

Trade, conflict, and informality: Evidence from the South Sudanese civil war

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Abstract: A significant proportion of trade in Africa takes place informally. In this paper we postulate that informal trade is more sensitive to security-related trade costs than formal trade. To test this hypothesis, we combine unique aggregated survey data on Uganda's informal cross-border trade with formal customs data and exploit the spatial and time variation of the South Sudanese civil war to causally identify the impact of conflict on different types of trade. Our preferred estimates suggest that the civil war reduced Uganda's informal exports to South Sudan by as much as 80 percent, compared to an estimated effect of 12 percent for formal exports. Further, we show that the impact of the conflict on formal exports is driven entirely by a reduction of industrial goods exports while exports of agricultural products continued to flow, presumably reflecting necessities in consumption for which willingness to pay is high. Taken together our results are consistent with the hypothesis that security-related trade costs have heterogeneous effects on different types of international trade.

I. Introduction

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How does civil conflict affect different types of trade? Conflict in general creates uncertainty and disrupts transport routes thereby increasing trade costs. Civil war in a trading partner's territory might additionally affect demand for foreign goods through channels like lower purchasing power, stagnant domestic production or a volatile exchange rate.² However, while large formal firms might be able to circumvent conflict affected areas and find new routes to the same or alternative destinations, informal cross-border traders, which are often part of poor and vulnerable groups and without access to adequate means of transportation might feel the effects of conflict more keenly. Similarly, civil conflict could affect demand for certain types of foreign goods more strongly than others (e.g., inputs into infrastructure projects which are likely to stall during times of conflict versus food items). Especially in Sub-Saharan Africa, where civil conflict is rife, where intra-regional trade has been growing over the past decades (*cf.* Calderon et al 2020: 10), and where cross-border trade constitutes an important source of income for many poor border communities, understanding the effects of civil war on different types of trade is of considerable importance.

In this paper we provide evidence on the heterogeneous effects of civil conflict on trade by examining the impact of the South Sudanese civil war on Uganda. The case of South Sudan makes for an illustrative case study due to the severity and length of the conflict and the importance of South Sudan as a market for Ugandan traders. Since the outbreak of the civil war in December 2013 (a mere two and a half years after the country gained independence in July 2011) the conflict has resulted in devastating social and economic consequences. Beyond claiming tens of thousands of victims and leaving more than a third of the country's population forcibly displaced, the conflict has led to a contraction of South Sudan's real GDP by more than 5 percent on average over the last five years. Agricultural production has stagnated and inflation has been soaring with the year-on-year CPI increasing by almost 90 percent from June 2017 to June 2018 (World Bank 2018). The World Bank estimates that in 2016, about 82 percent of all South Sudanese were living under the international poverty line of 1.90 USD (2011 PPP), marking a significant backward trend since 2009 when about 51 percent of all South Sudanese were living in poverty. As a result, today South Sudan is one of the poorest nations in the world, ranking 186 out of 189 countries in the Human Development Index (UNDP 2019).³ Regarding the importance of South Sudan as a market for regional trading partners a plethora of anecdotal evidence suggests that the civil war resulted in Uganda losing a key export destination.⁴ However, to date no study exists that attempts to quantify or show these effects.

To examine the impact of the South Sudanese civil war on Uganda's trade, we exploit a unique data set-up. First, we analyse transactional level customs data collected by the Ugandan tax authority. To complement this standard source of data on formal trade, we exploit that Uganda is one of very few countries in Sub-Saharan Africa that maintains a continuous effort to record informal (or "small scale")

² Cf. the stylized facts on the case of South Sudan presented below.

³ While president Salva Kiir and opposition leader Riek Machar signed a peace agreement in September 2018, such efforts are unlikely to translate into peace without proper commitment by both sides to end the violence. For example, Reuters (2019) reports that in November 2019 the two opposing leaders extended the November 12th deadline to form a unity government by an additional 100 days, with the United States recalling their ambassador as a consequence.

⁴ For example, the Ugandan *Daily Monitor* (2018) concludes that exporting to South Sudan "(...) has been rendered impossible since December 2013 when the insurgency broke out in Juba (...)" (Daily Monitor, 2018). In an unstructured E-mail interview for this paper, a Ugandan exporter reported that he used to sell around 50 cars per year to South Sudan before the outbreak of the crisis, a figure that subsequently dropped to about 12-15 sells, with his South Sudanese clients citing the devaluation of the South Sudanese pound as the prime reason their low demand.

trade through a survey implemented at the country's borders.⁵ Access to aggregated data from this survey allows us to enrich our study by examining a type of trade that is normally not captured in official government statistics. In our empirical strategy, we exploit the time and spatial variation of the conflict to causally identify the impact of the South Sudanese conflict on both types of trade: We postulate that the conflict only (directly) affects trade passing through borders that Uganda shares with South Sudan and only in periods after the outbreak of the civil war in December 2013.⁶ For both types of trade data introduced above we observe the same borders used for shipments, allowing us to estimate conceptually identical specifications for two types of trade that substantially differ from each other.

To illustrate, arguably the most fundamental difference between formal and informal trade lies in the characteristics of agents behind trade transactions. Formal trade recorded by the government is conducted by firms that are registered with the tax authority and that use trucks, rail, air or sea cargo to trade comparatively large shipments with foreign buyers and sellers. Additionally, a standard finding in any country setting is that formal traders are the largest and most productive firms of the economy. For Uganda specifically, Spray (2017) employs administrative tax data to show that exporters have higher productivity and profitability and employ more workers than non-exporters.⁷

On the other hand, informal cross-border traders are normally poor individuals, often female and typically live in close proximity to borders. In their trading activities these traders typically rely on simple means of transportation to carry small quantities of perishable goods across borders (Brenton et al 2011: 2).⁸ Direct consequences of these features of informal traders are that first, informal trade (unlike formal trade) almost exclusively takes place between neighbouring countries and, second, that informal traders will typically be unable to switch to alternative markets if access to the neighbouring country they trade with is cut off. As a result, the closure of a nearby market for any reason likely results in significant net economic losses to informal traders, whereas formal traders have greater scope to switch to alternative export destinations.

⁵ While there is no universal definition of informal cross border trade, an important qualification is that informality does normally not imply illegality (cf. Brenton 2011: 3). Acknowledging the magnitude and importance of informal cross border trade for livelihoods, many regional blocs establish regimes that allow traders to legally export and imports goods below a certain threshold subject to less restrictive bureaucratic conditions. In line with the survey underlying our data, in this paper we use the term informal cross border trade for this type of trade.

⁶ See the data on conflict intensity over time presented in the second section of this paper.

⁷ For the literature documenting "exporter exceptionalism" in other countries see for example van Biesebroeck (2005) for Sub-Saharan Africa, Bernard and Jensen (1999) for the USA and Isgut (2001) for Columbia. Spray (2017) also finds that importers are more productive than non-importing companies, a result also established in Halpern et al (2015) for Hungarian firms. It should be noted that by virtue of being both formally registered and larger than their non-trading peers, Ugandan traders form the highly productive tail of a private sector largely characterised by informality: In Uganda, the business sales turnover threshold requiring firms to register for corporate income tax was 50 million Uganda Shilling (ca. 20 000 USD) until 2015 when it was raised to 150 million UGX. To put these figures into context, the most recent census of business establishments in Uganda shows that in 2011 a mere 11 percent of businesses in manufacturing had an annual turnover exceeding 10 million Uganda Shilling (Shepherd et al. 2016: 2).

⁸ It should be noted that heterogeneity of informal traders exists as can be seen from comparing characterizations provided in Brenton et al (2011) who survey cross border traders in the great lakes region and Siu (2019) who conducts a survey of cross border traders at Busia and Malaba, Uganda's major borders with Kenya. Notably, Siu's findings on the characteristics of cross border traders differ from the findings presented in Brenton et al (2011). Specifically, regarding gender and age characteristics of informal traders, Siu (2019: 36) reports that about 40 percent of surveyed informal traders are male and have a mean age of 38 years. Additionally, Siu also reports that generally informal traders operating at these borders are not likely to switch to formal passages even after the implementation of facilitating interventions like One Stop Border Posts (Siu 2019: 15). We address the issue of formalization of informal trade in section four of this paper.

Despite the small value of individual transactions, Uganda's aggregate informal trade is sizeable: in 2016, informal exports to neighbouring countries corresponded to roughly 40 percent of formal exports to the same destinations.⁹ Finally, Brenton et al (2011: 1-3) survey cross border traders at four borders in the great lakes region and document the importance of informal trade from a poverty perspective. Almost 80 percent of all cross border traders surveyed report that their "household income is heavily dependent on their trading activities" with Brenton et al (2011) going so far to conclude that "cross-border trade is nothing more than a mode of survival for these women rather than an opportunity for growth and development." Consequently, employing both data on formal and informal trade allows us to analyse and compare the impact of the South Sudanese civil war on the trade of Uganda's largest and most productive firms, and on a kind of trade that mostly constitutes an important source of income for poor Ugandan border communities.

In this paper we establish two key results. First, while the South Sudanese civil war had a sizeable negative impact on both formal and informal Ugandan trade, the latter was hit much harder. Our preferred estimates suggest that the civil conflict reduced formal exports through conflict-affected borders by about 12 percent compared to control observations, while informal exports through the same borders were reduced by close to 80 percent. Applying these figures to export volumes with South Sudan and Sudan (the only countries served through conflict affected borders) in the last pre-crisis year and expressing the losses as share of Uganda's overall export volume in the same year, our estimates suggest that total formal Ugandan exports were reduced by about two percent due to the conflict while Uganda's total informal exports were reduced by almost 25 percent. Second, while the impact of the conflict on informal exports from Uganda does not differ by good type, we document a remarkable heterogeneity for the impact of the civil war on formal exports: Our observed effect is driven entirely by a decrease of industrial goods exports while exports of agricultural commodities continued to flow through conflict-affected borders. These results are robust to dropping outliers and varying control groups. Crucially, for both types of trade the observed reductions seem to represent a real reduction of trade with South Sudan and Sudan, rather than lower traffic through conflict-affected borders due to exporters choosing alternative transport routes to the same destinations. For formal exports, the only trade through conflict-affected borders is trade destined for Sudan or South Sudan, and, vice versa, these borders are the only ones used to reach those destinations. Informal trade only takes place with immediate neighbours, suggesting that a decline of informal exports through conflict affected borders represents an actual reduction rather than a diversion.¹⁰

Our results extend the body on the trade effects of civil war in a number of ways. A key reference for our paper is Martin et al. (2008) who employ gravity equations and find that civil war has a large and long-lasting effect on trade, with estimates ranging from a reduction of about 10-45 percent over the first ten years of a civil war dependent on the severity of the conflict (Martin et al. 2008: 4).¹¹ Most

⁹ This figure is in line with estimates from other countries and regions in Sub-Saharan Africa. For example, Afrika and Ajumbo (2012: 4) estimate that in SADC informal trade may constitute 30-40 percent of formal trade within the region.

¹⁰ The analysis presented in this paper is strictly concerned with the impact of the South Sudanese civil war on Uganda's exports. Formal imports from South Sudan and Sudan to Uganda are virtually non-existent, while informal imports from South Sudan do not satisfy the necessary assumption of parallel trends between conflict affected and unaffected trade flows required for our identification strategy (see data section).

¹¹ Work concerned with studying the effect of trade on civil conflict is not directly relevant to our project, as we consider the impact of the South Sudanese civil war on trade with a neighbouring country. However, it should be noted that this literature is not necessarily conclusive. While Mayer and Thoenig (2016) find pacifying effects of trade in the case of the

relevant to our own exercise in terms of geographic focus is Mayer and Thoenig (2016), who combine gravity with a general equilibrium simulation. While their main focus is on the peace promoting effects of a deepening of regional integration in the *East African Community*, they also simulate the impact of a civil war in Burundi. Their findings suggest that on average the country would experience an 11 percent reduction of exports and a 5 percent reduction in imports with other EAC members. Trade relationships between country pairs not involving Burundi would barely be affected (Mayer and Thoenig 2016: 1-3, 26). Since the cited studies focus on countries' overall formal trade, a first contribution of our paper is to show that civil war in a neighbouring country can affect different types of trade differently. Second, it is difficult to establish a causal relationship in the context of a gravity model, notwithstanding the use of cutting edge methodologies and the availability of panel data. Our second contribution is therefore to provide the literature with estimates for the effect of a civil war on trade in a Difference-In-Difference set-up, allowing for stronger causal identification.

Another strand of the literature that our paper links to is on informal trade. Due to measurement difficulties, the formal literature in this area is very small. Nonetheless, there are some important contributions. Fisman and Wei (2004, 2009) find substantial discrepancies between declared exports and mirror imports in markets with high quality reporting. The existence of the discrepancy is correlated with restrictive trade policies, such as export prohibitions or license requirements governing cultural artefacts, or even standard customs tariffs. In addition, the amount is correlated with external data on corruption prevalence in the exporting country. The implication is that if it is possible to circumvent trade costs by resorting to informal channels, some economic actors will likely choose to do so, for given probability of detection and level of penalty. As such, informal trade can be an important factor in the trade relations of countries where trade costs are high, as is the case in many lower income countries. Bensassi et al. (2019) confirm this insight for African countries, using survey data from Benin, but also note that there is substantial heterogeneity. A key contribution of our paper is to show that informal trade is more responsive to exogenous, demand-side shocks than is formal trade, perhaps because the "insecurity tax" (Anderson and Marcouiller 2002) is higher in the informal sector than in the formal sector.

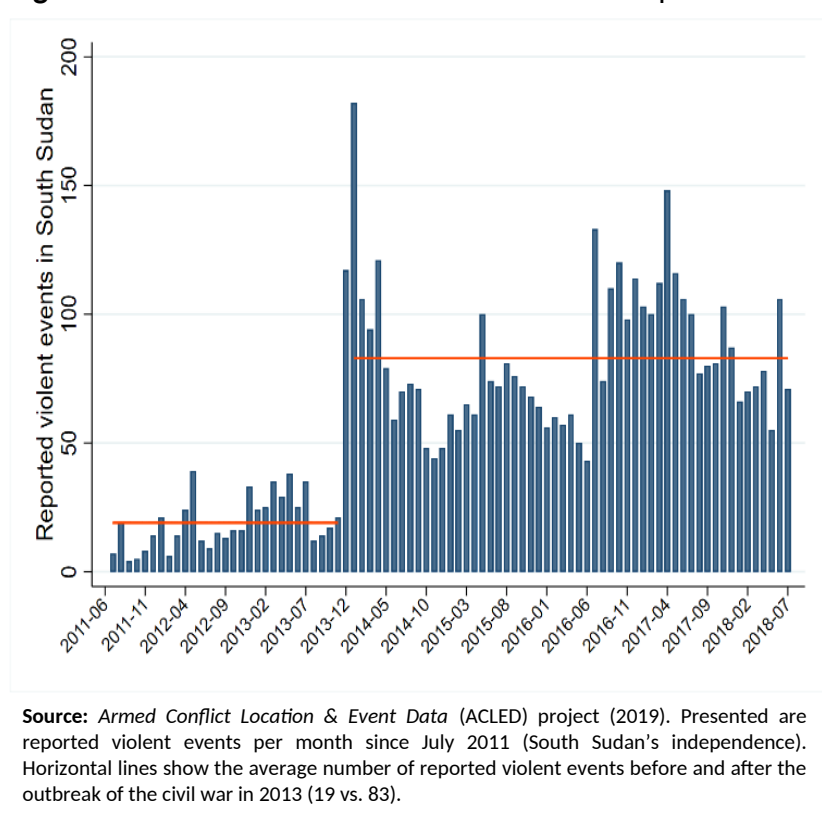
The remainder of this paper is organized as follows: In the next section we lay out our identification strategy. The third section describes the data and considers the issue of parallel trends. Section four presents empirical results, robustness checks and discusses our results from the vantage point of their impact on the Ugandan economy. Section five concludes.

II. Identification strategy

To causally identify the effect of the South Sudanese civil war on Uganda's formal and informal trade we exploit the geographic and time variation of the conflict in a standard Difference-in-Difference setting.

EAC, work by Cali and Mulabdic (2017) suggests that increases in the price of a country's exported commodities increases both the risk and the duration of civil conflict.

Figure 1: Violent events in South Sudan since independence.



Turning first to the time variation of the conflict we chose the outbreak of the civil war in December 2013 as a hard-cut off to define treatment periods. Figure 1 provides empirical backing for this choice by providing a graphical illustration of the extent of violence and political unrest in South Sudan since December 2013. The graph tracks the number of distinct violent events per month in South Sudan as recorded through the *Armed Conflict Location & Event Data* (ACLED) project.¹² As evident from the figure, the number of violent events as reported by ACLED increases sharply in December 2013 and stays high throughout

the civil war years. On average political violence as measured by ACLED is more than four times as high during conflict years than before. In no month after December 2013 is the number of reported violent events in South Sudan lower than in any month before the outbreak of the civil war.¹³

Regarding spatial variation of the conflict, we argue that the civil war only directly affects Ugandan trade passing through borders that Uganda shares with South Sudan (namely the borders of Oraba and Elegu), but does not affect trade through other borders. Figure 2 provides a map of Uganda showing major border crossings. As evident from the map, Oraba and Elegu are border that South Sudan shares with Uganda.¹⁴ At all border shown in Figure 2, the *Informal Cross Border Trade Survey* conducted by the *Bank of Uganda* and the *Ugandan Bureau of Statistics* collects data on Ugandan informal trade with neighbouring countries which we utilize in this paper. Most of these (and additional) border crossings are also used for Uganda's formal trade and observed in the customs data introduced below.

¹² ACLED collects data on the geographical and time distribution of fatalities and reported "violent events" like battles, explosions, violence against civilians or riots in nearly 100 countries. To illustrate, according to ACLED a violent event took place in the South Sudanese district of Aliek Payam on 15th January 2014, when according to the *Sudan Tribune* "(...) *pro-Machar fighters raided over 100 cattle and killed two people.*" Data is collected from secondary information like reports by international organizations or local and international news reports (ACLED 2019) and is freely accessible at acleddata.com.

¹³ Our identification strategy is similar to Siu (2019), who investigates the impact of One Stop Border Posts (OSBPs) on the formalisation of Ugandan trade. In her framework, Siu exploits the fact that over the course of time only some of Uganda's borders got equipped with OSBPs, creating treatment and control groups for trade flows subject to this intervention.

¹⁴ Borders that are physically close to the conflict affected borders (i.e., those that Uganda shares with the DRC) could also be affected by the civil war. We address this concern in robustness checks in the results section of this paper.

Figure 2: Uganda's major borders.



Source: Nations Online (2019). Black dots are border crossings at which the Informal Cross Border Survey by the *Bank of Uganda* and the *Uganda Bureau of Statistics* records informal exports and imports. Informal and formal border passages are usually in direct vicinity to each other. Oraba and Elegu are Uganda's major borders with South Sudan.

Combining the time and geographic variation of the South Sudanese conflict, we translate these considerations and observations into an empirical model (Equation 1). In our estimations we take advantage of the different levels of aggregation in the two datasets presented below and estimate models that are conceptually identical but differ at the level of the observational unit. Specifically,

when employing transaction-level customs data on Uganda's exports we estimate specifications of the following kind:

$$(1) \quad Y_{itb} = \beta_0 + \beta_1 * SSNConflic t_{tb} + d_{ib} + u_t + \varepsilon_{itb}$$

Y_{itb} is the log of the value; the number of transactions; or the average value per transaction by exporter i , in period t (year-month), through border b for three different indicators: Total exports, exports of agricultural goods and exports of industrial products.¹⁵ d_{ib} is a firm-border fixed effect that allows us to control for time-invariant characteristics at the firm-border level that could impact how much a firm trades, such as its physical distance from any given border point. u_t is a period (year-month) fixed effect allowing us to control for general trends in our dependent variables over time such as improvements in technology increasing the value of exports. ε_{itb} is an error term capturing unobserved variables that may affect Y_{itb} , but are by assumption uncorrelated with included regressors. When using the informal trade data, which is available only in aggregated form at the month/border level, we lose the firm dimension i of Equation 1. In these estimations, the dependent variable consequently becomes Y_{tb} , the log value of one of three measures of informal cross border trade recorded during period t and passing through border b : Total exports as well as exports of agricultural and industrial goods.¹⁶ Finally, $SSNConflic t_{tb}$ is a dummy that is equal to "1" only for periods t after and including December 2013 (the outbreak of the civil war) and only for trade passing through conflict affected borders b . Our interest is on the estimate for β_1 , the effect of civil war in South Sudan on Uganda's trade with that country.

Three important comments on this framework are as follows. First, we assume that the outbreak of civil war in South Sudan is exogenous to Ugandan exports and interpret all estimates for β_1 as causal. Second, our identification strategy rests on the assumption that modelling the effect of the South Sudanese civil war on Ugandan trade through a hard cut-off in December 2013 is adequate. To elaborate, we assume that the outbreak of the civil war results in South Sudan becoming a destination characterized by an extremely high level of violence and that further fluctuations and spikes will not affect trade flows additionally. As pointed out in the previous section, violence in South Sudan as measured by ACLED is more than four times as high in post- than in pre-civil war periods.¹⁷ Finally, we address the key requirement of parallel trends between conflict affected and unaffected trade flows in the next section.

III. Data and parallel trends assumption

Our formal customs data ranges from July 2011 (South Sudan's independence) to February 2017. Collected by the Ugandan authorities for the purpose of taxation, the data is transaction level and

¹⁵ In our estimation we only utilize data on shipments recorded in Uganda's customs system, which naturally only collects information when a firm actually conducts a trade. In results available on request we amend our data set to explicitly incorporate information on exporters not exporting across a given border and month. Specifically, we add zeroes to our data for all exporter-border combinations that actually exist in the original data, in months after their first occurrence in which the firm did not export across the border under consideration. We then re-estimate Specification 1 using the Poisson Pseudo Maximum Likelihood estimator and obtain results that are qualitatively identical to the ones presented next.

¹⁶ Similarly, in estimations with the informal trade data d_{ib} becomes d_b (a border fixed effect) and ε_{itb} becomes ε_{tb} .

¹⁷ See also our discussion around outliers and the results obtained from using the (log) monthly number of reported violent events from the ACLED database as a continuous treatment variable in section four of this paper.

includes variables on the type of traded product, country of destination, value of a transaction, border a shipment passes through as well as a firm identifier (masked Tax Identification Number). We perform a number of operations to make this data suitable for our analysis. First, as the data is raw and entered by hand we correct for a number of entry errors.¹⁸ Second, as we are interested in studying how the crisis affects different types of trade we split the data into two broad categories: agricultural and industrial products.¹⁹ Third, we are forced to drop a number of observations from the dataset for which the firm identifier variable is missing.²⁰ Finally, we aggregate the data to the exporter/month/border level. This is to avoid deflated standard errors if we were to use the original transaction-level data with our more aggregate treatment variable at the border/month level. We limit our analysis on Uganda's formal exports as imports through borders assumed to be affected by the civil war (Oraba and Elegu) are negligible.²¹ We present descriptive statistics in Table 4 of the Annex.

Data on Uganda's informal (or "small scale") trade is collected by the *Bank of Uganda* (BoU) in a joint effort with the *Uganda Bureau of Statistics* (UBOS) through their *Informal Cross Border Trade Survey*. Enumerators monitor informal exports and imports at the 19 official customs point shown in Figure 2 for two weeks each month from 7 am to 6 pm with data for missing days being interpolated by personnel at the institutions.²² The survey collects data on all merchandise entering or leaving the country carried on foot, on bicycles, motorcycles, vehicles and push carts at the monitored border posts, capturing trade that is not properly declared to customs, is not transit trade and is not smuggled into or out of Uganda (e.g., during night time activities). To value traded goods, enumerators use prices from markets close to the border and wholesale prices for large consignments (BoU 2017: 3). Upon collection of the survey data, trade values are converted into USD using the official exchange rate. While the survey collects transaction level data, we only have access to aggregate trade flows at the

¹⁸ We correct for the most important error of customs clearing agents entering the dollar value of a transaction into the field intended for the value of the transaction in Uganda shilling by following Spray (2017: 7): We first compare the values of a transaction with the average valuation of an HS8 product in the whole dataset. We then keep the Uganda shilling equivalent of the transaction (USD or UGX entry) which is closest to the average value at the product level.

¹⁹ Our split of trade into agricultural and industrial products is relatively broad and in line with the *Harmonized System* nomenclature of international goods trade: For agricultural products we include chapter 1-5 (live animals and animal products), chapters 6-14 (vegetable products) chapter 15 (animal/vegetable fats and oils) and chapter 16-24 (prepared foodstuffs and beverages). For simplicity, all other products are considered industrial goods.

²⁰ Explicitly, we lose about 1.41 million export transactions out of 2.14 million found in the raw customs extractions due to missing Tax Identification Numbers (TINs). Crucially, however, the export transactions with valid TINs account for about 80% of Ugandan exports and total export values in our data match with international and government reports. For example, for 2013 we find aggregate Ugandan exports of about 2.49 billion USD in our data set. *UNComtrade* reports 2.41 billion USD, while the Bank of Uganda reports 2.407 billion USD (see here: <https://www.bou.or.ug/bou/bouwebsite/Statistics/Statistics.html>).

²¹ During 2013 as the last pre-crisis year, only 558 import shipments reached Uganda through these borders contributing less than 0.1% to Uganda's imports in the same year. Almost all of these shipments originated from South Sudan or Sudan.

²² The raw data includes information on trade flows at two additional border points: Sono (with Kenya) and Bugango (with Tanzania). We drop data collected at these borders from our sample as collection only took place up to December 2012 or from January 2015, respectively, and reasons for why collection ended or started late are unclear and could confound results. However, including these observations in the analysis does not affect estimates. For all other borders we have a complete set of monthly observations from July 2011 to July 2018. The survey form is provided as Figure 6 in the Annex.

month-border level for agricultural and industrial goods.²³ The data is available from July 2011 to July 2018.²⁴

Some noteworthy facts emerge from a descriptive examination of the two types of trade data. First and foremost, Uganda's informal trade with neighbouring countries is sizeable: In 2016 informal exports from Uganda to neighbouring countries totalled about 418 million USD, while formal exports to the same destinations stood at 1,219 million USD. Second, South Sudan is a relatively more important destination for Ugandan informal exports than for formal exports: Over the whole study period under consideration South Sudan accounted as destination for about 19 percent of all informal exports from Uganda. With regard to formal exports South Sudan absorbed about 4.5 percent of all Uganda's formal exports per year.²⁵ Finally, available data on "leading export items" per border crossing allows us to infer the composition of Uganda's informal exports through conflict affected borders with South Sudan. Referring to the 2013 data, industrial goods exports to South Sudan mostly comprise consumer items like shoes, soaps, beverages, maize and wheat flour as well used cloths, together accounting for about a third of Uganda's informal exports to South Sudan in this year. Agricultural exports include crops like beans, potatoes, maize grains, bananas, eggs, fish, vegetables and fruits as well as live stock.

Next, to motivate our identification strategy of exploiting the geographic and time variation of the South Sudanese civil war, we graphically present the development of different trade indicators over time separating trade assumed to be affected by the crisis from unaffected trade flows. In the graphs of Figure 3, we track trade through conflict affected borders in red (Oraba and Elegu) and trade passing through all other borders in blue.²⁶ Panel A shows the value of formal exports, formal agricultural exports and formal exports of industrial good over time, while Panel B employ the aggregated survey data and present the development of the same variables for informal exports. Vertical lines in December 2013 indicate the outbreak of the civil war in South Sudan. A number of insights emerge from these illustrations. First, in the case of both formal and informal trade overall exports through affected borders decline as the civil war in South Sudan breaks out. Second, formal and informal trade through all borders that are by assumption not directly exposed to the conflict (i.e., borders with Rwanda, the DRC, Kenya and Tanzania) seems insensitive to increased violence in South Sudan and continues to follow their respective pre-conflict trend. Crucially, before December 2013, trade through borders affected by the conflict and trade through unaffected borders largely follows a parallel trend.

²³ We verify that available indicators allow us to capture all of Uganda's informal trade collected through this survey by cross-checking annual values resulting from the data with official reports by the Bank of Uganda (BoU). The data is complete. For example, the BoU reports that "[d]uring 2016, informal exports were estimated at US \$ 419.2 million (...)" (BoU 2017: 7). In the data we find that exports for 2016 total 417.5 million USD.

²⁴ Table 5 in the Annex presents summary statistics for Uganda's informal exports. Same as for formal trade, we omit imports as informal imports through borders affected and unaffected by the conflict do not follow a parallel trend in pre-conflict periods thereby violating a key assumption of our identification strategy.

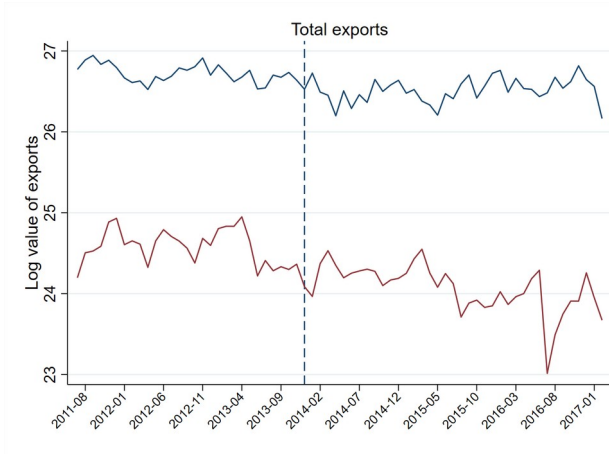
²⁵ Notably, this formal export share increases to 9.4% once we take into account both Sudan and South Sudan as export destinations. This is important, as the *Uganda Revenue Authority* only technically enabled exporters to indicate South Sudan as destination for a shipment in April 2012 when they embedded this country option in their ASYCUDA system.

²⁶ Formal shipments through Elegu border used to be handled in the town of Bibia (ca. 10 miles away) until February 2012. In the formal customs data we consequently find that up to mid-2015 "Bibia" is entered in the customs data for transactions passing through the Elegu border (cf. Figure 5 in the Annex). We refer to transactions passing through Elegu/Bibia as trade passing through Elegu for simplicity. Additionally, we include the borders of Moyo and Madi Opei as affected to the conflict in our assessment of formal trade. These borders are not well frequented and account for less than 1% of all export transactions to South Sudan and Sudan over the study period.

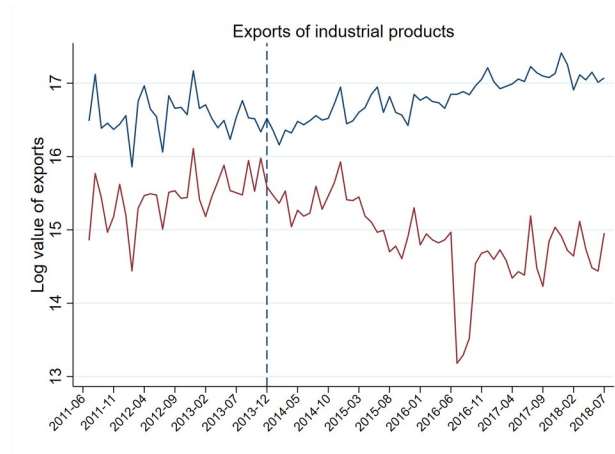
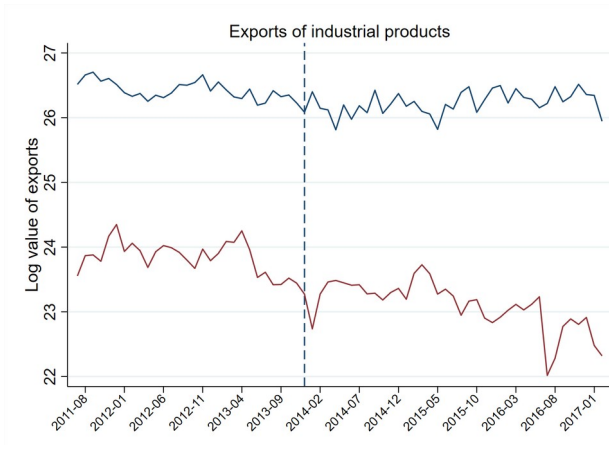
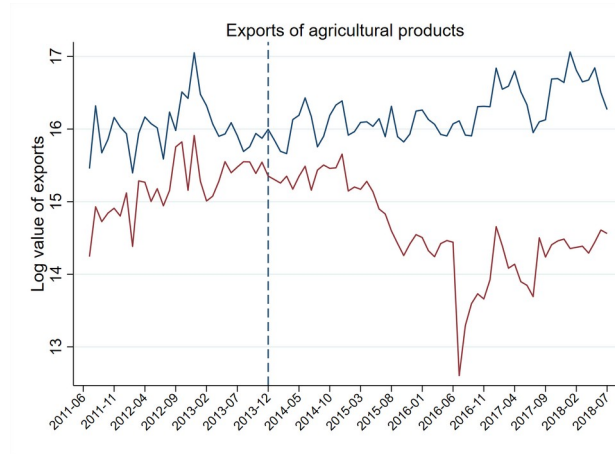
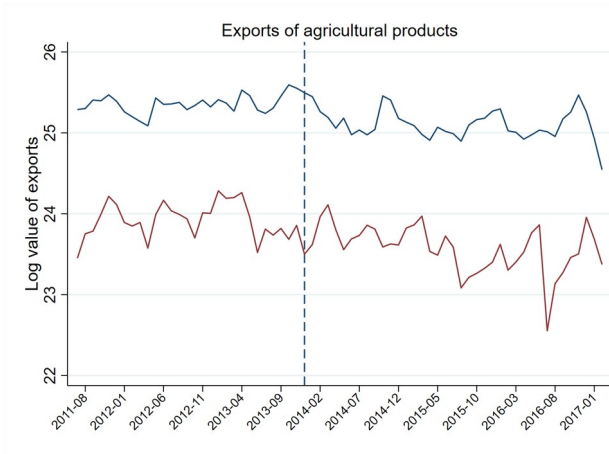
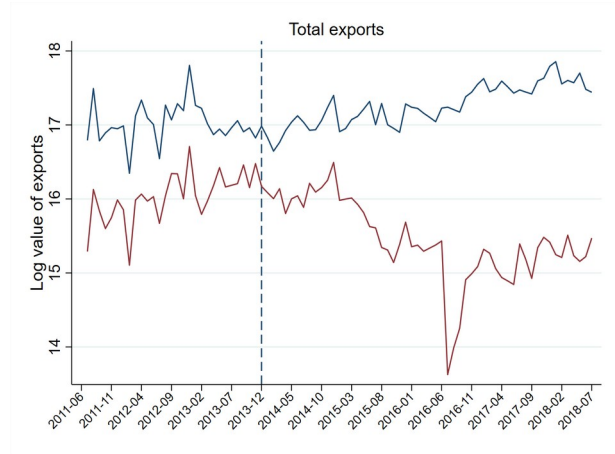
This is essential for our identification strategy as it provides empirical support for the assumption that trade passing through unaffected borders is a suitable counterfactual for those exposed to the conflict.

Figure 3: Trade through borders affected (red) and unaffected (blue) by the South Sudanese civil war.

Panel A: Formal exports.



Panel B: Informal exports.



IV. The impact of the South Sudanese civil war on Uganda's trade: Results and robustness.

We bring our empirical framework to the data and separately study the impact of the South Sudanese conflict on both formal and informal exports. For each set of estimations, we take full advantage of the respective level of disaggregation of the data employed.

i. Uganda's formal exports

Table 1 presents results for estimating Equation 1 with Uganda's formal export data. Top rows show estimates for β_1 (the effects of the South Sudanese civil war on Uganda's formal trade) using (logged) variables for formal exports at the firm/period/border level as dependent variable for total exports, agricultural exports and exports of industrial products (Columns 1, 2 and 3). In all regressions, we employ standard errors clustered by border to account for correlation of unobserved errors across firms that export through a given border crossing.²⁷

Table 1: The effect of the South Sudanese civil conflict on Uganda's formal exports.

	(1)	(2)	(3)
	Total	Agricultural	Industrial
Dependent variable: Log value of exports (per firm-border-period).			
SSNConflict	-.130* (-2.55)	-.028 (-0.28)	-.150** (-2.83)
Constant	17.40** (518)	17.85** (210)	17.00 (375)
R ²	0.001	0.000	0.000
N	82,626	30,256	57,570
Dependent variable: Log number of transactions (per firm-border-period).			
SSNConflict	-.100** (-2.87)	.000 (0.00)	-.132** (-3.75)
Constant	1.06** (34.24)	1.48** (23.81)	0.80** (21.10)
R ²	0.000	0.000	0.000
N	82,626	30,256	57,570
Dependent variable: Log average value per transaction (per firm-border-period).			
SSNConflict	-.028 (-0.88)	-.029 (-0.49)	-.018 (-0.59)
Constant	16.34** (699)	16.37** (392)	16.20** (574)
R ²	0.000	0.000	0.000
N	82,626	30,256	57,570

Notes: * $p < 0.05$; ** $p < 0.01$. Estimation by OLS. T-statistics computed on the basis of standard errors clustered by border are reported in parantheses. All estimations include period (year-month) fixed effects and firm-border fixed effects and all dependent variables are log transformed. The discrepancy between the number of observations when comparing regressions with total values with the sum of observations used in regressions using agricultural exports and exports of industrial goods stems from the fact that we aggregate the value of individual transactions in the raw data to the firm-border-period level.

²⁷ In additional results available on request, we aggregate the data to the year level by summing. Qualitative interpretations are unchanged but this type of aggregation reduces the risk of understated standard errors due to serial correlation.

Turning first to Row 1, Column 1 in Table 1, we find a sizeable effect of the South Sudanese civil war on Uganda's formal exports: Our estimate on *SSNConflict* is statistically significant at the five percent level ($p=0.016$) and suggests that the civil war reduced formal exports through conflict affected borders by about 12 percent compared to export flows passing through borders assumed to be unaffected by the crisis. An important qualification to this finding is that the estimated effect is representative of the impact of the civil conflict on Ugandan trade through lower exports to South Sudan and Sudan and not a reflection of lower traffic through these borders due to traders choosing alternative transport routes for the same destinations to avoid the conflict: The data shows that conflict affected borders are almost exclusively used to reach South Sudan and Sudan and vice versa these borders are the only ones used by Ugandan exporters to reach these destinations.²⁸ With conflict affected trade flows isolated in such a way, we can infer that the estimated effect represents the direct effect of the civil conflict on (South) Sudanese demand for Ugandan goods.

Next, we separately consider exports of agricultural and industrial products and note that the negative impact of the South Sudanese civil war on Ugandan exports is entirely driven by a decline in exports of industrial goods: Employing exports of agricultural products as dependent variable (Column 2, Row 1) reduces the estimated coefficient on *SSNConflict* to close to zero and renders the estimate statistically insignificant ($p=0.58$). On the contrary, the estimate for the effect of the conflict on Uganda's exports increases significantly when employing exports of industrial products as dependent variable and is estimated with a high level of precision ($p=0.008$; Column 3 in Row 1).

We find the same qualitative results when considering the effect of the South Sudanese crisis on the extensive margin of Uganda's exports to South Sudan in the second row of Table 1, where we use the (log) monthly number of export shipments per firm/border pair as the dependent variable: The point estimate on exports of agricultural exports becomes literally zero while the point estimate for the effect of the civil conflict increases and is estimated with higher precision when using exports of industrial goods as the dependent variable. Employing the log of the average value per transaction as dependent variable we find that the conflict had no effect on the intensive margin of Uganda's exports (bottom row in Table 1).

We further explore our result that the civil conflict seems to have affected exports of different goods differently by re-estimating our model with varying subsets of the data where we use the harmonized system classification to define more granular product categories (e.g., "vehicles" or "machinery"). The results for these estimations can be found in Table 6 in the Annex. In line with our results at the more aggregate level we do not find a negative effect of the conflict on formal exports of any agricultural products. In fact, for one product category ("animals and animal products") we obtain at least suggestive evidence that the conflict seems to have increased exports of these products through conflict affected borders. For exports of industrial products, we obtain sizeable and statistically significant estimates for the negative effect of the conflict on exports of "vehicles", "metals" as well

²⁸ In our data we find that over the whole period under consideration more than 98 percent of all shipments that were exported from Uganda through conflict affected borders were destined for South Sudan or Sudan, with either country absorbing about the same amount of Ugandan exports. Vice versa, in excess of 95 percent of all shipments destined for South Sudan and Sudan were shipped through these borders with no discernible upwards trend in periods after December 2013 (see robustness section and Figure 5 in the Annex of this paper).

as “wood and wood products”, while exports of “machinery”, “textiles, foot- and headwear” or “cement and stone” seem unaffected by the conflict.

Next, we run three broad types of robustness checks on the results presented in Table 1. First, as apparent from the graphs in Panel A of Figure 3 formal exports through conflict affected borders dropped to unusually low levels in July and August 2016. This timing coincides with the intensification of the civil war in Juba and Yei, two South Sudanese cities that are in close geographic proximity to borders with Uganda.²⁹ To ensure that our estimated average effects are not largely driven by observations in these two months, we re-perform all estimations presented in Table 1 after dropping them from the data. This leads to a marginal reduction of the point estimates for the effect of the civil war on exports (by about 5 percent in all specifications) but does not change qualitative results.

A second set of tests concerns the validity of our assumption that borders other than those that Uganda shares with South Sudan are unaffected by the civil war. We test for this by re-estimating Equation 1 with different sets of borders in our control group. First, we drop observations from the data that pass through borders that are physically close to the conflict affected border of Oraba and could be affected directly by the conflict.³⁰ Dropping transactions shipped through these borders decreases our sample size only marginally and does not affect point estimates or qualitative results in a noticeable way. A second and related threat to identification is that other borders may not be directly affected by the conflict but could be used by traders as alternative transport routes to reach South Sudan and Sudan. If this is the case, we wrongly assume destruction of trade to South Sudan when in reality exports continued to flow to these destinations but through different routes. However, and as touched upon in the previous section, we can practically rule out this possibility through a detailed examination of the data: The only exports through conflict affected borders are shipments destined to Sudan or South Sudan and vice versa these borders are the only ones used to reach those two countries.³¹ Similarly, we also explore the possibility that borders in the control group were subject to interventions that are not captured by border-period fixed effects. Specifically, towards the end of 2015, Uganda and its neighbours started introducing *One Stop Border Posts* (OSPBs) to reduce the time and cost associated with trading within the region. If these initiatives indeed led to improved intra-regional trade through borders not exposed to the civil war and included in our control group, this could result in an upward bias of our estimate for the impact of the civil war

²⁹ Cf. Pape and Parisotto (2019: 35) for details on the spatial distribution of violence from the South Sudanese civil war over time.

³⁰ We drop transactions through major borders that Uganda shares with the Democratic Republic of the Congo: Goli, Vurra and Arua. There are no borders close to Elegu that could be used as alternative transport routes (cf. Figure 2). Similarly, we might be concerned that other borders were subject to violence from conflict other than the South Sudanese civil war, most particularly the DRC. We therefore also perform a set of regressions dropping all borders the DRC shares with Uganda. This does not change our results in any significant way.

³¹ See Figure 5 in the Annex. For a more formal test, we perform a regression where we only keep exports passing through Uganda’s “major” borders of Busia and Malaba (with Kenya). These exit points from Uganda are geographically distant from South Sudan so that we can practically rule out a direct exposure to the conflict (cf. Figure 2). However, they could nonetheless be used as alternative transport routes. Estimating Equation 1 with this sub-set of the data yields higher estimates for the effect of the South Sudanese conflict on total Ugandan exports. While this could indicate a diversion of exports to South Sudan or Sudan away from Oraba and Elegu and through these unaffected borders, a descriptive examination of the data does not lend support to this hypothesis. Much rather it seems likely that this result is driven by different pre-crisis trends in exports.

on Ugandan exports. To address this concern, we run a set of regressions where we exclude export flows through borders where OSBPs were introduced from our control group.³² Excluding these observations does not affect point estimates significantly and leaves qualitative results unaffected.

A final test concerns a data related issue. In our export data we find a number of transactions for which firms record their TIN in the field meant to be populated if the shipment is an export, yet the transaction itself is labelled as a transit shipment through a *Customs Procedure Code* (CPC). Examining the raw customs data (and as to be expected) we find that most transit shipments as identified through CPCs are not linked to a Ugandan TIN, but recorded in the system without a firm identifier. Nonetheless, for a portion of these transactions a Ugandan importer or exporter TIN is recorded, strongly suggesting Ugandan involvement in the transaction.³³ From the data itself it is not clear whether transactions that are both labelled as transits and conducted by firms declaring to act as an exporter are actual “transits” or whether, for example Ugandan (re-)exporters of goods that are only re-exported from Uganda (like vehicles) keep their imported goods on their accounts as transits to avoid the bureaucratic burden associated with formally clearing imports prior to re-exporting to the region. We re-estimate all specifications reported in Table 1 again without transactions labelled as transit shipments but conducted by exporters (results are provided in Table 7 in the Annex). The point estimates and statistical significance for the effect of the civil conflict on total Ugandan exports (Column 1 in Table 7) are barely affected. However, with this sub-set of the data neither using exports of agricultural products nor exports of industrial goods (Columns 2 and 3) results in statistically significant estimates.

ii. Uganda’s informal exports

³² We employ the information available in Siu (2019: 10) who documents OSBPs in the EAC and exclude all export flows through the borders of Mutukula with Tanzania after the second quarter of 2016, Busia with Kenya after the first quarter of 2016, Mirama Hills with Rwanda after the third quarter of 2015 and Malaba with Kenya after the first quarter of 2016.

³³ Deleting transactions that are labelled as transits in the Ugandan customs data but are conducted by exporters results in aggregate export values far below official figures reported by sources like *UNComtrade*. On the contrary, the dataset with these transactions included results in an overall export volume for Uganda in 2013 of about 2.49 Billion USD. *UNComtrade* reports 2.41 Billion USD.

Table 2 reports results from estimating Specification 1 with the informal cross border trade data. We present results for three dependent variables at the month/border level: The (log) value of total exports, exports of agricultural goods as well as exports of industrial goods. Standard errors are again clustered by border.

Table 2: The effect of the South Sudanese civil conflict on Uganda's informal exports.

	(1)	(2)	(3)
	Total	Agricultural	Industrial
SSNConflict	-1.59* (-2.63)	-1.49* (-2.55)	-1.58* (-2.45)
Constant	13.11** (109.4)	11.57** (68.4)	12.49** (78.4)
R^2	0.19	0.12	0.18
N	1,615	1,615	1,615

Notes: * $p < 0.05$; ** $p < 0.01$. Estimation by OLS. T-statistics computed on the basis of standard errors clustered by border are reported in parantheses. All dependent variables are aggregated trade volumes at the month-border level and are log-transformed. All estimations include period (year-month) and border fixed effects.

The results suggest at a devastating impact of the conflict on Uganda's informal exports across conflict affected borders. The estimates for all dependent variables in Table 2 suggest that the civil conflict led to a decrease of informal exports to South Sudan by about 80 percent.³⁴ All three estimates are statistically significant at the five percent level and of comparable size, suggesting that for informal exports the impact of the civil war did not differ by type of exported good.

As for the formal export data an important qualification to these findings is that the documented reduction of trade through conflict affected borders is likely to largely represent trade destruction rather than diversion: A characteristic of informal trade is that the location where a transaction takes place (i.e., the border area) is normally in the immediate vicinity of the place of final consumption (see also robustness tests below). Finally, and in stark contrast to results obtained from the formal export data, our estimated specifications explain a relatively large portion in the variation of informal exports as documented by an R^2 of between 0.12 to 0.19 (compared to values of less than 0.01 for formal exports). This reflects the more crucial role of South Sudan as a destination for informal exports as compared to formal exports.

As for our analysis with the formal customs data, we inquire the robustness of these findings in a number of ways. First, as for formal exports, we observe large drops of informal exports through conflict affected borders in July and August 2016 coinciding with the intensification of violence close to the Ugandan border (*cf.* Figure 3, Panel B). Re-estimating the model without observations from those two months leads to a marginal reduction of our point estimates for the effect of the conflict on trade but does not change qualitative results. Second, we consider the possibility that informal trade with South Sudan plummeted in comparison to trade with other neighbours due to trade diversions away from conflict affected borders. In the context of the informal trade data, we may

³⁴ The point estimate for β_1 using the logged export variables as dependent variables ranges from -1.49 to -1.59, with $e^{-1.49} \sim 0.22$ and $e^{-1.59} \sim 0.20$. This means that on average trade exposed to the crisis will only be about 20 percent of its counterfactual, corresponding to a fall of exports to South Sudan by 80 percent due to the civil war.

specifically worry that traders active in Uganda's north (i.e., in the provinces of Moyo, Gulu, Arua and Nebbi) decide to export their goods to the DRC instead of South Sudan due to the ongoing conflict. If this is the case, we overestimate the negative impact of the crisis on Uganda's informal trade due to increased trade volumes in the counterfactuals precisely due to the effect we wish to isolate, leading us to infer trade destruction where there is simply rerouting of trade. Again, we re-estimate our model with a subset of the data where we drop all trade flows that pass through the borders with the DRC in Uganda's north.³⁵ Re-running the model we find that the estimated size and statistical precision of our point estimates remain virtually unchanged. Similarly, and same as for our approach with the formal customs data, we also run a set of regressions where exclude control observations through borders where One Stop Border Posts (OSBPs) were implemented after the outbreak of the conflict which does not affect our results significantly. A final threat to identification stemming from the fact that the informal trade data used in this analysis is aggregated survey data cannot be tested empirically: With the data underlying our analysis being collected by enumerators physically based at the borders there is a possibility that the drop of trade with South Sudan we observe in the monthly data is partly due to periodic non-collection of data due to risks associated with conducting the surveys.³⁶ Similarly, and equally related to the way these data are collected, we cannot rule out that informal cross border exports continued to flow but increasingly took place during night time or through other border passages that are not surveyed by enumerators.

iii. Does conflict intensity and its spatial distribution matter?

³⁵ That is, we drop data collected at the borders of Goli, Paidha, Vurra and Odramachaku. We also perform a regression dropping all borders with the DRC which yields the similar results.

³⁶ We expressed this concern in a conversation with the head of trade statistics at the *Bank of Uganda* who stated support for our finding that low recorded trade through conflict affected borders was due to little activity taking place rather than non-collection of data. However, there also was an instance where enumerators were asked to leave border posts with South Sudan due to security concerns.

Key assumptions behind our Difference-in-Difference strategy are that violence in South Sudan only had an impact on Ugandan exports after the outbreak of the civil war and that additional fluctuations in the intensity of the conflict do not matter for exporters choices. We argue that this approach is reasonable against the background of parallel trends of pre-conflict exports depicted in Figure 3 and because violence in post periods is about four times as high on average as before the outbreak of the civil war, with no conflict month showing a lower number of reported violent events than any month before the outbreak. This seems to provide support for the hypothesis that after December 2013 South Sudan was perceived as a highly unstable destination by Ugandan traders and therefore to be avoided.

In this section we explore this issue empirically. We present estimates where we replace the treatment dummy in our Difference-in-Difference specification with a continuous measure of conflict intensity in South Sudan. Exploiting the time and spatial coverage of the ACLED data, we construct two measures of conflict intensity at the monthly level: The (log) number of reported violent events in all of South Sudan and the (log) number of reported violent events in those South Sudanese states adjacent to conflict affected borders.^{37/38} Results are presented in Table 3 for all three broad types of goods considered in this paper (aggregate exports as well as exports of agricultural and industrial goods) and for both types of Ugandan exports (formal and informal).

Results obtained from estimating with a continuous treatment variable confirm the qualitative findings from previous sections employing a standard Difference-in-Difference setting. First, we find a statistically significant effect of conflict in South Sudan on both aggregate formal and aggregate informal exports, with the latter being considerably higher. Comparing point estimates reported in Column 1 of Table 3, we find that an increase of violence in South Sudan by one percent reduces formal exports by around 0.07 percent compared to exports through unaffected borders. For total informal exports (Panel B) we find that the same increase in conflict intensity yields a decrease of informal exports by circa 0.87 percent. Second, for formal exports we do not find an effect for agricultural exports, but statistically significant and sizeable results for exports of industrial goods. As in our baseline specification we do not find an effect on the intensive margin of formal exports.

Additionally, we find at least suggestive evidence that the location of violent events matters, at least for formal exports. Point estimates obtained when using a version of conflict intensity constructed from the number of reported violent events in the two South Sudanese states that share a border with Uganda are around 30 percent larger.³⁹

³⁷ The two states are Central Equatoria and Eastern Equatoria.

³⁸ Referring to the formal exports data, we estimate $Y_{itb} = \beta_0 + \beta_1 * \log(ACLED_{itb}) + d_{itb} + u_t + \varepsilon_{itb}$, where $ACLED_{itb}$ is the number of violent events in South Sudan in month "t" as a measure of conflict intensity. Following the same rationale as for our standard DiD dummy, we assume that violence in South Sudan only affects trade through borders "b" that Uganda shares with South Sudan and set $ACLED_{itb}$ equal to one for all other borders before we log transform regressors. For the version of $ACLED_{itb}$, where we include the number of violent events in South Sudanese states adjacent to Uganda, we find that there were no reported violent events in a total of five months prior to the outbreak of the conflict in December 2013. To avoid estimating with missing observations we therefore include $\log(ACLED_{itb} + 1)$ in our regression in this case.

³⁹ It should be noted that this finding is not robust to dropping months in the pre-conflict period from the regression during which there were no recorded violent events in the two South Sudanese states that border Uganda.

Table 3: Ugandan exports and the spatial and time distribution of the South Sudanese civil conflict.

	Total		Agricultural		Industrial	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Uganda's formal exports						
Dependent variable: Formal exports – Log value of exports (per firm-border-period).						
log(# violent events in SSN)	-0.073 ** (-3.25)		-0.051 (-1.37)		-0.073 * (-2.68)	
log(# violent events at borders)		-0.098 ** (-5.85)		-0.073 (-1.85)		-0.096 ** (-4.16)
R ²	0.000	0.000	0.000	0.000	0.000	0.000
N	82,626	82,626	30,256	30,256	57,570	57,570
Dependent variable: Formal exports – Log number of transactions (per firm-border-period).						
log(# violent events in SSN)	-0.057 ** (-3.66)		-0.034 (-1.14)		-0.061 ** (-3.18)	
log(# violent events at borders)		-0.076 ** (-6.15)		-0.048 (-1.85)		-0.080 ** (-4.99)
R ²	0.000	0.000	0.004	0.003	0.000	0.000
N	82,626	82,626	30,256	30,256	57,570	57,570
Dependent variable: Formal exports – Log average value per transaction (per firm-border-period).						
log(# violent events in SSN)	-0.016 (-1.06)		-0.018 (-0.65)		-0.012 (-0.77)	
log(# violent events at borders)		-0.023 (-1.72)		-0.025 (-1.06)		-0.016 (-1.23)
R ²	0.000	0.000	0.000	0.000	0.001	0.001
N	82,626	82,626	30,256	30,256	57,570	57,570
Panel B: Uganda's informal exports						
Dependent variable: Informal exports – Log value of exports (per border-period).						
log(# violent events in SSN)	-0.874 * (-2.46)		-0.861 * (-2.43)		-0.859 * (-2.31)	
log(# violent events at borders)		-0.864 * (-2.44)		-0.860* (-2.45)		-0.835 * (-2.25)
R ²	0.193	0.253	0.131	0.166	0.178	0.225
N	1,615	1,615	1,615	1,615	1,615	1,615

Notes: * $p < 0.05$; ** $p < 0.01$. Estimation by OLS. T-statistics computed on the basis of standard errors clustered by border are reported in parantheses. Intercept included but not reported. **Panel A:** All estimations include period (year-month) fixed effects and firm-border fixed effects. **Panel B:** All estimations include period (year-month) fixed effects and border fixed effects. All dependent variables are log transformed. "Violent events in SSN" proxies the intensity of the South Sudanese conflict with the (log of) the number of violent events in South Sudan reported in the ACLED database. "Violent events at borders" is the same but includes only events in the South Sudanese states of Central and Eastern Equatoria which border Uganda in the country's north.

iv. Civil conflict and the formalization of Ugandan exports

A question closely related to the robustness of one of our key results that the South Sudanese civil war significantly reduced Uganda's informal exports is whether after the outbreak of the crisis some informal exporters switched to formal passages and avoided trading informally. If this happened for at least a portion of informal exports we overestimate the negative impact of the civil conflict on informal exports.⁴⁰ Several reasons motivate inquiring this possibility further. Most importantly, formal border crossings, which in the case of Uganda are normally located in the direct vicinity of informal ones offer better security when entering South Sudan and might therefore be preferred by traders in times of conflict. Additionally, and as shown in our results in Table 1, Uganda's formal agricultural exports specifically were not affected by the crisis and for some product groups exports even seem to have increased after the outbreak of the crisis (cf. Table 5 in the Annex of this paper).

As for specific mechanisms through which informal exporters could have used formal border passages three possibilities are worth discussing. First, informal exporters could carry goods to the borders with South Sudan and engage truck drivers to carry their produce across as part of their formal cargo. If formalization through this mechanism took place, we are unlikely to observe it in the data: The specifics of a firm's formal export shipments are usually registered by customs agents with the Uganda Revenue Authority in their customs software (ASYCUDA) prior to shipping and not at the border, while the informal cross border trade data is recorded through a survey at informal crossings. Additionally, since there are only very few export taxes in Uganda there seems to be little incentive for customs officials on the Ugandan side to verify and possibly correct entries about formal export shipments in the customs data.⁴¹ A related possibility is that informal cross border traders stopped exporting themselves and instead sold their produce to formal firms domestically who then exported more frequently or in larger shipments. While we cannot observe interactions between formal and informal traders, as evident from our results in Table 1, we do not find evidence for more (row two) or larger (row three) shipments by formal exporters (and for agricultural exports in particular).⁴²

⁴⁰ Another, competing explanation for the observed reduction of informal exports through conflict affected borders could be that border control measures were tightened at some point after the outbreak of the civil conflict (December 2013) with the goal to formalize and tax trade between Uganda and neighbouring countries. While in fact many trade facilitation and border initiatives have been implemented by Uganda and other members of the East African Community since December 2013, we are not aware of noteworthy initiatives concerning South Sudan since then. To elaborate, South Sudan only joined the East African Community in April 2016 and at least over the study period did not liberalize trade with other members or adopted the EAC Common External Tariff (cf. Charalambides 2017). Regarding initiatives that could directly affect trade between Uganda and South Sudan at the border level the two countries implemented a One Stop Border Post at Elegu, but operation of this facility only commenced in November 2019 (cf. Nugent and Soi 2020: 450). Before the conflict (around February 2012), Uganda moved operations for one of the border passages from Bibia to Elegu, two towns about 10 miles apart from each other.

⁴¹ Specifically, at the time the civil conflict erupted, Uganda only implemented a one percent cess on coffee exports, a two percent cess on cotton exports and USD 0.8/kg on exports of raw hides and skins (World Trade Organisation 2013: A5-517). Examining the data, we find close to no exports of these products to South Sudan.

⁴² As an additional test, we also estimate specifications where the dependent variable is either the extensive or the intensive margin of formal exports for each of the two more granular agricultural categories shown in Table 6 of the Annex of this paper for which we find a positive estimate: "*Vegetables and prepared foodstuffs*" and "*Animals & animal products*". For the latter we indeed find a positive and statistically significant coefficient for the effect of the civil conflict on the average value per shipment (intensive margin), which could indicate that after the outbreak of the conflict formal exporters started purchasing these products from individuals that used to informally export these goods to South Sudan. However, a descriptive assessment of the data reveals that for this product category the parallel trends assumption does not seem to hold.

The third possibility we investigate is that informal exporters registered with the tax authority and commenced trading formally themselves after the outbreak of the civil war to take advantage of the better security offered by formal border passages. If this took place, we should find an unusually high number of new entrants into formal exporting across conflict borders after December 2013. To explore this, we first compute the number of traders that entered the formal export market after the outbreak of the civil war. We define these as firms for which we do not have a recorded export flow in the pre-conflict period (July 2011 - November 2013, inclusive), but for which we find at least one recorded export shipment recorded after the civil conflict erupted. We find that out of 2,551 new Ugandan exporters that exported at least once after the outbreak of the civil war, 689 firms exported only across borders affected by the South Sudanese conflict.⁴³ Given the relatively small size of South Sudan as a destination for Uganda's formal exports this could indeed suggest that the conflict incentivized some of Uganda's informal exporters to South Sudan to formalize.

We further explore this possibility and plot the number of export shipments conducted by new formal exporters across conflict affected borders against the number of export shipments across these borders by firms that also exported to South Sudan before the outbreak of the civil conflict (Figure 4). While comparatively small in size, a pattern emerging from this illustration is that export shipments by firms that did not export across conflict affected borders before the outbreak of the crisis increase steadily, while those by firms that exported across conflict affected borders also before the outbreak of the crisis decrease.⁴⁴ This pattern is most pronounced for agricultural goods, where we do not establish a statistically significant estimate for the effect of the civil conflict on the volume or the number of shipments in our baseline estimates (Table 1). While this pattern could be counted as evidence of traders previously exporting informally now choosing official routes, we should be careful with such an interpretation because we do not observe whether new entrants traded informally before.

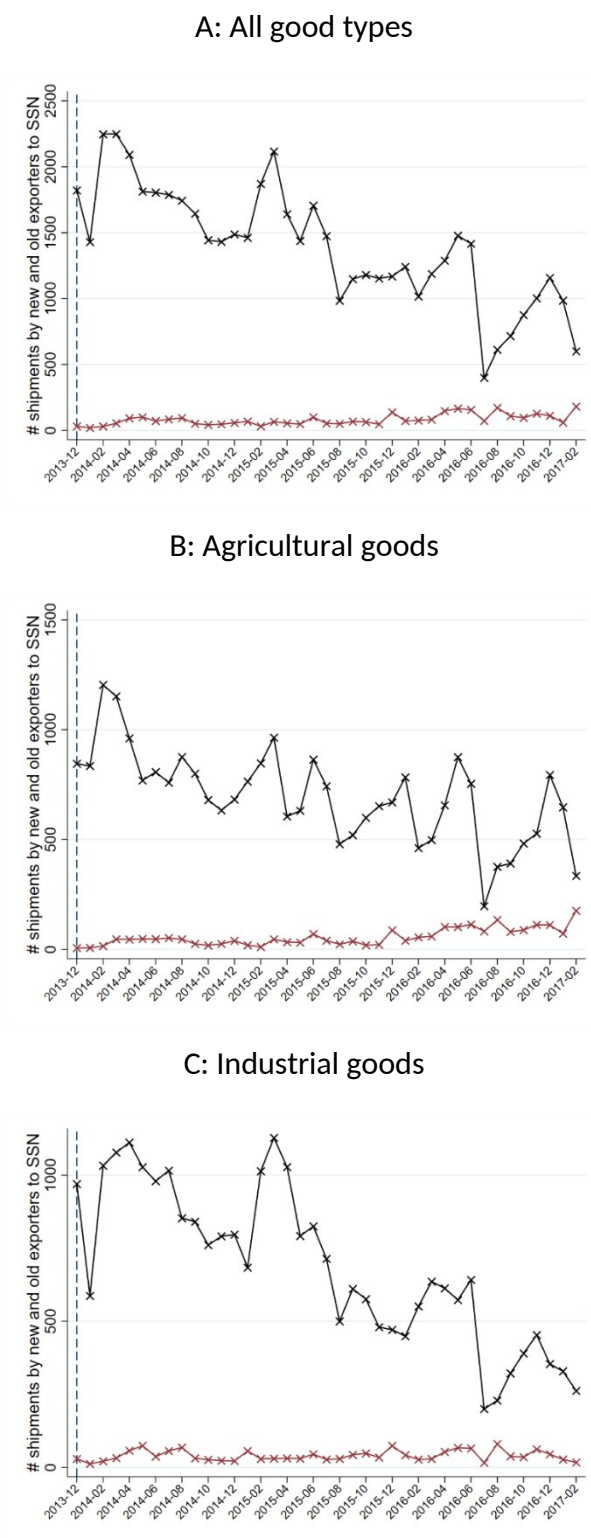
As a final test, we also re-estimate Specification (1) with our formal exporter data, but replace the dependent variable with (the log of) the number of formal exporters per border/month. If in fact the civil war led informal exporters to formalize, strong supportive evidence would be a statistically significant and positive point estimate on β_1 . As shown in Table 8 in the Annex, all point estimates for the effect of the civil conflict on the number of exporters are statistically insignificant (as well as negative): We cannot reject the null that the conflict had no effect on the number of individual exporters exporting through conflict affected borders.

⁴³ For exporters of agriculture goods, the number of firms only starting to export after the outbreak of the crisis is 671, with 183 of these only exporting across conflict affected borders. For exporters of industrial goods, the same figures are 2,175 and 617, respectively. When counting the number of firms exporting across conflict affected borders after the outbreak of the crisis, we drop firms that started exporting to destinations other than South Sudan as well: Our interest is on exploring whether the South Sudanese civil war led to a re-routing of exports to South Sudan from informal to formal channels by incentivizing informal traders, which normally live close to the border and are unlikely to serve other markets, to formalize. New exporters that reach other markets as well are unlikely to be former informal traders to South Sudan, but simply new entrants into exporting. The number of new entrants into formal exporting that we drop for this reason is 210 for new exporters of any type of good, 49 for new exporters of agricultural goods and 185 for exporters of industrial products.

⁴⁴ Again, "new exporters to South Sudan" only include those firms that exported exclusively to South Sudan in the post conflict period.

Taken together, the evidence presented in this sections means that we cannot rule out that some informal traders formalized and used formal border crossings after the civil war erupted, but we do not find strong supporting evidence for this mechanism either.

Figure 4: Formal export shipments by new (red) and old (black) exporters to South Sudan.



Notes: Each graph plots the number of export shipments by firms that only started exporting across conflict affected borders after the outbreak of the civil war in December 2013 (in red) against the number of export shipments done by formal exporters that exported to South Sudan already before the outbreak of the crisis (black). New exporters across conflict affected borders include only those firms that are not found to also export to destinations other than South Sudan.

v. Results discussion

The estimates presented in the preceding section suggest considerable heterogeneity regarding the impact of the South Sudanese civil war on Ugandan trade. While the estimated coefficient for the impact of the conflict on formal exports is sizeable, this seems to only have affected traders of industrial goods. A possible explanation is that these types of products are used as inputs into activities like construction or manufacturing that have largely stagnated since the outbreak of the civil war. We should also note that while our results suggest that reductions of exports through conflict affected borders represent “real” reductions of exports to Sudan and South Sudan (and are not indicative of traders using alternative routes to reach the same destinations), Uganda’s formal firms may have found other export destinations to compensate for losses resulting from the crisis.

Focussing on the difference between the estimated coefficients for the impact of the conflict on formal and informal exports in our standard Difference-in-Difference framework, our key finding is that the latter is almost seven times as large than the former. This result seems line with the characteristics of agents behind transactions: Informal traders are frequently part of poor and vulnerable groups that often lack access to adequate means of transport preventing them from switching to alternative destinations. They may therefore be more subject to security related trade costs and feel the effects of conflict more strongly. Relatedly, we do not find strong evidence for informal exporters switching to formal border passages to take advantage of better security.

To facilitate a more nuanced understanding of our key estimates it is useful to translate these into monetary values. Applied to the total export volume to South Sudan and Sudan in 2013 (the only countries served through conflict affected borders) as the last “full” pre-conflict year, our estimate of a 12 percent reduction of total formal exports to these countries corresponds to a loss of exports to these destinations of about 50 million USD annually. Repeating the same exercise for informal exports to South Sudan, the estimated 80 percent reduction translates into exports foregone of about 105 million over the course of a year.

Putting these approximations into a broader context, Uganda’s total formal export volume in 2013 was about 2.41 Billion USD implying that formal exports foregone due to the South Sudanese conflict are equal to about two percent of Uganda’s total export volume. While this is sizeable, the loss is distinctively more dramatic for informal exports. Again comparing the reduction of informal exports due to the civil war with Uganda’s total informal exports in 2013 of about 421 million USD, the loss of roughly 105 million USD corresponds to a reduction of Uganda’s total informal exports by almost 25 percent. In sum, the crisis did have a distinct yet comparatively small impact on formal exporters while for Uganda’s informal traders the conflict had devastating consequences. This insight matters from a social point of view: The northern districts of Uganda that are adjacent to South Sudan are disproportionally poor in comparison to the rest of the country.⁴⁵ The large reduction in informal exports through conflict affected borders is likely to have further worsened the living conditions of impoverished border communities.

⁴⁵ Wang et al (2019) provide estimates for sub-national GDP per capita in Uganda for 2015. Their findings suggest that three districts in the central region of Uganda (Kampala, Mukono and Wakiso) account for about as much GDP as the remaining 103 districts combined and that western and central Uganda tend to have larger GDP per Capita estimates than Eastern and Northern Uganda (Wang et al. 2019: 6).

V. Concluding remarks

This paper examines the impact of the South Sudanese civil war on Uganda's trade. We employ a strategy of using variation in conflict exposure at the border level to causally identify the impact of the conflict on both formal and informal (or "small scale") exports. We establish the following results. First, while negative and sizeable for both types of exports, the South Sudanese civil war had a larger impact on informal exports than on formal exports. Our estimates suggest that the latter was reduced by about 12 percent, while informal exports were reduced by close to 80 percent. For both types of trade our evidence suggests that observed reductions are "real" and not reflective of traders using alternative transport routes to the same destinations.⁴⁶ Second, in our analysis of Uganda's formal export data we find substantive evidence that the conflict had a negative impact only on Ugandan exports of industrial goods while exports of agricultural goods continued to flow through conflict affected borders.

Taken together our analysis sheds light on the effects of civil war in trading partners on different types of export commodities and different kinds of trade. For the Ugandan case, our results suggest that the South Sudanese civil war had a large and negative effect on border communities in the country's north by destroying an important source of income for informal cross border traders. Formal traders were hit by the conflict as well, but only in specific sectors and not to a comparable extent. This is partly due to South Sudan's and Sudan's comparatively small importance as destinations for formal exports. While the size of our estimated coefficient on formal exports seems largely in line with the related literature (e.g., Martin et al 2008), this paper is the first to provide estimates for the effect of civil war in a trading partner on informal cross border trade. As such, we contribute both to the general literature on the trade effects of civil conflicts, but also more specifically to the literature on the determinants of informal trade, particularly in Sub-Saharan Africa.

⁴⁶ Formal imports through conflict affected borders are essentially zero and therefore not considered in this paper. Informal imports from South Sudan to Uganda are negligible in size. In the working paper version of this article, we examined price data for major food items traded informally (e.g., maize flour) from Uganda's north. In line with South Sudan's insignificance as a supplier and mirroring our result that informal agricultural imports were not affected by the crisis we do not find a price effect.

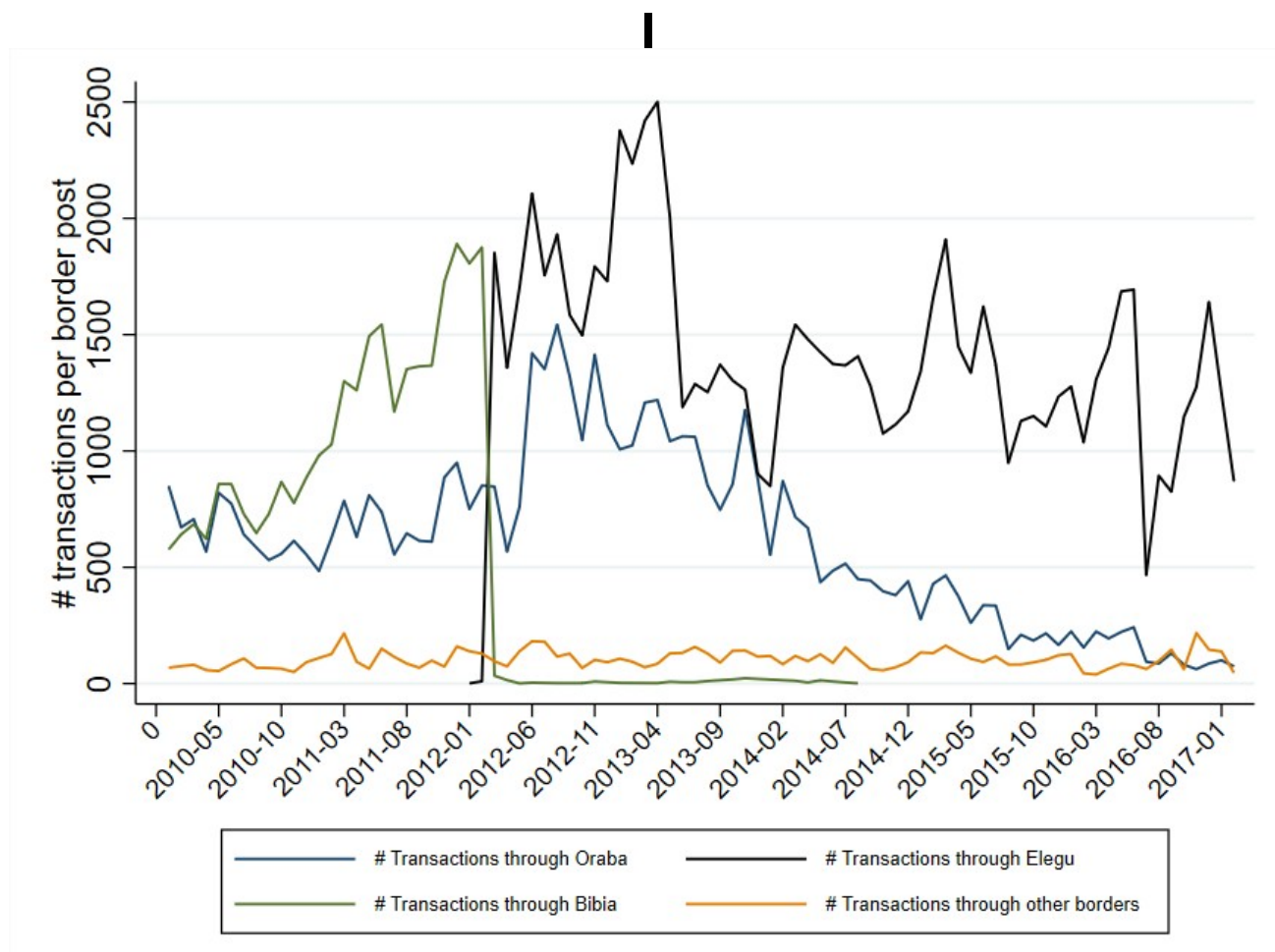
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Annex

Figure 5: Alternative transport routes to South Sudan and Sudan and the borders of Bibia and Elegu.



Notes: The graph tracks the number transactions destined for South Sudan or Sudan through major border crossings. As evident from the graph, the functions of Bibia were taken over by Elegu around February 2012. Both places are only about 10 km apart from each other so that an alternative explanation is a renaming of border posts. The vast majority of transactions reaching South Sudan or Sudan through “other borders” (yellow line) pass through the borders of Malaba and Busia (with Kenya), Uganda’s most important borders in terms of volume of transactions handled. “# Transactions through other borders” also includes other but unimportant borders with South Sudan (Madi Opei and Moyo) which together account for less than 1% of all transactions to South Sudan and Sudan over the study period.

Figure 6: Survey form for the BoU/UBOS *Informal Cross Border Trade Survey*.

[illegible]

Source: Bank of Uganda (2019).

Table 4: Descriptive statistics of Uganda's formal exports.

Variable	Observations	Mean	SD	Min	Max
Value of exports	82,626	330	4,113	0	208,782
Value per export transaction	82,626	42	336	0	16,149
Number of transactions	82,626	7	16	1	538

Notes: All variables are expressed per exporter/border/month triplet. “Value of exports” and “Value per export transaction” are expressed in ‘000 000 Uganda Shilling at constant 2010 values. The total number of export transactions over the time period covered is 581,062 and the total value of exports is 27 233 Billion Uganda Shilling. The data covers July 2011 (South Sudan’s independence) to February 2017 and covers 7,043 exporters, shipping goods from Uganda through 32 border points (including Entebbe airport) and to a total of 170 destinations.

Table 5: Descriptive statistics of Uganda' informal exports.

Variable	Observations	Mean	SD	Sum	Min	Max
Agricultural exports	1,742	745	1,388	1,299,057	0.02	15,725
Exports of industrial goods	1,746	1,260	1,814	2,199,796	1.76	14,096
Total	3,488					

Notes: All values are expressed in '000 USD and expressed at the month/border level. Time coverage of the data is July 2011 (South Sudan's independence) to July 2018, with 19 border crossings included.

Table 6: Heterogeneous effects of the South Sudanese civil war on different formal export commodities.

	Animals and animal products	Mineral products and chemicals	Machinery	Vegetables and prepared foodstuffs	Misc. manufactures	Textiles; Footwear and Headwear	Metals	Vehicles	Wood and wood products	Stone, cement, ceramic, glass
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SSNConflict	0.322*** (-3.35)	0.005 (-0.03)	-0.011 (-0.12)	-0.027 (-0.27)	-0.037 (-0.5)	-0.178 (-1.22)	-0.196* (-1.77)	-0.238*** (-4.87)	-0.385*** (-5.72)	-0.428 (-1.31)
Constant	17.74*** (110)	16.80*** (230)	16.13*** (125)	17.76*** (267)	16.38*** (216)	16.46*** (254)	17.38*** (-118)	16.52*** (-378)	16.40*** (71.97)	15.38*** (-57.48)
R ²	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.001	0.014
N	4 740	11 960	7 686	26 499	12 929	6 499	7 617	21 187	1 313	1 617

Notes: * $p < 0.1$; ** $p < 0.05$, *** $p < 0.01$. The dependent variable in all regressions is the value of exports per month per firm/border pair for identified product categories. Estimation by OLS. T-statistics computed on the basis of standard errors clustered by border are reported in parentheses. All estimations include period (year-month) fixed effects and firm-border fixed effects and all dependent variables are log transformed. The commodity group “Misc. manufactures” also includes paper products, plastics and rubbers.

Table 7: Robustness – Dropping transactions labelled as transits.

	(1)	(2)	(3)
	Total	Agricultural	Industrial
Dependent variable: Value of exports (per firm-border-period).			
SSNConflict	-0.139** (-2.77)	-.236 (-1.52)	-0.078 (-1.34)
Constant	17.25 (262)	17.68 (152)	16.69 (236)
R ²	0.000	0.000	0.000
N	39 815	18 048	25 028
Dependent variable: Number of transactions (per firm-border-period).			
SSNConflict	-0.102 (-1.68)	-0.214 (-1.79)	-0.039 (-0.84)
Constant	1.18 (27.08)	1.56 (19.43)	0.85 (21.60)
R ²	0.000	0.005	0.000
N	39 815	18 048	25 028
Dependent variable: Average value per transaction (per firm-border-period).			
SSNConflict	-0.036 (-1.37)	-0.021 (-0.40)	-0.040 (-1.15)
Constant	16.07 (315)	16.11 (260)	15.84 (321)
R ²	0.000	0.005	0.001
N	39 815	18 048	25 028

Notes: * $p < 0.05$; ** $p < 0.01$. Estimation by OLS. T-statistics computed on the basis of standard errors clustered by border are reported in parantheses. All estimations include period (year-month) fixed effects and firm-border fixed effects and all dependent variables are log transformed. The discrepancy between the number of observations when comparing regressions with total values with the sum of observations used in regressions using agricultural exports and exports of industrial goods stems from the fact that we aggregate the value of individual transactions in the raw data to the firm-border-period level.

Table 8: The effect of the South Sudanese conflict on the number of individual exporters.

	(1)	(2)	(3)
	Total	Agricultural	Industrial
Dependent variable: Log number of exporters (per border-period).			
SSNConflict	-0.109 (-0.43)	-0.047 (-0.17)	-0.214 (-0.87)
Constant	3.317 *** (16.56)	2.354 *** (11.4)	3.025 *** (15.88)
R ²	0.037	0.016	0.048
N	1 863	1 615	1 845

Notes: * $p < 0.05$; ** $p < 0.01$. Estimation by OLS. T-statistics computed on the basis of standard errors clustered by border are reported in parantheses. All estimations include period (year-month) fixed effects and border fixed effects and the dependent variable (number of distinct exporters per border/period) is log transformed.