Working paper

International Growth Centre

Regional economic spillovers from the South Sudanese civil war

Evidence from formal and informal cross border trade

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March 2020

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Regional economic spillovers from the South Sudanese civil war: Evidence from formal and informal cross border trade

Jakob Rauschendorfer and Ben Shepherd[1]

Abstract: This paper examines the impact of the South Sudanese civil war on trade in East Africa. In a first step, we employ a gravity model to examine the impact of civil conflict on the trade of neighbouring countries in a general sense and conduct a counterfactual simulation for the South Sudanese case. We show that an increase in the number of violent events to 2014 levels in 2012 (the last full pre-conflict year) would have reduced exports of neighbours to South Sudan by almost 9 percent. In a second step we conduct a case study for the impact of the conflict on Uganda. Here, we take advantage of unique survey data on informal cross-border trade as well as formal customs data and exploit the spatial and time variation of the conflict for causal identification. Our first result is that while the civil war had a sizeable negative impact on both formal and informal Ugandan exports the latter was hit much harder: Our preferred estimates suggest reductions of formal exports to South Sudan and Sudan by about 12 percent while informal exports to South Sudan were reduced by close to 80 percent compared to trade flows not exposed to the conflict. Converting these losses into monetary values, these figures suggest a reduction of Uganda's total informal exports by a staggering 25 percent, while total formal exports were reduced by about two percent as a consequence of the conflict. Our second result is that the impact of the conflict on Uganda's formal exports is driven entirely by a reduction of industrial goods exports while exports of agricultural commodities continued to flow. Taken together our results suggest considerable heterogeneity for the impact of civil war on different types of trade.

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I. Introduction

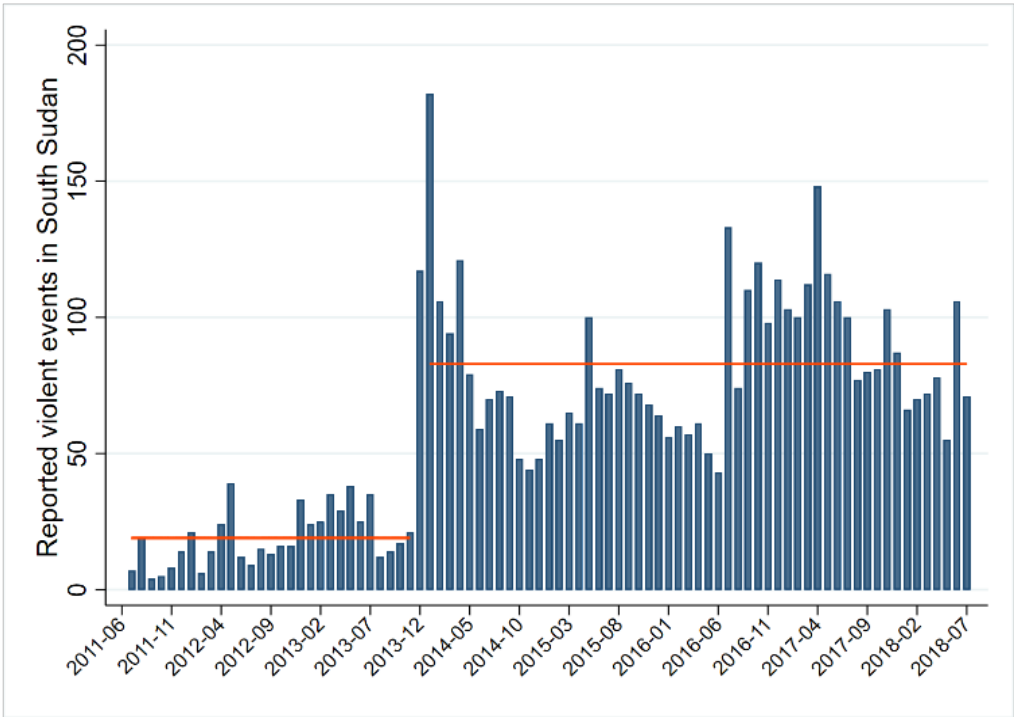
Just two and a half years after gaining independence in July 2011, South Sudan's civil war broke out on the 15th of December 2013. Since then, the conflict has fuelled a humanitarian crisis resulting in devastating social and economic consequences. Beyond claiming tens of thousands of victims and leaving more than a third of the country's population forcibly displaced, the conflict has led to a contraction of the country'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). As a direct consequence of high food prices most rural and urban households are not able to meet their basic needs. 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). 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.[2] Figure 1 provides a graphical illustration of the high degree of instability characterizing the country since December 2013 by tracking the number of reported violent events in South Sudan as recorded by the *Armed Conflict Location & Event Data Project* (ACLED).[3]

While the civil war in South Sudan has received considerable attention from the donor community and wide coverage in the international media, academic study of the economic consequences of the conflict has been hampered considerably by lack of data.[4] In addition to its impact on South Sudan itself, the crisis is likely to have impacted the country's neighbours: Ample anecdotal evidence suggests that the crisis had economic consequences for the rest of the region through channels like refugee flows, regional procurement of food assistance by donors, increased military spending and deployment as well as trade disruptions. However, and despite the severity of the civil war and better data availability, not much is known about the conflict's impact on South Sudan's neighbours.[5]

[2] 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 USA recalling their ambassador as a consequence.
[3] 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. The analysis presented in this paper makes use of ACLED data on South Sudan both in the gravity model (Section II) and in the country case study on Uganda (Section III). In line with the graphical representation in Figure 1, we use December 2013 as a hard cut-off to define treatment periods. Corroboratively, there is not a single month in the treatment period thus defined where the number of violent events in South Sudan was lower than at any point in the pre-treatment period.
[4] A notable effort to overcome this obstacle is the *High Frequency South Sudan Survey* implemented by the South Sudan National Bureau of Statistics in collaboration with the World Bank (see Pape and Parisotto, 2019) for a summary). The survey provides the first update of national poverty estimates since 2009.
[5] An important exception is the ongoing effort on understanding the economic impact of refugees (from South Sudan and elsewhere) on their East African host countries through the *Refugee Economies Programme* at the *University of Oxford* (see for example Betts et al (2014)).

This paper aims at contributing to a better understanding of the regional economic spillovers of the South Sudanese civil war by exploring its impact on trade in the region. Conflict in general creates uncertainty and disrupts transport routes thereby increasing trade costs, while conflict in a trading partner's territory might additionally affect demand for foreign goods through channels like purchasing power, lower production levels of domestic goods or a volatile exchange rate.[6] Anecdotal evidence certainly suggests that the war in South Sudan impeded on the regions trade and resulted neighbouring countries losing out on an important export destination.[7] However, to date no study exists that attempts to quantify or even only show these assumed negative effects. This absence is related to a broader lack of attention in the literature to the trade effects of civil conflict.

Figure 1: Reported violent events in South Sudan since independence.



Source: *Armed Conflict Location & Event Data* (ACLED) project (2019). Presented are reported violent events per month since July 2011 (South Sudan's independence). Horizontal lines show the average number of reported violent events before and after the outbreak of the civil war in 2013 (19 vs. 83).

A key reference for our project is Martin et al. (2008), who employ gravity equations to assess the impact of civil war on a country's trade; this paper is one of the rare contributions in this area. They find that civil war has a large and long-lasting effect on trade, with estimates ranging from a reduction of 10-45 percent over the first ten years of a civil war, dependent on the severity of the conflict (Martin et al. 2018: 4).[8] The study that is most relevant to our own exercise is Mayer and Thoenig (2016). These authors combine gravity with a general equilibrium simulation to quantify the peace promoting effects

[6] See the stylized facts presented in World Bank (2018) and introduced above for the South Sudanese case specifically.

[7] 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).

[8] Work concerned with studying the effect of trade on civil conflict is not directly relevant to our project, as we are interested in studying the impact of the South Sudan civil conflict on the trade relationships of neighbouring countries. 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 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.

of regional integration in the *East African Community* (EAC). Embracing a retro-perspective approach, they estimate that the formation of the EAC led to a reduction of bilateral risk of conflict by 12 percent. They also estimate prospective gains from a deepening of the agreement and estimate that an effective implementation of the common market would not only lead to a substantial increase in intra-regional trade but would also lower the risk of conflict by around 4 percent. Crucially, in a final stage the authors simulate the impact of a civil war in Burundi. Their findings suggest that on average Burundi would experience an 11 percent reduction of exports and a 5 percent reduction in imports with other EAC member states. Trade relationships between country pairs not involving Burundi would barely be affected (Mayer and Thoenig 2016: 1-3, 26).

Aiming to contribute to and extend the current body of knowledge, in our approach we take advantage of two different methodologies. First, we use a global dataset and a gravity model to look at the impacts of civil conflicts on the trade of neighbouring countries in a general sense, and conduct a counterfactual simulation for the South Sudanese case. Results show that conflict in an importing country is indeed an important predictor of neighbouring countries' exports to it. When we consider South Sudan in particular, we show that an increase in the number of violent events to 2014 levels in 2012 would have reduced the exports of neighbours to South Sudan by around 8.6%.

While useful in terms of a scoping exercise, it is difficult to establish a causal relationship in the context of a gravity model, notwithstanding our use of cutting edge methodologies and the availability of panel data. Our second approach is therefore to use more detailed data for Uganda in a differences-in-differences set up to identify more precisely the relationship between conflict in South Sudan and trade relations with these two neighbouring countries.

We employ two different kinds of trade data for our Uganda case study: formal customs data, and aggregated survey data on *Informal Cross Border Trade* (ICBT). ICBT is not normally captured in official reports of a country's exports and imports and as such the availability of this data allows us a unique perspective on the effects of the South Sudanese crisis on Uganda's trade. Exploiting the time and geographical variation of the conflict we find that in the South Sudanese civil war has led to a reduction of formal exports to South Sudan and Sudan by about 12 percent, an effect that is driven exclusively by exports of non-agricultural goods. This figure is around 50% higher than the effect suggested by our gravity model, but given the significant uncertainties involved in estimation in this case, the two estimates can be considered to be of a similar order of magnitude. Additionally, and in line with the higher degree of vulnerability of the agents behind transactions, we find even bigger effects for the effects of the crisis on informal cross border exports from Uganda: Our estimates suggest that the crisis led to a reduction of informal exports to South Sudan by about 80 percent. Converting these losses for formal and informal exports into monetary equivalents, our estimates suggest a reduction of total Ugandan informal exports by a staggering 25 percent, while total formal exports were reduced by about two percent due to the South Sudanese civil war. In line with South Sudan's insignificance as a supplier to Uganda, we do not identify a price effect for traded food items.

This remainder of this paper is organized as follows. In Section II we study the relationship between civil conflict and trade by means of a global gravity model on trade. In Section III we conduct a case study for the impact of the South Sudanese civil war on Uganda's formal and informal trade. Section IV concludes.

II. A global view on trade and civil conflict using the gravity model

The gravity model is the workhorse of empirical international trade. Initially developed as the expression of sensible but ad hoc intuition, the more recent literature has focused on supplying solid micro-foundations for the core relationship.

i. Model set-up

Anderson et al. (2018) develop a simple method for conducting theory-consistent policy simulations using the familiar structural gravity model derived from CES preferences across countries for national varieties differentiated by origin (the Armington assumption). The model takes the following form:

$$(1)\ X_{ij} = \left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma} Y_i E_j$$

$$(2)\ P_j^{1-\sigma} = \sum_i \left(\frac{t_{ij}}{\Pi_i}\right)^{1-\sigma} Y_i$$

$$(3)\ \Pi_i^{1-\sigma} = \sum_j \left(\frac{t_{ij}}{P_j}\right)^{1-\sigma} E_j$$

$$(4)\ p_j = \frac{Y_j^{\frac{1}{1-\sigma}}}{\gamma_j \Pi_j}$$

Where: X is exports in value terms from country i to country j; E is expenditure in country j; Y is production in country i; t captures bilateral trade costs; sigma is the elasticity of substitution across varieties; P is inward multilateral resistance, which captures the dependence of bilateral shipments into j on trade costs across all inward routes; Π is outward multilateral resistance, which captures the dependence of bilateral shipments out of i on trade costs across all outward routes; p is the exporter's supply price of country i; and gamma is a positive distribution parameter of the CES function. Full details of the model's solution and characteristics are provided by Anderson et al. (2018), and Yotov et al. (2017).

Most commonly, the model represented by (1) through (4) is estimated by fixed effects, which collapses it into the following empirical setup:

$$(5)\ X_{ij} = exp\left(T_{ij}\beta + \pi_i + \chi_j\right)e_{ij}$$

Where: T is a vector of observables capturing different elements of trade costs; π is a set of exporter fixed effects; χ is a set of importer fixed effects; and e is a standard error term.

The model has a number of salient features, which are well known, but need restating. First, its structure makes clear that the elasticity of trade with respect to particular observable trade costs specified within t is not an accurate summary of the impact of a change of trade costs on trade. The reason is that the multilateral resistance indices depend on trade costs across all partners, which means that the model takes account of general equilibrium effects. This point is typically recognized at the estimation stage, when fixed effects by exporter and by importer are included to account for multilateral resistance. However, when a counterfactual simulation is conducted, the effects need to

be passed through the two price indices, not simply extracted from the relevant regression coefficient. This point is much less commonly appreciated in the literature.

Second, if the model is estimated by PPML with fixed effects as recommended by Santos Silva and Tenreyro (2006), then Fally (2015) shows that the estimated fixed effects correspond exactly to the terms required by the structural model. In other words, if (5) is estimated correctly, then it follows that:

$$(6)\ \widehat{\Pi_i^{1-\sigma}} = E_0 Y_i \exp(-\pi_i)$$

$$(7)\ \widehat{P_J^{1-\sigma}} = \frac{E_j}{E_0}\exp(-\pi_i)$$

Where E0 corresponds to the expenditure of the country corresponding to the omitted fixed effect (typically an importer fixed effect) in the empirical model, and the normalization of the corresponding price terms in the structural model.

Let $\hat{\beta}$ be the PPML estimates of the trade cost parameters in (5). To see the impact of a counterfactual change in trade costs, we can re-estimate (5) imposing $\hat{\beta}$ as a constraint and with counterfactual trade costs T_{ij}^c:

$$(8)\ X_{ij} = exp\left(T_{ij}^c\hat{\beta} + \pi_i + \chi_j\right)e_{ij}$$

Estimating (8) with PPML and the original trade data means that output and expenditure remain constant, so the PPML fixed effects adjust to take account of changes in multilateral resistance brought about by the change in bilateral trade costs. Once estimates have been obtained, counterfactual values of relevant indices can be calculated, but they are conditional on fixed output and expenditure although they take account of general equilibrium reallocations. In particular, $\widehat{X_{ij}}$ from (8) provide counterfactual values of bilateral trade that are consistent with the general equilibrium restrictions of theory, but which still sum to give observed output and expenditure, consistent with a remarkable property of the PPML estimator (Arvis and Shepherd, 2013; Fally, 2015).

It is possible to push the model further, by allowing counterfactual changes in factory-gate prices to drive changes in output and expenditure, which in turn lead to additional changes in trade flows, until the system converges. Specifically, endogenous responses in output and expenditure are as follows in an endowment economy where trade imbalance ratios $\phi_i = E_i/Y_i$ remain constant:

$$(9)\ Y_i^c = \left(\frac{p_i^c}{p_i}\right)Y_i$$

$$(10)\ E_i^c = \left(\frac{p_i^c}{p_i}\right)E_i$$

Anderson et al. (2018) propose an iterative approach to solving the system. First, use structural gravity to translate changes in output and expenditure into changes in trade flows:

$$(11)\ X_{ij}^c = \frac{\left(t_{ij}^{1-\sigma}\right)^c}{t_{ij}^{1-\sigma}}\frac{Y_i^c E_j^c}{Y_i E_j}\frac{\Pi_i^{1-\sigma}P_j^{1-\sigma}}{(\Pi_i^{1-\sigma})^c\left(P_j^{1-\sigma}\right)^c}$$

Where superscript c indicates counterfactual values obtained from constrained estimation of (8) and calculation of relevant indices. Counterfactual values of output and expenditures come from applying

market clearing conditions $p_i = \left(\frac{Y_i}{Y}\right)^{1/1-\sigma} \frac{1}{\gamma_i \Pi_i}$, which makes it possible to translate changes in the fixed effects between (8) and (5) into first order changes in factor-gate prices:

$$(12)\ \frac{p_i^c}{p_i} = \frac{\exp\left(\widehat{\pi_i^c}\right)}{\exp\left(\widehat{\pi_i}\right)}$$

Further changes occur in a second order sense, as changes in prices lead to further changes in output and expenditure, which in turn drive changes in trade. By iterating the PPML estimation and calculation of changes until convergence, it is possible to obtain full endowment general equilibrium estimates of trade flows and relevant indices.

To summarize, Anderson et al. (2018) show that starting with the standard structural gravity model, it is possible to design a simple approach for first estimating the model's parameters, and then using the estimated parameters to perform counterfactual simulations in a way that is fully consistent with the general equilibrium implications of gravity theory. The methodology can be broken down as follows:

1. Estimate the model using PPML and fixed effects to obtain estimates of trade costs and trade elasticities for the baseline.
2. Solve the gravity system using the output from step 1 to provide baseline values of all indices.
3. Define a counterfactual scenario in terms of an observable trade cost variable.
4. Solve the counterfactual model in conditional general equilibrium, i.e. direct and indirect changes in trade flows at constant output and expenditure.
5. Solve the counterfactual model in full general equilibrium, i.e. direct and indirect changes in trade flows with endogenous output and expenditure driven by trade-induced changes in factory-gate prices.

Yotov et al. (2017) provide a detailed explanation of the above steps, as well as Stata code for implementing them in a general setting. We adopt their approach and freely adapt their code here. Concretely, we use PPML to estimate (8) on a balanced panel of 57 exporters and importers for period 1997-2015, using three year gaps between observations in line with the suggestion in Yotov et al. (2017). This setup allows us to introduce importer-time, exporter-time, and country-pair fixed effects to account for multilateral resistance, expenditure, output, and pair-varying trade costs. In this first stage, we include a dummy for RTA membership as the only explanatory variable, as the use of panel data attenuates simultaneity bias and produces credible estimates of the impact of trade agreements on bilateral trade. Given the rigor of the fixed effects setup, we can use a very simple trade costs function with just a dummy variable for RTAs in addition to the variable of interest, an interaction between the number of violent events in the importing country interacted with a geographical contiguity dummy:

$$T_{ijt}\beta = \beta_0 rta_{ijt} + \beta_1 \log\left(Violent\ Events_{jt}\right) * Contig_{ij}$$

The coefficient of interest is β_1, which gives the elasticity of bilateral trade flows with respect to the number of violent events in a given year in an importing country, interacted with an indicator equal to unity for countries that share a land border with that importer. Because of the pair and importer-time fixed effects, as discussed above, our claim to identification of an impact of conflict lies on changes in conflict intensity in neighbouring countries over time. As such, it is unlikely to be overly affected by simultaneity bias. The interaction term therefore captures the spillover effects of conflict on neighbouring countries through the trade channel.

Once we have isolated β_0 and β_1 from the panel regression, we use data for 2014 only to estimate a model in which we constrain the value of the coefficients on the RTA dummy and the conflict variable, and include data on standard gravity controls.

Finally, we take the estimates obtained as above and use them to conduct a counterfactual simulation following Anderson et al. (2018) in which we consider the impact of increasing the number of violent events in South Sudan in 2012—before the civil war had erupted—to their level in 2014 (the first full year of civil war). This counterfactual shows the impact of the civil conflict by allowing us to compare estimated trade in 2012 with counterfactual trade if the number of violent events had escalated to 2014, but all other factors had remained constant.

ii. Data

Trade data for the gravity modelling exercise are sourced from the *Eora* database, which is a global input-output table that allows reconstruction of trade flows. The reason for using this data source rather than a more standard one, like UN Comtrade, is that the input-output tables also allow construction of data for production that is consumed within a country (Xii), which has to be included in the gravity model dataset in order for the PPML-based simulation approach discussed above to be feasible. We consider alternately total trade, trade in primary products (agriculture and mining), trade in manufactured goods, and trade in services. Standard gravity model controls come from the CEPII distance dataset. In addition, we include a dummy for RTA membership taken from Egger and Larch (2008) and updated by Mario Larch.

The key variable of interest is the number of violent events by country, which is sourced from ACLED, and presented above in the introductory section on the South Sudan civil conflict. Data are only available for 57 countries that are also in the Eora data, hence the sample size is 57 importers, but we retain all 182 exporters in the original data.

iii. Estimation results

We present results first for the panel data estimates, which are used to pin down appropriate estimates of the effect of RTA membership on bilateral trade, and the impact of conflict in an importing country on its neighbours' exports. Table 1 shows that the RTA coefficient is relatively stable across sectors, with the exception of primary products, where it does not have a statistically significant coefficient. Taking the figure for total trade as a benchmark, the model suggests that two countries that are both members of the same RTA tend to trade 5% more than two countries that are not both part of the same RTA on an impact basis. This estimate is on the low end, no doubt influenced by the fact that the importing country sample is limited to developing countries due to limitations in the ACLED data used in the next stage regressions. It also reflects the fact that identification is based on movement primarily into RTA status over time, and so is more robust to simultaneity bias than much previous work.[9]

[9] In additional results available on request, we show that unconstrained regressions for a single year only, 2014, with an RTA dummy result in estimated coefficients that are as much as ten times as large, thus providing support for the argument that there is a clear simultaneity issue.

The key result is the coefficient on the number of violent events in neighbouring importing countries. We find relatively small but statistically significant elasticities in this case, somewhat larger for primary products and smaller for manufactured goods. Using the total trade regression as a benchmark, we can see that on an impact basis, an increase in the number of violent events in an importing country by 10% decreases the exports of countries with which it shares a border by 0.6%. Although small, this effect has the potential to be economically significant when it is recalled that conflict situations typically see a very high escalation of violent events in a short time period, as indeed was the case in South Sudan. We investigate this issue further in the counterfactual simulations below.

Table 1: Panel data estimates.

	(1)	(2)	(3)	(4)
	Total	Primary	Manufacturing	Services
RTA	0.049 ***	-0.003	0.072 ***	0.045 ***
	(0.013)	(0.058)	(0.013)	(0.014)
Log(Violent Events) * Contig	-0.061 **	-0.118 ***	-0.036 *	-0.064 *
	(0.026)	(0.039)	(0.022)	(0.037)
Constant	4.511 ***	1.784 ***	2.872 ***	4.408 ***
	(0.001)	(0.005)	(0.003)	(0.000)
Observations	64428	64428	64428	64428
R2	0.970	0.897	0.925	0.976

Notes: Estimation is by PPML with fixed effects by exporter-year, importer-year, and country-pair in all cases. Robust standard errors corrected for clustering by country pair are in parentheses below the parameter estimates. Statistical significance is indicated as follows: * (10%), ** (5%), and *** (1%).

Results for the second stage regressions are presented in Table 2. Standard gravity controls typically have the expected signs and sensible magnitudes, although only some are statistically significant at the 10% level or better. These results are in line with previous work, and suggest that the models are well estimated, even when the constrained coefficients of interest from the panel regressions are applied.

Table 2: Estimates for 2012 with panel constraints applied.

	(1)	(2)	(3)	(4)
	Total	Primary	Manufacturing	Services
Log(Violent Events)*Contig	0.049	-0.003	0.072	0.045
RTA	-0.061	-0.118	-0.036	-0.064
Log(Distance)	-0.840 ***	-0.740 ***	-0.798 ***	-0.944 ***
	(0.082)	(0.099)	(0.071)	(0.106)
Contig	0.419	1.879 ***	0.389	0.171
	(0.309)	(0.284)	(0.287)	(0.334)
Common Colonizer	-0.089	-0.979 ***	0.002	-0.138
	(0.248)	(0.259)	(0.271)	(0.238)
Common Language	0.722 ***	0.490 **	0.873 ***	0.352 **
	(0.149)	(0.197)	(0.167)	(0.168)
Same Country	0.028	0.902 *	-0.226	0.252
	(0.624)	(0.534)	(0.708)	(0.426)
International	-6.522 ***	-5.909 ***	-5.674 ***	-7.110 ***
	(0.321)	(0.343)	(0.308)	(0.431)
Constant	10.789 ***	7.218 ***	9.993 ***	10.666 ***
	(0.475)	(0.559)	(0.428)	(0.606)
Observations	10374	10374	10374	10374
R2	0.963	0.899	0.915	0.975

Notes: Estimation is by PPML with fixed effects by exporter and importer in all cases. RTA and violent events coefficients are applied as a constraint from the panel estimates above. Robust standard errors corrected for clustering by country pair are in parentheses below the parameter estimates. Statistical significance is indicated as follows: * (10%), ** (5%), and *** (1%).

iv. Simulation results

Data from the ACLED database show that in 2012, South Sudan saw 197 violent events, while in 2014 that number was 906. In other words, the eruption of a full-scale civil conflict led to an increase of violent events of nearly 360%. The size of this change shows that despite the moderate elasticity estimate above, there is still the potential for significant economic impacts on neighbouring countries. To consider the impact of the conflict on the region, we conduct a counterfactual simulation to look at what bilateral trade patterns would have looked like in 2012 if violence had escalated to 2014 levels, but all other factors had remained constant.

Given data availability and the setup of the model, we report results for the Central African Republic, Democratic Republic of the Congo, Ethiopia, Kenya, Sudan, and Uganda. Table 3 summarizes. For the sake of comparability with the additional analysis below, we show impacts on exports to and imports from South Sudan; as the South Sudanese market is very small, aggregate trade impacts are less than 0.5% in all cases.

Counterfactual simulation results show significant impacts on neighbouring countries, around 8.6% on the export side in all cases. By contrast, impacts on the import side are negligible. Of course, the baseline for the reported percentages is important: it is exports to and imports from South Sudan of the country concerned. When full general equilibrium results are calculated, as mentioned above, impacts are very small due to the size of the South Sudanese economy and the ability of firms to switch export destinations in the face of conflict.

Table 3: Counterfactual simulation results (trade with South Sudan).

Country	Exports	Imports
Central African Republic	-8.65	-0.19
DRC	-8.66	-0.18
Ethiopia	-8.66	-0.17
Kenya	-8.66	-0.17
Sudan	-8.60	-0.25
Uganda	-8.65	-0.19

Note: Table reports counterfactual percentage changes in exports and imports based on a scenario where 2012 violent events were increased to the level of 2014, but all other factors remained constant.

III. The impact of the South Sudanese civil war on Uganda's formal and informal trade

Equipped with our results from the gravity model we next conduct a case study for the impact of the South Sudanese civil war on Uganda. Here we exploit the availability of data on both formal and informal (or "small scale") cross border trade and take advantage of the time and geographic variation of the conflict to obtain causal estimates in a *Difference-in-Difference* setting.

i. Background

For our analysis of the impact of the South Sudanese civil war on Ugandan 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 the fact that Uganda is one of very few countries in Sub-Saharan Africa that maintains a continuous effort to record informal (or "small scale") trade through a survey implemented at the country's borders.[10] Access to aggregate data from this survey allows us to enrich our approach by studying a kind of trade that is normally not captured in official government statistics and that radically differs from formal trade.

Arguably the most fundamental difference between formal and informal trade lies in the characteristics of agents behind the 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.[11]

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 rely on their feet or simple means of transportation to carry small quantities of perishable goods across borders (Brenton et al 2011: 2).[12] A direct consequence of these characteristics is that informal trade (unlike formal trade) almost exclusively takes place between neighbouring countries and informal traders will typically be unable to switch exports to alternative markets if the neighbouring country they serve is cut off for some reason. As a result, closing of a nearby market for any reason likely results in significant

[10] 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.

[11] 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).

[12] For a more complete characterization of informal traders in East Africa, see Brenton et al (2011) who survey cross border traders in the great lakes region or 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 regarding gender and age characteristics of informal traders.

net economic losses to informal traders, whereas formal traders have greater scope to switch to alternative, albeit more distant, markets.

Despite the small size 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.[13] 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, considering 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 constitutes an important source of income for poor Ugandan border communities.

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.

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 in the introduction 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. To recap, 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. 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.[14]

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.[15] 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 Ugandan

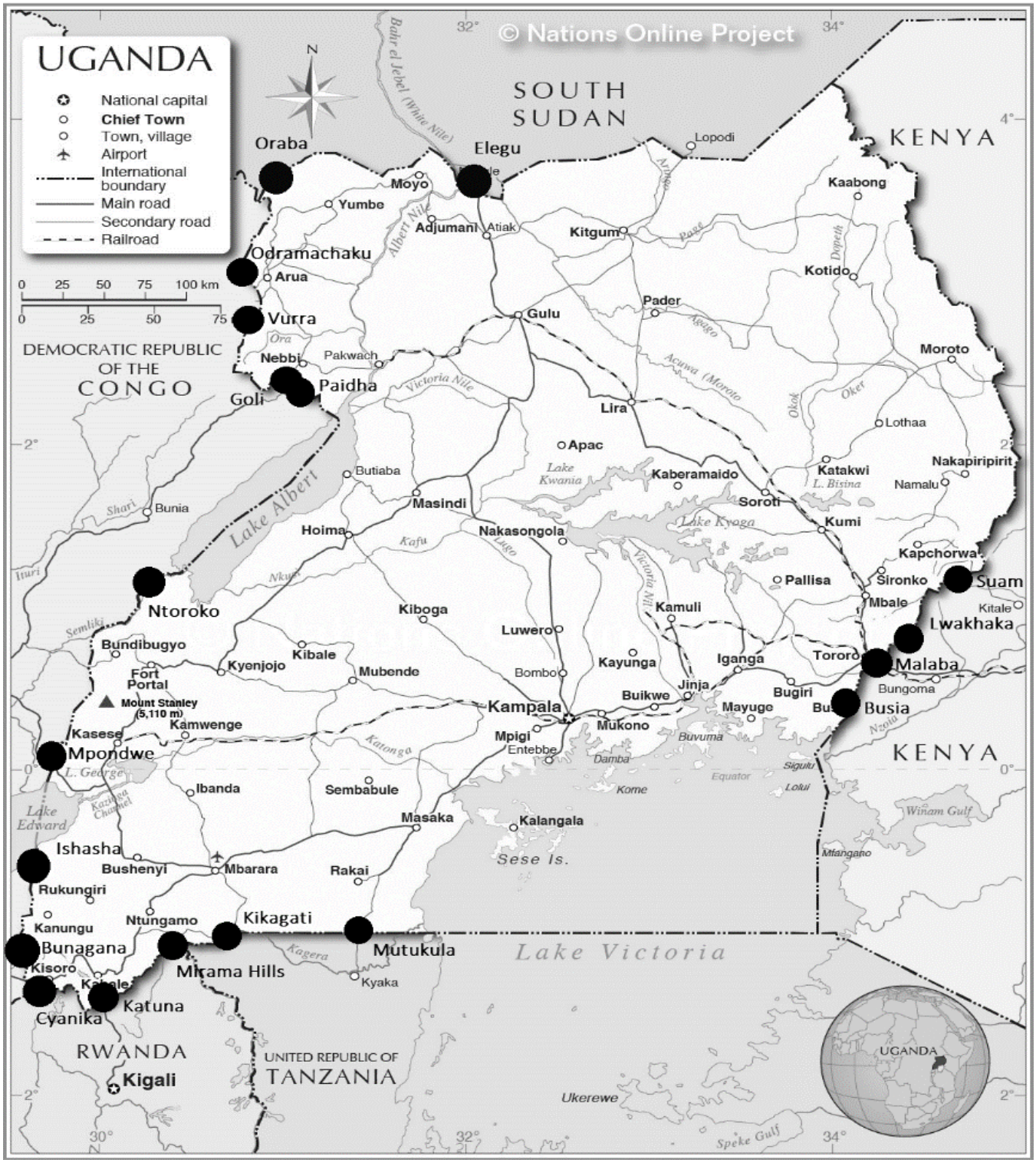
[13] This figure is in line with findings from other countries and regions. For example, Afrika and Ajumbo (2012: 4) estimate that in SADC informal trade may constitute between 30-40 percent of formal trade within the region.

[14] 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.

[15] 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.

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.

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. 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 in the next section 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:

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

Y_{itb} is the log of either 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. 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 six measures of informal cross border trade recorded during period t and passing through border b: Total exports and imports as well as exports and imports of agricultural and industrial goods.[16] Finally, $SSNConflict_{tb}$ 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 trade and interpret our estimate 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 correct. 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.[17] 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. Finally, we address the assumption of parallel trends between conflict affected and unaffected trade flows in section ii.) below.

[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 on the exclusion of outliers in the fourth section of this paper. Additionally, we experimented with the monthly number of reported violent events from the ACLED database as a continuous treatment variable. The sign of estimated beta coefficients is in line with the results presented in this paper but are estimated imprecisely.

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 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 TIN). 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. Finally, we aggregate the data to the exporter/month/border level to avoid deflated standard errors if we were to use the original transaction-level data with a more aggregate treatment variable. 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 virtually non-existent.[20] Table 4 in the annex presents descriptive statistics of key variables of interest for the analysis.

Data on Uganda's informal (or "informal") 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.[21] 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 month-border level for the following indicators: Agricultural exports, agricultural imports as well as exports and imports of industrial goods.[22] The data is available from July 2011 to July 2018. Table 5 in the annex presents summary statistics for Uganda's informal trade.

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[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 produce.

[20] To illustrate, during the last pre-crisis year 2013, only 558 import shipments reached Uganda through these borders together accounting for about 730 000 USD worth of goods (or less than 0.1% of Uganda's total import bill in the same year). Close to all of these shipments originated from South Sudan or Sudan.

[21] 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 the reasons for why collection stopped or started late are unclear and could confound results. However, including these observations in the following analysis does not affect our estimates. For all other borders we have a complete set of monthly observations from July 2011 to July 2018. Figure 5 in the annex shows the survey form.

[22] We verify that the four available indicators allow us to capture all of Uganda's informal trade recorded through this survey by cross-checking the annual values resulting from the data with the official reports by the BoU and find that our

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. For example, 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. Informal imports were recorded at 65 million USD in 2016, while formal imports were about 2,112 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.[23] Finally, incomplete data on "leading export items" per border allows us to infer information about the composition of Uganda's informal exports through conflict affected borders with South Sudan, which are dominated by products like maize flour (16% of all informal exports in 2016), clothes (7%), livestock (ca. 5%) as well as agricultural produce like beans, potatoes, maize grains, bananas and other vegetables and fruits (ca. 11.5%).[24]

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.[25] Panel A shows the value of formal exports, formal agricultural exports and formal exports of industrial good over time, while Panel B and C employ the aggregated survey data and present the development of the same variables for informal exports and imports. Vertical lines in December 2013 indicate the outbreak of the civil war in South Sudan.

A number of messages emerge from these graphs. 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, informal imports seem to react to the crisis as well, but to a lesser degree than informal exports. Third, 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 for almost all indicators considered. 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.[26]

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dataset 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.

[23] 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 market for shipment in April 2012 when they embedded this country in their ASYCUDA system.

[24] We note that the informal trade data counts products like maize flour or tea leaves as industrial goods.

[25] With respect to the formal customs data we find that transactions through Elegu used to be handled in the town of Bibia: Up to mid-2015 we find Bibia in the customs data for transactions passing through Elegu (cf. Figure 4 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.

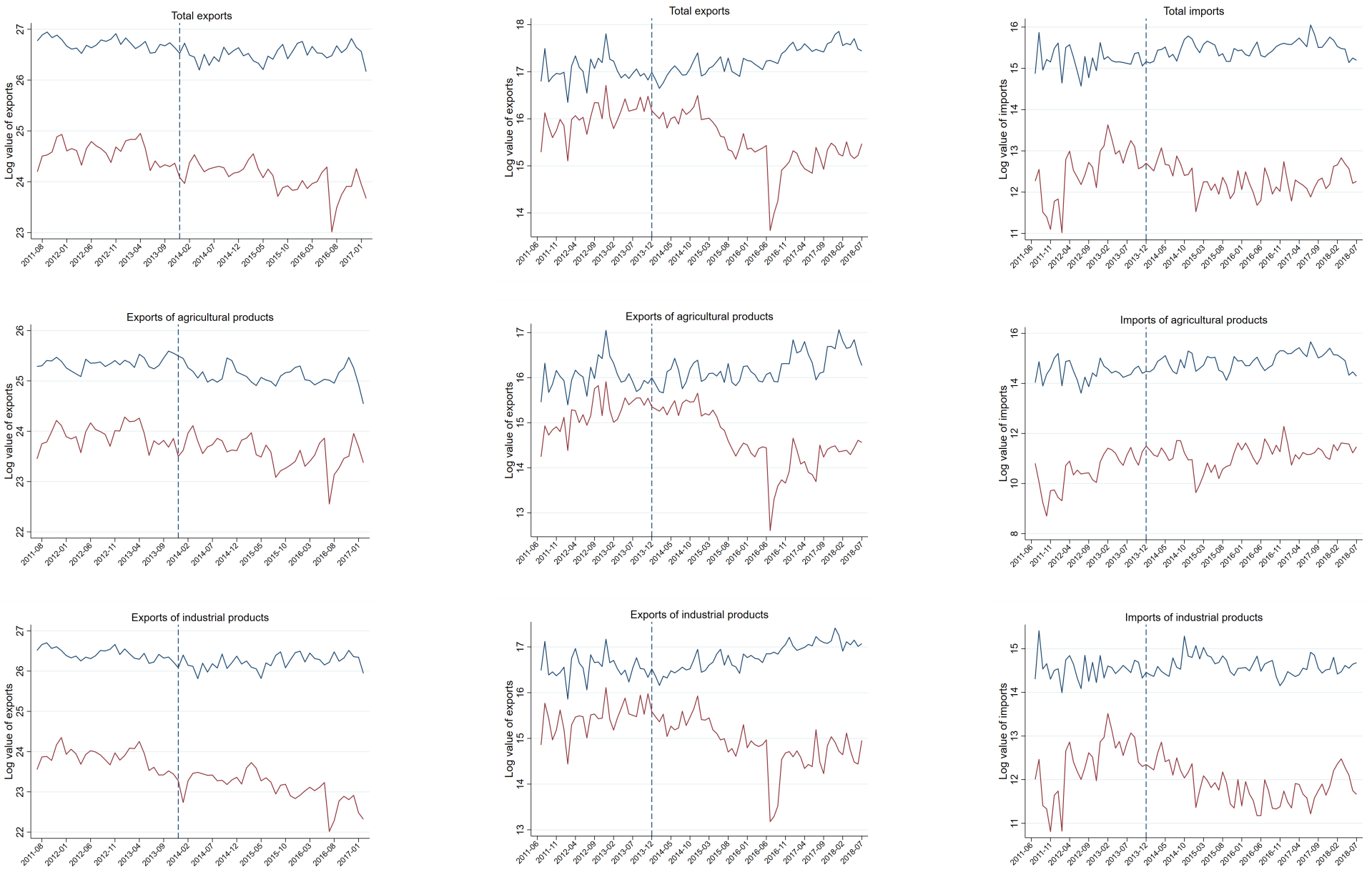
[26] In all export graphs we observe a considerable drop of trade through conflict affected borders in June 2016. This coincides with the intensification of conflict associated violence in Juba and Yei in the summer of 2016, major South Sudanese cities that are located relatively close to South Sudan's borders with Uganda (cf. Pape and Parisotto 2019: 35).

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

Panel A: Formal exports.

Panel B: Informal exports.

Panel C: Informal imports.



Notes: Coverage from July 2011 (South Sudan's independence) to most recent available. Dotted, vertical lines mark the outbreak of the civil war in South Sudan in December 2013. Panel A is constructed from Ugandan customs data collected by the *Uganda Revenue Authority*. Panels B and C are constructed from aggregated *Informal Cross Border Trade* (ICBT) survey data collected by the *Bank of Uganda* and the *Uganda Bureau of Statistics*.

iv. 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 trade. For each set of estimations, we take full advantage of the respective level of disaggregation of the data employed.

a. Uganda's formal exports

Table 6 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 6: The effect of the South Sudanese civil conflict on Uganda's formal exports.

	(1)	**(2)**	**(3)**
	Total	**Agricultural**	**Industrial**
Dependent variable: Value of exports (per firm-border-period).			
SSNConflict	-.130*	-.028	-.150**
	(-2.55)	(-0.28)	(-2.83)
Constant	17.40	17.85	17.00
	(518)	(210)	(375)
R^2	0.001	0.000	0.000
N	82 626	30 256	57 570
Dependent variable: Number of transactions (per firm-border-period).			
SSNConflict	-.100**	.000	-.132**
	(-2.87)	(0.00)	(-3.75)
Constant	1.06	1.48	0.80
	(34.24)	(23.81)	(21.10)
R^2	0.000	0.000	0.000
N	82 626	30 256	57 570
Dependent variable: Average value per transaction (per firm-border-period).			
SSNConflict	-.028	-.029	-.018
	(-0.88)	(-0.49)	(-0.59)
Constant	16.34	16.37	16.20
	(699)	(392)	(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 6, we find a sizeable effect of the South Sudanese civil conflict on Uganda's formal exports: Our estimate on $SSNConflict$ is statistically significant at the five percent level and suggests that the civil war reduced formal exports through conflict affected borders by about 12 percent compared to export flows passing through borders 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: 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 sizeably 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 6, 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 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 7 in the annex. In line with our results at the more aggregate level we do not find a negative effect of the conflict on exports of 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 theses borders with no discernible upwards trend in periods after December 2013 (see robustness section and Figure 4 in the annex).

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 6. 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 6 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 falsely assume trade destruction with South Sudan where 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 by means of a descriptive 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]

A final test addresses 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 Uganda’s 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. Nonetheless, for a portion of these transactions a Ugandan importer or exporter TIN is recorded, strongly suggesting Ugandan involvement in the

[29] Cf. Pape and Parisotto (2019: 35) for the spatial distribution of civil war associated violence over time.

[30] We drop transactions through major borders that Uganda shares with the DRC: Goli, Vurra and Arua. There are no borders close to Elegu that could be used as alternative transport routes (cf. Figure 2).

[31] See Figure 4 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) as well as those being flown out of the country from Entebbe as control observations. These exit points from Uganda are so far away from the civil conflict that we can rule out a direct exposure to the conflict (cf. Figure 2), but they could nonetheless be used as alternative transport routes. Estimating Equation 1 with this portion of the data yields higher estimates for the effect of the South Sudanese conflict on total Ugandan exports. While in theory this could indicate a diversion of exports to South Sudan or Sudan away from Oraba and Elegu and through these unaffected borders, we the descriptive examination of the data does not lend support to this hypothesis. Much rather it seems likely that this result is driven by differing trends.

transaction.[32] 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 cars keep their imported goods on their accounts as transits to avoid the bureaucratic burden associated with formally clearing imports prior to re-exporting. We re-estimate all specifications reported in Table 6 again without transactions labelled as transit shipments but conducted by exporters (results are provided in Table 8 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.

Box 1: Anecdotal evidence on the impact of the South Sudanese civil war on Uganda's trade.

Our quantitative results on the negative impact of the South Sudanese civil war are backed by a comprehensive body of anecdotal evidence. In an E-mail response to the question "Did the South Sudanese civil war affect your business?" a Ugandan exporter of Japanese cars reported that he used to sell around 50 cars per year to South Sudan before the outbreak of the crisis, a figure that dropped to about 12-15 cars per year today with his South Sudanese clients citing the devaluation of the South Sudanese pound as a prime reason their low demand. The same exporter reports that some businesses based in Arua (Uganda's north) who used to export construction materials and hardware to South Sudan experienced a significant decrease in their exports after the outbreak of the crisis, because "*people are (…) focusing on their basic necessities and safety*".

Mirroring this exporter's experiences, the loss of South Sudan as an export destination remains a frequent topic in the local newspapers, with hopes shining through for the country to regain South Sudan as an export destination. For example, in an article published in the East African in October 2018, a Ugandan trader of fruits and vegetables summarizes his views on South Sudan as follows:

"*South Sudan was dangerous since we were always ambushed by gunmen who demanded money or stole our merchandise. Although it was a profitable market, we had to look elsewhere for our safety but we shall go back as soon as all is safe*."

- The East African (October 6th 2018).

Finally, while the negative effect of the South Sudanese crisis on Uganda's formal and informal goods exports is clear, a data related gap in our analysis is that the crisis may have had an impact on Uganda's trade in services as well, where expected and documented effects may be different. For example, while most services exports such as construction services are likely to have suffered in a way similar to goods exports others may well have benefitted. For example, 2016 data by the *Bank of Uganda* reveals that South Sudanese form the second highest group of foreign students in Uganda.

[32] Deleting transactions that are labelled as transits 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.

b. Uganda's informal trade

Table 9 reports results from estimating Specification 1 with the informal cross border trade data for six dependent variables at the month/border level: The (log) value of total exports, total imports and exports and imports of agricultural goods as well as exports and imports of industrial goods. Standard errors are again clustered by border.

Table 9: The effect of the South Sudanese civil conflict on Uganda's informal trade.

	Exports			**Imports**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Total	**Agricultural**	**Industrial**	**Total**	**Agricultural**	**Industrial**
SSNConflict	-1.59*	-1.49*	-1.58*	-0.48**	0.01	-0.66*
	(2.63)	(2.55)	(2.45)	(3.27)	(0.05)	(2.75)
Constant	13.11**	11.57**	12.49**	11.14**	10.22**	9.65**
	(109.4)	(68.4)	(78.4)	(72.9)	(46.8)	(40.1)
R^2	0.19	0.12	0.18	0.11	0.15	0.09
N	1,615	1,615	1,615	1,607	1,607	1,607

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 agggregated 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 trade across the conflict affected borders. Turning first to the estimates obtained from using exports as dependent variables (Columns 1-3 in Table 9) we find that the civil conflict led to a decrease of informal exports to South Sudan by about 80 percent.[33] All three estimates are statistically significant at the five percent level and of comparable size, suggesting that for informal trade the impact of the civil war did not differ by type of exported commodity.

The estimated effects of the crisis are larger for export flows than for import flows where the estimated impact ranges from a reduction of trade by between 40-50 percent (columns 4-6 in Table 9). For agricultural imports, the estimated effect is economically small and not statistically significant at conventional levels suggesting that imports from South Sudan (while negligible in size) continued to flow despite of the crisis.

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 below).

Finally, and in stark contrast to results obtained from the formal export data, our specifications explain a relatively large portion in the variation of informal exports as documented by an R^2 of

[33] The point estimate for β_1 using the logged export variables as dependent variables ranges from -1.49 to -1.59, with $e^{-1.49}$ ~ 0.22 and $e^{-1.59}$ ~ 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.

between 0.12 to 019 (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 run three types of robustness checks on these results. 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 South Sudan increasing the volume across other borders. In the context of the informal trade data, we may specifically worry that traders active in Uganda's north (i.e., in the provinces of Moyo, Gulu, Arua and Nebbi) decide to carry 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 and infer trade destruction where there is trade diversion. 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.[34] Re-running the model we find that estimated size and statistical precision of our point estimates remain virtually unchanged. A final threat to identification stemming from the fact that the small 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.[35]

[34] That is, we drop data collected at the borders of Goli, Paidha, Vurra and Odramachaku.

[35] 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.

v. Results discussion

The estimates presented in this 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), Ugandan exporters 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, 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 often part of poor and vulnerable groups and do not normally have access to adequate means of transportation preventing them from switching to alternative routes or destinations. They may therefore be more subject to security related trade costs and feel the effects of conflict more keenly.

To facilitate a more nuanced understanding of our estimates it is useful to translate these into monetary values. Applied to the total export volume to South Sudan and Sudan in 2013 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 drastic for informal exports. Again comparing annual exports foregone due to the civil war in South Sudan with Uganda's total informal exports in 2013 of about 421.3 million USD, the loss of roughly 104.6 million USD corresponds to a reduction of Uganda's total informal exports due to the crisis by almost 25 percent. These figures suggest that at large the crisis did have a distinct yet comparatively small impact on formal exporters while for Ugandan informal traders the conflict had devastating consequences. This insight is also important from a social point of view: The northern districts of Uganda that are adjacent to South Sudan are disproportionally poor compared to the rest of the country.[36] Against this background, a large reduction of informal exports through the conflict affected borders of Oraba and Elegu is likely to have had an significant negative impact on the livelihoods of poor border communities in Uganda's north.

[36] Wang et al (2019) estimate sub-national GDP per capita in Uganda in 2015 by combining night time lights data with information on population figures, market prices and agricultural production at the district level to overcome the limitations associated with using night time lights only to estimate economic activity (e.g., poor performance for regions dependent on agriculture). They find 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).

Finally, taking into account our findings on Ugandan imports, our results suggest that the main channel through which the civil war in South Sudan has affected livelihoods in Uganda is through the collapse of an important export destination rather than through affecting food prices in Uganda due to reduced imports. Formal imports from South Sudan to Uganda are virtually non-existent, while informal imports of agricultural products from South Sudan to Uganda seem to have continued to flow. Informal imports of industrial products decreased and these also include products like maize flour but only in small volumes and are therefore unlikely to have had an impact on food prices. The right panel of Figure 6 in the annex of this paper takes advantage of available price and informal cross border trade data at the commodity level to underpin this notion graphically: We track informal imports of maize flour and dry beans from South Sudan along with the development of prices for these staple foods at different markets in Uganda. Prices for these commodities do not seem to have increased significantly due to lower imports and we do not observe a different trend in markets close to South Sudan (Gulu and Arua in northern Uganda) than in Kampala. Finally, the left panel of the same figure tracks informal exports of the same products from Uganda to South Sudan along with the extreme increase in prices for these goods in Juba. While it is possible that lower informal exports of agricultural products from Uganda have contributed to the soaring inflation of food prices in South Sudan, it is important to note that Uganda's formal exports of food continued to flow and that higher prices in South Sudan are likely to have been caused by multiple factors (low local production, depreciation of the South Sudanese pound, lower imports from other countries etc.).

IV. Concluding remarks

This paper examines the spillover effects of the South Sudanese civil war on neighbouring countries, focusing on the trade channel. Our maintained hypothesis was that conflict and uncertainty in South Sudan would increase trade costs in the region, which in turn would decrease the exports of neighbouring countries to South Sudan. Using micro-data for Uganda, as well as a global gravity model, we have shown that this effect is indeed statistically and economically significant. This finding is in line with the existing literature on the effects of civil conflict, although it is innovative in terms of the mechanism it allows for. For Uganda specifically we establish that first, while negative and sizeable in both cases, 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. In the case of 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. 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.

The key implication of our results is that there is potentially a role for the international development community in supporting traders affected by conflict. Our findings suggest that this support should not only be in conflict zones themselves, but should extend to neighbouring countries. In terms of targeting, our results generally but not always indicate that effects are more severe in industrial sectors than in agriculture, which means that resources should be concentrated on firms and traders dealing with industrial products in the first instance. In addition, a clear implication of our work is that the effects on informal traders are much larger than for formal traders. Development practitioners should therefore focus their efforts on informal traders to the extent possible.

What form should external support take? Clearly, where conflict is ongoing, it is difficult to argue that links with the conflict affected country should be strengthened. Uncertainty, and therefore trade costs, are largely exogenous in this case. A better use of resources would be to help traders, and in particular informal operators, identify alternative markets for their goods, so as to take up the short term slack in demand caused by conflict in a neighbouring country. This intervention is likely to have positive impacts in any event, as diversifying the export base is a key objective of many developing countries. The mechanics of producing this outcome are of course complicated, but given ongoing interest in export diversification, it would seem fruitful to examine whether existing projects and programs could be refocused and adapted to deal specifically with the need to find alternative markets in the case of conflict in a key export destination.

In closing, it is important to highlight that our study only considers one channel through which the South Sudanese civil war has impacted on the Ugandan economy. Other channels beyond trade, such trade in services, refugee flows or increased military spending and deployment may all have both negative and positive effect on neighbouring countries and require further study.

REFERENCES

Afrika, J.-G. K. and G. Ajumbo (2012) "Informal Cross Border Trade in Africa: Implications and Policy Recommendations" AfDB Africa Economic Brief, Vol. 3, Issue 10.

Anderson, J., M. Larch, and Y. Yotov (2018) "GE PPML: General Equilibrium Analysis with PPML." *World Economy*, 41(10): 2750-2782.

Arvis, J.F., and B. Shepherd (2013) "The Poisson Quasi-Maximum Likelihood Estimator: A Solution to the Adding Up Problem in Gravity Models." *Applied Economics Letters*, 20(6): 515-519.

Bank of Uganda (2017) "The informal cross border trade survey report 2016".

Betts, A., Bloom, L., Kaplan, J. and N. Omata (2014) "Refugee Economies: Rethinking Popular Assumptions." The Refugee Economies Programme, University of Oxford, Oxford.

Brenton, P., Bucekuderhwa, C. B., Hossein, C. Nagaki, S. and J. B. Ntagoma (2011) "Risky Business: Poor Women Cross-Border Traders in the Great Lakes Region of Africa" World Bank Africa Trade Policy Notes: Note #11.

Bernard, A. B. and J. B. Jensen (1999) "Exceptional Exporter Performance: Cause, Effect, or Both?" Journal of International Economics 47 (1), 1–26.

Biesebroeck, J. (2005) "Exporting raises productivity in sub-Saharan Africa manufacturing firms." Journal of International Economics Vol. 67, 373–391.

Cali, M. and A. Mulabdic (2016) "Trade and Conflict: Revisiting the cross-country evidence." Review of International Economics, Vol. 25, Issue 1, 195-232.

CLiMIS (2019) Climis Database. Accessible online at: http://www.climis-southsudan.org.

Daily Monitor (2018) "South Sudan: How should Uganda do business this time?". Newsarticle, 24th July 2018. Accessible online at: https://www.monitor.co.ug/Business/Prosper/South-Sudan-How-should-Uganda-do-business-this-time/688616-4677370-ll2sgpz/index.html

The East African (2018) "Peace attracts traders back to South Sudan". Newsarticle, 6th October 2018. Accessible online at: https://www.theeastafrican.co.ke/business/Peace-attracts-traders-back-to-South-Sudan/2560-4794590-awahyjz/index.html

Egger, P., and M. Larch (2008) "Interdependent Preferential Trade Agreement Memberships: An Empirical Analysis." *Journal of International Economics*, 76(2): 384-399.

Fally, T. (2015) "Structural Gravity and Fixed Effects." *Journal of International Economics*, 97(1): 76-85.

Halpern, L., M., Koren, A. Szeidl (2015) "Imported Inputs and Productivity" American Economic Review, Vol. 103 (12), 3660-3703.

Isgut, A. E. (2001) "What's Different about Exporters? Evidence from Colombian Manufacturing." Journal of Development Studies Vol 37 (5), 57–82.

Martin, P., Thoenig, M. and T. Mayer (2008) "Civil wars and international trade." Journal of the European Economic Association, Vol 6 (2–3): 541–550.

Mayer, T. and M. Thoenig (2016) "Regional Trade Agreements and the Pacification of Eastern Africa". International Growth Centre Working Paper, April 2016.

Nations Online (2019) "Political map of Uganda." Accessible online at: https://www.nationsonline.org/oneworld/map/uganda-map.htm.

Pape, U. and L. Parisotto (2019) "Estimating poverty in a fragile context – The high frequency survey in South Sudan." World Bank Policy Research Working Paper 8722, January 2019.

Raleigh, C., Linke, A., Hegre, H. and J. Karlsen (2010) "Introducing ACLED-Armed Conflict Location and Event Data." Journal of Peace Research 47(5) 651-660."

Reuters (2019) "U.S. recalls ambassador from South Sudan after unity government failure." Reuters World News, November 25th, 2019. Accessible at: https://www.reuters.com/article/us-usa-southsudan-diplomacy/u-s-recalls-ambassador-to-south-sudan-to-consult-on-unity-government-failure-state-department-idUSKBN1XZ1UV.

Santos Silva, J.M.C, and S. Tenreyro (2006) "The Log of Gravity." *Review of Economics and Statistics*, 88(4): 641-658.

Shepherd, B. (2016) "Uganda – Improving export performance" IGC Policy Paper F-38213-UGA-1.

Siu, J. (2019) "Trade costs, trade facilitation and formalisation of trade: Evidence from One-Stop-Border-Posts in Uganda." IGC Working Paper F-43435-UGA-1.

Spray, J. (2017) "Reorganise, replace or expand? The role of the supply-chain in first-time exporting" Cambridge-INET Working Paper Series No: 2017/18, Cambridge Working Papers in Economics: 1741.

United Nations Commodity Trade Database (*UNComtrade)* (2020): Ugandan export volume in 2013. Accessible online at: comtrade.un.org.

United Nations Development Programme (2019) "Human Development Report 2019. Beyond income, beyond averages, beyond today: Inequalities in human development in the 21st century."

Yotov, Y., R. Piermartini, J.A. Monteiro, and M. Larch (2017) "An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model (Online Revised Version)". United Nations and WTO: Geneva.

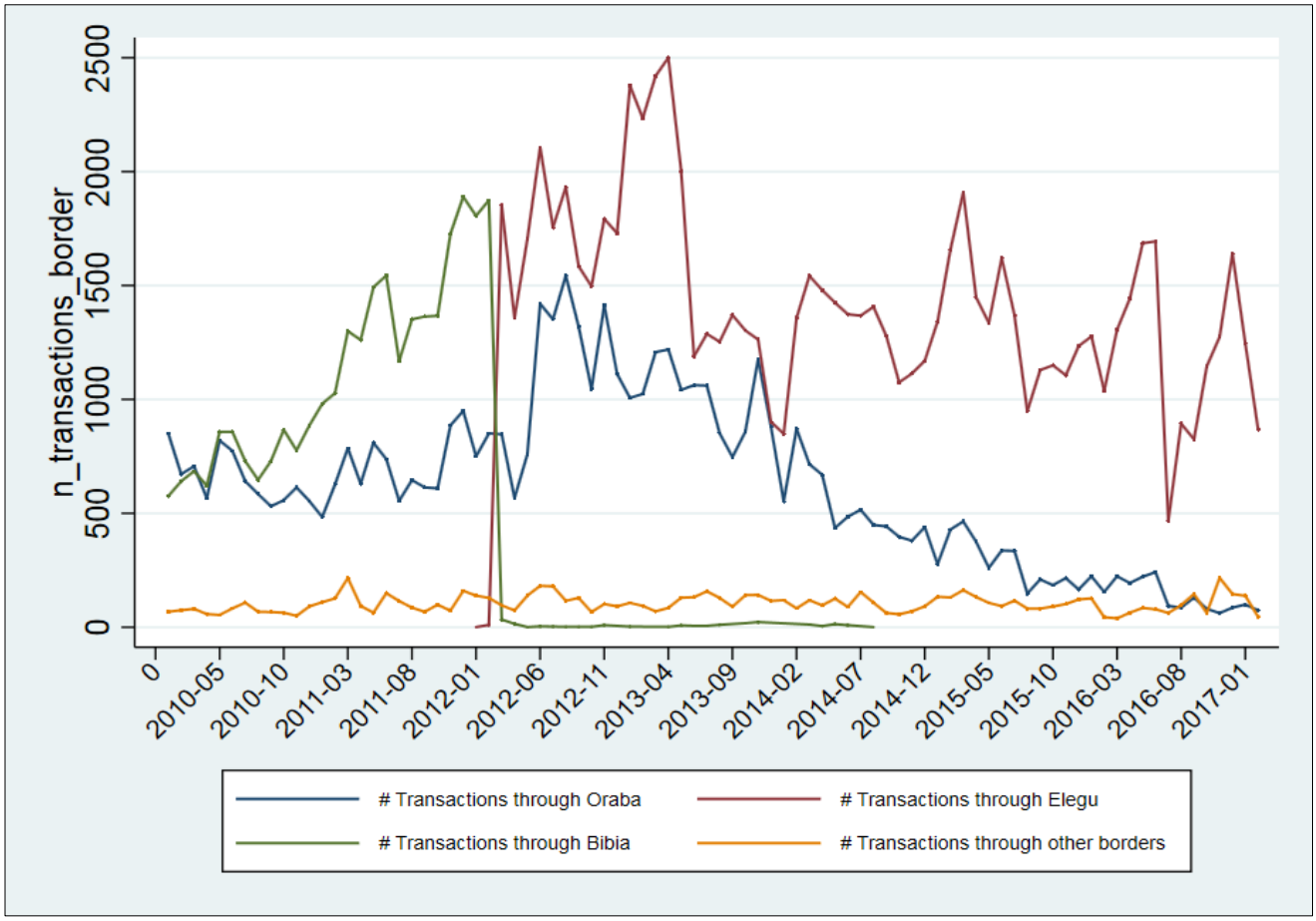
Wang, X., Rafa, M., Moyer, J.d., Li, J., Scheer, J., and P. Sutton (2019) "Estimation and Mapping of Sub-National GDP in Uganda Using NPP-VIIRS Imagery", Remote Sensing, 2019, Volume 11, (2).

World Bank (2018) "South Sudan Economic Update", July 2018.

World Bank (2019) World Development Indicators: GDP deflator for Uganda, base year 2010. Accessible online at: https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS.

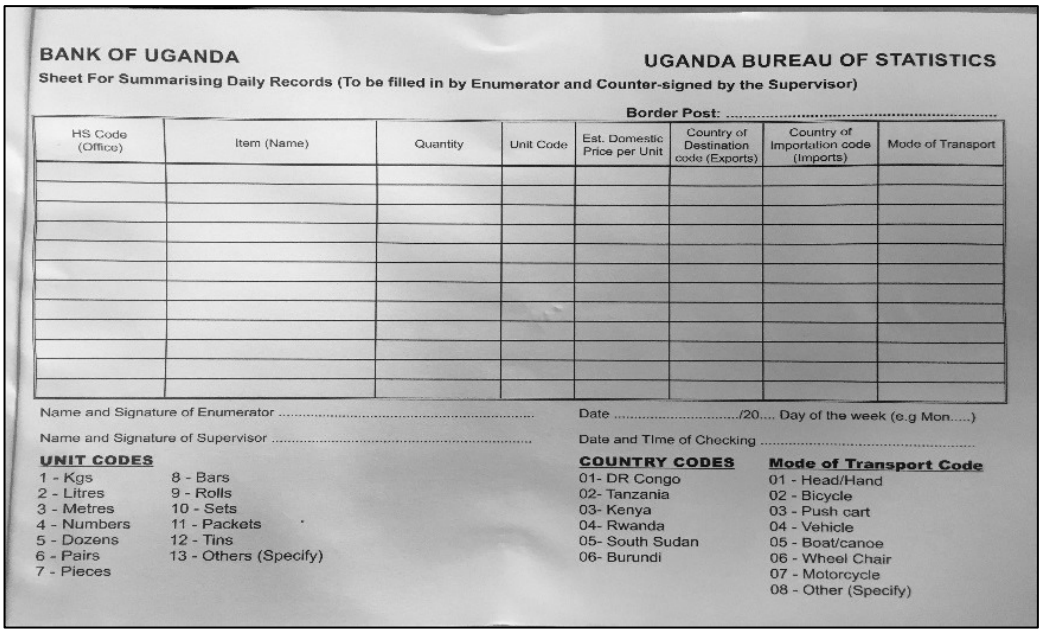
ANNEX: Additional figures and tables.

Figure 4: Alternative transport routes to South Sudan and Sudan and the borders of Bibia/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 Elegu were taken over by Bibia 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 5: Survey form for the BoU/UBOS *Informal Cross Border Trade Survey*.



BANK OF UGANDA

UGANDA BUREAU OF STATISTICS

Sheet For Summarising Daily Records (To be filled in by Enumerator and Counter-signed by the Supervisor)

Border Post: .....

HS Code (Office)	Item (Name)	Quantity	Unit Code	Est. Domestic Price per Unit	Country of Destination code (Exports)	Country of Importation code (Imports)	Mode of Transport

Name and Signature of Enumerator .....

Date ...../20.... Day of the week (e.g Mon.....)

Name and Signature of Supervisor .....

Date and Time of Checking .....

UNIT CODES

1 - Kgs
2 - Litres
3 - Metres
4 - Numbers
5 - Dozens
6 - Pairs
7 - Pieces
8 - Bars
9 - Rolls
10 - Sets
11 - Packets
12 - Tins
13 - Others (Specify)

COUNTRY CODES

01- DR Congo
02- Tanzania
03- Kenya
04- Rwanda
05- South Sudan
06- Burundi

Mode of Transport Code

01 - Head/Hand
02 - Bicycle
03 - Push cart
04 - Vehicle
05 - Boat/canoe
06 - Wheel Chair
07 - Motorcycle
08 - Other (Specify)

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 air cargo) and to a total of 170 destinations.

Table 5: Descriptive statistics of Uganda' informal trade.

Variable	Observations	Mean	SD	Sum	Min	Max
Agricultural exports	1,742	745	1,388	1,299,057	0.02	15,725
Agricultural imports	1,607	147	282	237,195	0.21	3,112
Exports of industrial goods	1,746	1,260	1,814	2,199,796	1.76	14,096
Imports of industrial goods	1,607	127	262	205,170	0.03	3,298
Total	6,702					

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 7: 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***	0.005	-0.011	-0.027	-0.037	-0.178	-0.196*	-0.238***	-0.385***	-0.428
	(3.35)	(0.03)	(-0.12)	(-0.27)	(-0.5)	(-1.22)	(-1.77)	(-4.87)	(-5.72)	(-1.31)
Constant	17.74	16.80	16.13	17.76	16.38	16.46	17.38	16.52	16.40	15.38
	(110)	(230)	(125)	(267)	(216)	(254)	(-118)	(-378)	(71.97)	(-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

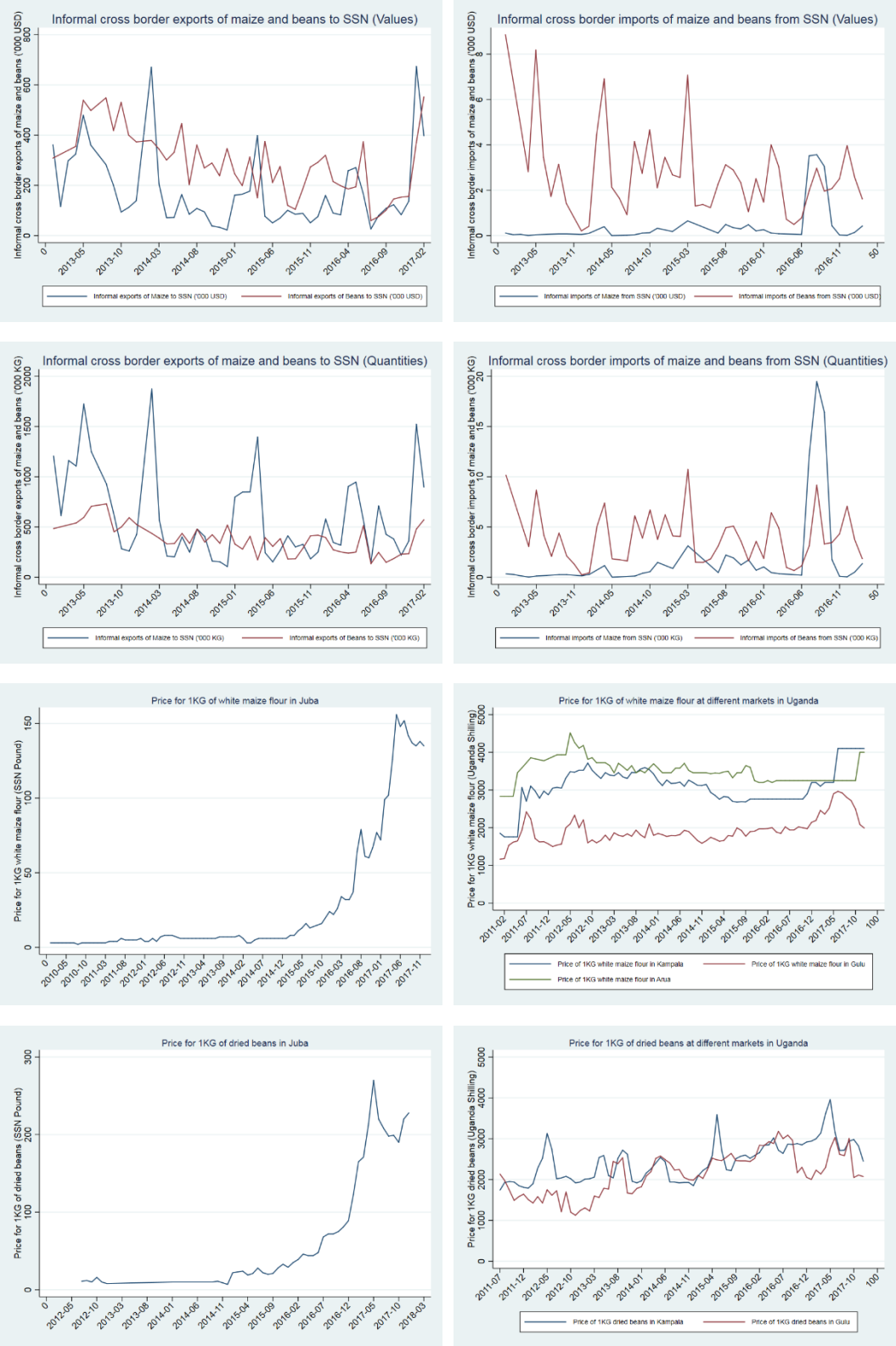
Notes: * $p<0.1$; ** $p<0.05$, *** $p<0.01$. The dependent variable in all regressions is the value of exports per month per firm/border pair for identified product categories. Estimation by OLS. T-statistics computed on the basis of standard errors clustered by border are reported in parantheses. All 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 8: Robustness – Dropping transactions labelled as transits.

	(1)	(2)	(3)
	Total	**Agricultural**	**Industrial**
Dependent variable: Value of exports (per firm-border-period).			
SSNConflict	-0.139	-.236	-0.078
	(-2.77)**	(-1.52)	(-1.34)
Constant	17.25	17.68	16.69
	(262)	(152)	(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	-0.214	-0.039
	(-1.68)	(-1.79)	(-0.84)
Constant	1.18	1.56	0.85
	(27.08)	(19.43)	(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	-0.021	-0.040
	(-1.37)	(-0.40)	(-1.15)
Constant	16.07	16.11	15.84
	(315)	(260)	(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.

Figure 6: Prices and trade flows of maize flour and dry beans – Uganda and South Sudan.



Notes: Data on informal cross border trade is taken from a list of "lead items by border" from the *Informal Cross Border Trade Survey* conducted jointly by the Bank of Uganda and the Uganda Bureau of Statistics. Data on prices in Uganda (Kampala, Arua and Gulu) is taken from the Consumer Price Indices compiled by the Uganda Bureau of Statistics and data on prices in Juba are from the CLiMIS database.

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