Macroeconomic Shocks and Conflict

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ABSTRACT: This paper contributes to the research on the macroeconomic origins of conflict. Based on a sample of 133 low- and middle-income countries over a 30-year period, it analyses to what extent changes in a country's commodity terms-of-trade (ToT) can explain an increase in the incidence and intensity of conflicts through their effect on aggregate income. While the evidence from previous studies on the link between macroeconomic conditions and conflict is rather inconclusive, we find a significant relationship. Our baseline model finds that a negative commodity ToT shock leads to an increase in the number of conflict events and fatalities. Moreover, the effect plays out over several years albeit with decreasing strength after the second year; and its magnitude is twice as large for Low-Income Countries and Fragile and Conflict-affected States when compared with the sample average. In addition, our results show that macroeconomic shocks are creating more violence in countries with higher inequality and in cases where fiscal policy faces relatively stronger constraints on financing a response to the initial shock to incomes. Our results are robust to a number of plausible variations in model specification. The paper's results, in conjunction with previous studies that emphasize the economic cost of conflicts, suggest the presence of a fragility trap—a vicious cycle of worsening economic conditions and deteriorating conflicts. Effective policies and well-tailored external financial support could be expected to help countries address this challenge.

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Contents

Executive Summary

This paper contributes to the research on the macroeconomic origins of conflict. Based on a sample of 133 low- and middle-income countries over a 30-year period, it analyses to what extent changes in a country's commodity terms-of-trade (ToT) can explain an increase in the incidence and intensity of conflicts through their effect on aggregate income. While the evidence from previous studies on the link between macroeconomic conditions and conflict is rather inconclusive, we find a significant relationship. Our baseline model finds that a negative commodity ToT shock leads to an increase in the number of conflict events and fatalities in our sample. Moreover, the effect plays out over several years albeit with decreasing strength after the second year; and its magnitude is twice as large for Low-Income Countries and Fragile and Conflict-affected States when compared with the sample average. In addition, our results show that macroeconomic shocks are creating more violence in countries with higher inequality and in cases where fiscal policy faces relatively stronger constraints on financing a response to the initial shock to incomes. Our results are robust to a number of plausible variations in model specification. The paper's results, in conjunction with previous studies that emphasize the economic cost of conflicts, suggest the presence of a fragility trap—a vicious cycle of worsening economic conditions and deteriorating conflicts. Effective policies and well-tailored external financial support could be expected to help countries address the challenge.

I. Introduction

The world suffers from a large number of violent conflicts. According to the Uppsala Conflict Data Program Georeferenced Event Dataset (UCDP GED),[1] which identifies conflict events as incidences of the use of armed force by an organized actor against another organized actor, or against civilians that result in at least one direct death, 17,000 conflicts occurred in 2021. These claimed almost 120,000 deaths. And while the incidence of conflicts subsided somewhat after the surge associated with the Arab Spring, their frequency over recent years has remained almost twice as high as that experienced in the outgoing decade of the 20th century (Figure 1).

Figure 1: Total Number of Conflict Events in the UCDP GED
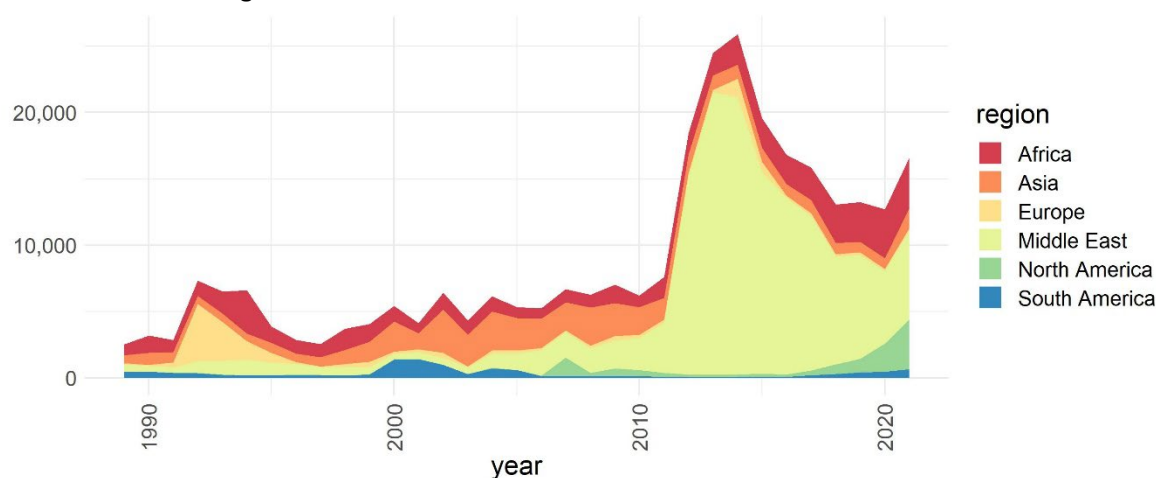
Source: UCDP GED.

How can economic conditions affect the likelihood of conflict? Since conflicts arise from complex political, social, and ethnic contexts, singling out an individual determinant seems infeasible. However, it is plausible to assume that economic factors, such as changes in aggregate income levels, would contribute to the dynamics that foster conflict. For instance, higher inflation would reduce purchasing power, thereby increasing the inclination of individuals to participate in violence. Less opportunities for gainful employment or reductions in salaries and wages may have similar effects. These would be the case especially in situations where governments are lacking the means to effectively mitigate economic hardship as macroeconomic shocks deplete their fiscal coffers.

Recent years have seen several major economic shocks on a global scale with a negative effect on output and thus aggregate income, including the Covid-19 pandemic, an increasing number of severe climate events, and Russia's invasion of Ukraine. The Ukraine war has had a particularly strong impact on households' purchasing power through its effect on energy, food, and fertilizer prices (Figure 2). Low-Income Countries (LICs) have been hit the most, as they host sizeable populations of poor and vulnerable households while their social safety nets tend to remain underdeveloped (see Rother et al., 2022).

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[1] The details will be presented in Section III.

Figure 2: Selected Commodity Prices
(2016=100)
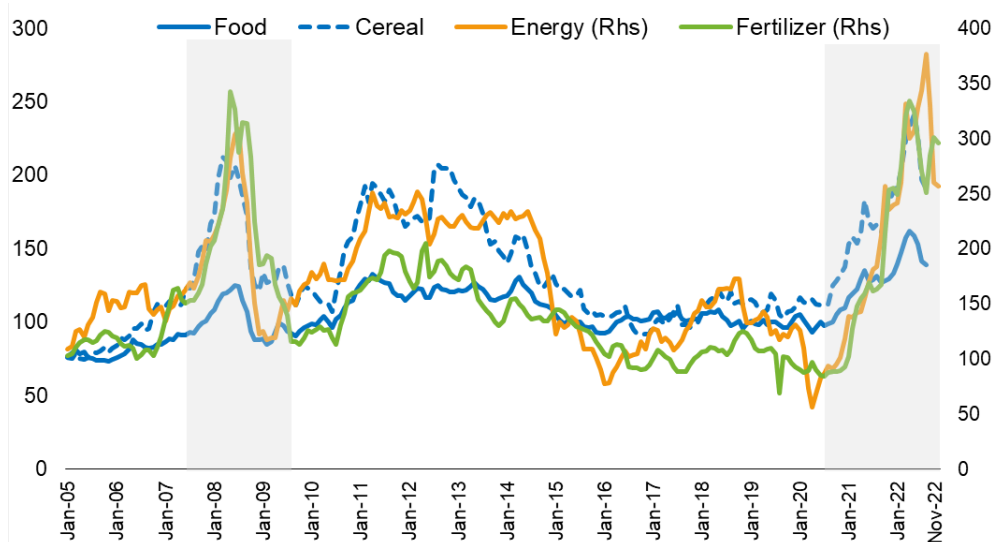
Source: IMF Primary Commodity Price Database.

Against the current background of elevated global economic pressures and a high incidence of conflicts, this paper seeks to contribute to a better understanding of the causality between the two phenomena. In particular, we hope that a deeper understanding of the transmission channels from economic shocks to violence will help policymakers at the national level and in international institutions with policy design—aimed at both preventing conflicts in the first place and at achieving durable exits from the vicious cycle of recurrent conflict and economic stagnation, which was identified elsewhere as a fragility trap (see Commission on State Fragility, Growth, and Development, 2018).[2]

Specifically, we use the broad commodity Terms-of-Trade (ToT) index compiled by Gruss and Kebhaj (2019) as a source of exogenous income variation. Based on that index, we employ the local projection method pioneered by Jorda (2005) to analyze the effects from ToT changes on the incidence and intensity of violent conflicts, which could show persistence over several years. Our data on conflicts comes from the Uppsala Conflict Data Program Georeferenced Events Dataset (UCDP GED) (Sundberg and Melander, 2013), which defines conflict events as incidences of the use of armed force by an organized actor against another organized actor, or against civilians that result in at least one direct death. In addition, we investigate transmission mechanism through which macroeconomic shocks affect conflicts by interacting the ToT shock variable with suitable proxies for the respective channels:

  i.   *an opportunity cost channel*: lower employment or lower pay could incentivize individuals to participate in non-productive activities such as violence (e.g., Becker, 1968; Figes, 1996; Weinstein, 2005; Collier

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and Hoeffler, 2004). Our modeling captures this channel by the level of inequality in an economy: the more unequal an economy as measured by the Gini coefficient, unemployment, and the share of the population affected by food insecurity, the larger the fraction of poor households with a low opportunity cost to engage in violent activity.

ii. *a state capacity channel*: lower national income leads to lower government revenue, weakening its capacity to prevent conflict or mitigate its economic fallout (e.g., Fearon and Laitin, 2003; Besley and Persson, 2008b, 2010). In our estimations, we proxy state capacity with the level of fiscal deficits and external debt as a share of GDP.

iii. *a predation channel*: higher commodity prices associated with an increase in income could cause conflict over the distribution of rents (e.g., Hirshleifer, 1991; Besley and Persson, 2008a; Adhvaryu et al., 2021). Previous studies often emphasized the importance of this channel for countries with oil and other natural resources (e.g., Ross, 2004).

The empirical results of our paper can be summarized as follows. First, a negative ToT shock significantly increases the incidence and intensity of conflict as measured by the number of conflict events. Our estimates indicate that a negative shock equivalent to one percent of GDP leads to an increase of 0.05 conflict events per one million people. The estimate of 0.05 events per one million people can explain 1.6 percent of the average conflict incidences that countries in our sample experience. Notably, the explanatory power of ToT shocks is twice as large for Low-Income Countries (LICs) and Fragile and Conflict-affected States (FCS). We complement this analysis by employing the number of fatalities caused by conflict as an alternative measure that tracks conflict intensity rather than conflict incidence. The respective results point in the same direction: a negative ToT shock of one point of GDP is associated with an increase of 0.39 fatalities per one million people, which explains about 0.75 percent of the average fatality count that sample countries experience. Second, we find that the impact of a commodity ToT shock is larger in countries with higher inequality and limited fiscal capacity. The former effect is consistent with the opportunity cost channel, whereas the latter supports the state capacity channel. Looking at the relative explanatory power of various variables to model fiscal capacity, we find that external debt is more relevant than fiscal balance and domestic debt. This is consistent with the criticality of external debt for LICs with limited domestic financing sources. Third, we explore spillover effects from ToT shocks to conflicts in neighboring countries and find that the number of conflict events increases in a statistically significant way within two to three years of the initial shock.

The remainder of the paper is organized as follows. Section II presents a short literature survey on the link between economic shocks and large-scale violence. Section III describes our data sources and empirical strategy. Section IV presents our main empirical results. Section V is devoted to robustness checks before Section VI concludes.

II. Literature Review

This paper joins a wealth of literature on the relationship between economic performance and conflicts. Two broad strands can be distinguished. A first set of studies analyzes the economic consequences of conflict. Typically, these studies find that violent conflicts lead to significant and persistent GDP losses (e.g., Collier,

1999; Rodrik, 1999; Cerra and Saxena, 2008; Rother et al., 2016; Novta and Pugacheva, 2021). The transmission works through a variety of channels, including destruction of physical capital (e.g., Collier 1999), reduced consumption (e.g., Novta and Pugacheva, 2021), elevated economic uncertainty (e.g., Hadzi-Vaskov, Pienknagura, and Ricci 2021), and worsening fiscal balances (e.g., Besley and Persson, 2008; IMF, 2019). Several studies also highlight spillover effects of conflicts on neighboring countries' economic performance (e.g., Anselin and O'Loughlin, 1992; Buhaug and Gleditsch, 2008; Beardsley, 2011; Rother et al, 2016), including due to the impact of large refugee populations on public infrastructure and fiscal accounts.

A second strand of work, including this paper, turns the research question around and focuses on the impact of economic performance on violent conflicts. While we leave a comprehensive survey of the literature to others (including Elbadawi and Sambanis, 2002; Blattman and Miguel, 2010; Koubi et al., 2014; Ross, 2004, 2015; and WB and UN, 2018), the following provides a focused overview of papers that we considered in developing our research design.[3]

The research program started out with several studies that identified a statistically significant association between poverty and conflicts (e.g., Schroder, 2001; Fearon and Laitin, 2003; Collier and Hoeffler, 2004). This said, more recent work has called into question the causal effect by showing that the statistical link tends to disappear once country-specific characteristics are controlled for (e.g., Djankov and Reynal-Querol, 2010; Krueger and Maleckova, 2003; Abadie, 2006; Cotet and Tsui, 2013; a survey by Blattman and Miguel, 2010)[4] or in recent data (e.g., Miguel and Satyanath, 2011). One critical issue that has weighed on the econometric work is endogeneity, as the causation of effect between income and violence can run both ways and as there may be omitted variable bias in the specifications so that the economic shock variable is correlated with the error term. A line of literature addresses the endogeneity concern by resorting to global commodity prices as independent variable, which are plausibly exogenous for most countries.[5] However, as surveyed by Koubi et al. (2014), these studies have still produced mixed results: various authors find that higher export prices and lower import prices decrease violence consistent with the resulting income increases (e.g., oil price: Brückner and Ciccone, 2010; food price: Bellemare, 2015; van Weezel, 2016; crop export: Berman and Couttenier, 2015; Fjelde, 2015); but other studies find the opposite (e.g., Besley and Persson, 2008a; Collier and Hoeffler, 2005; Berman et al., 2017) or report insignificant results (e.g., Bazzi and Blattman, 2014).

A potential explanation of the mixed results is that multiple channels can work in different directions, and the relative significance of different commodities can vary across countries as a function of their respective industrial structures (e.g., Dal Bó and Dal Bó, 2011; Ross, 2004; Dube and Vargas, 2013). For instance, Dal Bó and Dal Bó (2011) demonstrate that output price increases in capital-intensive sectors lead to fights over rent

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[3] Though this paper exclusively focuses on economic factors that may shape conflicts, there is a vast literature on other drivers of conflicts. For instance, a strand of the literature highlights the relevance of political and social contexts. They include but are not limited to a confrontation between the elite and the poor (e.g., Acemoglu and Robinson, 2001); grievance arising from inequality or a lack of political rights and social contract (e.g., Collier and Hoeffer, 2004; Devarajan and Ianchovichina, 2017); information asymmetries between parties (e.g., Powell, 2002); the relationship between natural resources and political institutions (e.g., Ross, 2001); and demographic factors (e.g., Brunborg and Urdal, 2005).

[4] For instance, Djankov and Reynal-Querol (2010) report that once historical variables such as European settlers' mortality are included in the regression, poverty no longer have an effect on civil wars, arguing for the importance of historical phenomena that jointly determine income evolution and conflict.

[5] An alternative approach to addressing endogeneity is to exploit weather-related shocks as instruments for income variations. For instance, a seminal work by Miguel et al. (2004) uses rainfall variation as an instrument for economic growth, finding a strongly negative impact on conflicts. However, Ciccone (2011) highlights the sensitivity of Miguel et al. (2004)'s results to specification: the results no longer hold in a more recent sample. Moreover, several studies argue that weather-related shocks can affect conflicts through multiple channels other than income changes, including the direct damage of productive infrastructure (e.g., Hsiang et al., 2013; Dell et al., 2014; Sarsons, 2015; Burke et al., 2015; Harari and La Ferrara, 2018; Diallo and Tapsoba, 2022).

capture, whereas those in labor-intensive sectors tend to increase wages. The first case leads to more violence, the second discourages it. Moreover, returns to labor-intensive commodity production (e.g., in agriculture) are often directly linked to household income. Price increases should therefore directly increase household income and thus lower incentives to engage in violent activity. By contrast, revenues from capital-intensive commodities (e.g., oil and natural gas) are more likely to accrue to the state and may thus not necessarily affect household incomes directly. McGuirk and Burke (2020) offer an additional perspective. They find that higher crop prices reduce conflicts over control of territory in food-producing areas but intensify conflict over the appropriation of the surplus. This paper follows the earlier studies in relying on global commodity prices to avoid the endogeneity problem, but goes further than others in using a comprehensive commodity ToT index weighed by countries' economic structure rather than a simpler index.

Another factor underlying the diverse results obtained by previous studies relates to the measures employed for identifying conflicts, which differ greatly. Numerous studies examined the likelihood of conflict or civil war based on binary variables models (e.g., Miguel et al., 2004; many others). Other studies focused on the outbreak of conflict (e.g., Collier and Hoeffler, 2004; Brückner and Ciccone, 2010) or their duration (e.g., Collier et al., 2004; Buhaug et al., 2009). Akanbi et al. (2021) take a related but distinctive approach by examining entering and exiting from state fragility. The level of analysis also differs. While many studies anchored their analysis at the country level, several recent studies used disaggregated conflict data (e.g., see Sundberg and Melander, 2013 from the UCDP GED) for an analysis of conflict at the sub-national, regional level (e.g., McGuirk and Burke, 2020). This paper follows an approach somewhere in between: it uses information on individual conflict events but aggregates the number of conflict events and fatalities at the country level. This enables us to capture the intensity of each individual conflict but also to examine transmission channel involving state capacity at the country level.

III. Data and Empirical Strategy

3.1 Data

Conflict data. We conduct cross-country analysis to examine the impact of a macroeconomic shock on the intensity of conflicts. The main dependent variable in the regression analysis is the intensity of conflict, as measured by the number of conflict events per one million people. Conflict data rely on the Uppsala Conflict Data Program Georeferenced Events Dataset (UCDP GED) (Sundberg and Melander, 2013). It records all individual conflict events that are defined as organized violence. Conflict events are incidences of the use of armed force by an organized actor against another organized actor, or against civilians that result in at least one direct death. We use the total number of conflict events, including state-based conflicts in which incidents take place between two parties and at least one is the government of a state; non-state-based conflicts between two parties neither of which is the government of a state; and one-sided conflicts in which armed force is used by the government of a state or by a formally organized group against civilians.[6] By contrast, the data does not include non-organized or non-violent incidences, such as protests, riots, and violence by civilians. The UCDP GED contains events for all dyads[7] and actors that have surpassed the 25 deaths threshold at least in

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[6] We find that each type of conflict events displays similar responses to a commodity ToT shock.

[7] A dyad is defined in the UCDP GED as a pair of two opposing actors. In a state-based conflict, a dyad is composed of two actors, at least one of which is a government. A dyad in non-state conflict involves two organized armed actors, neither of which is a government. In one-sided conflicts, UCDP does not consider opposing actors a dyad, but rather an armed actor attacking the civilian population.

one calendar year. The information is based on global news reports found using search strings run through the Dow Jones Factiva aggregator. The data cover the period from 1989 to 2021.

Our dataset contains 133 countries, excluding high-income countries according to the World Bank's GNI per capita classification (above USD 12,535 in 2020). The list of countries is presented in Annex I. We aggregate the number of conflict events by country and year. We remove the top one percentile of observations of each variable as outliers, on the premise that extremely intensive conflict episodes (e.g., Rwanda in the 1990s) are likely not driven by economic channels applicable to most countries. We normalize the number of conflict events per one million people in the population to account for country size. Mueller (2016) and Novta and Pugacheva (2021) highlight that per-capita measures are arguably most relevant from a macroeconomic perspective, as absolute numbers skew the sample toward large countries. This is particularly relevant for our analysis as countries with relatively small populations often suffer intensive conflict.[8]

We complement the analysis by using the number of fatalities per one million people caused by conflicts as an alternative dependent variable measuring the intensity of conflict, obtaining similar results. Furthermore, to better understand how macroeconomic shocks affect different stages of conflict formation, we investigate entry and continuation of conflict dyads. Details are presented in Section IV.

Figure 3 displays a snapshot of the global landscape of conflict events for 2021. Conflict events were mostly concentrated in Sub-Saharan Africa, the Middle East and Central and Latin America, with the highest intensity of conflicts occurring in Afghanistan. Mexico, Syria, Yemen, Somalia, the Central African Republic, Cameroon and Mali all recorded more than 50 conflict events per one million inhabitants.

Figure 3: Number of Conflict Events per one Million Inhabitants, 2021
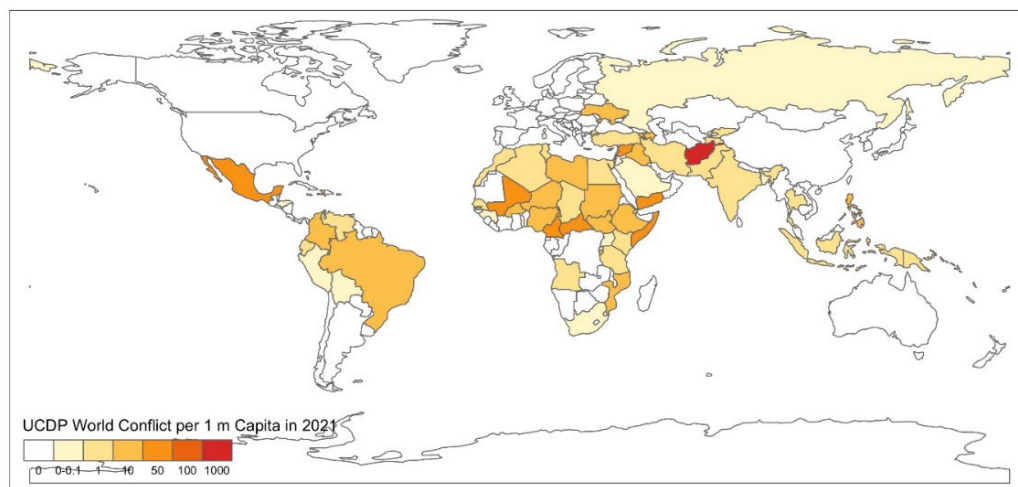
Source: UCDP GED.

Commodity terms-of-trade. A key identification challenge for exploring the impact of macroeconomic shocks on conflicts is to control for endogeneity since there is ample empirical evidence in the literature (see Section II) showing that macroeconomic conditions are affected by violence. To overcome this endogeneity concern, we

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[8] Novta and Pugacheva (2021) report that per-capita conflict measures have significant effects on macroeconomic variables whereas absolute figures do not. Likewise, we find that the absolute number of conflict cases increase, but not significantly, in response to a negative commodity ToT shock.

resort to an exogenous variation of income using the country specific commodity terms-of-trade (ToT) index, constructed by Gruss and Kebhaj (2019) and maintained by the IMF Research Department.[9] The commodity ToT index covers 182 economies and provides estimates for the gains and losses in income associated with changes in international commodity prices. Specifically, the index uses 45 world commodity prices from the IMF Primary Commodity Price database classifiable under the following four categories:

1. Energy: coal, crude oil, and natural gas.
2. Metals: aluminum, copper, gold, iron ore, lead, nickel, tin, uranium, and zinc.
3. Food and beverages: bananas, barley, beef, cocoa, coffee, corn, fish, fish meal, groundnuts, lamb, olive oil, oranges, palm oil, poultry, rapeseed oil, rice, shrimp, soybean meal, soybean oil, soybeans, sugar, sunflower seed oil, swine meat, tea, and wheat.
4. Agricultural raw materials: cotton, hard logs, hard sawnwood, hides, natural rubber, soft logs, soft sawnwood, and wool.

For every country in our sample, each commodity price in the index is weighed by its share in total net exports scaled to GDP to proxy its impact on aggregate income. Using net exports ensures that the effect of price changes for both exports and imports on GDP are accounted for: a one percentage point change in the index represents the equivalent percentage point change in GDP expected for each country due to net commodity price changes. The country-commodity level trade data is sourced from the United Nations Comtrade Database. The shares are built with three-year rolling averages for trade values, so that the index tracks changes in a country's industrial structure over time. Since the weights are lagged, changes in the index should reflect changes in international prices rather than possibly endogenous responses in trade volumes. It is worth noting that the commodity ToT index is different from a standard ToT measure as it accounts for the share of each export and import good in a country's economic structure. Gruss and Kebhaj (2019) compare the impact of the commodity ToT index and a standard ToT on macroeconomic variables and report that only the former influences macroeconomic aggregates in a statistically significant way.

Figure 4 presents the commodity ToT index for the sample countries with the highest gains and losses from commodity price changes in 2021. The figure shows that there is significant variation in ToT changes within and across regions. For example, within the Middle East and North Africa region, oil-exporting countries like Qatar, Kuwait and Libya experienced a positive change in their terms of trade, while other countries such as Jordan and Djibouti suffered significant losses. It is also worth noting that the changes in the index vary considerably even across oil exporting countries due to their different net export shares relative to GDP and the impact of price changes for other commodities.

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[9] The latest data is available at: https://data.imf.org/?sk=2CDDCCB8-0B59-43E9-B6A0-59210D5605D2.

Figure 4: Commodity Terms of Trade in Selected Countries, 2021
(year-on-year change, percent)
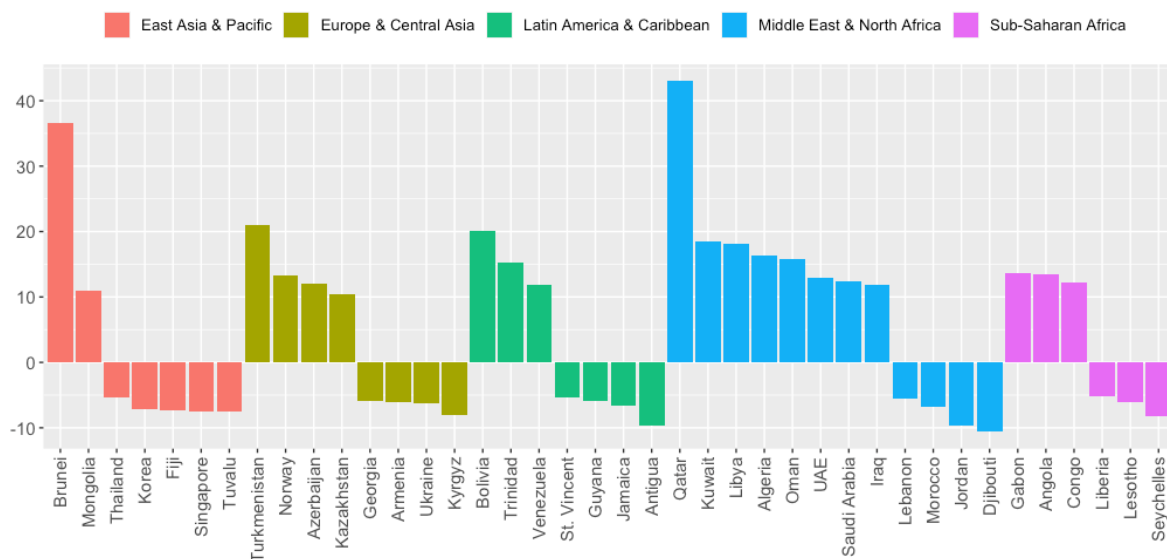
Other economic and political variables. Our study relies on a variety of economic and political indicators used as alternative dependent measures, control variables, and, importantly, to investigate the significance of macroeconomic effects in a variety of contexts. Missing values are imputed using the previous or subsequent year's observations to maintain sample size. Details on each variable are presented in the respective section. A full table of variables and sources can be found in Annex II.

Descriptive statistics. Table 1 reports summary statistics for our dependent conflict variables, independent variables, and some economic characteristics that we explore in the results section. Between 1989 and 2021, there are 4,412 observations for 133 countries. The average number of conflict events per year per country in our sample is 3.19 per one million people, with 51.7 resulting fatalities per one million people.[10] Notably, conflict intensity differs significantly by a country's income level. Low-Income Countries and Lower Middle-Income Countries (GDP per capita below US$4,045 in 2020) experienced an average 3.98 conflict events per one million people, resulting in 75.06 fatalities per one million people. This compares to 1.95 conflict events and 14.83 fatalities, respectively, for Upper Middle-Income Countries. Entry and continuation of conflict dyads are also higher for Low-Income and Lower Middle-Income Countries.

The table also includes summary statistics for the commodity ToT index, the independent variable for this study. The index is normalized to 100 in 2012 and fluctuates between a loss of about 10 percent of GDP and a gain of 8 percent of GDP between the tenth and ninetieth percentiles. Regarding other economic variables, given our sample of Low- and Middle-Income Countries, we see on average high levels of food insecurity and high unemployment rates (37.82 percent and 8.75 percent respectively). Readings on other variables are very diverse, reflecting the variety of economies included in our sample.

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[10] Standard deviations of conflict variables are high reflecting a few extremely severe conflict episodes. We exclude these outliers in the regression analysis by removing the top 1% of observations, as noted above.

Table 1. Descriptive Statistics

VARIABLE	Observations	Mean	Median	Standard Deviation	10th percentile	90th percentile
Number of conflict events (per million population)	4,412	3.19	0.00	32.54	0.00	3.31
Number of fatalities (per million population)	4,412	51.74	0.00	1392.17	0.00	32.82
Number of new conflict dyads	4,765	0.90	0.00	2.22	0.00	3.00
Number of continuing conflict dyads	3,232	1.08	0.00	2.45	0.00	3.00
Commodity ToT index	4,072	100.23	101.59	10.07	90.65	107.95
Low-Income and Lower Middle-Income Countries						
Number of conflict events (per million population)	2,696	3.98	0.00	34.78	0.00	4.95
Number of fatalities (per million population)	2,696	75.06	0.00	1774.51	0.00	56.70
Number of new conflict dyads	3,049	1.17	0.00	2.58	0.00	4.00
Number of continuing conflict dyads	2,336	1.21	0.00	2.69	0.00	3.00
Commodity ToT index	2,585	100.33	101.66	9.27	91.55	107.71
Upper Middle-Income Countries						
Number of conflict events (per million population)	1,749	1.95	0.00	28.38	0.00	1.67
Number of fatalities (per million population)	1,749	14.83	0.00	183.87	0.00	4.60
Number of new conflict dyads	2,092	0.36	0.00	1.14	0.00	1.00
Number of continuing conflict dyads	992	0.70	0.00	1.56	0.00	2.00
Commodity ToT index	1,611	99.87	101.28	11.33	88.04	108.42
Other Economic Variables						
GDP per capita (US$)	4,196	2,710.29	1,576.14	2,901.54	331.82	6,955.94
Gini coefficient	4,026	41.39	40.50	8.29	31.70	53.40
Unemployment rate (percent)	4,290	8.75	6.90	7.13	1.80	19.03
Food insecurity (percent of population)	2,574	37.82	36.50	22.18	11.20	72.50
External debt (percent of GDP)	4,323	62.03	42.56	77.63	-7.67	119.70
Fiscal balance (percent of GDP)	4,521	-2.77	-2.31	14.36	-37.59	2.73

Table 2 reports pairwise correlations among conflict-related variables, commodity ToT, and other economic variables. While a causal investigation is left for Section IV, the table presents several noteworthy facts. First, different conflict measures are positively correlated with each other, reflecting the close relationship among the number of conflict events, fatalities, and the evolution of conflict dyads. Second, the negative correlation between conflict variables and GDP per capita confirms a well-known association of conflict and income. The commodity ToT index is also negatively correlated with conflict variables, suggesting that deterioration of commodity ToT is associated with high intensity of conflict. Third, food insecurity and external debt are mostly positively correlated with the various measures of conflict. The Gini coefficient (a measure of inequality) and the unemployment rate are negatively correlated with all measures of conflict. These suggest the relevance of inequality and fiscal indicators for the occurrence of conflicts. At the same time, these indicators are clearly correlated with GDP per capita, which suggests a need for rigorous econometric analysis to identify the various statistical relationships.

Table 2. Correlations

	N. of conflict events	N. of fatalities	N. of new dyads	N. of cont. dyads	Commodity ToT index	GDP pc.	Gini coeff.	Unemp. rate	Food insecurity	External debt	Fiscal balance
N. of conflict events	1										
N. of fatalities	0.4946	1									
N. of new dyads	0.2009	0.1557	1								
N. of cont. dyads	0.2925	0.1154	0.6523	1							
Commodity ToT index	-0.121	-0.2014	-0.1335	-0.0369	1						
GDP pc.	-0.089	-0.0882	-0.119	-0.0187	-0.0152	1					
Gini coeff.	-0.02	-0.0132	-0.1117	-0.0386	-0.0292	0.1658	1				
Unemp. rate	-0.026	0.0115	-0.1244	-0.1481	-0.1989	0.1564	0.1826	1			
Food insecurity	0.1017	0.1462	0.1473	0.0727	-0.0706	-0.3676	0.3016	-0.0544	1		
External debt	0.156	0.2379	0.069	-0.0154	-0.2255	-0.2378	-0.0297	0.0315	0.1398	1	
Fiscal balance	0.0189	0.0023	-0.0015	-0.0037	-0.0962	-0.0058	0.0475	0.038	-0.0055	-0.0634	1

Table 3 shows correlations of the commodity ToT index and its sub-categories, including the 4 broad categories mentioned above (food and beverages, raw agricultural materials, base metals, and energy), as well as crude oil. Interestingly, the correlations between the sub-categories and the ToT index are quite low (last row). While individual export and import price indices are highly correlated with individual commodity prices, the construction of the ToT index nets out the effects on the export and import sides, leaving the index specific to individual economies to reflect their net export structure. In other words, the dynamics of the ToT index capture a country's income gains and losses, rather than just tracing the underlying commodity price fluctuations.

Table 3. Commodity Price Index Correlations

	Food and Beverages index	Raw Agricultural Materials index	Base Metals index	Energy index	Crude Oil index	Commodity Export price index	Commodity Import price index	ToT index
Food and Beverages index	1							
Raw Agricultural Materials index	0.666	1						
Base Metals index	0.589	0.7453	1					
Energy index	0.6306	0.5828	0.6528	1				
Crude Oil index	0.5134	0.5344	0.6386	0.971	1			
Commodity Export price index	0.3684	0.36	0.389	0.4688	0.4558	1		
Commodity Import price index	0.5598	0.4757	0.5109	0.6989	0.6746	0.3288	1	
ToT index	0.03	0.0697	0.0777	0.0404	0.0412	0.8074	-0.2849	1

Note: The table shows correlation of year-on-year changes of indexes.

3.2 Transmission Channels

Figure 5 shows how income shocks are expected to affect the incidence and intensity of conflicts via three channels outlined by the literature: (i) opportunity costs; (ii) state capacity; and (iii) predation.

Figure 5: Potential Channels of ToT Shock Effects on the Incidence and Intensity of Conflict

Cause → **Channels** → **Effect**

Intensity of conflict:
Number of conflict events per year [1]

Negative commodity ToT shock will:

Commodity Terms-of-Trade Shock:

E.g., 1% decrease in GDP due to all commodity price changes

Opportunity cost — Lower household income incentivizes individuals to engage in conflict activities — **+** **increase**

State capacity — Lower government revenue weakens the control over conflicts — **+** **Increase**

Predation — When commodity export prices are lower, a fight over rents becomes less profitable. — **–** **decrease**

the intensity of conflict.

1/ The number of fatalities, and entry and continuation or exit of conflicts are also examined.

Commodity price shocks can affect the opportunity costs of engaging in conflict activities. A negative commodity export price shock would lower household income, thus incentivizing households to engage in conflict. Case studies suggest that such a mechanism influenced the outbreak of the First Ivorian Civil War in the 2000s (Woods, 2003; McGuirk and Burke, 2020). In the 1980s and 1990s, Côte d'Ivoire experienced a persistent decline in the price of coffee and cocoa exports – products on which its economy relied heavily. The decline led the state and individual producers to expand their production to compensate for lower revenues. This resulted in competition over land that could be cultivated and the rise of ethnic and religious tensions, which promoted the context for the war. On the other hand, commodity import price increases reduce households' real income, which also lowers opportunity costs. Schneider (2008) examines news reports and finds that food price increases in 2007 and early 2008 led to the eruption of food riots in more than 20 countries.

The effect of a negative commodity ToT shock working through the state capacity channel is also expected to increase conflict intensity. A negative export price shock may lower government revenue, while import price increases may increase the fiscal cost of measures such as subsidies to support the population. In both cases, the state's ability to mitigate the economic shock is weakened. For example, Sayne and Hruby (2016) describe that in Nigeria, Africa's largest oil producer, falling oil revenue due to the oil price slump in 2014 and 2015, compounded by lower investor confidence and exchange rate volatility, constrained the government's resources to address the expansion of Boko Haram in the northeast regions of the country.

Finally, a negative ToT shock resulting from lower export prices would lower the gains to be made through rent capture, thereby decreasing incentives for conflict through the predation channel. Previous studies often report the significance of this channel for the oil and other natural resource sectors (e.g., Ross, 2004).

Given the different expected direction of effect, the overall impact of commodity price changes on conflicts is ambiguous ex ante and requires careful regression analysis.

3.3 Empirical Strategy

Local projection. We apply the local projections technique (Jorda, 2005) to estimate the impact of a change in the commodity ToT index on the change in an outcome variable, which is the number of conflict events per one million people in the baseline specification. Local projections provide a flexible framework that can accommodate lagged and persistent effects following the initial shock. The impulse response (IR) function is defined as

$$IR(t, s, d_t) = E(y_{t+s}|v_t = d_t; X_t) - E(y_{t+s}|v_t = 0; X_t) \quad \cdots (1)$$

where y_{t+s} is an outcome variable, v_t is a shock of interest, and X_t includes control variables. We implement this by estimating

$$y_{i,t+s} - y_{i,t-1} = \beta_s \Delta tot_{i,t} + \sum_{l=1}^{L} \alpha_{ls} \Delta y_{i,t-l} + \sum_{k=1}^{K} \delta_{ks} \Delta tot_{i,t-k} + \mu_{i,s} + \lambda_{t,s} + v_{r,t,s} + \varepsilon_{i,t,s} \quad \cdots (2)$$

for $s = 0, 1, 2, ...$, where $y_{i,t+s}$ is the number of conflict events per one million people in country i at time $t + s$ and $\Delta tot_{i,t}$ is a percentage change in the commodity ToT index in country i at time t. $\mu_{i,s}$ and $\lambda_{t,s}$ are country and time fixed effects, which capture time-invariant country characteristics and time-series global common components, respectively. $v_{r,t,s}$ is a region-by-time fixed effect at time t for region r that country i belongs to, which captures time-varying regional level shocks. $\varepsilon_{i,t,s}$ is an error term. Standard errors are clustered by country to accommodate persistent country-specific shocks. We follow Olea et al. (2021) by including lagged outcome and explanatory variables, $\Delta y_{i,t-l}$ and $\Delta tot_{i,t-k}$, to address serial correlation, and choose a lag length of two using the Bayesian Information Criterion in the Levin-Lin-Chu panel unit root test. The unit root test confirms that both explanatory and outcome variables are stationary. In this specification, we treat $\Delta tot_{i,t}$ as an exogenous shock as discussed above, and test for the robustness of this assumption in Section V. The sequence of estimated coefficients, $\{\beta_s\}$ for $s = 0, 1, 2, ...$, represents the impulse response.

We choose the commodity ToT index as an explanatory variable in the baseline specification, instead of using it as an instrument, following the convention in the literature (e.g., Bazzi and Blattman, 2014). However, we also test using the commodity ToT index as an instrument. This yields similar results, which are presented in Section V.

We use the simple baseline specification without time-varying control variables since the commodity ToT index is plausibly exogenous to country economic conditions. Although adding more control variables would improve efficiency by reducing variances of the estimators, macroeconomic conditions are likely to be affected by a commodity ToT shock, and thus the inclusion of these variables results in a bias in estimating the impact of our interest. Nevertheless, we present the results of robustness checks with additional controls in Section V.

IV. Results

4.1 Baseline Specification

Figure 6 shows the response in terms of the number of conflict events per one million people to a commodity ToT shock in the full sample of Low- and Middle-Income Countries. A deterioration of the commodity ToT, on average, increases the frequency of conflicts. Specifically, we find that a negative ToT shock equivalent to one percent of GDP increases the likelihood of experiencing a conflict by 0.05 events per one million people in the year following the shock. The estimate of 0.05 events per one million people is equivalent to or explains 1.6 percent of the average country's conflict events per year in our sample. Conflicts remain more likely for 2-3 years after a shock to income before the impact gradually decays.

As discussed above, the literature highlights the potential for different directions of the effect of an income shock on conflicts. The opportunity-cost and state-capacity channels predict that a negative income shock increases conflict, whereas the predation effect would work in the opposite way. Previous studies trace the significance of each channel in specific economic sectors. For instance, the predation effect is often reported in oil and other natural resources sectors (e.g., Ross, 2004; Adhvaryu et al., 2021). Dal Bó and Dal Bó (2011) theoretically demonstrate that output price increases in capital-intensive sectors lead to fights over rent through predation, whereas the opportunity cost channel prevails in labor-intensive sectors. Our estimated negative response in the baseline implies that the former two channels should be dominant at the aggregate level. This is consistent with our use of a broad-based commodity ToT index that de-emphasizes idiosyncratic effects in specific sectors.

Figure 6: Responses of the Number of Conflict Events to a Commodity ToT Shock, Baseline Specification
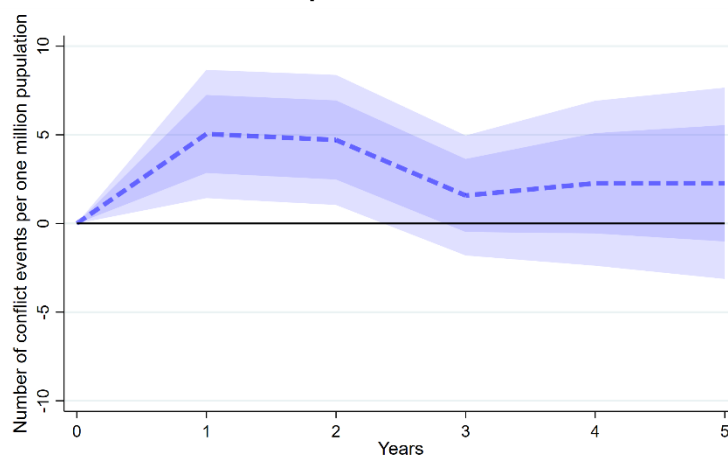
Notes: The sign of the estimated coefficients is flipped and multiplied by 100. A positive response in the figure indicates an increase in conflict events following a negative commodity ToT shock. Shaded areas indicate the 68 and 90 percentiles of the responses (same below).

4.2 Evolution of Conflict dyads

We further analyze the impact of the commodity ToT shocks on the evolution of underlying conflict dyads. To do so, we decompose conflict dyads, defined as a pair of two opposing actors that are involved in conflict events, into those starting in a given year ("entry") and those continuing from a past year ("continuation"). We count a dyad as "active" and therefore an "entry" if it causes at least one conflict event in a given year, but was not active in the previous year as a new conflict dyad. We define "continuation" of a conflict dyad if a dyad in a given year was active in the previous year too. Then, we use the number of entry and continuation of dyads as an outcome variable in the regression.

The results in Figure 7 illustrate that negative commodity ToT shocks increase the number of continued conflict dyads and prolong existing conflicts in Panel (a).[11] This said, the effect is not strong enough to trigger an entry of a new dyad in Panel (b). The results imply that the increase in the total number of conflict events shown in Figure 6 can be attributed to the intensification of violent activities by existing dyads. It echoes a narrative that conflicts arise from complex contexts, including political, ethnical, and social factors. Economic factors may not be the main driver of a new occurrence of conflict but seem to play an important role in determining the duration of violent activities.

Figure 7: Responses of Continuation and Entry of Conflict dyads
(a) Continuation   **(b) Entry**
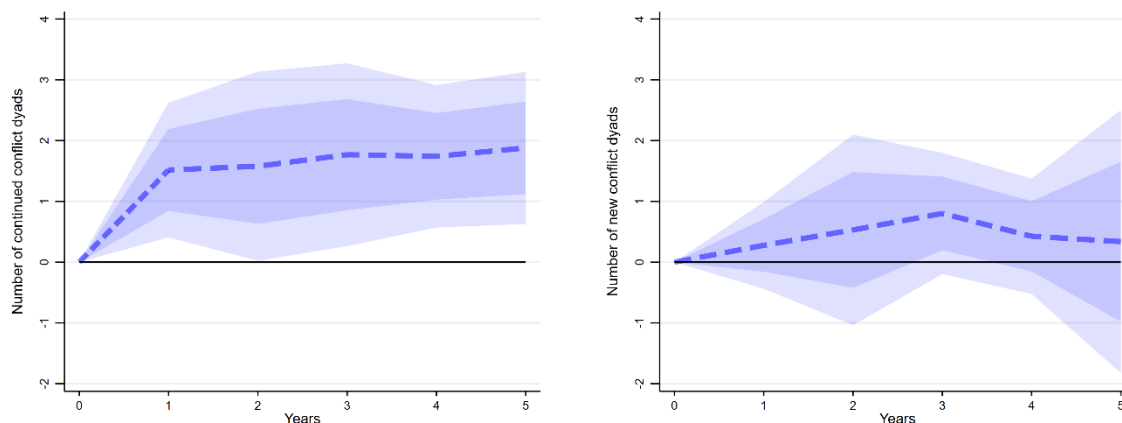
4.3 Countries at Risks

Given the statistically significant response of a commodity ToT shock on conflict intensity, a natural next question relates to the type of countries that are most at risk of conflicts when an economic shock hits. To answer this question, we first look at the differences in impact across country groups. Then we examine the relevance of each economic channel.

Income level. Previous studies often associate income level with the occurrence of conflicts (e.g., Blattman and Miguel, 2010). However, it is less clear how the impact of a Terms-of-Trade shock differs across countries'

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[11] The choice of outcome variables here is closely related to the studies that focus on the onset and duration of conflict of (e.g., Collier and Hoeffler, 2004; Brückner and Ciccone, 2010; Collier et al., 2004; Buhaug et al., 2009). These studies tend to use a binary variable that indicates the onset and presence of conflict at the national level, and thus do not differentiate dyads within countries.

income levels. To see this point, we modify the regression equation (2) by accommodating differential impacts through interaction terms:

$$y_{i,t+s} - y_{i,t-1} = \mathbf{1}_{i,t,j} \left[\beta_{s,1} \Delta tot_{i,t} + \sum_{k=1}^{K} \delta_{ks,1} \Delta tot_{i,t-k} \right] + (1 - \mathbf{1}_{i,t,j}) \left[\beta_{s,0} \Delta tot_{i,t} + \sum_{k=1}^{K} \delta_{ks,0} \Delta tot_{i,t-k} \right] + \sum_{l=1}^{L} \alpha_{ls} \Delta y_{i,t-l}$$
$$+ \mu_{i,s} + \lambda_{t,s} + \nu_{j,t,s} + \varepsilon_{i,t,s} \quad \cdots (3)$$

where $\mathbf{1}_{i,t,j}$ is an indicator function that takes a value of one for given characteristic j and zero otherwise. The IR of each group is represented by $\{\beta_{s,1}\}$ and $\{\beta_{s,0}\}$ for $s = 0, 1, 2, ...$, respectively. We split the sample into LICs and lower MICs (GNI per capita below US$4,045 in 2020) and upper MICs according to the World Bank's income classification. We complement the classification by using eligibility to the concessional lending resources of the IMF (Poverty Reduction and Growth Trust, PRGT), which is based on an assessment of the level of income per capita, market access, and the severity of short-term vulnerabilities. The lower-income groups include 81 countries according to the World Bank's income classification and 69 PRGT-eligible countries. The country classification is presented in Annex I.

Figure 8 displays quite different patterns across income groups. The responses in LICs/lower-MICs and PRGT-eligible countries (red) are considerably larger. The impact peaks at 0.10 conflict events per one million people for both low-income country groups, almost double that for the whole sample shown in Figure 6. The impact can explain 2.5 percent of the average conflict incidents in these country groups, implying that not only the number of countries experiencing conflicts is higher among LICs but also that these countries are more sensitive to economic shocks. Another notable feature is that the impact is highest in the second year after an initial shock and is persistent for more than five years, while the first-year response stays close to that of higher income groups (blue). By contrast, the responses in the higher income groups remain muted over the estimation period. In combination with the number of conflict events shown in Figure 3, this evidence implies that while several upper MICs, for example Mexico, suffer a large number of domestic violent events, the impact of economic shocks is relatively weak compared to that found in LICs.

Figure 8: Responses of the Number of Conflict Events, Comparison of Income Groups

(a) LICs and lower MICs   (b) PRGT-eligible countries
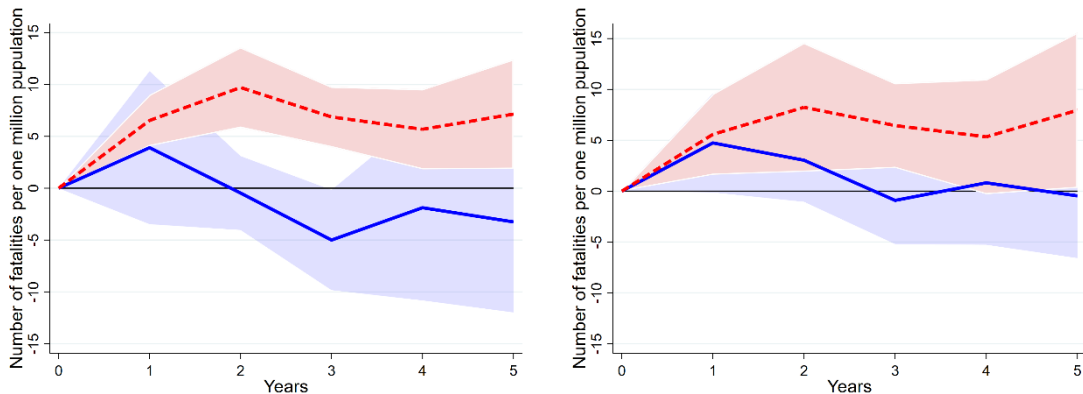
Note: Red lines show the IRs of LICs and lower MICs in panel (a) and of PRGT-eligible countries in panel (b).

FCS. Figure 9 shows the impact of a commodity ToT shock for FCS and non-FCS. As a part of international efforts to support countries suffering conflict, the World Bank releases annually a list of FCS.[12] Noting the complexity of fragility and conflict, it relies on two considerations for identifying FCS: (i) countries with high levels of institutional and social fragility, assessed through measures of the quality of policies and institutions, and manifestations of fragility; and (ii) countries affected by violent conflict, identified based on a threshold number of conflict-related deaths relative to the population. The World Bank's list for 2023 contains 37 economies, most of which are LICs. We use the FCS classification as an alternative country grouping in the heterogeneity regression equation (3). As the list is available only after 2006, we use the 2006 classification for earlier years. As can be expected, our results presented in Figure 9 indicate that FCS display a significantly larger number of conflict events in response to a ToT shock. The initial impact is close to that of LICs shown in Figure 8 and there is no unwinding of the effect even 5 years after the initial shock. In what follows, we look more closely into several dimensions of country characteristics to disentangle potential transmission channels.

Figure 9: Responses of the Number of Conflict Events, FCS and non-FCS
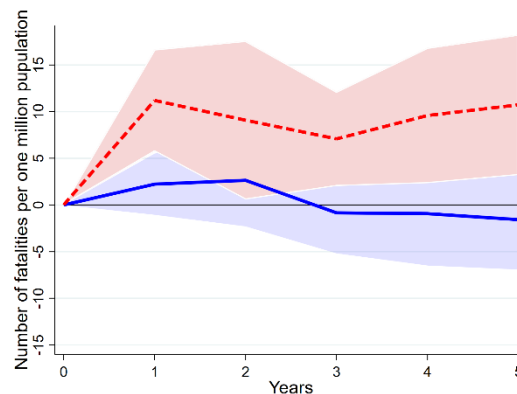
Note: Red line shows the IRs of FCS.

4.4 Tracking the Transmission Channels

What economic channels account for the differential impacts of the commodity ToT shocks on conflict intensity? Indeed, income levels are known to be highly correlated with various country characteristics in the development context. For instance, Blattman and Miguel (2010) emphasize that the aggregate income level serves as an indicator for both the opportunity costs of individuals to participate in conflict activities and state capacity to control conflicts, thus not identifying the channel in effect. Here we use measures of inequality and fiscal space as an indicator of country characteristics, $\mathbf{1}_{i,t,j}$, in the regression equation (3) to examine the relevance of the opportunity-cost and state-capacity channels.[13] Finding heterogenous effects across inequality levels would support the opportunity cost hypothesis, which states that individuals with limited income sources are more easily involved in violent activities. Analysis of heterogeneity across fiscal space would likewise indicate that the provision of public goods and services is constrained and governments cannot properly manage the economy during periods of adverse shocks.

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[12] The latest list is found here: https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/harmonized-list-of-fragile-situations

[13] We focus on these two channels as they imply increases of conflicts responding to an adverse income shock in line with our empirical result, while setting aside the predation channel which works in the other direction. These channels' relevance is often highlighted by policy makers (e.g., WB and UN, 2018).

Inequality. We consider three measures of inequality from the World Bank database: (i) Gini coefficient, (ii) unemployment rate, and (iii) the share of the population exposed to food insecurity.[14] Note that while the unemployment rate is not a direct measure of inequality, a higher unemployment rate implies that more unemployed individuals are vulnerable to recruitment into violent forces as their alternative options are likely to be less profitable than those of employed individuals. We identify countries with higher inequality by splitting the sample along the top 25th percentile of each measure and compare the IRs of the two groups. Each variable is lagged by one period from the shock to isolate its impact. The left side of Figure 10 displays the result. For ease of presentation, the figure shows the peak response of the higher inequality group (red) and that of the other group (blue). The estimated responses are considerably larger in countries that are in the highest quantile in each of three inequality measures, meaning that countries with higher inequality experience more severe violence in response to a deterioration of their ToT. Inequality increases the likelihood of conflicts in a range of 0.10 to 0.15 conflict events per one million people; these effects are even stronger than those for the LICs in the sample. By contrast, the estimates for countries with low levels of inequality are close to zero. These results are consistent with the opportunity cost hypothesis presented by the literature. They are also consistent with the hypothesis of the economics of crime (Becker, 1968) that high inequality increases the benefit of committing a crime or engaging in violent activities.

Figure 10: Heterogenous Responses in Inequality and Fiscal Capacities
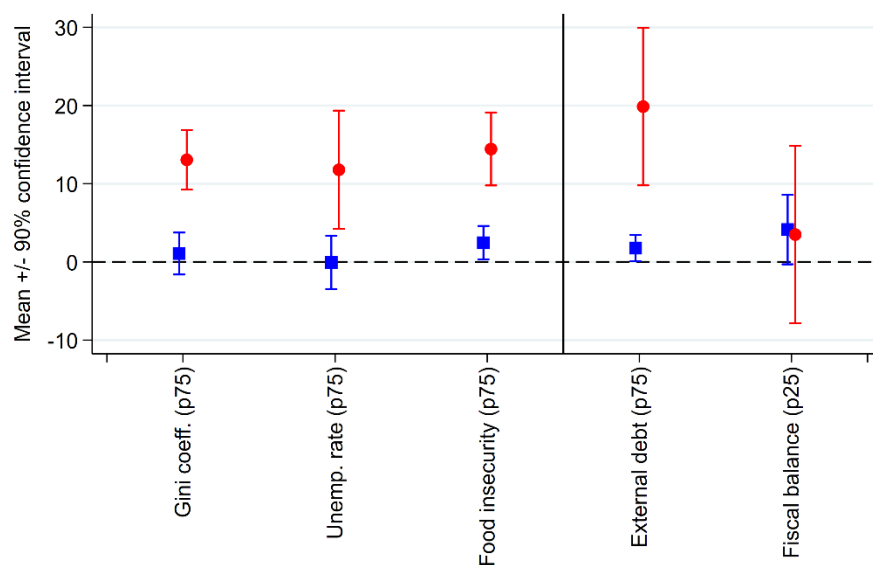
Notes: The responses of the number of conflict events per one million population 1 year after a negative commodity ToT shock. Red markers show the response of country groups with higher inequality or lower fiscal space.

Fiscal Capacity. Fiscal policies can mitigate macroeconomic shocks. To assess the effect of fiscal policies as a tool for mitigating the economic fallout from ToT shocks, we identify countries with limited fiscal space using gross external debt and the fiscal balance in percent of GDP from World Bank data and the July 2022 vintage of the IMF's World Economic Outlook Database, respectively. We use the third quartile cutoff (top 25th

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[14] The indicator is defined as the percentage of people in the population who live in households classified as moderately or severely food insecure. A household is classified as moderately or severely food insecure when at least one adult in the household has reported to have been exposed, at times during the year, to low quality diets and might have been forced to also reduce the quantity of food they would normally eat because of a lack of money or other resources.

percentile) to split the sample and compare the IRs in the two country groups, as we do for the inequality measures described above. The hypothesis is that countries with a higher level of external debt or with a higher fiscal deficit are more likely to face fiscal constraints when hit by a negative ToT shock, thereby limiting the government's ability to organize an effective response to support the economy. The right-hand side of Figure 10 indicates that the estimated impact tends to be larger in countries with relatively low fiscal space. The estimated coefficient is substantially larger for counties with higher external debt, even if the standard error is somewhat large. The result could reflect the fact that most LICs and lower MICs rely on external financial support to implement their budget. In these cases, an elevated level of external debt can become a binding constraint for fiscal policies.

Overall, the analysis in this section suggests the presence of both opportunity-cost and state-capacity channels in determining the impact of commodity ToT shocks on conflict. These channels have often been discussed in the literature. Our innovation is that we separately test each of these hypotheses using proxy indicators and find the expected results. This said, we note that these proxies may also capture deep-rooted structural issues. For instance, limited fiscal capacities may be a consequence of intensive conflicts in past years, which may also account for the large standard error in the regression analysis. We conduct further robustness checks in Section V.

4.5   Testing for Spillovers Across Countries

Consequences of conflicts can spread to neighboring countries. For instance, Buhaug and Gleditsch (2008) document that the eruption of civil war in the Democratic Republic of Congo (then Zaire) was influenced by events in neighboring countries. With such spillover of conflicts, the overall impact of a macroeconomic shock could be larger than that captured in a single country. We examine this hypothesis by constructing a distance-weighted index of other countries' commodity ToT:

$$\sum_{i' \neq i} \kappa_{i'} \Delta tot_{t-m,i'}$$

where $\kappa_{i'}$ is the distance between country i and country i', and $\Delta tot_{t-m,i'}$ is the commodity ToT change in country i' at time $t-m$. We use the distances from the country of interest to all other country pairs to construct the weights. The distance data are from United States International Trade Commission. We add the one- to two-year lagged terms, i.e., $m = 1, 2$, to the baseline regression equation (1).

The results are presented in Figure 11. The IRs become significant three years after the occurrence of the initial ToT shocks, implying that the spillover effect occurs with some time lag. The literature highlights various potential mechanisms that could drive the spillover of conflicts. First, there could be a direct expansion of violent activities or advancement of armed forces into neighboring countries. Another possible explanation is that information on a country's conflict can trigger conflict events in other countries by influencing people's beliefs. Furthermore, refugee flows can weigh on budgets (e.g., through the provision of shelter or healthcare) and weaken their fiscal capacity in host countries. In LICs and MICs, which host 74 percent of refugees,[15] pressure on already stretched government budgets can lead to a deterioration in the provision of public services essential for human capital development, unless humanitarian and development support is scaled up to both meet these needs (Rother et al., 2016; Bohmelt, Bove and Gleditsch, 2018) and enable policies that

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[15] https://www.unhcr.org/refugee-statistics/

raise the economic welfare of the local and displaced communities (IMF, 2022b). In these contexts, support for state capacity is critical (e.g., Salehyan and Gleditsch, 2006). Finally, ToT shocks can generate negative economic spillovers that potentially lead to conflicts in neighboring countries as well. Although our empirical results are agnostic with regard to the precise channels at work, the presence of spillovers implies that economic shocks can have an impact on conflicts that extends beyond the borders of the countries that were hit at first.

Figure 11: Spillover
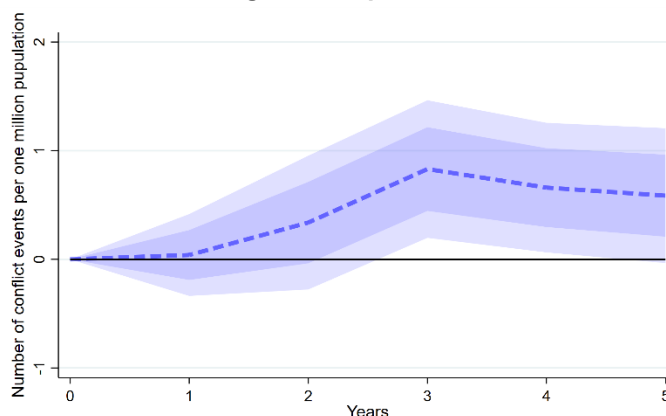
V. Robustness Check

5.1   Alternative Specifications

Alternative outcome variables. We consider the number of fatalities per one million people as an alternative measure of conflict intensity. The fatality data is also provided by the UCDP GED. The IRs shown in Panel (a) of Figure 12 are similar to those in the baseline specification, although the responses are somewhat more persistent with the impact remaining significant for three years after the shock. The estimates imply that a one-percentage point change in the commodity ToT accounts for an additional 0.39 fatalities per one million people. With the average population of 40 million among our sample countries, the estimate implies an increase of 15.6 fatalities as a response to the initial shock. This can account for 0.75 percent of the average fatalities for the whole sample.

Commodity ToT shocks as an IV. In Panel (b) of Figure 12, we use commodity ToT shocks as an instrumental variable of per capita GDP growth. The result is quite consistent with the baseline specification. We choose to use the commodity ToT shocks directly as an explanatory variable in our baseline specification since we wanted to explore the effect of shocks on the numbers of conflict events through channels other than only aggregate income changes. For example, higher prices of a certain commodity could result in competition over scarce resources without changing the aggregate income level. However, our results imply that the main channel of the commodity ToT shock is in fact through its effect on aggregate income.

Sample selection. Our identification strategy hinges on the exogeneity of the commodity ToT shock. Gruss and Kebhaj (2019) argue that the assumption is justifiable since each country exports and imports a variety of

commodity goods and the product shares of most commodities in the index are split across multiple countries. It is hard to imagine that any single country would have influence over the price of the basket of commodity goods. We confirm this point by excluding large commodity exporters from the regression analysis. Specifically, we calculate the export share for each commodity-country pair using UN Comtrade data for 2018 and remove from our sample countries with an export share higher than 10 percent for any commodity. The methodology leads to the exclusion of 36 countries from our sample as listed in Annex I. The IRs are shown in Panel (c) of Figure 12 below, which display a mostly similar pattern to the baseline case. We confirmed that the result is also robust to using a 20 percent of export share cutoff value, which would exclude 24 countries from the sample. Furthermore, we check the case in which the Middle East countries are excluded from the sample. Panel (d) confirms the robustness of the baseline result.

Figure 12: Alternative Specifications

(a) Fatalities

(b) IV result

(c) Exclusion of top exporters

(d) Exclusion of the Middle East countries
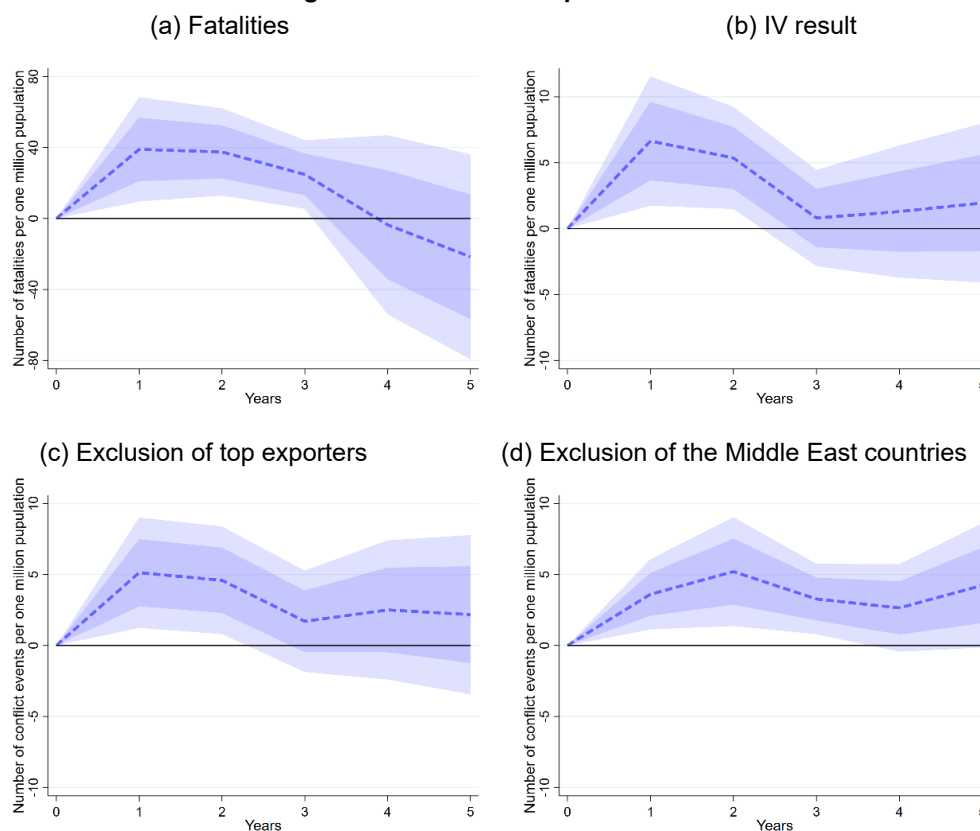
5.2 Additional Controls

In the baseline analysis, we do not control for macroeconomic or policy variables to allow for transmissions of an initial shock through these variables. Again, the specification relies on the premise that the commodity ToT shocks are not affected by these variables. Here we assess the sensitivity of the baseline specification with respect to various control variables. We first control for initial conditions before a shock in Panel (a) of Figure 13. Specifically, we include 9 macroeconomic and policy variables (per capita GDP growth, unemployment rate, CPI inflation, current account balance, fiscal balance, gross external debt, foreign reserve, USD-local currency exchange rate, and broad money); 1 social indicator (Gini coefficient); 4 indicators of political instability (the number of major cabinet changes, the number of successful, attempted, and planned coups);

and 1 indicator of political regime (polity score),[16] as they may have a persistent effect on the conflict intensity even after controlling for the lagged outcome and explanatory variables. These controls are one period lagged to avoid endogenous reactions of these variables in response to an initial shock. The panel indicates that the estimated impact of the commodity ToT shock is close to the baseline estimation, confirming the exogeneity of the commodity ToT shocks with respect to the initial conditions. Somewhat tighter confidence intervals suggest the efficiency gain by removing the variations of control variables from error terms.

In Panel (b), we add the contemporaneous terms of the control variables mentioned above, meaning that the coefficient of the commodity ToT is identified as a marginal impact keeping these control variables constant in the initial period following a shock. For instance, controlling for the current fiscal balance implies eliminating the transmissions through a deterioration of fiscal balance in the initial year in response to a negative commodity ToT shock. As expected, the IRs become smaller in the initial year with the 90 percent interval almost covering 0, whereas they increase in the second year. Overall, controlling various variables only modestly affects our baseline results.

Figure 13: Additional controls

(a) Initial conditions

(b) Initial + current conditions
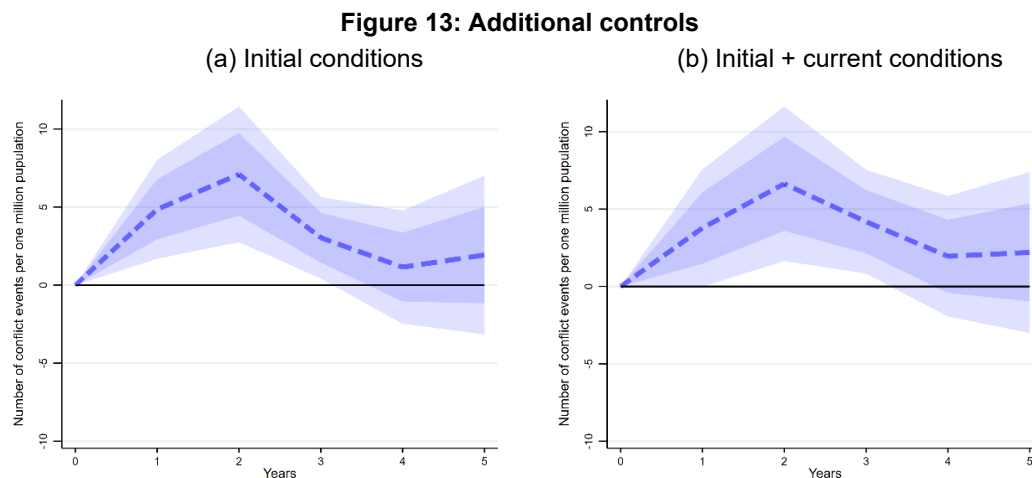
A potential concern regarding the country-group regressions presented in Section IV is that the degree of inequality and fiscal capacity may represent more deep-rooted structural factors such as poverty and past conflicts. To address this concern, we run a regression with additional interaction terms with income groups or a dummy variable for the presence of conflict events. Table 4 shows the regression result. The interactions with the measures of inequality and fiscal capacity remain significant, except for the fiscal balance in column (6) when adding the interaction with the low- and lower middle-income group in Panel (a). The result is quite similar in Panel (b) where the commodity ToT shocks are interacted with the presence of conflict events, confirming the significance of the opportunity-cost and fiscal capacity channels. These results imply the greater relevance of external debt for representing fiscal space. This is a reasonable assumption for many LICs and MICs since these countries often rely on external financing to finance their budgets. It is also notable that the interaction terms with the income group and conflict events are significant in most specification. For instance, both interactions with the Gini coefficient and the income group remain significant in column (1) of Panel (a),

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[16] The number of major cabinet changes is based on the Cross-National Time-Series Data Archive (CNTS). The information regarding coups and the polity score are from the Polity5 dataset. The polity score affords a rank of democracy on a scale from −10 to 10 with -10 being extremely autocratic. The score is derived from operational indicators concerning the qualities of executive recruitment, constraints on executive authority, and political competition.

indicating that the mean income level and inequality play an important role in determining the impact of income changes on conflict.

Regarding model specification, a Wald test indicates that the inclusion of the macro, policy, and political variables shown in Figure 13 does not improve the overall explanatory power of the regressions. This may suggest a challenge for predicting conflict incidence and intensity by using a stylized statistical model based on conventional macroeconomic variables. This finding is in line with those of previous studies that emphasize the complex nature of the origin of conflicts and report relatively low performance levels of forecasting models, especially with low frequency data (e.g., Cederman and Weidmann, 2017; Bassi et al., 2022).[17]

Table 4. Regression Result with Additional Controls
(a) Income level

	(1)	(2)	(3)	(4)	(6)
	Dependent variable: Number of conflict events per capita				
Independent variables:					
Δlog(Commodity ToT)	2.382	2.163	-3.037	1.415	1.816
	(1.835)	(3. 562)	(2.097)	(1.849)	(2.693)
Δlog(Commodity ToT)*1(LICs and lower-MICs)	-7.610**	-5.076	0.590	-4.973*	-8.171***
	(2.990)	(3.782)	(2.874)	(2.672)	(3.070)
Δlog(Commodity ToT)*1(High Gini Coef)	-8.983***				
	(2.677)				
Δlog(Commodity ToT)*1(High unemployment rate)		-12.478***			
		(4.583)			
Δlog(Commodity ToT)*1(High food Insecurity)			-11.981***		
			(3.406)		
Δlog(Commodity ToT)*1(High gross external debt)				-19.498***	
				(5.793)	
Δlog(Commodity ToT)*1(Low Fiscal Balance)					-10.462
					(7.847)
Observations	3,263	3,563	2,107	3,361	3,420
R-squared	0.210	0.172	0.270	0.227	0.222
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Region-by-year FE	Yes	Yes	Yes	Yes	Yes
SE clustering	Country	Country	Country	Country	Country

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(b) Presence of conflict

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[17] Nevertheless, recent literature advances in forecasting of conflict by utilizing abundance of data (e.g., Kleinberg et al., 2015). For instance, Mueller et al. (2022) develop a forecast model which uses machine learning and text downloads to predict outbreaks and intensity of internal armed conflict.

	(1)	(2)	(3)	(4)	(6)
	Dependent variable: Number of conflict events per capita				
Independent variables:					
Δlog(Commodity ToT)	1.342	3.642	3.045	3.852*	0.935
	(1.343)	(2.221)	(1.886)	(2.089)	(1.702)
Δlog(Commodity ToT)*1(Number of conflict event>0)	-5.226	-8.032*	-10.117***	-10.593***	-7.317**
	(3.855)	(4.138)	(3.226)	(3.054)	(3.296)
Δlog(Commodity ToT)*1(High Gini Coef)	-10.637***				
	(2.612)				
Δlog(Commodity ToT)*1(High unemployment rate)		-12.207***			
		(4.409)			
Δlog(Commodity ToT)*1(High food Insecurity)			-9.714***		
			(3.602)		
Δlog(Commodity ToT)*1(High gross external debt)				-18.343***	
				(5.610)	
Δlog(Commodity ToT)*1(Low Fiscal Balance)					-9.376
					(7.336)
Observations	3,288	3,589	2,107	3,386	3,445
R-squared	0.207	0.172	0.271	0.227	0.220
Year FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Region-by-year FE	Yes	Yes	Yes	Yes	Yes
SE clustering	Country	Country	Country	Country	Country

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable is one period ahead other than in column (2) where the contemporaneous variable is used. The timing is chosen as the period when the impact is peaked. One- and two-period lagged dependent and independent variables are included in the regressions.

VI. Concluding Remarks

This paper investigates the impact of a shock to a country's national income on the intensity of conflicts. It does so by exploiting the commodity terms-of-trade (ToT) as an exogenous source of income variation. Our approach uses a more comprehensive ToT index than earlier studies, tracking a variety of commodities and time-varying trade shares while being scaled to the impact on aggregate income. As a result, our measure minimizes the dependence of results to movements in individual commodities such as oil and is sensitive to fluctuations in aggregate income.

Our analysis indicates that a negative ToT shock significantly increases the intensity of conflicts, as measured by the number of conflict events per one million population. We find that the impact tends to be larger and more persistent for Low-Income Countries (LICs) and for Fragile and Conflict-affected States (FCS). Moreover, the impact is positively correlated with the level of inequality and a country's external debt burden. The former effect is consistent with the opportunity-cost channel, which posits that lower income incentivizes individuals to

participate in non-productive activities such as violence. The latter supports the relevance of a state-capacity channel, with lower income weakening a government's capacity to address the impact of an economic shock on income levels and/or the fallout from conflicts, including through adequate social safety nets. Moreover, we find second-round effects from ToT shocks on the security situation of neighboring countries through spillovers of conflict. Overall, our results highlight that ToT shocks have heterogeneous consequences on the incidence and intensity of conflicts, as the impact is affected by a country's underlying macroeconomic, institutional, and geographical conditions.

The paper's empirical results suggest that policies matter for the link between macroeconomic shocks and conflicts. First, inclusive growth that increases incomes and reduces inequality should help to enhance an economy's resilience to shocks and work towards preventing violence. Second, adequate fiscal buffers in the form of sustainable (external) debt levels are critical to mitigate the impact of ToT shocks on an economy's income and thus the likelihood of conflicts. It is plausible to assume that these fiscal buffers can facilitate the provision of adequate social safety nets, ideally targeted to vulnerable households, to break the negative cycle between economic shocks and violence. The results also suggest that financing engagement by international institutions can play an important role to help countries reduce the likelihood of conflicts when faced with an economic shock, as such financing increases the scope for more budget spending and eases foreign exchange constraints that many LICs tend to experience.

We conclude this paper with some suggestions for future research.

- First, while this paper uses an overall commodity ToT index, which affects aggregate income variations, future research could analyze different sources of macroeconomic shocks. Variation in the nature of these shocks for example with regard to their persistence may also have different implications.

- Second, this paper focuses on a broad measure of organized violence. However, different types of conflicts may be associated with different causes—for example, there may be a systematic difference in the impact of ToT shocks on conflicts associated with state actors and others that feature non-state actors. Moreover, the impact of economic shocks on other forms of social unrest, including but not limited to protests, riots, and non-organized violence, could be worth exploring. Recent advances in data compilation, including the Armed Conflict Location and Event Data Project (ACLED) and the Conflict Barometer of the Heidelberg Institute for International Conflict Research, could help in such endeavors.

- Third, it would be interesting to learn more about the effectiveness of policy and reform agendas in preventing conflicts and/or mitigating their economic fallout. While our results indicate the relevance of several economic conditions that affect the transmission of ToT shocks to violence, including income level, inequality, and debt burdens, there remain open questions regarding the measures that could be taken by policymakers to build more resilience.

- Fourth, and related, more research could be conducted on the role of external financial support to LICs and FCS in conflict prevention, conflict containment, and durable post-conflict reconstruction.

- Last but not least, along with the literature that emphasizes the economic cost of conflict, our empirical results imply the presence of a fragility trap, i.e., a nexus between weak economic performance and conflicts. Future research could focus on the conditions that are conducive to overcoming this vicious cycle, including effective policy and reform choices as well as adequate external financing support.

Annex I. List of Countries for Empirical Analysis

COUNTRY	WORLD BANK CLASSIFICATION 2020	PRGT ELIGIBLE	GNI PER CAPITA *ATLAS METHOD (CURRENT US$) IN 2020*	LARGE COMMODITY EXPORTER
AFGHANISTAN	Low income	Yes	500	
ALBANIA	Upper middle income		5260	
ALGERIA	Lower middle income		3570	
AMERICAN SAMOA	Upper middle income		-	
ANGOLA	Lower middle income		1780	
ARGENTINA	Upper middle income		9080	Yes
ARMENIA	Upper middle income		4220	
AZERBAIJAN	Upper middle income		4480	
BANGLADESH	Lower middle income	Yes	2340	
BELARUS	Upper middle income		6280	
BELIZE	Upper middle income		3930	
BENIN	Lower middle income	Yes	1280	
BHUTAN	Lower middle income	Yes	2840	
BOLIVIA	Lower middle income		3190	Yes
BOSNIA AND HERZEGOVINA	Upper middle income		6080	
BOTSWANA	Upper middle income		6500	
BRAZIL	Upper middle income		7800	Yes
BULGARIA	Upper middle income		9630	
BURKINA FASO	Low income	Yes	770	
BURUNDI	Low income	Yes	230	
CABO VERDE	Lower middle income	Yes	3060	
CAMBODIA	Lower middle income	Yes	1510	
CAMEROON	Lower middle income	Yes	1520	
CENTRAL AFRICAN REPUBLIC	Low income	Yes	510	
CHAD	Low income	Yes	630	
CHINA	Upper middle income		10530	
COLOMBIA	Upper middle income		5830	
COMOROS	Lower middle income	Yes	1410	
CONGO, DEM. REP.	Low income	Yes	560	
CONGO, REPUBLIC	Lower middle income	Yes	1820	
COSTA RICA	Upper middle income		11580	
COTE D'IVOIRE	Lower middle income	Yes	2280	Yes
CUBA	Upper middle income		8630	
DJIBOUTI	Lower middle income	Yes	3120	
DOMINICA	Upper middle income	Yes	7140	

DOMINICAN REPUBLIC	Upper middle income		7270	
ECUADOR	Upper middle income		5540	Yes
EGYPT	Lower middle income		3000	Yes
EL SALVADOR	Lower middle income		3630	
EQUATORIAL GUINEA	Upper middle income		5800	
ERITREA	Low income	Yes	600	
ESWATINI	Lower middle income		3390	
ETHIOPIA	Low income	Yes	890	
FIJI	Upper middle income		4930	
GABON	Upper middle income		7030	
GAMBIA	Low income	Yes	740	
GEORGIA	Upper middle income		4260	
GHANA	Lower middle income	Yes	2310	Yes
GRENADA	Upper middle income	Yes	8910	
GUATEMALA	Upper middle income		4490	
GUINEA	Low income	Yes	960	
GUINEA-BISSAU	Low income	Yes	760	
GUYANA	Upper middle income		8220	
HAITI	Lower middle income	Yes	1320	
HONDURAS	Lower middle income	Yes	2190	
INDIA	Lower middle income		1910	
INDONESIA	Lower middle income		3870	Yes
IRAN	Lower middle income		3370	
IRAQ	Upper middle income		4990	
JAMAICA	Upper middle income		4670	
JORDAN	Upper middle income		4310	
KAZAKHSTAN	Upper middle income		8710	
KENYA	Lower middle income	Yes	1840	Yes
KIRIBATI	Lower middle income	Yes	2910	
KOREA, NORTH	Low income		-	
KYRGYZSTAN	Lower middle income	Yes	1180	
LAOS	Lower middle income	Yes	2490	
LEBANON	Lower middle income		4660	
LESOTHO	Lower middle income	Yes	1210	
LIBERIA	Low income	Yes	600	
LIBYA	Upper middle income		7740	
MACEDONIA	Upper middle income		5690	
MADAGASCAR	Low income	Yes	470	
MALAWI	Low income	Yes	590	
MALAYSIA	Upper middle income		10570	
MALDIVES	Upper middle income	Yes	6450	
MALI	Low income	Yes	830	
MARSHALL ISLANDS	Upper middle income	Yes	4940	

MAURITANIA	Lower middle income	Yes	1670	
MAURITIUS	Upper middle income		10230	
MEXICO	Upper middle income		8530	Yes
MICRONESIA, FED STATES	Lower middle income	Yes	3960	
MOLDOVA	Upper middle income	Yes	4520	
MONGOLIA	Lower middle income		3740	
MONTENEGRO	Upper middle income		7910	
MOROCCO	Lower middle income		3020	
MOZAMBIQUE	Low income	Yes	470	
MYANMAR	Lower middle income	Yes	1340	
NAMIBIA	Upper middle income		4550	Yes
NEPAL	Lower middle income	Yes	1190	
NICARAGUA	Lower middle income	Yes	1770	
NIGER	Low income	Yes	550	Yes
NIGERIA	Lower middle income		2000	
PAKISTAN	Lower middle income		1460	
PALAU	Upper middle income		14390	
PAPUA NEW GUINEA	Lower middle income	Yes	2720	
PARAGUAY	Upper middle income		5150	
PERU	Upper middle income		6060	Yes
PHILIPPINES	Lower middle income		3430	Yes
RUSSIA	Upper middle income		10740	Yes
RWANDA	Low income	Yes	770	Yes
SAINT LUCIA	Upper middle income	Yes	8910	
SAINT VINCENT AND THE GRENADINES	Upper middle income	Yes	7790	
SAMOA	Lower middle income	Yes	4050	
SAO TOME AND PRINCIPE	Lower middle income	Yes	2090	
SENEGAL	Lower middle income	Yes	1430	
SIERRA LEONE	Low income	Yes	510	
SOLOMON ISLANDS	Lower middle income	Yes	2300	
SOMALIA	Low income	Yes	420	
SOUTH AFRICA	Upper middle income		6010	Yes
SOUTH SUDAN	Low income	Yes	1090	
SRI LANKA	Lower middle income		3720	
SUDAN	Low income	Yes	640	
SURINAME	Upper middle income		4620	
SYRIA	Low income		930	
TAJIKISTAN	Lower middle income	Yes	1050	
TANZANIA	Lower middle income	Yes	1080	
THAILAND	Upper middle income		7070	Yes
TIMOR-LESTE	Lower middle income	Yes	1990	

TOGO	Low income	Yes	920	
TONGA	Upper middle income	Yes	5190	
TUNISIA	Lower middle income		3300	
TURKIYE	Upper middle income		9040	
TURKMENISTAN	Upper middle income		7220	
TUVALU	Upper middle income	Yes	6340	
UGANDA	Low income	Yes	800	
UKRAINE	Lower middle income		3570	Yes
UZBEKISTAN	Lower middle income	Yes	1740	
VANUATU	Lower middle income	Yes	3240	
VIETNAM	Lower middle income		3390	Yes
YEMEN	Low income	Yes	670	
ZAMBIA	Low income	Yes	1160	
ZIMBABWE	Lower middle income	Yes	1140	

Annex II. Variables used for Empirical Analysis

VARIABLE	DESCRIPTION	SOURCE	NOTES
CONFLICT EVENTS	Number of conflict events. Conflict events are defined as the incidences of the use of armed force by an organized actor against another organized actor, or against civilians that result in at least one direct death.	Uppsala Conflict Data Program	Aggregate the number of conflict events by year and location.
CONFLICT EVENTS PER MILLION CAPITA	Number of conflict events per million people in the population	Uppsala Conflict Data Program	Aggregate the number of conflict events by year and location. Calculate per million capita using World Bank population statistics.
NUMBER OF FATALITIES	Number of battle-related fatalities	Uppsala Conflict Data Program	Aggregate the number of fatalities by year and location.
NUMBER OF FATALITIES PER MILLION CAPITA	Number of battle-related fatalities per 1 million people in the population	Uppsala Conflict Data Program	Aggregate the number of fatalities by year and location. Calculate per million capita using World Bank population statistics.
NUMBER OF NEW CONFLICT DYADS	New conflict dyads that were not present in the previous year.	Uppsala Conflict Data Program	A dyad is a pair of two opposing actors. In a state-based conflict, a dyad is composed of two actors, at least one of which is a government. A dyad in non-state conflict involves two organized armed actors, neither of which is a government. In one-sided conflicts, opposing actors consist of an armed actor attacking the civilian population.
NUMBER OF CONTINUING CONFLICT DYADS	Conflict dyads that were already occurring in the previous year	Uppsala Conflict Data Program	Identified as dyads that were in conflict in the previous year
COMMODITY TERMS-OF-TRADE INDEX	Aggregate income changes from commodity price changes	IMF Research Department Dataset by Gruss and Kebhaj	
GNI INDEX	Captures variation across the income distribution	World Bank	
FOOD INSECURITY	Percentage of population who live in household classified as moderately or severely food insecure	World Bank	
UNEMPLOYMENT RATE	Percent of the labor force which is unemployed.	World Bank	
EXTERNAL DEBT	Total gross external debt, percent of GDP	World Bank	
FISCAL BALANCE	Fiscal Balance, percent of GDP	World Economic Outlook, IMF	

PER CAPITA GDP GROWTH	Percent change, year-on-year	World Bank
CPI INFLATION	Percent change, year-on-year	World Economic Outlook, IMF
CURRENT ACCOUNT BALANCE	Percent of GDP	World Economic Outlook, IMF
FOREIGN RESERVE	Percent of GDP	World Economic Outlook, IMF
EXCHANGE RATE	Local currency per USD	World Economic Outlook, IMF
BROAD MONEY	Percent of GDP	World Economic Outlook, IMF
THE NUMBER OF MAJOR CABINET CHANGES	The number of time in a year that a new premier is named and/or 50% of the cabinet posts are assumed by new ministers.	CNTS
THE NUMBER OF SUCCESSFUL COUPS	Number of coups d'état that occurred in the year of record which resulted in effective authority being exercised by new executive for at least one month.	Polity5
THE NUMBER OF ATTEMPTED COUPS	Number of attempted (but ultimately unsuccessful) coups d'état that occurred in the year of record.	Polity5
THE NUMBER OF PLANNED COUPS	Number of (thwarted) coup plots that were reported by government officials during the year of record.	Polity5
POLITY SCORE	Rank of democracy on a scale from −10 to 10, -10 being extremely autocratic	Polity5

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