, X_i is a vector of traders' characteristics and u_i is the error term.

Table 6 shows the results. In column 1, I find that gender and perishability of the traded good. These results are consistent with those we see when examining the likelihood of the trader crossing the border formally. In particular, these results point to the gendered aspect of trade costs – males face lower informal payments compared to women. This may suggest why we find that there is a higher likelihood of male traders crossing the border informally than female traders. This is consistent with other findings which suggest that informal payments and taxes are biased against women (e.g. amongst market traders in Zimbabwe (Ligomeka, 2019), households in Sierre Leone (Van den Boogaard, 2018), and toilet-usage fees amongst market traders in Tanzania (Siebert and Mbise, 2018)).

Traders with perishable goods tend to be subject to higher informal payments, but they are also more likely to use informal routes. This is unsurprising as they are willing to pay more for less delays – this is more easily done using informal routes rather than official border posts.

Table 5: Payments at border crossing

	(1)	(2)	(3)
	All	At customs	At informal crossing
Age	0.0175	0.0589	0.0116
	(0.0188)	(0.0595)	(0.00966)
Male	-0.603**	-0.779*	-0.513*
	(0.162)	(0.345)	(0.221)
Education	0.0450	0.0693	0.0625
	(0.0617)	(0.227)	(0.129)
kiswahili	0.377	1.461*	0.0950
	(0.265)	(0.661)	(0.186)
Received training	-0.440	-1.398**	-0.0451
	(0.241)	(0.518)	(0.136)
Know SCOO	0.303	0.193	0.00868
	(0.460)	(0.720)	(0.180)
Perishability	0.573**	2.503**	0.228
	(0.220)	(0.951)	(0.200)
VAT	3.942	17.67	0.890
	(2.585)	(9.221)	(1.444)
Export restricted	-0.371	-0.438	-0.162
	(0.204)	(0.594)	(0.113)
Observations	235	69	165
R^2	0.146	0.347	0.138

Standard errors in parentheses

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

Table 6: Association of traders' characteristics with informal payments at border crossings (measured as 0.01 USD per one USD value of goods being traded across the border). All estimated using OLS, including enumerator fixed effects.

6 Conclusion

This study examines the effect of a change in official trade costs on (in)formality of trade flows between Uganda and its neighbours. Such informal trade flows includes both under-invoicing at customs and trade at established informal border crossings. I use the introduction of a One-Stop-Border-Post – a border facility which combines two border posts into one to reduce border delays and corruption – as

the vehicle through which trade costs are reduced at customs.

Theoretically, the effect of the OSBP on formalisation of trade is ambiguous. I test this relationship empirically in two steps. First, using quarterly ICBT survey data, collected by the Ugandan Bureau of Statistics and the Bank of Uganda, I use a Poisson pseudo-maximum likelihood estimation to examine whether a fully operating OSBP affects the ratio of informal trade-to-total trade between Uganda and its neighbours. I find evidence that the average treatment effect of the OSBP on informal-total trade ratio is a reduction of 68 percent, but I find no evidence of lagged effects, suggesting this effect is only one-off. Additional estimations suggest that this reduction is mainly driven by a boost in formal trade in industrial products.

I further investigate whether existing informal traders have switched to trade formally by using trader-level data which my enumerators and I have collected at two major border crossings between Uganda and Kenya, both of which have recently constructed an OSBP. A random sample is drawn from a census of 4757 shops and stalls, which was conducted immediately before the survey was undertaken. Using responses from 876 traders, I find that, since the operation of the OSBP, hardly any traders have decided to switch their main border crossing routes. Using hypothetical scenarios, I find that a quarter of them declared that they would cease trading if they can only trade through the customs office.

By using a probit estimation with sample selection, I find that the choice of border crossing is gendered and is influenced by the level of border taxes. Further analysis using self-reported data on border costs paid to different agents, including informal payments, reveal that male traders make less informal payments than female traders. In addition, traders of perishable items pay higher informal taxes and are more likely to use the informal route.

This study provides a first attempt to estimate the effect of a reduction in trade costs, through trade facilitation, on formalisation of trade and attempts to unpack the persistence of informality. Such persistence of informality could mean that total regional trade (the sum of both formal and informal trade) might shrink if formality is abruptly and stringently enforced. The potential loss of traders, and a potential reduction in the flow of goods (particularly staples), has important implications for the welfare of not just the traders themselves, but also for regional food security and the regionâĂŹs vulnerability to external shocks. Further analysis at sectoral and product level could also reveal productivity implications.

A Appendix: Trade flow analysis

Variable	Description	Type	Obs	Mean	Std. Dev.	Min	Max
Informal-total ratio (USD)	Informal-total trade ratio	Continuous	864	0.4567	0.3643	0	1
Informal trade (USD)	Informal trade from ICBT survey conducted by UBOS and BoU	Continuous	864	1632	3940	0	3.83E+07
Formal trade (USD)	Formal trade recorded at customs	Continuous	864	5485	1.38E+07	0	1.10E+08
Sector	Equals 1 if sector is agriculture, 0 if industrial	Dummy	864	0.5	0.500	0	1
OSBP	Equals 1 if OSBP is in full operation in that quarter, 0 otherwise	Dummy	864	0.1343	0.3411	0	1
Physical infra	Equals 1 if physical infrastructure of the modern custom facility is completed in that quarter, 0 otherwise	Dummy	864	0.1574	0.3644	0	1
Precipitation	Median preciptiation of that quarter	Continuous	864	1.6938	1.2426	0	5.795

Table A.1: Summary statistics for trade flows

	(1)	(2)	(3)	(4)	(5)	(6)
	No lag	1 quarter lag	2 quarters lag	1 lead	Agriculture	Industrial
OSBP in operation	0.224	0.0744	0.0242	0.229	-0.0210	0.889*
	(0.360)	(0.135)	(0.126)	(0.435)	(0.207)	(0.513)
OSBP in full operation (t-1)		0.123	0.422***			
		(0.270)	(0.115)			
OSBP in full operation (t-2)			-0.359			
			(0.289)			
OSBP in full operation (t+1)				0.122		
				(0.186)		
OSBP construction completed	-0.259	-0.260	-0.187		-0.0437	-0.441*
	(0.249)	(0.234)	(0.220)		(0.172)	(0.251)
Precipitation	-0.0469	-0.0506	-0.0400	-0.0272	0.0740	-0.103**
	(0.0399)	(0.0361)	(0.0359)	(0.0267)	(0.0607)	(0.0454)
R-squared	0.729	0.724	0.722	0.728	0.941	0.940
N	844	774	704	774	412	432
Degrees of freedom	38	36	36	38	37	36

Standard errors clustered by country-pair-customs in parentheses

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

Table A.2: Effect of an introduction of an OSBP on quarterly total regional trade with neighbouring countries. Includes the following fixed effects: exporter, importer, exporter-time, importer-time, country-pair, country-pair-time, customs, sector, sector-time, time.

	(1)	(2)	(3)	(4)	(5)	(6)
	No lag	1 quarter lag	2 quarters lag	1 lead	Agriculture	Industrial
OSBP in operation	0.150	0.189	0.144	-0.0274	-0.233	1.446**
	(0.386)	(0.186)	(0.218)	(0.547)	(.)	(0.691)
OSBP in full operation (t-1)		-0.0464	0.202*			
		(0.392)	(0.121)			
OSBP in full operation (t-2)			-0.285			
			(0.389)			
OSBP in full operation (t+1)				0.460*		
				(0.270)		
OSBP construction completed	-0.308	-0.298	-0.213		-0.0282	-0.549**
	(0.268)	(0.239)	(0.227)		(.)	(0.249)
Precipitation	-0.0467	-0.0538	-0.0514	-0.0236	0.100	-0.124**
	(0.0463)	(0.0392)	(0.0422)	(0.0257)	(.)	(0.0578)
R-squared	0.687	0.680	0.675	0.688	0.930	0.915
N	864	792	720	792	428	423
Degrees of freedom	36	36	39	37	-1	37

Standard errors clustered by country-pair-customs in parentheses

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

Table A.3: Effect of an introduction of an OSBP on quarterly formal trade with neighbouring countries. Includes the following fixed effects: exporter, importer, exporter-time, importer-time, country-pair, country-pair-time, customs, sector, sector-time, time.

	(1)	(2)	(3)	(4)	(5)	(6)
	No lag	1 quarter lag	2 quarters lag	1 lead	Agriculture	Industrial
OSBP in operation	-0.177	-0.189	-0.0823	0.227	-0.188	-0.219
	(0.202)	(0.280)	(0.296)	(0.305)	(0.263)	(0.150)
OSBP in full operation (t-1)		0.0324	0.795**			
		(0.308)	(0.324)			
OSBP in full operation (t-2)			-0.859***			
			(0.257)			
OSBP in full operation (t+1)				-0.347		
				(0.245)		
OSBP construction completed	0.111	0.00125	-0.118**		-0.251***	0.491***
	(0.0913)	(0.0567)	(0.0584)		(0.0721)	(0.0776)
Precipitation	-0.0470	-0.0479	-0.0178	-0.0230	-0.0381	-0.0266
	(0.0405)	(0.0389)	(0.0381)	(0.0439)	(0.0538)	(0.0425)
R-squared	0.887	0.885	0.882	0.881	0.984	0.982
N	864	751	683	792	432	410
Degrees of freedom	34	33	33	35	36	34

errors clustered by country-pair-customs in parentheses

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

Table A.4: Effect of an introduction of an OSBP on quarterly informal trade with neighbouring countries. Includes the following fixed effects: exporter, importer, exporter-time, importer-time, country-pair, country-pair-time, customs, sector, sector-time, time.

	(1)	(2)	(3)	(4)	(5)	(6)
	No lag	1 quarter lag	2 quarters lag	1 lead	Agriculture	Industrial
OSBP in operation	-0.485***	-0.391***	-0.340**	-0.231	-0.415**	-0.573***
	(0.146)	(0.122)	(0.160)	(0.200)	(0.210)	(0.160)
OSBP in full operation (t-1)		-0.0716	0.0263			
		(0.166)	(0.141)			
OSBP in full operation (t-2)			-0.127			
			(0.117)			
OSBP in full operation (t+1)				-0.160		
				(0.191)		
OSBP construction completed	0.287	0.275	0.265		0.316*	0.381*
	(0.185)	(0.230)	(0.212)		(0.180)	(0.220)
Precipitation	-0.146	-0.118	-0.0561	-0.143	-0.473***	0.129
	(0.0953)	(0.101)	(0.0717)	(0.101)	(0.0941)	(0.156)
R-squared	0.576	0.580	0.577	0.564	0.681	0.726
N	384	352	320	352	192	192
Degrees of freedom	14	14	14	14	14	14

Standard errors clustered by country-pair-customs in parentheses

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

Table A.5: Effect of an introduction of an OSBP on quarterly informal-total trade ratio with neighbouring countries, excluding the DRC and South Sudan as a trading partners. Includes the following fixed effects: exporter, importer, exporter-time, importer-time, country-pair, country-pair-time, customs, sector, sector-time, time.

	(1)	(2)	(3)	(4)	(5)	(6)
	No lag	1 quarter lag	2 quarters lag	1 lead	Agriculture	Industrial
OSBP in operation	-0.484***	-0.375**	-0.329	-0.224	-0.409	-0.571***
	(0.170)	(0.181)	(0.239)	(0.250)	(.)	(0.137)
OSBP in full operation (t-1)		-0.0888	0.0252			
		(0.245)	(0.206)			
OSBP in full operation (t-2)			-0.134			
			(0.144)			
OSBP in full operation (t+1)				-0.167		
				(0.282)		
OSBP construction completed	0.293	0.288	0.268		0.323	0.369
	(0.251)	(0.310)	(0.283)		(.)	(0.261)
Precipitation	-0.0308***	-0.0142**	-0.00762	-0.0325**	-0.0528	-0.00923
	(0.00737)	(0.00712)	(0.00531)	(0.0131)	(.)	(0.0123)
R-squared	0.591	0.571	0.566	0.591	0.738	0.704
N	864	751	683	792	432	410
Degrees of freedom	9	8	8	8	-1	8

Standard errors clustered by country-pair in parentheses

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

Table A.6: Effect of an introduction of an OSBP on quarterly informal-total trade ratio with neighbouring countries. Includes the following fixed effects: exporter, importer, exporter-time, importer-time, country-pair, country-pair-time, customs, sector, sector-time, time.

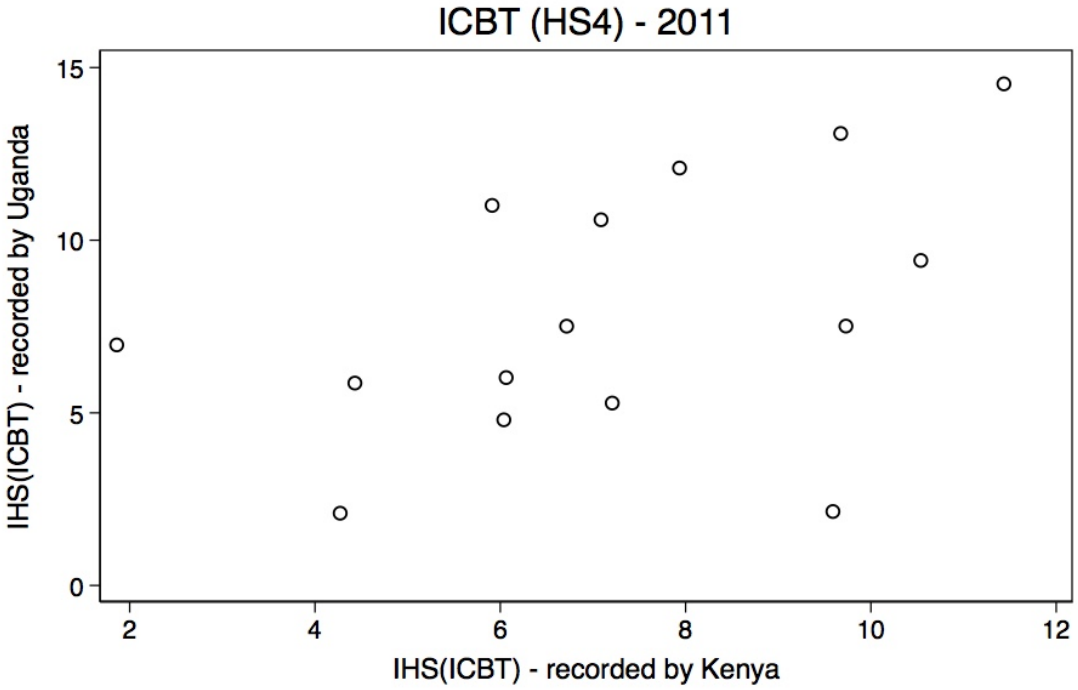

Figure 6: Comparing ICBT data recorded by Kenyan and Ugandan Bureau of Statistics. Currency converted into USD for comparability and then took a IHS transformation. Only available for June 2011. Product aggregation by HS4.

B Trader analysis

B.1 Survey responses

Reason	Import	Export	Crossing choice
Availability and choice of goods	12.67		
Experience	0.34		
Quality of goods	12.33		
Travelling time or proximity to market	6.51	6.00	21.68
Price of goods (buying or selling)	66.78	60.00	
Transport cost	0.68		
Other	0.68		
Competitors		8.00	
Customers		25.33	
Payments at border crossing			10.46
Time taken to cross the border			34.69
Facilities of border crossing			0.77
Procedures required at border crossing			0.51
Security			31.89
Obs	292	150	392

Table B.1: Reasons for importing, exporting and border-crossing choices (percentage of exporters, importers and cross-border traders.) Data collected by author in the cross-border trader survey implemented in Busia and Malaba, border towns between Uganda and Kenya.

Variable	Description	Type	Obs	Mean	Std. Dev.	Min	Max
Cross border trader	Equals 1 if respondent is a cross-border trader, 0 otherwise	Dummy	818	0.4621	0.4989	0	1
Exporter	Equals 1 if respondent is an exporter, 0 otherwise	Dummy	818	0.1614	0.3681	0	1
Importer	Equals 1 if respondent is an importer, 0 otherwise	Dummy	818	0.3374	0.4731	0	1
Surveyed in Uganda	Equals 1 if respondent was surveyed in Uganda, 0 otherwise	Dummy	818	0.5758	0.4945	0	1
Surveyed in Busia	Equals 1 if respondent was surveyed in Busia, 0 otherwise	Dummy	818	0.8423	0.3647	0	1
Channel of border crossing	Equals 1 if respondent's main border crossing is through the official customs, 0 otherwise	Dummy	378	0.2857	0.4524	0	1
Changed border crossing since OSBP	Equals 1 if respondent changed border crossing since OSBP was introduced, 0 otherwise	Dummy	377	0.05570	0.2297	0	1
Age	Age of respondent	Continuous	818	38.4377	9.6656	18	86
Male	Equals 1 if respondent is a male, 0 otherwise	Dummy	818	0.3716	0.4835	0	1
Education	Equals 1 if not completed primary; 2 if completed primary; 3 if completed secondary; 4 if had some college or university education; 5 if completed university	Categoric	816	2.4522	0.9982	1	5
Kiswahili	Equals 1 if respondent's main language is Kiswahili, 0 otherwise	Dummy	818	0.4364	0.4962	0	1
Perishability	Equals 0 if product of trade is not perishable, 1 if semi-perishable, 2 if perishable	Categoric	804	0.8221	0.8243	0	2
Threatened to confiscate good, pay bribe	Equals 1 if trader has been paid a bribe in the past 3 months after being threatened of confiscation, 0 otherwise	Dummy	582	0.0997	0.2998	0	1
Physically harassed	Equals 1 if trader has been physically harrassed by officials in the past 3 months, 0 otherwise	Dummy	582	0.04296	0.2029	0	1
Verbally harassed	Equals 1 if trader has been verbally harrassed by officials in the past 3 months, 0 otherwise	Dummy	580	0.0534	0.2251	0	1
Received training	Equals 1 if trader has received training regarding trading across the border, 0 otherwise	Dummy	817	0.1848	0.3884	0	1
Know SCOO	Equals 1 if trader knows about the Simplified Certificate of Origin, 0 otherwise	Dummy	593	0.2277	0.4197	0	1
VAT dummy	Equals 1 if the good traded has been imposed a non-zero VAT, 0 if VAT is 0	Dummy	746	0.3472	0.4764	0	1
Export restricted	Equals 1 if the good traded has export restrictions, 0 otherwise	Dummy	818	0.06480	0.2463	0	1
Source of price info	Equals 1 if trader uses mobile in add. to market visit to find price information, 0 otherwise	Dummy	818	0.8325	0.3736	0	1
Risk aversion	Equals 1 if trader is fully prepared to take risks, 0 otherwise	Dummy	817	0.5080	0.5002	0	1
Recall ability	Scale of 1 to 5 with 1 indicating low recall ability, 5 indicating high recall ability	Categoric	815	2.8908	1.2517	1	5

Table B.2: Trader-level analysis: summary statistics

	(1) Naive	(2) With enumerator, strata dummies
Channel		
Age	-0.0135	-0.00651**
	(0.0112)	(0.00325)
Male	-0.444***	-0.275*
	(0.172)	(0.157)
Education	-0.0754*	0.0687
	(0.0399)	(0.0584)
kiswahili	0.296	0.0843
	(0.206)	(0.238)
Perishability	-0.820***	-0.351
	(0.317)	(0.254)
VAT dummy	-0.812**	-0.126
	(0.350)	(0.682)
Export restricted	-0.990**	-0.434
	(0.409)	(0.279)
Received training	0.410*	0.415***
	(0.230)	(0.141)
Know SCOO	0.570***	0.387***
	(0.196)	(0.0586)
Threatened to confiscate good, pay bribe	-0.245**	-0.197
	(0.104)	(0.162)
Risk aversion	0.0982	0.0435
	(0.256)	(0.251)
Recall ability	0.0867	0.0163
	(0.0966)	(0.0282)
select		
Age	-0.00154	-0.00181
	(0.00396)	(0.00318)
Male	0.0507	0.0599
	(0.126)	(0.123)
Education	0.0133	0.0215
	(0.0543)	(0.0385)
kiswahili	-0.0651	-0.102
	(0.218)	(0.206)
Perishability	0.883***	0.886***
	(0.0966)	(0.0954)
VAT dummy	1.006**	1.030***
	(0.407)	(0.344)
Export restricted	0.174*	0.169
	(0.105)	(0.111)
Received training	0.382	0.427*
	(0.238)	(0.258)
Risk aversion	0.185	0.172
	(0.177)	(0.148)
Recall ability	0.00382	0.00704
	(0.0311)	(0.0340)
info_price_calldigital	-0.0731	-0.164*
	(0.0891)	(0.0883)
Strata dummies	No	Yes
Enumerator dummies	No	Yes
Rho	0.360	1.000
Test indept Chi-squared	0.797	10.27
Test indept p-value	0.372	0.00135
N	730	730

Clustered standard errors by strata in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.3: Cross border traders' border crossing decision with behavioural variables. Estimated using probit with sample selection. First panel provides results from the outcome equation; second panel provides results from the selection equation.

	(1) Naive	(2) With strata, enumerator dummies
Channel		
Age	-0.0225**	-0.0138*
	(0.0110)	(0.00813)
Male	-0.353**	-0.161
	(0.170)	(0.136)
Education	-0.0411	0.133*
	(0.0928)	(0.0693)
kiswahili	0.338*	0.154
	(0.186)	(0.203)
Perishability	-0.455	-0.168
	(0.286)	(0.136)
VAT dummy	-0.395	0.301
	(0.441)	(0.200)
Export restricted	-1.254***	-0.709***
	(0.312)	(0.230)
Received training	0.341	0.375**
	(0.215)	(0.164)
Know SCOO	0.642***	0.427**
	(0.233)	(0.194)
Threatened to confiscate good, pay bribe	-0.323	-0.343
	(0.272)	(0.241)
select		
Age	0.000953	0.000457
	(0.00565)	(0.00555)
Male	0.0927	0.0823
	(0.113)	(0.109)
Education	0.0366	0.0324
	(0.0582)	(0.0568)
kiswahili	-0.0682	-0.0985
	(0.104)	(0.100)
Perishability	0.861***	0.860***
	(0.0834)	(0.0826)
VAT dummy	1.376***	1.379***
	(0.140)	(0.135)
Export restricted	0.186	0.184
	(0.266)	(0.265)
Received training	0.369***	0.393***
	(0.132)	(0.127)
info_price_calldigital	-0.0759	-0.143
	(0.106)	(0.0947)
Strata dummies	No	Yes
Enumerator dummies	No	Yes
Rho	0.498	1.000
Test indept Chi-squared	.	.
Test indept p-value	.	.
N	731	731

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.4: Cross border traders' border crossing decision with survey weights. First panel provides results from the outcome equation; second panel provides results from the selection equation.

	(1) No selection, cluster SE	(2) No select, enumerator FE	(3) No select, survey weights
Channel			
Age	-0.0162	-0.0140	-0.0240**
	(0.0108)	(0.0109)	(0.0119)
Male	-0.450***	-0.460***	-0.414**
	(0.150)	(0.149)	(0.184)
Education	-0.0587**	0.0505	-0.0537
	(0.0259)	(0.0788)	(0.105)
kiswahili	0.340*	0.204	0.377*
	(0.176)	(0.225)	(0.201)
Perishability	-1.042***	-1.074***	-0.769***
	(0.260)	(0.274)	(0.218)
Threatened to confiscate good, pay bribe	-0.250**	-0.220*	-0.340
	(0.0977)	(0.134)	(0.314)
Received training	0.351**	0.403***	0.263
	(0.150)	(0.150)	(0.243)
Know SCOO	0.651***	0.338*	0.693***
	(0.167)	(0.185)	(0.245)
VAT dummy	-1.066***	-0.908***	-0.867**
	(0.317)	(0.341)	(0.374)
Export restricted	-1.016***	-1.043***	-1.434***
	(0.314)	(0.363)	(0.383)
Constant	1.521***	0.255	1.488*
	(0.318)	(0.567)	(0.836)
Observations	312	312	312

Clustered standard errors in parentheses, except column (3) where survey weights are applied.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B.5: Cross border traders' border crossing decision without selection. Estimated using probit.

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