

The Role of Ethnic Characteristics in the Effect of Income Shocks on African Conflict*

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Abstract

This paper disentangles the ethnic drivers of the effect of food-related income shocks on African conflict employing geolocalized information. We consider diversity and political ethnic variables and several conflict definitions. We find that differentiating between organized armed-force and non-organized conflict can be more informative than between factor and output conflict. We show evidence that conflict is driven by the opportunity cost and state capacity mechanisms. Furthermore, ethnic cleavages have a large role in the transmission process of income shocks on organized armed-force conflict; whereas their role in non-organized violence is more limited. The sensitivity to ethnic heterogeneity for producer-price and droughts shocks is much larger than for consumer-price changes.

Keywords: conflict, income shocks, food security, Natural Resources.

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1 Introduction

Conflict is among the most robust determinants of low economic growth and high mortality (see, e.g., Collier and Hoeffler, 2004, and Hegre and Sambanis, 2006). It causes unemployment, human capital losses, reductions in income and displacements of the population, and is a leading cause of hunger and general food insecurity in several parts of the world. Therefore, understanding the determinants of conflict is an important objective that investigators have integrated into their research agendas.

Among those determinants, the impact of income on conflict has been widely studied in the literature.¹ Economists and political scientists have also emphasized the role of ethnic cleavages on the generation of violence.² However, much less attention has been devoted to the study of the role of ethnic status in the propagation of income shocks. This is an important gap, because ethnic marginalization and diversity may work as amplifiers of the perceived economic costs and benefits—through for example a sense of grievance—and also as means of filtering areas where governments might be stronger.

We fill this gap focusing on Africa, a very vulnerable part of the world with a relatively low capacity of adaptation. In fact, Africa is the region most affected by conflicts after the Second World War. In early January of 2016, twenty-eight countries and 201 militias-guerrillas were involved in conflicts. More specifically, we answer the following question. How do the diversity and political status of ethnic groups affect the impact of income shocks on conflict? We focus on shocks coming from agriculture, because of its importance in food security, and because the agricultural sector still

¹A common approach has been to employ external shocks captured by fluctuations in commodity prices in order to isolate the effect. At the country level, as Berman and Couttenier (2015) argue, results have been mixed. At the micro-level, on the other hand, the analysis points out a more robust causal relationship. For instance, Dube and Vargas (2013), Fjelde (2015), and Berman et al. (2017) find that agricultural price shocks are negatively correlated with conflict, whereas mineral and oil prices are positively correlated.

²In particular, the role of ethnic fractionalization and ethnic polarization in civil wars have been studied, among others, by Montalvo and Reynal-Querol (2005), Esteban and Ray (2008 and 2011) and Esteban et al. (2012); and the importance of the presence of ethnic groups excluded from political power and ethnic groups that enjoy monopoly over the state have been analyzed, for example, by Cederman et al. (2009) and as Cederman et al. (2011).

employs more than 50% of the total labor force in Sub-Saharan Africa according to ILO (2019). Unlike previous literature, we work with a full grid of African countries divided into sub-national units of 0.5×0.5 degrees latitude and longitude, and consider different measures of ethnic status, namely, spatial polarization and fragmentation, and monopoly and excluded political power. Our approach exploits the arguably exogenous nature at the cell level of variations in income shocks related to international commodity prices and climate conditions.³ To further preserve exogeneity, international prices are weighted at the cell level using information about crop suitability from the FAOs global agroecological zones (GAEZ) as in Berman and Couttenier (2015), and ethnic variables are measured before the start of the sample period.

Nevertheless, even though the effect of this interaction on conflict is still far from being well understood, it has already received some interest. Janus and Riera-Crichton (2015) analyze it, but at the country level, focusing on the onset of conflict instead of its incidence, employing fully aggregated price shocks, and considering only ethnic polarization and fragmentation.⁴ We change the level of observation and consider additional variables. More specifically, our analysis concentrates on a grid-country cell level, combining sub-national, time-invariant maps of crop suitability with information on the movement of global commodity prices, climate conditions, and the four different ethnic-status variables mentioned previously (fragmentation, polarization, excluded groups and monopoly groups). We also make a step forward by introducing the spatial ethnic fractionalization index developed at the cell level by Montalvo and Reynal-Querol (2017) and by adapting the spatial ethnic polarization index to the cell level.

Following the work of McGuirk and Burke (2020) (MB from now on), which also employs geocoded data, we differentiate between two sources of violence—factor conflict and output conflict—and between two types of locations—food-producing cells

³Bazzi and Blattman (2014) argue that several African nations produce a large volume of commodity output, leading to a potential endogeneity problem related to prices. For example, from the supply side, a conflict could lead to reduced production, and hence, increase commodity prices. Even though this can be important at the country level, it is much less so at the cell level.

⁴Albeit not focusing directly on violence, Brückner and Gradstein, (2015) find that, across countries, the marginal effect of oil price changes on political risk increases with ethnic polarization.

and food-consuming cells. Factor conflict is related to large-scale conflict such as battles over the control of territory and production means. Output conflict, in turn, is associated to smaller-scale conflict over the appropriation of surplus. Food prices in food-producing areas are captured through a producer price index, and in food-consuming cells through a consumer price index.

MB estimate a negative impact of food prices on factor conflict in food-producing cells but a positive one in food-consuming cells. As argued by MB, this opposing-effects result is difficult to reconcile with theories that emphasize a one-direction impact such as the state capacity mechanism or the rapacity effect, and provides evidence that the opportunity-costs channel, whose direction can vary depending on whether agents are producers or consumers, is a main source of conflict. They also find that food prices have a positive impact on output conflict in both food-producing and food-consuming areas, which gives also support to the opportunity cost mechanism.⁵

Our findings reinforce the ones obtained by MB but add new aspects and point out an important role of state-capacity (as in Bazzi and Blattman, 2014) and ethnic grievance as determinants of conflict. More specifically, results reproduce the ones obtained by MB for factor and output conflict even when ethnic heterogeneity is considered in the regression. Support for the state capacity channel, on the other hand, comes from the interactions of the agricultural-commodity income shocks with the ethnic diversity variables. The sign of the estimates is always positive across price indices and conflict definitions. That is, the effect of food-price shocks tends to be less negative (or more positive) in more ethnically fractionalized and polarized areas. The lack of opposing effects in food-producing and food-consuming areas on factor conflict makes the result inconsistent with the opportunity cost mechanism. Moreover, the necessary dominance of opportunity costs over the rapacity effect to get the MB results leads us to interpret this finding as pointing to an important role of state capacity, given that more fractionalized or polarized societies signal weaker states suffering more from social tensions (Esteban and Ray, 1999).

⁵See Section 5.5 for a more detailed discussion.

Additionally, our estimates imply that the effect of the interaction between food prices and political ethnic cleavages depends on the type of cell and conflict. In food-producing areas, the impact is negative with battles and with output conflict. In food-consuming areas is, on the other hand, positive with both types of violence as well. These results provide evidence and add a location dimension that supports the argument put forward by Roessler (2011) that excluded ethnic groups can have different effects depending on the type of conflict. He sustains that the gain in government's power (or state capacity) from the exclusion of certain groups may come at the cost of displacing the conflict from politics to society, due to the feeling of grievance induced on the excluded population. It could be argued that this trade-off shows in our estimates: in food-consumption cells, the grievance mechanism dominates, possibly exacerbating the perceived opportunity cost, and due to a larger capacity of excluded-group members to get organized in urban areas. In food-producing cells, on the contrary, the state capacity effect dominates at least in the output conflict regression; otherwise, the sign would have to be positive.

We also disaggregate the measure of output conflict, which is the one considered by MB, in its two components: riots and violence against civilians. Both measures are taken from the Armed Conflict Location and Event Data Project (ACLED). Riots represent violent events where rioters engage in disruptive acts. Violence against civilians, in turn, refers to an organized armed-group inducing violence upon unarmed civilians. Hence, violence against civilians is an intermediate type of conflict that lies between organized armed-group battles—which in the main analysis is taken from the Uppsala Conflict Data Program (UCDP) to proxy factor conflict—and riots. This distinction shows up clearly in our estimations. In particular, the response of violence against civilians to the income shocks shares with factor conflict more than twice the number of coefficient signs and significance than with riots. They share, for example, with one exception, all signs of the coefficients related to both producer and consumer prices, possibly signaling that in both cases conflict is exerted by organized armed groups. However, like riots and unlike factor conflict, violence against civilians

responds positively to consumer prices in urban areas; thus, implying that this type of output conflict has an important urban component. It is also interesting that, unlike violence against civilians, riots respond much less to political ethnic heterogeneity.

Another interesting result from the disaggregation is that the estimated direct effect of food-prices on riots is negative; and although the coefficient is not significant in the main analysis, it becomes significant in some of the robustness tests, and the rest of robustness exercises retain the sign. This negative direct impact of food prices in food-consuming cells suggests an increase in state capacity to control insurgence, because the other two theories (i.e., opportunity cost and surplus predation) are not consistent with the estimated sign, and because the employed consumer price is a country-wide index that should reflect, at least in part, the capacity of local and central governments to raise revenues.

We consider droughts as another proxy for income shocks and estimate its effect jointly with food prices. The reason is that we expect that droughts capture variations in the quantity of local crop production much more closely than international prices. Following Harari and La Ferrara (2018) (HF from now on), we employ the SPEI Global Drought Monitor database that provides estimates of the potential evapotranspiration (PET). Without ethnic variables, the regression gives a positive impact of droughts on conflict. However, this direct effect tends to disappear once the political ethnic variables are included. In general, the qualitative results are the same than for producer prices, although as expected, with the opposite sign—notice that higher food prices and levels of droughts represent positive and negative income shocks, respectively. Our results are consistent with von Uexkull et al. (2016) who find, using georeferenced data, that droughts help sustain civil conflict battles, especially for agriculturally-dependent politically-excluded groups. We confirm their factor-conflict findings with our sample and methodology. In addition, when we look at the determinants of output conflict, the existence of excluded groups turns out insignificant for riots, whereas excluded and monopoly groups raise the marginal effect of droughts on violence against civilians.

The rest of the paper is organized as follows. Section 2 reviews the mechanisms proposed in the literature to justify a possible connection of income shocks and ethnicity with conflict. The data and the econometric methodology are presented in sections 3 and 4, respectively. Section 5 shows our main results. Several robustness checks of the results are conducted in section 6. Section 7 concludes.

2 Theories of Conflict

There exist several competing theories of the effect of income shocks on conflict. All of them are based on the economic insight that rational individuals weight the relative returns, costs, and risk for choosing between to produce or predate (Becker, 1968). One of them is the opportunity cost theory. Models of rebellion suggest that civilian's incentives to rebel rises as economic opportunities and household's real income decline (Grossman, 1991). As MB show, the effect can be positive or negative depending on the type of shock and conflict definition. If labor productivity (e.g., due to proper weather) or producer prices increase, real wages will go up and individuals will have less incentives to join armed groups. This predicted strong inverse relationship between commodity prices and conflict have been used in several papers such as Dal Bò and Dal Bò (2011). However, as MB argue, if consumer prices go up, the real wage of workers will go down, and individuals will have more incentives to fight.

A second theory, based on the state-is-a-prize mechanism suggests that rising prices should increase the risk of insurrection as a mechanism to capture rents or the surplus. This channel is also known as predatory behavior or the rapacity effect. It is especially relevant in the case of mineral and oil and gas that are many times controlled by the state. Nevertheless, as MB show, even though surplus predation can be also present in the case of agricultural income shocks in food-producing areas, its effect is dominated by the opportunity costs mechanism.

A third channel, the state capacity theory (see, e.g., Ross, 2012), states that rising rents provide the state with a stronger capacity to buy off the opposition, counter

insurgents and strengthen control, and therefore, help prevent conflict. In addition, we argue that the state capacity effect does not need to show up only at the country level. All different layers of government—central, regional and municipal—have, many times, transferred revenue-collection and expenditure discretionary powers. Therefore, the capacity to buy off opponents and control rebellion and violence can vary between different cells that experience different shocks. Notice that predictions based on the state capacity mechanism are the opposite to the ones from the state-is-a-prize theory.

Moving now to the impact of ethnic diversity, papers such as Blattman and Miguel (2010) have emphasized ethnic nationalism as a preeminent source of group cohesion. Conflict can be rooted in intense emotional reactions based on deep biological, cultural or psychological nature of ethnic cleavages (Alesina et al., 1999; Alesina and La Ferrara, 2000). Consequently, indexes of fractionalization and polarization as measures of diversity have been used in several empirical studies with the idea that ethnically diverse societies have a higher probability of ethnic conflicts (Collier and Hoeffler, 2004; Fearon and Laitin, 2003; Miguel et al, 2004). Whereas ethnic fractionalization measures the probability that two randomly selected individuals from a given location do not belong to the same ethnic group, the polarization index assesses how far the distribution of the ethnic groups is from a bipolar distribution. Results using fractionalization indexes are surprisingly murky. However, papers like Montalvo and Reynal-Querol (2005) have found polarization as significant to explain the incidence of civil war.

Finally, political sciences have emphasized the potential importance of ethnic political diversity and political marginalization of ethnic groups in the incidence of conflict (Gurr, 1970; Horowitz, 1985; Baseadu and Pierskalla, 2014; Cederman et al., 2009, 2010, 2011; Wimmer et al. 2009). For example, Cederman et al. (2011) find the political inequality affects positively civil wars through grievance-based mechanisms.⁶

Other authors argue that the effect may depend on the type of conflict and political

⁶von Uexkull et al. (2016) point out that politically excluded groups are more likely to be barred from government-sponsored compensation programs or even aid in the case of negative income shocks such as floods and severe droughts.

inequality. Roessler (2011) argues that the exclusion of certain ethnic groups from politics increases the government's power, reducing the risk of a coup, but raises the threat of suffering a future ethnoregional rebellion. Baseadu and Pierskalla (2014), focusing on the interaction with the oil and gas endowment, hypothesize that ethnic exclusion should amplify the risk of conflict, while monopoly power of ethnic groups should cause the opposite effect through an state-capacity channel; they find evidence of the latter effect but not of the former.

In this paper, we consider both excluded groups from the central power and monopoly groups. Excluded groups are defined as relevant ethnic communities that are excluded from government relevant processes, whereas monopoly groups mean that elite members hold monopoly power in the executive that leads to the exclusion of members of other ethnic groups. Both excluded and monopoly ethnic groups can or cannot be at the same cell at a given point in time.⁷ Few papers (e.g., Baseadu and Pierskalla, 2014; and von Uexkull et al., 2016) have used these variables in a grid-panel data context and never in conjunction with other measures of ethnic diversity.

Our key contribution is analyzing whether a plausible effect of ethnicity on conflict can be indirect. That is, we hypothesize that a positive income shock might have a different impact depending on the degree of ethnic diversity and the political status of ethnic groups. For example, a positive agricultural shock can decrease the probability of incidence of battles because of the opportunity cost mechanism. However, if trade among different ethnic groups involves monitoring costs because of the lack of trust between them, this opportunity cost effect will be weaker in cells with a higher degree of ethnic fragmentation. Another example, social tension that leads to weaker governments in more ethnically fractionalized or polarized societies can also cause a lower state capacity to benefit from positive income shocks. A third one, the presence of monopoly groups might exacerbate income inequality within the cell, thus reducing the opportunity cost of poor individuals, or alternatively allow the dominant tribe to more tightly control natural-resource rents that can provide the means to repress

⁷As we can see in Figure A3 in the Appendix, most African countries have excluded ethnic groups, whereas only Angola, Mali, Rwanda, Libya, and Egypt have settled monopolist ethnic ones.

military threats or buy peace. Therefore, the type and degree of ethnic heterogeneity can affect the impact of income shocks on the probability of conflict, but the sign and magnitude of this effect is uncertain; it will depend on how ethnic characteristics alter the state capacity, state-as-a-prize and opportunity costs channels. We want to provide empirical evidence that help advance in this direction.

In sum, the main hypotheses that we want to test are the following. (i) If the opportunity cost channel dominates, positive income shocks reduce armed conflict in food-producing cells, but increase it in food-consuming areas. (ii) If the state-capacity mechanism dominates, positive income shocks decrease conflict in both food-producing and food-consuming locations. (iii) If the rapacity effect predominates, positive income shocks rise conflict in both locations. (iv) Ethnic fractionalization and polarization signal weaker states with less capacity to deliver the possible conflict-reducing effects of positive income shocks. (v) The existence of ethnic groups with monopoly political power signals stronger governments that enjoy stronger state capacity to get advantage of positive income shocks and reduce conflict. (vi) Political marginalization of ethnic groups (either monopoly or excluded) may increase the sense of grievance, thus raising the opportunity costs perceived.

3 Data

Our baseline unit of analysis is a full grid of Africa divided into sub-national units of 0.5 x 0.5 grades latitude and longitude (which corresponds to a cell of roughly 55 km x 55 km at the equator).⁸ This is the result of intersecting a grid of 10,638 cells provided by PRIO-GRID (<http://www.prio.no/Data/PRIO-GRID/>) with a map of the entire Africa and their national political borders provided by the Global Administrative Unit Layers, 2010 release, a project from the United Nations Food and Agricultural Organization (FAO). From the PRIO-GRID database, we download most of our non-conflict variables. The level of aggregation is the cell-year rather than eth-

⁸See Figure A1 in the appendix.

nicity or administrative boundaries, in order to ensure that our unit of observation is not endogenous to conflict events. The sample coverage of the conflict data goes from 1998 to 2013 across forty-nine African countries. In the rest of this section, definitions and sources for the main variables employed in our regressions are given.⁹

3.1 Conflict data

We use two different datasets containing the geo-location of conflict events in Africa: the Armed Conflict Location and Event Dataset or ACLED (Raleigh and Dowd, 2015); and the Uppsala Conflict Data Program Georeferenced Event dataset or UCDP-GED, version 5.0 (Sundberg and Melander, 2013; Croicu and Sundberg, 2016). As will become evident, the use of different datasets allows us to test different competitive theories and the robustness of our results. UCDP defines a conflict event as an incident where armed force was used by an organized actor against another organized actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date.¹⁰ However, UCDP records events related to battles in consecutive years between an organized armed-group dyad only when they have caused at least 25 fatalities in at least one of those consecutive years. In this case, events are included for the entire period, that is, both for the years when such conflict crossed the 25 battle-related deaths threshold and for the years when it did not.

The ACLED dataset, in turn, has a broader perspective and records violent activity both within and outside the context of a civil war, and does not require any battle-related deaths threshold. We will use as dependent variable three different ACLED aggregates: political violence in the form of (i) battles and (ii) violence against civilians; and protest events in the form of (iii) riots.

Given that factor conflict represents large-scale violence related with the perma-

⁹The appendix provides this information in more detail, including several descriptive statistics tables (Tables A1 to A9) organized by variable, country, crop and natural resource, and maps (Figures A2 to A6) that illustrate the different independent variables considered. The explanations for the socioeconomic variables employed in the regressions mainly as controls (i.e., the commodity price indices for oils and gas and mines, and urban area) are also relegated to the appendix.

¹⁰According to UCDP-GED, two-side armed force battles are classified as state-based conflict or non-state conflict, and armed-force violence against civilians as one-sided violence.

ment control of territory, MB argue that the appropriate measure is the UCDP-GED one, because it captures organized armed-force conflict. We later in the paper, for robustness, employ also ACLED battles as an alternative proxy. Output conflict, on the other side, captures conflict generated for the transitory appropriation of surplus. We are then targeting events that are less organized than large-scale battles. Therefore, and again following MB, output conflict will be measured using the ACLED categories riots and violence against civilians.

To create the measure of conflict incidence, we follow Berman et al. (2017) and MB and aggregate to the cell-year, coding with a value of 1 if cell c experienced a conflict during the year, and zero otherwise. In the robustness section, we also employ information on conflict intensity from the same sources.

3.2 Food-price indices

Our identification strategy is based on the use of income shocks related to agricultural commodities that can be considered exogenous at the cell level. We employ three proxies: an agricultural producer price (APP) index, a consumer price (CP) index, and a measure a droughts. The construction of the first two follow MB and employ international prices, and the construction of the third one follows HF and uses weather variables. Droughts are introduced in the regressions jointly with prices, because local climate conditions are more closely related to the quantity of production. Next we explain how we construct them.

To construct the agricultural-production price shocks, we combine time-series data on international commodity prices from the International Monetary Fund (IMF), the International Finance Statistics and the World Bank Global Economic Monitor with cell-specific time-invariant data of crops suitability and potential production from the FAO's Global Agro-Ecological Zones (GAEZ) dataset.¹¹ GAEZ provides crop potential production data constructed using location characteristics such as soil properties

¹¹<http://www.imf.org/external/np/res/commod/index.aspx>, <https://datacatalog.worldbank.org/dataset/global-economic-monitor>, and <http://gaez.fao.org/Main.html>.

and climate conditions (temperature and rainfall), considering the average climate during the baseline period 1961-1990. This information is combined with crops growing requirements to generate a global GIS raster on the potential suitability of a cell for each crop potential production. A cell is considered suitable for crop production if it could achieve at least 40% of its maximum capacity. For each cell, these data can be used to have exogenous weights for agricultural-commodity prices, because the weights are not based on actual levels of production and consumption. In addition, we take the potential capacity in years before the starting date of our database sample. GAEZ produces spatial detail at the 0.0833 decimal degree, which we aggregate to our 0.5 degree cell level.¹²

We cover the following crops: banana, barley, cocoa, coffee, coconut oil, groundnuts, maize, oranges, oil palm, olive oil, rice, soybeans, sugar cane, sunflower, tea, tobacco and wheat. The next step is aggregating the monthly international commodity prices to an annual price series for each commodity, normalized to 1 in year 1990 (Fjelde, 2015; and Bruner and Ciccone, 2010). At each date t , the APP index in cell i at time t (APP_{it}) is the average across the $j = 1, \dots, n$ agricultural commodities of the international crop prices (P_{jt}^A) weighted by the time-invariant potential production shares (w_{ij}) of suitable crops; that is,

$$APP_{it} = \sum_{j=1}^n w_{ij} P_{jt}^A. \quad (1)$$

Our consumer price index is built using country-level data on food consumption patterns from the FAO Balance Sheets following the methodology in MB. The measure of food consumption is the calories per person-day available for human consumption from each primary commodity. Data on food supply are calculated combining statistics of production, imports and stock changes, corrected to eliminate the fed to livestock, the use of seeds, and losses during storage and transportation.¹³ The resulting time-invariant consumption shares represent averages over the period 1990-2013.

¹²In the robustness section, we also try alternative data on crop production from the M3-Crops dataset (Monfreda et al., 2008).

¹³<http://www.fao.org/faostat/en/data/FBSH>.

The reason for taking average shares is minimizing data issues based on gaps in the quality of the consumption series across countries and time.¹⁴

From the consumption side, the aggregation of prices is performed in a similar way as for the APP Index, although using the same time-invariant crop shares for all the cells that belong to the same country. The time variability of our index is given by the vector of commodity prices P_{jt}^A . In particular, the CP index in year t and a cell i that belongs to country c is given by:

$$CP_{ct} = \sum_{j=1}^n \kappa_{jc} P_{jt}^A; \quad (2)$$

where κ_{jc} represents the crop share of calories per day and person in country c ; and crops $j = 1, \dots, n$ are contained in the set of primary commodities consumed for which international prices exist. Most of the important staple food, like maize, sorghum and wheat, are included in the index, along with more processed commodities such as sugar cane, oil olive and palm oil. All together, these products represent a big proportion of the calorie intake consumed by people in Africa.

3.3 Climate variables

We complete agricultural income shocks considering a measure of droughts, given the dependence of agriculture on weather conditions. Following von Uexkull et al. (2016) and HF, we focus on a crop-specific climate shock, the drought SPEI Growing Season, which captures low SPEI episodes occurring during the growing season of the main crop in a given cell.¹⁵ Higher values of this variable means low levels of SPEI in the growing season in consecutive months, that is, a higher incidence of drought. We look at the impact of climatology during the crop growing season because is then

¹⁴Notice as well that, in the case of the consumption shares, endogeneity issues should be much less important due to the relative stability of consumer tastes and the possibility of importing products.

¹⁵SPEI stands for Standardized Precipitation-Evapotranspiration Index. These data are provided by the PRIO-GRID project from the Global Precipitation Climatology Center. The SPEI Global Drought Monitor is based on the Thornthwaite equation for estimating potential evapotranspiration (PET). According to HF, PET depends on several factors, including most notably temperature but also rainfall, sunshine exposure, latitude and wind speed. Variable definition from PRIO-GRID codebook: <https://grid.prio.org//codebook>.

when crops are more sensitive to adverse climate conditions, and hence, affect more intensively farms' future agricultural income and food availability. Robustness checks are conducted also for the climate variable adding the annual average SPEI.

3.4 Spatial ethnic diversity and political status

Our next task is describing the construction of the four different ethnic diversity measures: ethnolinguistic fractionalization, polarization, monopoly groups, and excluded groups. Their values in the regressions are maintained constant at their 1997 level, that is, one year before the starting point of the conflict data to mitigate possible endogeneity issues. We follow Montalvo and Reynal-Querol (2017) to compute the spatial ethnolinguistic fractionalization index (EF). Firstly, we use Vogt et al. (2015) that codes the settlement patterns of politically relevant ethnic groups in independent states based on the group list in the Geo-referencing Ethnic Power Relation (GeoEPR) 2014 database. Matching our grid structure and the regional and statewide ethnic groups patterns for the year 1997, we estimate the share of the territory settled by a specific ethnic group. In particular, the index in cell i takes the form:

$$EF_i = 1 - \sum_{j=1}^N \pi_j^2 = \sum_{j=1}^N \pi_j(1 - \pi_j); \quad (3)$$

where π is the proportion of area that belongs to ethnic group j (for $j = 1, \dots, N$).¹⁶

The calculation of the spatial ethnolinguistic polarization index (EP), on the other side, follows Montalvo and Reynal-Querol (2005). In particular,

$$EP_i = 4 \sum_{j=1}^N \pi_j^2(1 - \pi_j). \quad (4)$$

These two ethnic diversity measures are bounded below by zero and above by one, but differ in a key aspect: while fractionalization increases monotonically if existing ethnic groups are divided into smaller groups, polarization is maximized when there are precisely just two, equally large groups.

¹⁶Because the sum of the shares of the territory that are occupied by each ethnic group can sum to more than one, they are re-scaled so that the sum equals one.

Moving now to the spatial political ethnic diversity proxies, we control for both excluded and monopoly groups reflecting these political statuses. Excluded groups is based on the numbers directly supply by PRIO-GRID 2.0. Specifically, the excluded-group variable counts the number of excluded groups (discriminated or powerless) in a particular cell. The monopoly group proxy feeds from the Ethnic Power Relations (EPR) Dataset Core 2014. It is a dummy variable coded as 1 if there is at least a monopoly group in cell i , and as 0 otherwise. To create this variable, we use the groups identifiers provided by Cederman et al. (2011) and match our grid structure with the information on the political status of monopoly ethnic groups from the EPR 2014 data.¹⁷

4 Empirical Methodology

As we mentioned previously, the aim of the paper is to study the sensitivity of the effect of agricultural-commodity income shocks on the likelihood of conflict to ethnic diversity and political status. In order to achieve this goal, we build on MB and propose a fixed-effect framework that takes the form:

$$Conflict_{ict} = D_i + T_{ct} + \sum_{k=0}^2 ACIP_{ict-k} \beta_{t-k} + \sum_{j \in J} \sum_{k=0}^2 (EC_{ic}^j * ACIP_{ict-k}) \gamma_{t-k}^j + \sum_{k=0}^2 Z_{ict-k} \delta_{t-k} + \varepsilon_{ict}. \quad (5)$$

This general estimation equation for conflict serves to explain all the different versions employed in our regression. In the main estimations, $Conflict_{ict}$ is a binary variable that takes on one if there have been conflict incidents in cell i , at country c and time period t and zero otherwise.¹⁸ When the outcome variable wants to capture factor

¹⁷These databases also provide information about ethnic groups that are part of power-sharing arrangements and groups that are politically dominant. We have chosen the two extremes, like Basedau and Pierskalla (2014) for example, because they seem more appropriate to capture the impact of grievance and government power.

¹⁸According to Beck and Katz (2011), estimated coefficients can be biased when using incidence if lags of the dependent variable are not included as additional aggressors due the persistence of conflict. This problem is particularly important at the country level. Which has led some papers to explore the robustness of their results to using conflict onset and conflict offset as dependent variables, because they do not suffer from this potential problem. At a cell level, however, conflicts are less persistent. As

conflict, it will represent armed-force incidence from the UCDP-GED dataset in the benchmark estimation, and later for robustness we will use battles from ACLED and conflict intensity from UCDP-GED.¹⁹ If, on the other hand, the dependent variable proxies output conflict, it will consist of the category social unrest from ACLED or its components riots and violence against civilians.

The variable D_i is a cell fixed-effect dummy. The term T_{ct} controls for time effects and can take two different formats. When the country-wide CP index is not included in the regression, $T_{c,t}$ corresponds to a set of country-year fixed effect dummies. However, when the three income-shock proxies are present, the country-year dummies would subsume the effect of the CP index, and consequently, to avoid this problem, T_{ct} is formed by two components—an year fixed effect dummy and a country-specific time trend. Because shock variables could be correlated with other cell-specific characteristics such as economic activity, our benchmark specification incorporates the matrix Z_{ict} , a set of control variables that include the oil-and-gas price index and the mineral-commodity price index described in the previous subsection. Later, this control matrix is expanded to consider the fraction of urban area and its interaction with the CP index.²⁰

The variable ε_{ict} is the disturbance term. Because the shocks and the conflict measures can be clustered in time and space, we allow for serial and spacial correlation applying the method developed by Conley (1999) and Hsiang et al. (2011).²¹ More specifically, the coefficients' standard errors are estimated employing a spatial heteroskedasticity and autocorrelation consistent (HAC) covariance matrix that allows for both location-specific 5-year-lag serial correlation and cross-sectional spatial

Berman and Couttenier (2015) for example argue, using cell-level observations, about 75% of conflict events do not last more than 2 years. We therefore decide not to use onset and ending as dependent variables.

¹⁹Conflict intensity is not a binary variable. It gives the number of events in a given year and cell.

²⁰Other standard controls employed by the literature include geographic characteristics, population size and satellite night lights (see, e.g., Alesina et al., 2016). We do not use them as regressors because the geographic characteristics are time invariant, and therefore, their effect is subsumed in the cell dummy, and population and night lights suffer from strong endogeneity concerns with conflict and the latter can also possibly generate a post-treatment bias.

²¹We use the STATA routine based on Hsiang et al. (2011) and its extension to multidimensional fixed effects by Fetzer (reg2hdfespatial.ado).

correlation in a radius of 110 km. Following Berman et al. (2017), later we test the robustness of our results to spatial kernels from 55 to 1000 km, and serial correlations from 2 lags to assuming a temporal decay for the Newey-West/Bartlett kernel so slow that makes the serial correlation vanish in an infinite amount of (i.e. 100,000) years.

Moving now to our main variables of interest. The agricultural-commodity income proxy matrix $ACIP_{ict}$ can include, depending on the version, the APP index, the SPEI index for droughts, and the CP index. Because local weather events in producer countries could generate a correlation between international prices and the error term if those events are linked to global weather patterns such as the El Niño-Southern Oscillation (see, e.g., MB) the climate variable is always present in our regressions. These price and weather variables are incorporated over three consecutive years—the current period and two lags—to take into account possible effects of past shocks. We do the same for the control set Z_{ict} . Later in the paper we check results considering up to five lags. All price indices are introduced in the regression taking logs as in Berman et al. (2017).

The set J provides indices for each of the four ethnic characteristics considered in the paper. In particular, the different ethnic variables EC_{ic}^j are the following: the excluded group, the monopoly group dummy, ethnolinguistic fractionalization, and ethnic polarization. Notice that in the regression the ethnic variables are time invariant—we assign pre-sample values of the ethnic characteristic to all periods in order to mitigate endogeneity concerns. Because of this, we exclusively focus on the interactions with the income shock variables, and do not include in the estimation model their independent effects, as they are captured by the cell fixed-effect dummies.

Finally, the vectors β_t , γ_t^j and δ_t are composed of the coefficients that we want to estimate. The β s capture the direct impact on conflict of the exogenous income shocks, and the γ s provide the effect of their interactions with the ethnic variables. Equation (7) is estimated as a fixed effect linear probability model (LPM). We prefer this estimator to alternative frameworks for binary dependent variables such as the probit or the logit because it allows for a clear interpretation of the coefficients. The

estimated coefficient measures the change in the probability of conflict incidence if, *ceteris paribus*, the explanatory variable of interest increases in one unit. Nevertheless, in the robustness section, we also perform estimation employing a conditional fixed-effect logit.

5 Results

In all cases, the conflict variable is a binary measure of incidence. The tables (all of them located in the appendix) report, for each independent variable, the sum of the contemporaneous and lagged effects and the corresponding Conley (1999) standard error.²² First, we describe the findings when the dependent variable is factor conflict. Second, we search for the determinants of output conflict measured as a compound of riots and violence against civilians. Third, we analyze the determinants of each of the two components of output conflict separately. Fourth, we test for the role of urban area on the effect of consumer prices. Finally, we interpret the results in light of the existing theories.

The structure of Tables A10 to A13 is the same. Column (1) provides results when only the APP and the drought indices are considered as variables of interest. Column (2) shows the results when the CP index is added to the other two agricultural-commodity income-shock indices. Columns (3) to (12) search for the sensitivity of the income-shock effects to ethnic heterogeneity. Ethnolinguistic fractionalization and ethnic polarization are never jointly considered in the regressions because of the severe multicollinearity problem that this brings—the correlation between the two variables in our sample is 0.98. The most important columns are the last four, which consider how estimated coefficients and consistent standard errors in columns (1) and (2) change when the political and diversity ethnic measures are included together.

²²Reporting the sum is desirable at least for two reasons. To start with, the sum gives a more direct idea of the total effect of the shock. In addition, if the regressor is highly correlated over time or space, the sum is estimated with much more precision (see, e.g., MB). In the appendix, Figures A7 to A12 present the results for the different lags of interaction variables that are significant in the full regressions—columns (10) and (12).

Looking at the tables, it is immediate that results with fractionalization are almost identical to the ones with polarization and quantitatively very similar.²³ This high similarity occurs in all regressions estimated in this paper, due to the high correlation between the two ethnic diversity variables in our sample. The main difference between including one ethnic diversity variable or the other is just the precision of the estimated coefficients. In general, the coefficients of variables that contain polarization show significantly narrower confident intervals that the corresponding ones that include fractionalization. Given this, we will comment exclusively on the results obtained with polarization.

Moving now to the figures, Figures 1 to 4 share the same structure as well. Each figure consists of nine charts split in three columns of three charts. They are constructed employing the estimated coefficients and standard errors provided by our preferred regression, column (12) in the tables, which represents the most complete model with polarization.²⁴ The goal is to show the sensitivity of the income-shock effects to the different ethnic measures separately. The first column of charts provides the estimated marginal effect on conflict and its 90% confidence interval of a one unit increase in the log of the APP index, as a function of the number of excluded groups (first row), whether there is or not a monopoly group (second row) and the degree of polarization (third row), assuming that the other ethnic characteristics take on zero. The second and third columns of charts give the same information but focusing on the drought index and the log of the CP index, respectively.

5.1 Factor conflict

We start by presenting in Table A10 and Figure 1 results when in regression (7) the dependent variable signals whether there have been large-scale organized-armed-group

²³Previous literature, however, has found different results. For example, at the country level, Janus and Riera-Crichton (2015) and Gimenez-Gomez and Zergawu (2018) find that adverse changes in prices increase the probability of political instability in countries with higher level of ethnic polarization, whereas ethnic fractionalization has a mixed impact. In contrast, we find that both variables have a well-defined effect for all definitions of violence.

²⁴The model associated to column (11) gives very similar results.

conflict events according to UCDP-GED. We can see that without ethnic variables columns (1) and (2) in Table A10 reproduce the qualitative findings obtained by MB and HF. As in MB, the coefficient for the APP index is negative and significant with both time-effect formats, and the CP index is positive and significant. Additionally, as in HF, the coefficient for droughts is positive and significant in both columns.²⁵

Feeding on the results in column (12) of Table A10, Figure 1 displays the sensitivity of the income-shock effects to ethnic cleavages. Notice that the estimated values and confidence intervals when the ethnic variables take on zero give the direct impact of the income shocks and its significance. We can see that the APP and CP indices show significant direct effects, the former with a negative value and the latter with a positive coefficient, as in MB. The largest amplification effects are associated to the presence of excluded groups, and its interaction is significant with APP and with droughts (see Table A10).²⁶ For example, compared to cells without them, locations with two (five) excluded groups multiply the negative effect of APP shocks on the risk of factor conflict by 4.8 (10.6) times. This number for drought shocks is 20.0 (48.5) times.

The second row of charts imply that the presence of monopoly groups is important for the transmission of a producer price shock. In particular, its negative impact is 7.4 times larger when these groups exist. The existence of monopoly groups also multiply the positive effect of the CP shocks by 1.7 times. This difference in the case of consumer prices and droughts is not significant.

The role of polarization (third row) is the weakest. In Figure 1, differences across ethnic diversity levels in the marginal impact of the shocks are only significant in the case of APP. In particular, a sufficiently large degree of ethnic polarization makes the estimated effect of changes in producer prices become positive. Looking now at Table

²⁵In HF, the estimated coefficient is negative because they use a reversed scale. That is, in our regressions, SPEI growing season is introduced such that higher values of the variable imply a higher incidence of droughts; whereas in their work, they imply lower drought incidence.

²⁶A sufficient condition for the significance of the difference between the marginal effect when the ethnic variable takes on zero and when it takes on positive values is that the corresponding confidence intervals do not overlap over the range shown in the vertical axis. However, this is not a necessary condition, because the two marginal effects are perfectly positively correlated.

A10, it is interesting to notice as well that the interaction between consumer prices and polarization is positive and close to showing significance; later when we introduce urban area, it will do so.

To further quantify the results, we again concentrate on column (12) of Table A10 and measure, following a standard procedure in the literature, what we call from now on the “implied total impact”. More specifically, we look at the effect, in percentage points, of a one standard deviation change in an income proxy on the probability of conflict when all the ethnic variables take on their average value.²⁷ The impact measure, therefore, tells us the estimated change in the probability of conflict incidence in the average cell.

The implied total impact of the APP index equals -5.33. That is, a one standard deviation decrease in the log of the APP index raises the probability of armed conflict in the average cell by 5.33 percentage points; with the direct effect and the interaction with excluded groups contributing each of them about half of the impact. The interaction of producer prices with monopoly groups also decreases the probability of conflict by 1.06 percentage points, but this effect is almost exactly offset by ethnic diversity. The implied total impact of droughts is 0.23, due almost fully to the significant increase in the risk of conflict caused in cells with excluded groups. Finally, the implied total impact of consumer prices is 1.36. Hence, the strongest estimated effect is the one of producer prices and the smallest the one of droughts.

5.2 Output conflict

Next, we look at the determinants of output conflict, measured as events where riots and violence against civilians occur. Table A11 and Figure 2 present our findings with the ACLED incidence as the dependent variable. In columns (1) and (2) of Table A11, all the estimated coefficients are positive and, with the exception of the

²⁷The impact is computed as a marginal effect as follows. For a single independent variable, it is given by its standard deviation times the estimated coefficient multiplied by 100. For interaction terms $X*Y$, where X is the variable of interest, the marginal effect follows the same procedure described previously but multiplying also by the variable Y 's mean. Finally, the implied total impact is the sum of the marginal effects across all the terms that contain the variable of interest.

CP index, strongly statistically significant. These results are consistent with MB and HF.²⁸

Figure 2 tells us that, compared to the regressions without ethnic variables, the direct effects maintain the signs, but only the drought index remains significant. It also conveys the message that, for output conflict, the existence of monopoly ethnic groups is the most important amplifier. Monopoly groups change the sign of the effect of an APP shock to negative and increase its impact by 32.0 times in absolute value. They also multiply the effect of consumer prices by 4.0. The difference in the case of droughts is not significant.

Excluded groups are, in turn, only significant for changes in consumer prices (see Table A11). The estimated marginal effect of the CP index experiences a 2-fold (3.5-fold) increase when the number of excluded groups goes up from zero to two (five). Finally, the sensitivity to polarization is only significant for the effect of producer prices. A fully polarized society experiences a positive effect of producer prices on output conflict that is 6.8 times larger than a society with zero polarization.

Quantitatively, employing the estimates in column (12) of Table A11, the implied total impact of a one-standard-deviation increase in the APP index is -0.41 percentage points, much lower than in the case of factor conflict. The implied total impact of droughts equals 0.33 percentage points. Lastly, the total impact of the CP index on output conflict is 1.38.

Our estimates imply as well that the importance of ethnic cleavages in the risk of conflict depends on the type of shock and conflict definition. If we look at the sum of the absolute values of the different components of the implied total impact, the APP-index direct effect amounts to 36.34% of the total for factor conflict and 17.30% in the output conflict case. These figures for droughts are 16.45% and 50.56%, and for the CP index, 94.52% and 67.70%. Hence, looking at the sensitivity to ethnic heterogeneity, it

²⁸MB does not find significant the CP index, neither in the factor conflict regression, nor in the output conflict specification when year fixed effects are included, which in our case are always controlled for. They argue that consumer prices vary more over time than across space, and therefore, the inclusion of year fixed effects absorb a big part of the impact.

is much higher for producer prices and droughts than consumer prices, and droughts provides the largest one in factor conflict, whereas producer prices gives the biggest in output conflict.

5.3 Riots versus violence against civilians

We now disaggregate output conflict in its two components. This is important because the ACLED category “violence against civilians” could be considered an intermediate case of violence. Unlike the one-sided violence recorded in UCDP, ACLED considers all events, independently of the number of casualties; and then, it can be considered a small-scale conflict measure. However, as the one-sided violence recorded in UCDP, ACLED violence against civilians represents violence carried out by organized armed groups. As will become evident in a moment, both subcategories respond differently to income shocks and ethnic characteristics. The results with riots are closer to the original MB’s output conflict findings, whereas the determinants of violence against civilians are closer to the ones of factor conflict.

Tables A12 and A13 and Figures 3 and 4 present the estimation results based on this disaggregation. Looking at the findings for riots in Figure 3 and Table A12, the direct effects of the APP index and droughts are positive and significant. Conversely, the one of the CP index is not. The effect of excluded groups is statistically non-important; whereas the one of monopoly groups matters for the impact of APP and CP shocks, although not for droughts. In particular, monopoly groups flip the sign of the effect of changes in both price indices. In turn, the significant interactions of polarization with droughts and the CP index tend to offset their direct effects.

Column (12) of Table A12 implies a total impact of a one-standard-deviation rise in the APP index on the likelihood of riots of +5.11 percentage points; this is a consequence of its direct effect (6.86 percentage points) and the interaction with monopoly (-0.61). In turn, the implied total impact of droughts is 0.15 percentage points, and only its direct contribution and the one of its interaction with polarization

are significant and equal to 0.28 and -0.12, respectively. Finally, the total impact of the CP index is -0.30 percentage points; as a consequence mainly of its direct effect, partially offset by the incidence of the ethnic variables. The largest impact is then again the one of producer prices.

In Figure 4 and Table A13, we can see that, unlike in the case of riots, the direct effect of producer prices on violence against civilians is negative, the one of consumer prices is positive, and the one of droughts is insignificant. Also unlike in the case of riots, excluded groups play an important role as transmission channel for droughts and CP shocks. For example, the presence of two (five) excluded groups multiplies the effect of the droughts and CP indices on violence by -3.6 and 2.0 (-10.6 and 3.5), respectively. Monopoly groups also play a larger role, and become important for the three types of income shocks. When monopoly ethnic groups are present, the effects of APP, droughts and CP on violence against civilians are 11.1, -13.6 and 3.5 times larger, respectively. Contrary to the case of riots, ethnic polarization in the case of violence only matters for APP shocks, making their effect go from negative to positive if ethnic diversity is sufficiently large.

In terms of the implied total impact, column (12) of Table A13 delivers that the one of the APP index represents a decrease in the risk of violence of 3.12 percentage points: its direct effect contributes -2.87; and there are opposite indirect effects of politically-marginalized groups and ethnically diverse societies. The implied total impact of droughts and its components are the smallest among the three types of shocks and are always less than or equal to 0.20 percentage points. The total impact of a one-standard-deviation increase in consumer prices, in turn, equals 1.62 percentage points, with a direct effect of 1.20, and an amplifying effect of political ethnic variables of 0.47.

Comparing the importance of ethnic cleavages in riots and in violence against civilians, the direct effect in the case of riots represents 79.67%, 68.89% and 71.13% of the sum of all (direct and interaction) effects in absolute values for the APP index, droughts and the CP index, respectively. Thus meaning that ethnic differences are

relatively less important. However, in the case of violence against civilians, the corresponding direct effects are 38.11%, 31.18% and 69.80% of the impact sum; that is, for producer-price and drought shocks, the sensitivity to ethnic cleavages is key. This, again, makes violence against civilians closer to factor conflict than to riots.

5.4 Consumer prices and urban area

We have not found MB's positive direct effect on riots of food-price increases in food-consuming cells. However, consumer prices for food should be relatively more important in urban areas, where the weight of the agricultural sector on total employment is significantly lower. Consequently, the last set of results that we present in this section correspond to the scenario in which the fraction of urban area and its interaction with the CP index are included in the estimation model.

Table A14 and Figure 5 display the findings. Table A14 has a different format than the previous ones. Columns (1) to (4), (5) to (8), and (9) to (12) give results when the dependent variable is UC DP conflicts, riots and violence against civilians, respectively. Figure 5, in turn, shows the marginal effect of the three shocks for different fractions of urban area in the cell. We deduce from the figure that the sensitivity of the effect of CP shocks on riots (second chart) and violence against civilians (third chart) is positive and strongly significant, whereas the one of factor conflict (first chart) is insignificant. Thus confirming that, in urban areas, consumer prices do increase the probability of output conflict as predicted by the opportunity cost mechanism.²⁹ In addition, looking at Table A14, the urban area fraction shows up as negative and significant for both output conflict variables.

Regarding the other regressors, most qualitative effects of the income shocks and the ethnic variables remain more or less unchanged for all outcome variables. The only remarkable changes are the following: in the factor conflict regression, the interaction of consumer prices and polarization becomes positive and significant; and in the case of riots, political ethnic variables lose power and only the interaction of the CP index

²⁹This is consistent with the work of Hendrix and Haggard (2015) for example.

with monopoly groups remains significant.

In terms of the magnitudes, the implied total impacts only experience a significant change in the case of both price indices for riots and the APP index for violence against civilians. Nevertheless, for the APP index in violence against civilians this sensitivity still explains 55% of the total.

5.5 Theories behind the results

Our results in the main analysis sections reinforce the economic mechanisms emphasized by MB, but at the same time, add new aspects and point out a greater role of grievance and state capacity as determinants of conflict. One difference is that we find that the ACLED category violence against civilians has more determinants in common with factor conflict than with riots. Therefore, differentiating between organized and non-organized conflict can be more informative than between factor and output conflict.

To start with, producer prices in our sample have a negative effect on conflict that involves any type of organized armed groups, namely, the UCDP evens and the ACLED violence against civilians. This is also found by MB but only with the UCDP data. Nonetheless, the interpretation suggested by MB is still valid. That is, the result suggests an important role of the opportunity cost of becoming a soldier: in food-producing areas, increases in food prices raise the real value of salaries and generate opportunity-cost incentives for workers not to join armies engaged in organized violence. We also find, as MB, a positive effect of consumer-price shocks on organized-group conflict (but not on riots). Therefore, the decrease in real wages caused by food-prices in food-consuming areas leads more workers to become organized fighters through an opportunity cost mechanism.

Droughts play a weaker role with all conflict definitions. We have defended that international prices and local climate conditions should proxy different aspects of agricultural income. Nevertheless, it cannot be fully discarded that prices at a certain

extent capture the effect of droughts. Focusing on the direct effect, droughts during the growing season have a clear positive impact on riots. This effect has been already found by previous literature, like Almer et al. (2017). An opportunity costs mechanism is again more likely behind this result. As water, an important input of production, becomes scarcer, the productivity of land falls and the incentives to riot in favor of the appropriation of surplus increase.

The existence of politically excluded and monopoly groups reinforces also this channel for organized armed-group conflict and, unlike in Baseadu and Pierskalla (2014), amplify the risk of conflict in the same direction. More specifically, excluded and monopoly groups push the effect of an increase in the APP index or a decline in droughts towards a negative sign, and the one of a rise in consumer prices towards a positive sign. Given that increases in producer prices and less intense droughts can be seen both as positive income shocks that lead to higher real wages of farmers, the direction of their effect can be interpreted using the same theories. In particular, these results can be interpreted as an outcome of opportunity costs.³⁰ A lower degree of ethnic confrontation in government due to the exclusion or monopoly of certain groups can increase the sense of grievance, and therefore, the politically-harmed groups can become more sensitive to variations in the opportunity costs described in the previous paragraph that make food prices affect organized violence in opposite directions in food-producing and food-consuming areas. Notice that these opposing effects can be generated neither by the rapacity effect theory nor by the state capacity channel.

By the same token, the stronger positive response of organized armed-force conflict to both producer-price and consumer-price shocks that we find in more polarized societies when urban area is considered is not consistent with the opportunity cost effect. It cannot be either a consequence of a stronger predatory behavior in those areas, since as MB argues the opportunity cost effect dominates rapacity in the response of factor conflict to producer-price shocks. Hence, this positive response of conflict must be a consequence of state capacity; that is, a larger degree of ethnic diversity signals

³⁰The same effect is found by von Uexkull et al. (2016) for droughts in areas with excluded groups.

weaker states suffering more from social tensions (Esteban and Ray, 1999) that are able to benefit less from the violence-reducing opportunities offered by positive income shocks.

The generation of riots is also affected by the opportunity cost and state capacity mechanisms but not in same way than factor conflict. The role of producer prices is now the opposite than in organized violence, it is positive. As MB shows, this can be caused by a combination of the opportunity-cost and predatory effects. To fully understand this, let us briefly explain how the MB theoretical model works. Output conflict arises if the individual reallocates effort from the production activity to the appropriation of surplus. Prices in their model can be associated to three types of goods: agricultural-commodities produced in the cell but exported to other cells; food-items produced and consumed within the same cell; and crops imported from other cells for consumption. The first two affect the producer-price index and the last two the consumer-price index. Consequently, when the cell's producer price goes up, this increase is larger than the rise in the cell's consumer price, because some commodities are imported. Therefore, the real (consumer-price-deflated) value of the cell's production rises if these food-items are exported, but the real wage falls if the produced food is for within-cell consumption. The former triggers a rapacity effect, whereas the latter describes an opportunity cost channel. Both of these effects make output conflict increase, that is, generate additional allocation of effort to steal goods.

Next, let us examine the impact of the CP index on riots. As discussed previously, the opportunity cost channel can explain its positive impact in urban areas and cells with monopoly groups, and the state capacity effect can be behind the estimated positive effect in more polarized areas.³¹ We have also shown that, unlike in the case of organized armed-force conflict, political ethnic variables play a reduced role in the generation of riots. The lack of significance of political ethnic variables is especially

³¹There is, though, a possible alternative interpretation for the last result. The moderation of the state-capacity effect by polarization/fractionalization might be stronger in food-producing cells, and therefore, the positive sign in food-consuming areas can be still mainly capturing an opportunity cost mechanism. Notice that this alternative argument, although possible for the CP index, cannot be applied to food-producing cells, because there the negative sign is only compatible with the state-capacity channel.

evident when urban area is incorporated to the riots regression. Which suggests that the recruitment activity of organized violent groups is more successful if there is a sense of grievance in some ethnic groups, whereas this is much less important to become a temporary rioter.

Another interesting result is that the sign of the CP index is negative. Although the CP index coefficient is not always significant in the benchmark regressions, it shows again strong power and the same negative sign to explain riots in some of the robustness checks that we present next. This can be explained neither by the opportunity cost effect nor by surplus predation. Instead, it suggests an increase in state capacity to control insurgence.

6 Robustness Analysis

We perform nine different robustness checks of our main results, which are contained in the appendix. From them, we deduce that the findings obtained in Section 5 are generally robust. The main exceptions are when we use actual crop yields to construct the shares and when the size of our cells increases to 220 km x 220 km. However, these two scenarios are less suitable for our purposes than our main specifications (see explanations in the appendix). Overall, 72% of the estimated coefficients obtained with the full regressions in the robustness section agree with the main analysis in terms of either non-significance or sign and significance.

7 Conclusions

This paper has studied how agricultural-commodity shocks across ethnically-diverse cells affect several definitions of conflict outcomes. To that end, information on the location of conflict and social unrest for the entire African continent has been used, employing a fine-grained panel data for the period 1998-2013 with a spatial resolution of 0.5 x 0.5 degree latitude and longitude (equivalent to 55 km x 55 km at the equator).

Our main contribution has been to disentangle whether ethnic political status and diversity serve as amplifying mechanisms of the effect of income shocks on conflict.

We have obtained multiple interesting results. First, violence against civilians clearly arises as an intermediate type of conflict that lies between battles and riots. Furthermore, we have shown that differentiating between organized armed-force conflict (battles and violence against civilians) and non-organized violence (riots) is more informative about the determinants of conflict than between large-scale factor conflict and low-scale output conflict (violence against civilians and riots). Nevertheless, differentiating the three categories seems to be preferable.

Second, our results emphasize an important role of opportunity costs in the decision of getting involved in any type of violence and that the existence of excluded and monopoly ethnic groups can amplify the perception of those costs. This shows up both in the negative impact on organized armed-force conflict of the opportunity cost channel in food-producing cells, and its positive impact on output conflict in food-consuming areas.

Third, we also show evidence of the importance of state capacity. This is suggested by our finding that more ethnically polarized or fractionalized societies tend to push the effect on conflict of an increase in the APP and CP indices or a decline in droughts towards a positive sign. The reason is that a larger degree of ethnic diversity signals weaker governments that are able to benefit less from the rebellion-repressing capability offered by positive income shocks. The state capacity channel seems to be stronger in the case of riots. In particular, besides its indirect effect through ethnic diversity, consumer food-prices in our sample also have a negative direct impact on riots, which is again only consistent with an important role of state capacity.

Fourth, the consumer-price impact and the category riots respond to a much lower extent to ethnic cleavages. In particular, the weight of ethnic variables in the total effect of the CP index is always below 32%. Whereas for the producer-price index and droughts, the average contribution of ethnic heterogeneity is 73%, 28% and 68% for

battles, riots and violence against civilians, respectively. As a possible explanation of the low contribution of political ethnic variables in the generation of riots, we have suggested that a sense of grievance in some ethnic groups is much less important to become a temporary rioter than permanent soldiers.

From a policy side, the results could be interpreted as demanding an agricultural price-stabilization mechanism, because price fluctuations affect conflict. However, as we have also shown, whether this is the case and the right type of policy should depend on the nature of ethnic diversity and violence. This important issue clearly deserves further investigation. There are also several factors that can be behind the income-shock indirect-effect channeled through ethnic cleavages, and some of them have been pointed out in the text: trust, monitoring costs, labor market frictions, and quality of institutions. Incorporating these aspects into the analysis can represent as well a promising source of future research.

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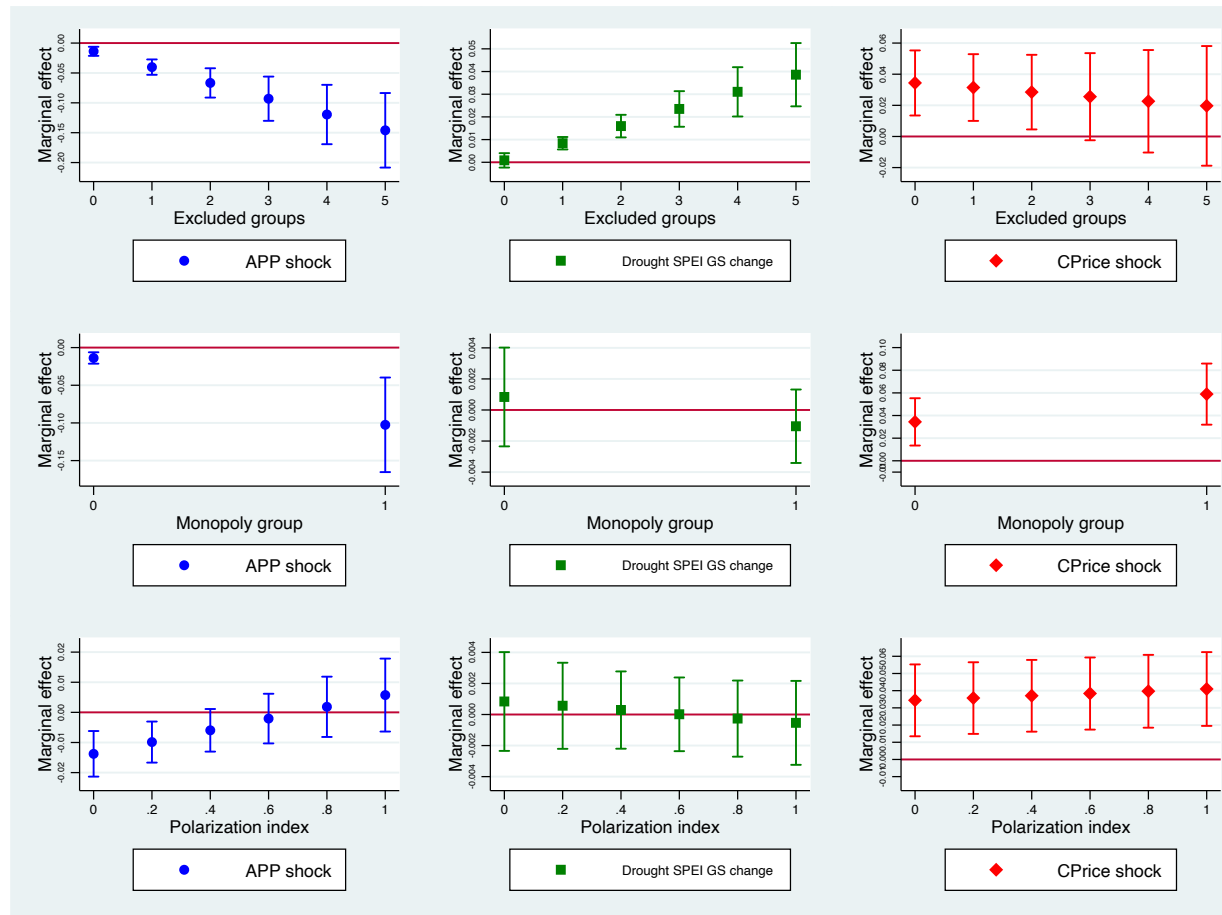


Figure 1: Factor conflict - UCDP incidence. Note: The charts give the estimated marginal effect of each income shock and their 90% confidence intervals for each value of the corresponding ethnic variable.

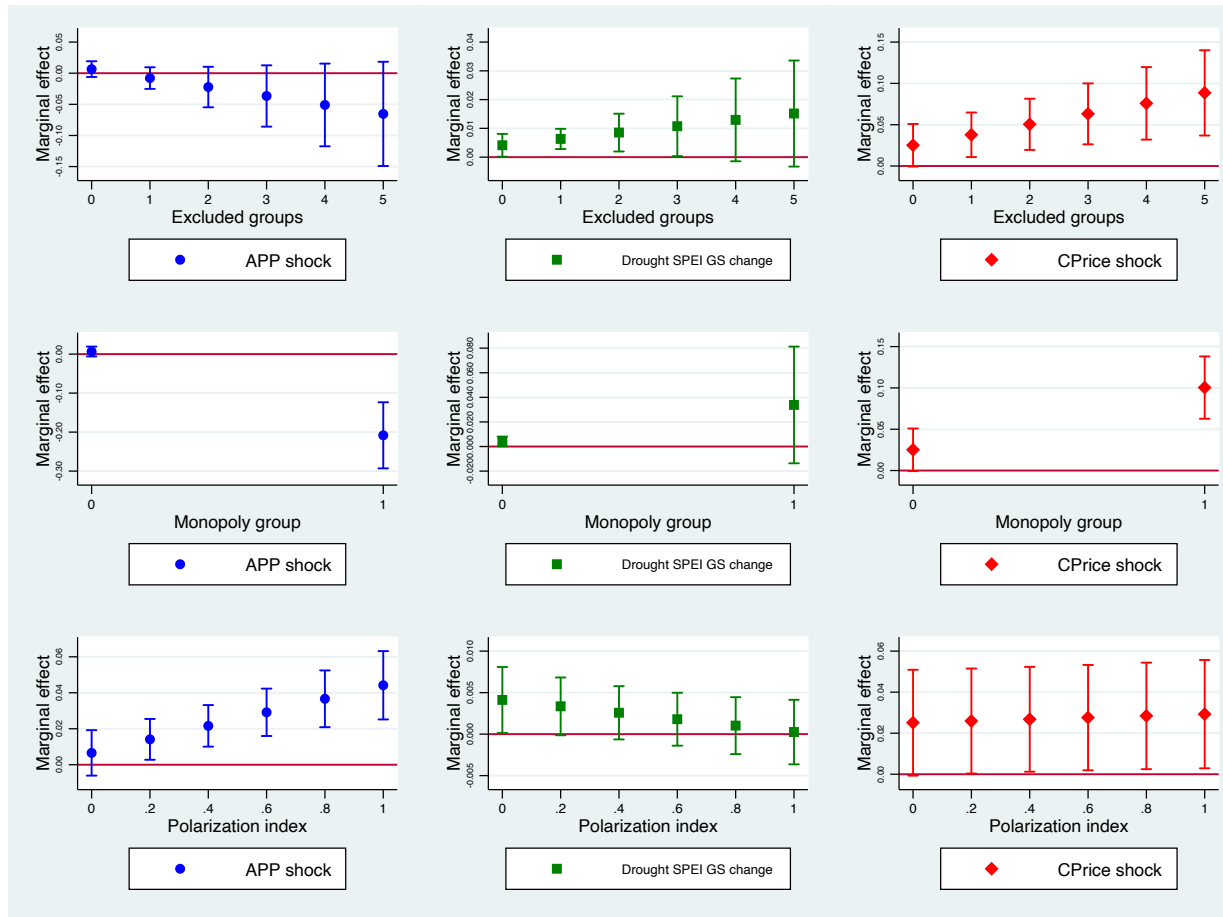


Figure 2: Output conflict - ACLED riots and violence. Note: The charts give the estimated marginal effect of each income shock and their 90% confidence intervals for each value of the corresponding ethnic variable.

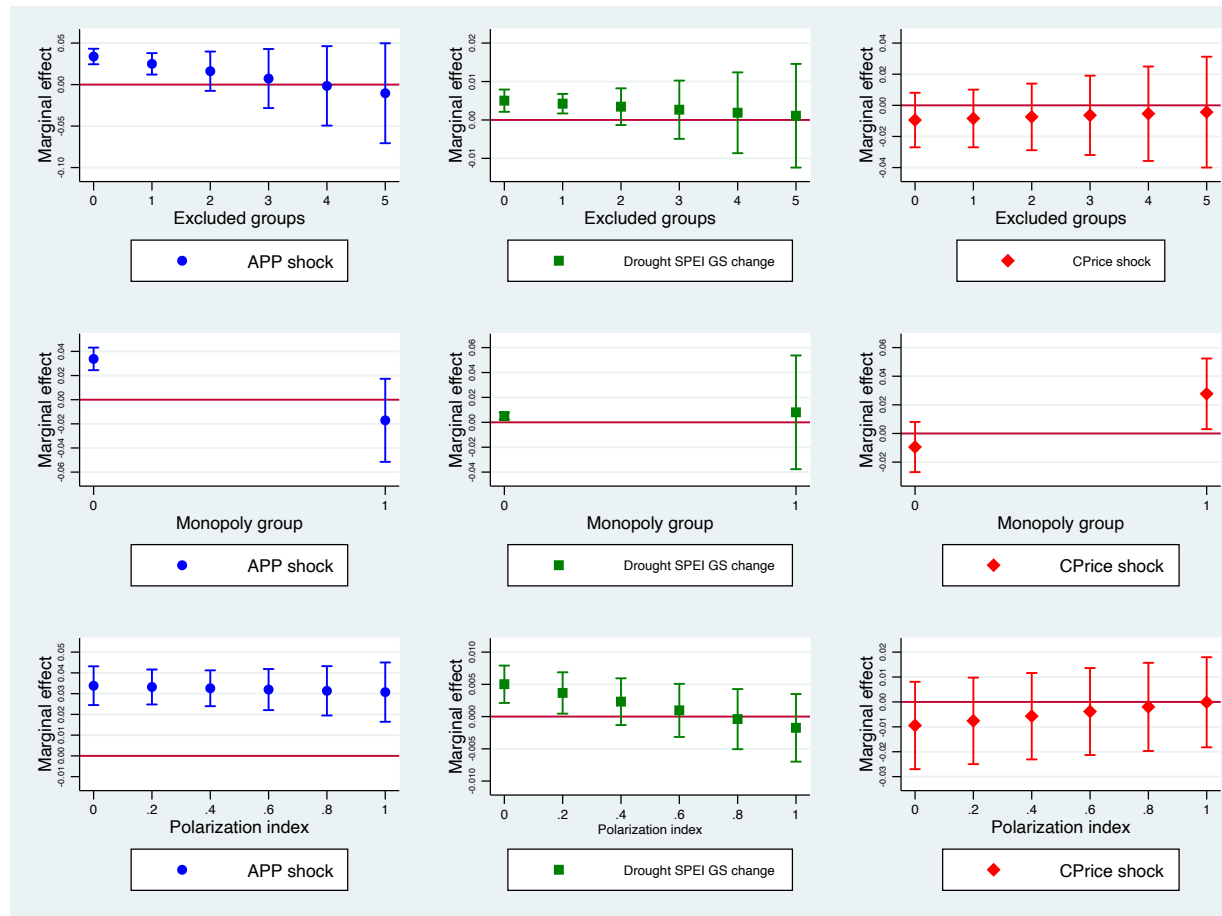


Figure 3: Output conflict - ACLED riots. Note: The charts give the estimated marginal effect of each income shock and their 90% confidence intervals for each value of the corresponding ethnic variable.

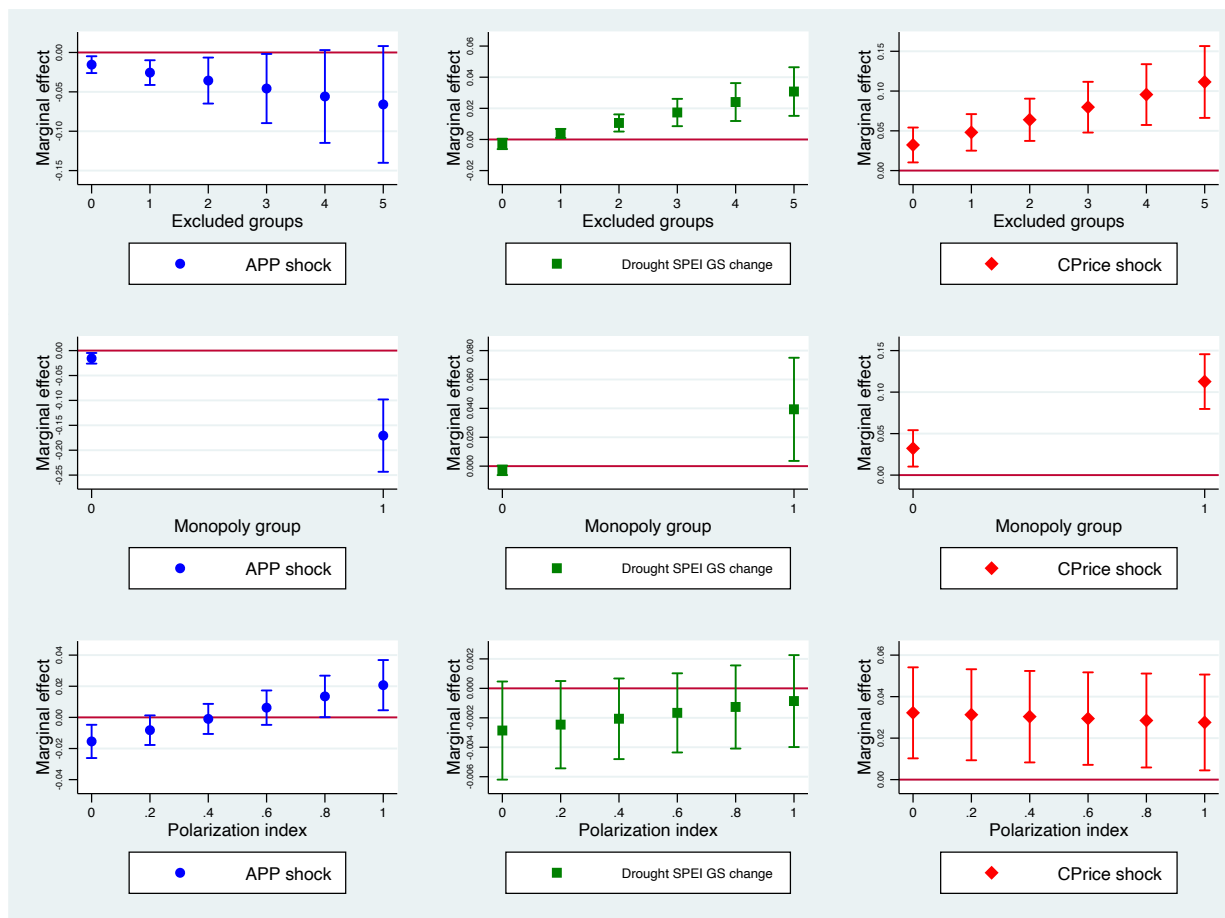


Figure 4: Output conflict - ACLED violence against civilians. Note: The charts give the estimated marginal effect of each income shock and their 90% confidence intervals for each value of the corresponding ethnic variable

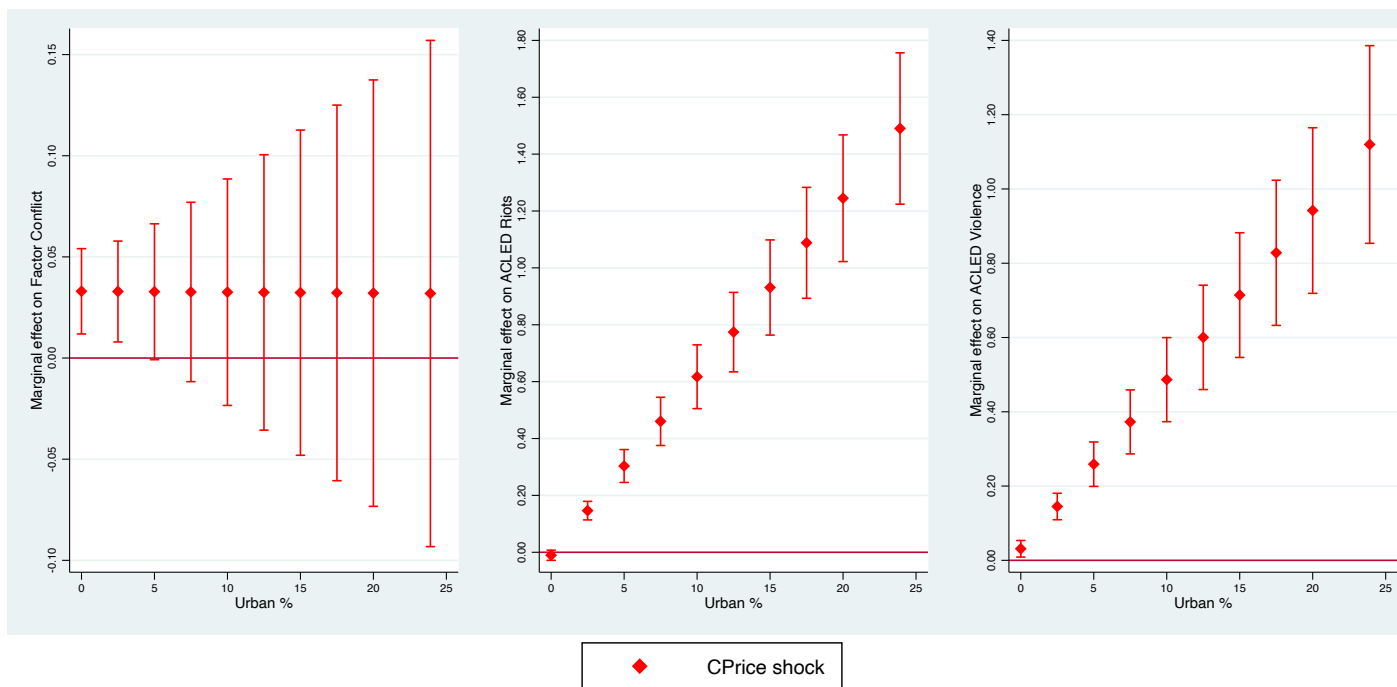


Figure 5: Conflict - Consumer Price shock on urban %. Note: The charts give the estimated marginal effect of consumer price shock on factor conflict (UCDP Incidence), and output conflict (ACLED Riots and Violence against civilians, respectively) and their 90% confidence intervals for each value of urban area (%).

The Role of Ethnic Characteristics in the Effect of Income
Shocks on African Conflict

—Appendix: Data Definitions, Robustness Analysis,
Descriptive Statistics, Main and Robustness Tables, and
Additional Figures. —

1 Data Description and Sources

1.1 Structure of the dataset. Our baseline unit of analysis is a full grid of Africa divided into sub-national units of 0.5 x 0.5 grades latitude and longitude (which corresponds to a cell of roughly 55 x 55 kilometers at the equator). This is the result of intersecting grid cells provided by the PRIO-GRID¹ structure, with a map of the entire Africa and their national political borders provided by The Global Administrative Unit Layers (2010), a project from the United Nations Food and Agricultural Organization (FAO). The use of the PRIO-GRID allows us to easily include cell specific data from this dataset. All conflict events are aggregate at the level of the cell. Administrative boundaries are taken at the end of our sample period. The country which stands for the largest share of a cell's area is assigned to this cell.

1.2 Conflict events. We make use of two different datasets containing the geo-location of conflict events in Africa: the UCDP-Georeferenced Event Dataset (UCDP-GED), version 5.0 (Croicu and Sundberg, 2016), and the Armed Conflict Location and Event Dataset (ACLED Dataset) (Raleigh et al., 2017). These data cover different countries and time periods. The events are collected from various sources, including humanitarian agents, research publications, and local, regional or international press news. In each dataset the unit of observation is the event. They contain latitude and longitude information, and the precise day (in most cases) of conflict events. UCDP defines an event as an incident where armed force was used by an organised actor against another organized actor, or against civilians, resulting in at least 1 direct death at a specific location and a specific date. In addition, only events linkable to a UCDP/PRIO Armed Conflict (or State Conflict), a UCDP Non-State Conflict or a UCDP One-Sided Violence instance are included are recorded separately. Events are included for the entire period of consecutive years during which conflicts were active as long as at least one of those years have crossed the 25 battle related deaths threshold.

¹<http://www.prio.no/Data/PRIO-GRID/>

Meanwhile, the ACLED Dataset registers “a range of violent and non-violent actions by political agents, including governments, rebels, militias, communal groups, political parties, rioters, protesters and civilians”. In a broader perspective, ACLED records violent activity both within and outside the context of a civil war. To that end, there is not specifically a battle-related deaths threshold.

More specifically, we consider the following dependent variables:

- **UCDP incidence.** We aggregate to the cell-year level, coding the variable as one if any conflict from UCDP data took place, zero otherwise.
- **ACLED riots.** We aggregate to the cell-year level, coding the variable as one if conflicts from ACLED data took place defined as “a protest [that] describes a non-violent, group public demonstration, often against a government institution”, and zero otherwise.
- **ACLED violence against civilians.** We aggregate to the cell-year level, coding the variable as one if conflicts from ACLED data took place defined as “violence against civilians [that] occurs when any armed/violent group attacks civilians”, and zero otherwise. “By definition, civilians are unarmed and not engaged in political violence. Rebels, governments, militias, rioters can all commit violence against civilians.”
- **ACLED battles.** We aggregate to the cell-year level, coding the variable as one if conflicts from ACLED data took place defined as “battle-no change of territory”, “battle-non-state actor overtakes territory” and “battle-government regains territory”, and zero otherwise.

1.3 Crop cover data.

- **Agricultural commodities: FAO-GAEZ.** Following the approximation of Berman and Couttenier (2015), we consider as our main crop database the FAO’s Global Agro-Ecological Zones (GAEZ). Specifically, the “GAEZ modeling framework for crop potential assessment using detailed agronomic-based knowledge

to assess land suitability, potential attainable yields and potential production of crops for specified management assumptions and input levels, both for rain-fed and irrigated conditions”. Suitability is defined as the percentage of potential production capacity that could be attained in each cell.

For our 18 crops, we have considered the data that corresponding to low input levels conditions. Which means that yields are based on the use of traditional ways of farming without any additional mechanical, chemical or irrigation methods (only rain-fed cases). The model is applied considering the average climate conditions of the baseline period 1961-1990. A cell is suitable for crop production if it could achieve at least 40% of its maximum capacity.

- **Alternative crop production database: M3 crops.** Data on the actual production of agricultural crops in each cell is drawn from the M3-Crops dataset by Monfreda et al. (2008).² Total production is the crop production in metric tons per hectare of a grid cell. We aggregate the raster information for production at the 5 arc minutes x 5 arc minutes resolution (about 9.2 km x 9.2 km at the equator) at the resolution of our grid structure. Thus, we match the crop maps raster with our grid structure, taking the statistical medium value of each crop on each cell.

1.4 FAO food balance sheets: Consumer prices index. We construct our Consumer Price Index taking the approximation of McGuirk and Burke (2020). In particular, we use country-level data on food consumption patterns from the FAO Balance Sheets. This webpage gives complete information concerning three components of a particular country’s food system: “1) Domestic food supply of the food commodities in terms of production, imports, and stock changes. 2) Domestic food utilization which includes feed, seed, processing, waste, export, and other uses. And 3) per capita values for the supply of all food commodities (in kilograms per person per year) and the calories, protein and fat content. Annual food balance sheets show the trends in the overall national food supply, disclose changes that may have taken place in the types of

²<http://www.earthstat.org/>

food consumed, and reveal the extent to which the food supply of the country is adequate in relation to nutritional requirements.”³ For each type of commodity, “the food consumption is constructed as the calorie per person and per day available for human consumption” (McGuirk and Burke, 2020, pg. 23). Besides, we have also followed the methodology of these authors constructing time-invariant consumption shares based on averages of the series 1990-2013 because of possible lack in the quality of the data.

1.5 Climate variables.

- **Drought SPEI growing season.** The variable droughtcrop-speigdm as is cited by PRIO-GRID v.2.0 datasets “gives the proportion of months in the growing season that are part of the longest streak of consecutive months in that growing season with SPEI-I values below -1.5. The growing season is the growing season for the cell’s main crop, defined in the MIRCA2000 dataset v.1.1. For growing seasons that cross 1 January, we define the whole season to belong to the year in which the season ended. Thus, a year with two consecutive months below -1.5 during the growing season that started in September the previous year and ended in March in the current year, is given a value of 2/7. Each year only has defined one growing season.”

SPEIbase is based on precipitation and potential evapotranspiration (PET) from the Climatic Research Unit (CRU) of the University of East Anglia CRU v.3.22. The PET estimation used by CRU is the Penman-Montheith method, considered to be better than the Thornthwaite estimation. Source: Standardized Precipitation and Evapotranspiration Index SPEIbase v.2.3 from the SPEI Global Drought Monitor.

- **Drought SEPI.** The variable droughtyr-speigdm from PRIO-GRID v.2.0 datasets “gives the proportion of months out of 12 months that are part of the longest streak of consecutive months ending in the given year with SPEI-I values below -1.5. For a year where the longest consecutive streak of months below -1.5 is

³This is an original text from <http://www.fao.org/economic/ess/fbs/en/>.

three, the cell will be given a value of $3/12 = 0.25$. When the longest streak starts in the previous year, it is only counted and included in the year in which the streak ended. Theoretically, the proportion can become higher than 1". The original source is SPEI Global Drought Monitor.

- **Temperature.** Temperature is also taken from PRIO-GRID v.2.0 datasets and “gives the yearly mean temperature (in degrees Celsius) in the cell, based on monthly meteorological statistics from GHCN/CAMS, developed at the Climate Prediction Center, NOAA/National Weather Service”. It is based on Y. Fan and H. van den Dool (2008): A global monthly land surface air temperature analysis for 1948-present, *Journal of Geophysical Research*, 113, D01103, doi:10.1029/2007JD008470.
- **Rainfall.** “Rainfall gives the yearly total amount of precipitation (in millimeter) in the cell, based on monthly meteorological statistics from the GPCP v.2.2 Combined Precipitation Data Set. Since the original data only reported the daily average for each month, the authors multiplied the daily average by the number of days in each month in order to obtain approximate monthly totals, from which yearly totals were estimated”. Definition provided by PRIO-GRID v.2.0 based on G.J. Huffman, D.T. Bolvin and R.F. Adler (2012): Estimating climatological bias errors for the Global Precipitation Climatology Project (GPCP), *Journal of Applied Meteorology and Climatology*, 51, 84-99. Last updated 2012: GPCP Version 2.2 SG Combined Precipitation Data Set. WDC-A, NCDC, Asheville, NC. Dataset accessed 26.06.2015 at <ftp://precip.gsfc.nasa.gov/pub/gpcp-v2.2/psg/>

1.6 Ethnicity

- **Political status.**
 - **Excluded.** Excluded accounts for the quantity of excluded groups that are settled in the grid cell for the year 1997. This variable is provided in PRIO-GRID v.2.0 and derived from the GeoEPR/EPR 2014 update 2 datasets.

The excluded variable “counts the number of excluded groups (discriminated or powerless)”. Powerless means “that elite representatives hold no political power at either national or the regional level without being explicitly discriminated against”. On the other hand, discrimination means “that group members are subjected to active, intentional, and targeted discrimination, with the intent of excluding them from both regional and national power. Such active discrimination can be either formal or informal”. See Cederman, Wimmer and Min (2010).

- **Monopoly.** It is a dummy variable which means that a monopoly group is settled in the grid cell for the year 1997. This variable is built matching the settlement areas from Ethnic Power Relations (EPR) Dataset Core 2014 with the grid structure provided in PRIO-GRID v.2.0. Monopoly means “that elite members hold monopoly power in the executive to the exclusion of members of other ethnic groups”. See Cederman, Wimmer and Min (2010).

- **Spatial ethnic diversity** We use data from Geo-referencing Ethnic Power Relation (GeoEPR 2014) from M. Vogt, N.C Bormann, S. Rügger, L.E. Cederman, P. Hunziker and L. Girardin (2015), Integrating data on ethnicity, geography, and conflict: The ethnic power relations data set family, *Journal of Conflict Resolution*, 59(7), 1327-1342. It “codes the settlement patterns of politically relevant ethnic groups in independent states with more than 500,000 inhabitants from 1946-2009 based on the group list in the Ethnic Power Relations dataset version 2014”. For each grid cell, we construct two diverse types of measures of ethnic diversity: Ethnic Fractionalization and Ethnic Polarization in 1997.

- **Spacial ethnic fractionalization and polarization.** The Spatial Ethnic Fractionalization index (EF_i) is based on the standard Herfindahl-Hirschman index of ethnic diversity or fractionalization and equals:

$$EF_i = 1 - \sum_{j=1}^N \pi_j^2 = \sum_{j=1}^N \pi_j(1 - \pi_j); \quad (1)$$

where π_j is the proportion of area that belongs to ethnic group j .

The spatial ethnolinguistic polarization index (EP), on the other side, equals

$$EP_i = 4 \sum_{j=1}^N \pi_j^2 (1 - \pi_j). \quad (2)$$

1.7 Natural resources and local commodity price indices. In each cell-year, we merge information on Natural Resources from PRIO-GRID v.1.2 and v.2.0 with the U.S. Geological Survey (USGS) dataset. We construct our indexes of Petrol Prices and Mineral Prices with this information.

Specifically, the construction of the local commodity price index for oil and gas uses geocoded data of the localization of oil and gas fields in Africa from PRIO-GRID v.1.2. This information is employed to build a time-invariant dummy variable (e_{ij}) coded as 1 if oil ($j = 1$) or gas ($j = 2$) or oil and gas ($(j = 3)$) are present in a cell at any time during the period 1990-2013. Finally, we combine the dummy with the IMF data on world oil and gas annual prices to estimate a price index for cell i and time t (PI_{jt}^E) as follows:

$$PI_{it}^E = \sum_{j=1}^3 e_{ij} P_{jt}^E; \quad (3)$$

where e_{ci} is a gas or/and oil dummy variable for cell i ; and P_{it}^E is the annual price for oil if $i = 1$, for gas if $i = 2$, and the average of P_{1t}^E and P_{2t}^E if both oil and gas are found in the cell. The index is normalized to 1 in the year 1990.

A similar methodology is employed to compute the mineral-commodity price index (PI_{ct}^M). We use the information from the Mineral Resources Data System provided by the USGS. Following Berman et al. (2017), we define a mineral-specific dummy variable coded as 1 in cells where at least one mine has been registered as active in the period 1990-2013 after its discovery or known production, and 0 otherwise. Because we do not have data on international commodity prices of gems and diamonds, the dummy variables only capture the presence of other mines. Specifically, we cover the following minerals: bauxite (aluminum), coal, copper, diammonium phosphate, gold, iron ore,

lead, nickel, manganese, phosphate, potash, silver, tin, uranium, and zinc. We combine the time-invariant dummies with price series from the IMF and the Global Economic Monitor (GEM) Commodities dataset, provided by the World Bank (WB), as follows:

$$PI_{it}^M = \sum_{j=1}^n m_{ij} P_{jt}^M; \quad (4)$$

where m_{ij} is the dummy variable of mineral- j mine-presence in cell i ; and P_{jt}^M is the annual price for minerals produced in the mine j normalized to 1 in the year 1990. If we have more than one mineral mine-presence, m_{ij} equals 1 divided by the number of mines in the cell.

1.8 Urban area. Source: PRIO-GRID v. 2.0. “To measure the coverage of urban areas the dataset includes the percentage of urban areas in a cell extracted from the Integrated Science Assessment Model-Historical Database of the Global Environment (ISAM-HYDE).” In PRIO-GRID, this indicator is available for the years 1950, 1960, 1970, 1980, 1990, 2000, and 2010. We interpolate these values to build our percentage of urban area in a cell.

2 Robustness Analysis

Here, we perform several robustness checks. Each of them proposes a modification of the basic regression specification. All the tables containing the results are located below, in the Tables section of this appendix.

First, we study how results change if the dependent variable is conflict intensity, instead of conflict incidence. The intensity data comes from the same sources than incidence. Tables A15 to A17 show how the results in Tables A10, A12 and A13 change when the dependent variable is the number of events related to UCDP-GED organized armed-conflict, ACLED riots and ACLED violence against civilians, respectively. In general, our main findings hold in terms of sign or sign and significance. An interesting difference, though, is the negative significant signs shown by the CP index for riots

(Table A16) and the interaction between consumer prices and excluded groups in the factor conflict (Table A15) and riots regressions. As explained previously, this time the only force that can be behind the sign is an increase in state capacity to control insurgence, especially in areas where the government is relatively strong, shown by its capacity to exclude certain ethnic groups from politics.

Second, Tables A18 to A20 revise the same conflict-incidence tables (A10, A12 and A13) when, instead of the GAEZ suitability and potential yield information, actual crop yields from the M3-Crop database (Monfreda et al., 2008) are employed to calculate the crop weights in the APP and CP indices.⁴ Given the strong endogeneity concerns that surround the relationship between actual crop yields and conflict, numbers for year 2000 are employed to compute a time-invariant share for each crop in each cell, and the regressions are estimated for the years between 2001 and 2013 to try to diminish those problems. In this occasion we find some differences compared to our benchmark results. The main one being that the interactions of the price indices and the ethnic monopoly-group variable show sometimes the opposite signs than before.

Third, we change the source of the measure of factor conflict. It could be thought that the UCDP-GED is a very specific and non-exhaustive dataset, because it contains only certain large conflicts. To address this potential issue, Table A21 adopts the category Battles from ACLED, which assesses violent interaction between two politically organized armed groups. Recall that, unlike UCDP-GED, ACLED does not have a lower bound requirement of at least 25 battle-related deaths in at least one year. Compared to the Table A10, the main difference is that monopoly groups and the CP index show stronger importance as determinants of factor conflict. Nevertheless, the signs of all significant coefficients are the same that were estimated in Table A10, and the interpretation of the results can follow the same logic as in the previous subsection.

Fourth, we consider spillover effects from income shocks in neighboring cells. This type of effects are important on their own and have been emphasized by previous literature, like HF in the case of droughts and MB for agricultural prices, because of their

⁴The M3-Crop database is available at <https://mygeohub.org/groups/drinet/cropdata>.

potential correlation over space and time. The shocks can spill over bordering cells directly, through changes in food-prices and climate conditions, or indirectly, through changes in conflict incidence triggered by income shocks. Given that the spillovers can persist over time, we follow MB and re-estimate the regressions including as explanatory variables the contemporaneous value and two lags of the APP index and the drought index averages across the 1- and 2-degree neighboring cells.⁵ Results are presented in Table A22. This table shares the same structure with Tables A23 to A28. Columns (1) to (3), (4) to (6) and (7) to (9) must be compared to Tables A10, A12 and A13, respectively; and in particular, to the results in columns (2), (10) and (12). Table A22 shows that our main findings again hold in terms of sign and significance, because spillovers do not show any power to explain conflict.

Fifth, in the main analysis, we have allowed for location-specific 5-year-lag serial correlation and cross-sectional spatial correlation in a radius of 110 km. Now, Table A23 considers spatial kernels of 55 and 1000 km and serial correlations of 2 lags and 100,000 years. Results are robust to these modifications.

Sixth, we address the modifiable areal unit problem by enlarging the cell surface. In particular, we consider cells of 110 km x 110 km and 220 km x 220 km and present the findings in Tables A24 and A25, respectively. When the areal unit is 110 km x 110 km (Table A24), results are robust in terms of sign and many times significance. Moving now to Table A25, where the areal unit is 220 km x 220 km, we see that using a larger cell as unit of the analysis substantially modifies the results. The difference possibly comes from a greater degree of coexistence of food-producing and food-consuming areas in the same cell as its surface is enlarged; which makes more difficult separate the effects of the APP and CP indices. We can see that the significance of many coefficients vanishes. For example, only five coefficients remain strongly significant in columns (3), (6) and (9); importantly, out of those, most are consistent with our main results.

⁵Estimation of the effects derived from the CP index cannot be implemented because it is a country-level aggregate. Notice also that we do not include the realizations of the outcome variable in bordering cells in this spillover regressions. As argued by Berman et al. (2017) and MB, among others, the reason is that the identification of spillovers is problematic, and introducing spatial lags of the dependent variable can generate a clear simultaneity bias due to its temporal persistence.

Seventh, we extend the number of lags of all the variables included in the regression from two to five (Table A26). As we can see, our main results are generally robust: the estimated coefficient signs are maintained and many times their significance. Interestingly, we find again a negative and significant sign for the CP index in the riots regression as we did in our first robustness test that adds evidence in favor of state capacity as a way to control rebellion.⁶

Eighth, an alternative estimation method for binary dependent variables is employed, namely, a conditional fixed-effect logit model (Table A27). Results are most of the time robust in terms of signs, but coefficients many times are not significant. This loss of significance is not surprising, because the conditional logit only uses observations that show an incidence equal to one for the estimation, and then the number of observations is reduced from about 140,000 in the main analysis to around 20,000 with the logit.

Finally, the annual average SPEI indicator along with the variables temperature and rainfall are added to our benchmark regressions (Table A28). As we can see, our main results are robust to this modification.

3 Tables

TABLE A1: CONFLICT VARIABLES STATISTICS

Variable	N	Mean	Std. Dev.	Min	Max
UCDP_Incidence	170112	0.025	0.157	0	1
Riots and Violence against civilians	170112	0.061	0.240	0	1
ACLED_Riots	170112	0.025	0.157	0	1
ACLED_Violence	170112	0.040	0.197	0	1
ACLED_Battles	170112	0.039	0.193	0	1
events UCDP_Incidence	170112	0.110	1.699	0	245
events ACLED_Riots	170112	0.104	2.473	0	779
events ACLED_Violence	170112	0.147	1.903	0	222

⁶When urban area and its interaction with the CP index are introduced in the riots regression, the CP index maintains its negative sign and CP*Urban shows a positive sign, and both are significant. This occurs with the intensity and 5-lags specifications.

TABLE A2: INDEPENDENT VARIABLES

Variable	Obs	Mean	Std. Dev.	Min	Max
Ln(APP Index)	170112	1.392	2.029	0	5.918
Drought SPEI GS	170112	0.050	0.565	-8.382	3.272
Ln(CP Index)	141801	0.231	0.373	-0.380	0.970
Excluded groups	132960	0.494	0.666	0	5
Monopoly groups	132960	0.059	.236	0	1
Fractionalization Index	169488	0.164	0.221	0	0.823
Polarization Index	169488	0.300	0.393	0	1
Urban (% cell)	164704	0.127	0.66	0	23.905
Ln(Mine Price Index)	170112	0.016	0.238	-1.920	6.455
Ln(Petrol&Gas Index)	170112	0.056	0.258	-0.564	1.653
SPEIbase	164144	0.059	0.079	0	0.833
Precipitation	170112	682.84	612.294	0.123	3275.409

Note: From FAO-GAEZ, PRIO-GRID, GeoEPR/EPR 2014, USGS and author's elaboration

TABLE A3: SUMMARY UCDP-GED SAMPLE

Country	N	# events	Max. # events	Country	N	# events	Max. # events
Algeria	13936	2573	72	Libya	10448	230	63
Angola	6960	744	44	Madagascar	4064	42	11
Benin	640	7	5	Malawi	624	0	0
Botswana	3280	1	1	Mali	6816	161	13
Burkina Faso	1392	14	9	Mauritania	5888	12	1
Burundi	176	1139	104	Morocco	4480	5	2
Cameroon	2496	26	4	Mozambique	4816	16	3
Central African Republic	3232	344	31	Namibia	4912	13	5
Chad	6256	184	10	Niger	6432	52	5
Congo	1792	192	36	Nigeria	4992	1505	123
Congo DRC	12208	1942	87	Rwanda	144	182	40
Djibouti	128	11	4	Senegal	1200	125	11
Egypt	6304	0	0	Sierra Leone	480	639	79
Equatorial Guinea	192	0	0	Somalia	3872	2630	245
Eritrea	816	39	5	South Africa	7728	45	13
Ethiopia	5952	1347	18	South Sudan	615	270	28
Gabon	1488	0	0	Sudan	12825	1641	36
Gambia	48	14	4	Swaziland	80	0	0
Ghana	1360	2	1	Tanzania	4960	12	3
Guinea	1360	75	12	Togo	304	90	47
Guinea-Bissau	208	35	10	Tunisia	1168	13	3
Ivory Coast	1808	268	67	Uganda	1280	1404	48
Kenya	3072	420	23	Zambia	4000	5	2
Lesotho	192	2	2	Zimbabwe	2160	49	7
Liberia	592	130	28				

Period 1998-2013. N: Number of observations by country. # events: total number of UCDP events in the country over the sample period. Max. # events: maximum number of yearly UCDP events in the country over the sample period.

TABLE A4: SUMMARY ACLED RIOTS SAMPLE

Country	N	# events	Max. # events	Country	N	# events	Max. # events
Algeria	13936	535	46	Libya	10448	313	62
Angola	6960	119	19	Madagascar	4064	299	72
Benin	640	59	11	Malawi	624	129	8
Botswana	3280	25	5	Mali 6816	175	37	
Burkina Faso	1392	158	23	Mauritania	5888	33	4
Burundi	176	67	7	Morocco	4480	401	41
Cameroon	2496	68	6	Mozambique	4816	161	17
Central African Republic	3232	23	4	Namibia	4912	285	44
Chad	6256	14	2	Niger	6432	90	8
Congo	1792	95	26	Nigeria	4992	1061	33
Congo DRC	12208	528	45	Rwanda	144	63	12
Djibouti	128	23	6	Senegal	1200	206	35
Egypt	6304	2648	779	Sierra Leone	480	23	5
Equatorial Guinea	192	1	1	Somalia	3872	669	31
Eritrea	816	5	4	South Africa	7728	3830	102
Ethiopia	5952	223	19	South Sudan	615	32	5
Gabon	1488	59	21	Sudan	12825	472	54
Gambia	48	9	4	Swaziland	80	93	31
Ghana	1360	74	7	Tanzania	4960	100	6
Guinea	1360	213	57	Togo	304	142	39
Guinea-Bissau	208	44	7	Tunisia	1168	754	164
Ivory Coast	1808	372	29	Uganda	1280	479	56
Kenya	3072	1363	71	Zambia	4000	478	48
Lesotho	192	3	1	Zimbabwe	2160	587	51
Liberia	592	145	27				

Period 1998-2013. N: Number of observations by country. # events: total number of ACLED riots events in the country over the sample period. Max. # events:: maximum number of yearly riots events in the country over the sample period.

TABLE A5: SUMMARY ACLED VIOLENCE SAMPLE

Country	N	# events	Max. # events	Country	N	# events	Max. # events
Algeria	13936	397	12	Libya	10448	244	45
Angola	6960	513	32	Madagascar	4064	108	16
Benin	640	14	2	Malawi	624	82	6
Botswana	3280	5	1	Mali	6816	192	24
Burkina Faso	1392	31	4	Mauritania	5888	8	1
Burundi	176	1235	78	Morocco	4480	81	15
Cameroon	2496	81	7	Mozambique	4816	151	11
Central African Republic	232	483	28	Namibia	4912	73	5
Chad	6256	202	7	Niger	6432	54	7
Congo	1792	135	21	Nigeria	4992	1818	67
Congo DRC	12208	2375	71	Rwanda	144	417	102
Djibouti	128	11	2	Senegal	1200	136	11
Egypt	6304	413	89	Sierra Leone	480	837	98
Equatorial Guinea	192	3	1	Somalia	3872	3065	222
Eritrea	816	88	8	South Africa	7728	713	28
Ethiopia	5952	432	27	South Sudan	615	284	41
Gabon	1488	13	3	Sudan	12825	1832	64
Gambia	48	22	7	Swaziland	80	26	5
Ghana	1360	73	7	Tanzania	4960	148	12
Guinea	1360	177	20	Togo	304	22	3
Guinea-Bissau	208	41	7	Tunisia	1168	90	15
Ivory Coast	1808	434	74	Uganda	1280	1669	63
Kenya	3072	1477	42	Zambia	4000	249	33
Lesotho	192	10	2	Zimbabwe	2160	3813	163
Liberia	592	229	21				

Period 1998-2013. N: Number of observations by country. # events: total number of ACLED violence events in the country over the sample period. Max. # events:: maximum number of yearly riots violence in the country over the sample period.

TABLE A6: COMMODITY PRICES. CROPS. SERIE 1990-2014

Variable	Obs	Mean	Std. Dev.	Min	Max
bananas	25	1.148	0.374	0.691	1.820
barley	25	1.509	0.615	0.893	2.981
cocoa	25	1.420	0.542	0.713	2.469
coconut oil	25	2.196	0.985	0.945	5.141
coffe	25	1.403	0.598	0.677	3.065
cotton	25	0.893	0.277	0.560	1.873
groundnuts	25	1.017	0.426	0.609	2.172
maize	25	1.326	0.581	0.807	2.731
olive oil	25	1.175	0.283	0.830	1.857
oranges	25	1.283	0.432	0.684	2.085
palm oil	25	2.198	0.995	0.995	4.495
rice	25	1.283	0.536	0.638	2.587
soybeans	25	1.333	0.527	0.770	2.454
sugar	25	0.974	0.207	0.714	1.633
sunflower oil	25	1.380	0.628	0.628	2.806
tea	25	1.140	0.260	0.808	1.717
tobacco	25	1.002	0.203	0.779	1.471
wheat	25	1.271	0.437	0.725	2.117
AgPrices	25	24.718	41.168	0	371.57

TABLE A7: AVERAGE OVER SERIES OF FOOD CROPS: 1990-2013.

Variable	Obs	Mean	Std. Dev.	Min	Max
Average_Bananas	14205	2.265	22.78	0	488.792
Average_Barley	14205	1.109	14.579	0	311.417
Average_Cocoa	14205	0.153	0.940	0	12.417
Average_Coconut	14205	0.836	14.325	0	345.625
Average_Coffee	14205	0.052	0.300	0	3.917
Average_Maize	14205	24.810	124.52	0	1339.75
Average_Nuts	14205	0.564	3.620	0	41.708
Average_OilPalm	14205	4.755	25.320	0	313.208
Average_OliveOil	14205	0.401	4.805	0	93.958
Average_Rice	14205	20.716	106.605	0	1004.875
Average_Sorghum	14205	7.903	48.666	0	679.591
Average_Soybean	14205	0.234	1.769	0	25.750
Average_Sugar	14205	11.461	48.369	0	365.417
Average_Sunflower	14205	1.452	10.997	0	154.625
Average_Tea	14205	0.029	0.181	0	2.167
Average_Wheat	14205	23.93	134.325	0	1611.875
Average_Food	14205	32158.23	11267.66	2353	60640
Consumer_Price	14205	1.286	0.071	0.0985	1.934

Food Balance Sheets. Old methodology. Author's elaboration

TABLE A8: COMMODITY PRICES. OIL AND GAS PRICES. SERIE 1990-2014

Variable	Obs	Mean	Std. Dev.	Min	Max
Natural gas Russian	25	2.721	1.830	0.888	6.456
Natural gas Indonesian	23	2.011	1.333	0.736	4.847
Natural gas Henry Hub terminal in Louisiana	24	2.761	1.490	1	6.112
Medium Price Gas	25	2.462	1.315	1	5.22
Crude Oil Price Medium	25	2.022	1.461	0.569	4.569
PriceGas&Oil	25	2.242	1.371	0.831	4.721

TABLE A9: COMMODITY PRICES. MINERAL PRICES. SERIE 1990-2014

Variable	Obs	Mean	Std. Dev.	Min	Max
aluminum	25	1.064	0.266	0.695	1.610
coal	25	1.424	0.840	0.653	3.433
copper	25	1.503	0.952	0.586	3.315
iron ore	25	3.173	3.569	0.815	11.942
lead	25	1.394	0.934	0.503	3.186
nickel	25	1.443	0.892	0.522	4.190
tin	25	1.703	1.157	0.667	4.281
uranium	25	2.756	2.420	0.851	10.191
zinc	25	0.996	0.454	0.513	2.152
gold	25	1.656	1.168	0.707	4.354
DAP	25	1.743	1.163	0.753	5.643
phosrock	25	1.95	1.811	0.815	8.533
platinum	25	1.779	1.047	0.763	3.646
potash	25	2.181	1.628	1	6.425
silver	25	2.196	1.846	.816	7.288
mangense	25	0.949	0.676	0.469	3.559
MineralPrices	25	1.744	1.161	0.793	4.138

TABLE A10: FACTOR CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES.

UCDP FACTOR CONFLICT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Incidence	Incidence	Incidence	Incidence	Incidence	Incidence	Incidence	Incidence	Incidence	Incidence	Incidence	Incidence
APP Index	-0.0200*** (0.003)	-0.0181*** (0.004)	-0.0096*** (0.004)	-0.0086** (0.004)	-0.0170*** (0.004)	-0.0190*** (0.004)	-0.0175*** (0.004)	-0.0186*** (0.004)	0.0108*** (0.004)	-0.0140*** (0.005)	-0.0110*** (0.004)	-0.0138*** (0.005)
Drought SPEI GS	0.0039*** (0.001)	0.0030*** (0.001)	0.0025*** (0.001)	0.0005 (0.001)	0.0040*** (0.001)	0.0033*** (0.001)	0.0039*** (0.001)	0.0033*** (0.001)	0.0029*** (0.001)	0.0011 (0.002)	0.0028*** (0.001)	0.0008 (0.002)
CP Index	0.0250** (0.011)	0.0250** (0.011)	0.0360*** (0.013)	0.0360*** (0.013)	0.0235** (0.011)	0.0235** (0.011)	0.0231** (0.011)	0.0231** (0.011)	0.0348*** (0.013)	0.0348*** (0.013)	0.0344*** (0.013)	0.0344*** (0.013)
APP Index x Excluded groups			-0.0223*** (0.004)	-0.0223*** (0.008)					-0.0237*** (0.005)	-0.0237*** (0.008)	-0.0236*** (0.005)	-0.0265*** (0.008)
Drought SPEI GS x Excluded groups			0.0048*** (0.002)	0.0073*** (0.002)					0.0054*** (0.002)	0.0076*** (0.002)	0.0053*** (0.002)	0.0076*** (0.002)
CP Index x Excluded groups				-0.0024 (0.004)						-0.0030 (0.004)		-0.0029 (0.004)
APP Index x Monopoly groups			-0.0607* (0.033)	-0.0879** (0.038)					-0.0608* (0.033)	-0.0885** (0.038)	-0.0600* (0.033)	-0.0887** (0.038)
Drought SPEI GS x Monopoly groups			-0.0041** (0.002)	-0.0017 (0.004)					-0.0040** (0.002)	-0.0019 (0.004)	-0.0040** (0.002)	-0.0019 (0.004)
CP Index x Monopoly groups			0.0260** (0.011)	0.0260** (0.011)					0.0245** (0.011)	0.0245** (0.011)	0.0245** (0.011)	0.0245** (0.011)
APP Index x Ethnic Fraction.					-0.0162* (0.010)	0.0051 (0.014)			0.0110 (0.011)	0.0379** (0.015)		
Drought SPEI GS x Ethnic Fraction.					-0.0010 (0.004)	-0.0028 (0.003)			-0.0047 (0.004)	-0.0039 (0.004)		
CP Index x Ethnic Fraction.						0.0107 (0.008)				0.0108 (0.008)		
APP Index x Ethnic Polariz.							-0.0075 (0.006)	0.0014 (0.006)			0.0063 (0.006)	0.0195** (0.008)
Drought SPEI GS x Ethnic Polariz.							-0.0003 (0.002)	-0.0012 (0.002)			-0.0021 (0.002)	-0.0014 (0.002)
CP Index x Ethnic Polariz.							0.0070* (0.004)	0.0070* (0.004)			0.0066 (0.004)	0.0066 (0.004)
Observations	170,112	139,136	170,112	110,000	169,488	138,592	169,488	138,592	169,488	109,968	169,488	109,968
Unconditional_Probability_FCConflict %	2.530%	2.168%	2.530%	2.435%	2.539%	2.176%	2.539%	2.176%	2.539%	2.434%	2.517%	2.434%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP incidence database (INCIDENCE). The Agricultural price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for the spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include interactions between the log of oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017), in both cases at t, t-1 and t-2.

TABLE A11: OUTPUT CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence	Riots&Violence
APPLE Index	0.0070 (0.005)	0.0113** (0.005)	0.0162*** (0.005)	0.0166** (0.007)	-0.0007 (0.006)	0.0062 (0.006)	0.0003 (0.006)	0.0079 (0.006)	0.0074 (0.006)	0.0054 (0.008)	0.0082 (0.006)	0.0065 (0.007)
Drought SPEI GS	0.0027** (0.001)	0.0038*** (0.001)	0.0028* (0.002)	0.0030 (0.002)	0.0039*** (0.002)	0.0059*** (0.002)	0.0038*** (0.002)	0.0056*** (0.002)	0.0038** (0.002)	0.0046* (0.002)	0.0037** (0.002)	0.0041* (0.002)
CP Index	0.00004 (0.014)	0.00004 (0.014)	-0.0171*** (0.006)	0.0251 (0.016)	-0.0051 (0.014)	-0.0051 (0.014)	-0.0051 (0.014)	-0.0054 (0.014)	-0.0275*** (0.006)	0.0249 (0.016)	0.0251 (0.015)	0.0251 (0.015)
APP Index x Excluded groups			-0.0171*** (0.006)	-0.0078 (0.011)					-0.0275*** (0.006)	-0.0159 (0.011)	-0.0251*** (0.006)	-0.0144 (0.011)
Drought SPEI GS x Excluded groups			0.0001 (0.002)	0.0018 (0.002)					0.0011 (0.002)	0.0023 (0.003)	0.0009 (0.002)	0.0022 (0.003)
CP Index x Excluded groups			-0.1725*** (0.040)	0.0152*** (0.005)					0.0122** (0.006)	0.0122** (0.006)	0.0127** (0.006)	0.0127** (0.006)
APP Index x Monopoly groups			-0.1725*** (0.040)	-0.2179*** (0.051)					-0.1745*** (0.043)	-0.2147*** (0.051)	-0.1746*** (0.043)	-0.2148*** (0.051)
Drought SPEI GS x Monopoly groups			-0.0015 (0.006)	0.0280 (0.029)					-0.0013 (0.006)	0.0296 (0.029)	-0.0013 (0.006)	0.0297 (0.029)
CP Index x Monopoly groups			0.0808*** (0.017)	0.0808*** (0.017)					0.0747*** (0.017)	0.0747*** (0.017)	0.0753*** (0.017)	0.0753*** (0.017)
APP Index x Ethnic Fraction.			0.0415*** (0.016)	0.0415*** (0.016)					0.0733*** (0.017)	0.0733*** (0.017)	0.0733*** (0.017)	0.0733*** (0.017)
Drought SPEI GS x Ethnic Fraction.			-0.0092** (0.005)	-0.0092** (0.005)					-0.0105** (0.005)	-0.0105** (0.005)	-0.0105** (0.005)	-0.0105** (0.005)
CP Index x Ethnic Fraction.			0.0457*** (0.011)	0.0457*** (0.011)					0.0457*** (0.011)	0.0457*** (0.011)	0.0457*** (0.011)	0.0457*** (0.011)
APP Index x Ethnic Polariz.								0.0156 (0.012)				0.0349*** (0.009)
Drought SPEI GS x Ethnic Polariz.								-0.0067*** (0.003)				-0.0039 (0.003)
CP Index x Ethnic Polariz.								0.0248*** (0.006)				0.0042 (0.006)
Observations	170,112	139,136	170,112	110,000	169,488	138,592	169,488	138,592	169,488	109,968	169,488	109,968
Unconditional_Probability_R&V %	6.138%	5.904%	6.138%	6.669%	6.156%	5.920%	6.156%	5.920%	6.156%	6.669%	6.156%	6.669%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of ACLED riots and violence database (RIOTS & VIOLENCE). The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. DPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. P-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between the log of oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017), in both cases at t, t-1 and t-2.

TABLE A12: OUTPUT CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES.

ACLED CONFLICTS	Riots (1)	Riots (2)	Riots (3)	Riots (4)	Riots (5)	Riots (6)	Riots (7)	Riots (8)	Riots (9)	Riots (10)	Riots (11)	Riots (12)
APP Index	0.0224*** (0.003)	0.0272*** (0.004)	0.0248*** (0.004)	0.0329*** (0.005)	0.0208*** (0.004)	0.0299*** (0.004)	0.0206*** (0.005)	0.0296*** (0.005)	0.0228*** (0.004)	0.0343*** (0.006)	0.0226*** (0.004)	0.0338*** (0.006)
Drought SPEI GS	0.0015* (0.001)	0.0028*** (0.001)	0.0024** (0.001)	0.0028* (0.001)	0.0028*** (0.001)	0.0057*** (0.001)	0.0026** (0.001)	0.0054*** (0.001)	0.0033*** (0.001)	0.0055*** (0.002)	0.0032*** (0.001)	0.0050*** (0.002)
CP Index	-0.0247*** (0.010)	-0.0247*** (0.010)	-0.0072 (0.011)	-0.0072 (0.011)	-0.0029*** (0.010)	-0.0029*** (0.010)	-0.0099 (0.011)	-0.0099 (0.011)	-0.0099 (0.011)	-0.0099 (0.011)	-0.0099 (0.011)	-0.0135 (0.010)
APP Index x Excluded groups			-0.0050 (0.004)	-0.0088 (0.007)					-0.0074 (0.008)	-0.0086 (0.004)	-0.0071* (0.011)	-0.0095 (0.011)
Drought SPEI GS x Excluded groups			-0.0017 (0.001)	-0.0008 (0.002)					-0.0009 (0.001)	-0.0007 (0.002)	-0.0011 (0.001)	-0.0008 (0.010)
CP Index x Excluded groups				0.0021 (0.004)						0.0006 (0.004)		0.0010 (0.004)
APP Index x Monopoly groups			-0.0205 (0.020)	-0.0546*** (0.021)					-0.0211 (0.020)	-0.0512** (0.021)	-0.0212 (0.020)	-0.0509** (0.021)
Drought SPEI GS x Monopoly groups			-0.0052 (0.005)	0.0010 (0.028)					-0.0050 (0.006)	0.0028 (0.028)	-0.0050 (0.006)	0.0030 (0.028)
CP Index x Monopoly groups				0.0419*** (0.011)						0.0371*** (0.011)		0.0372*** (0.011)
APP Index x Ethnic Fraction.					0.0080 (0.011)	-0.0198 (0.016)			0.0162 (0.013)	-0.0087 (0.018)		
Drought SPEI GS x Ethnic Fraction.					-0.0098*** (0.003)	-0.0199*** (0.004)			-0.0091*** (0.004)	-0.0153*** (0.004)		
CP Index x Ethnic Fraction.					0.0350*** (0.008)	0.0350*** (0.008)			0.0207** (0.009)	0.0207** (0.009)		
APP Index x Ethnic Polariz.							0.0048 (0.006)	-0.0099 (0.008)			0.0089 (0.007)	-0.0031 (0.010)
Drought SPEI GS x Ethnic Polariz.							-0.0044** (0.002)	-0.0097*** (0.002)			-0.0041** (0.002)	-0.0068*** (0.002)
CP Index x Ethnic Polariz.								0.1805*** (0.004)				0.0093** (0.005)
Observations	170,112	139,136	170,112	110,000	169,488	138,592	169,488	138,592	169,488	109,968	169,488	109,968
Unconditional_Probability_Riots %	2.540%	2.696%	2.540%	3.100%	2.547%	2.704%	2.547%	2.704%	2.547%	3.100%	2.547%	3.100%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of ACLED riots database (RIOTS). The Agricultural Price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between the log of oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017), in both cases at t, t-1 and t-2.

TABLE A13: OUTPUT CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES.

ACLED CONFLICT	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)	Violence (8)	Violence (9)	Violence (10)	Violence (11)	Violence (12)
APP Index	-0.0076* (0.004)	-0.0059 (0.005)	-0.0001 (0.005)	-0.0057 (0.006)	-0.0134*** (0.005)	-0.0124** (0.005)	-0.0127*** (0.005)	-0.0115** (0.005)	-0.0070 (0.005)	-0.0158** (0.005)	-0.0165 (0.005)	-0.0154** (0.006)
Drought SPEI GS	0.0004 (0.001)	0.0011 (0.001)	-0.0006 (0.001)	-0.0021 (0.002)	0.0007 (0.001)	0.0012 (0.002)	0.0009 (0.001)	0.0014 (0.001)	-0.0001 (0.001)	-0.0030 (0.002)	0.0001 (0.001)	-0.0029 (0.002)
CP Index		0.0176 (0.012)		0.0300** (0.013)		0.0146 (0.012)		0.0147 (0.012)		0.0316** (0.013)		0.0322** (0.013)
APP Index x Excluded groups			-0.0148*** (0.005)	-0.0041 (0.009)					-0.0228*** (0.005)	-0.0111 (0.009)	-0.0210*** (0.005)	-0.0101 (0.009)
Drought SPEI GS x Excluded groups			0.0037** (0.002)	0.0066*** (0.002)					0.0044*** (0.002)	0.0068*** (0.002)	0.0044*** (0.002)	0.0067*** (0.002)
CP Index x Excluded groups				0.0157*** (0.005)						0.0154*** (0.005)		0.0158*** (0.005)
APP Index x Monopoly groups			-0.1150*** (0.037)	-0.1558*** (0.044)					-0.1164*** (0.037)	-0.1549*** (0.044)	-0.1166*** (0.037)	-0.1553*** (0.044)
Drought SPEI GS x Monopoly groups			-0.0060 (0.004)	0.0417* (0.022)					-0.0059 (0.004)	0.0423* (0.022)	-0.0059 (0.004)	0.0422* (0.022)
CP Index x Monopoly groups				0.0827*** (0.015)						0.0798*** (0.015)		0.0805*** (0.015)
APP Index x Ethnic Fraction.					0.0304** (0.013)					0.0568*** (0.015)		0.0699*** (0.020)
Drought SPEI GS x Ethnic Fraction.					-0.0024 (0.004)					-0.0058 (0.004)		0.0041 (0.004)
CP Index x Ethnic Fraction.						0.0247*** (0.009)						-0.0035 (0.009)
APP Index x Ethnic Polariz.							0.0148** (0.007)	0.0174* (0.010)			0.0274*** (0.008)	0.0362*** (0.011)
Drought SPEI GS x Ethnic Polariz.							-0.0022 (0.002)	-0.0013 (0.002)				-0.0039** (0.002)
CP Index x Ethnic Polariz.								-0.0002 (0.005)				-0.0046 (0.005)
Observations	170,112	139,136	170,112	110,000	169,488	138,592	169,488	138,592	169,488	109,968	169,488	109,968
Unconditional_Probability_Violence %	4.030%	3.743%	4.030%	4.235%	4.044%	3.757%	4.044%	3.757%	4.044%	4.235%	4.044%	4.235%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of of ACLED violence database (VIOLENCE). The Agricultural price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between the log of oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the approximation of Berman et al. (2017), in both cases at t, t-1 and t-2.

TABLE A14: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES: URBAN CONFLICTS

Type of CONFLICT	UCDP_Incidence (1)	UCDP_Incidence (2)	UCDP_Incidence (3)	UCDP_Incidence (4)	ACLED_Riots (5)	ACLED_Riots (6)	ACLED_Riots (7)	ACLED_Riots (8)	ACLED_Violence (9)	ACLED_Violence (10)	ACLED_Violence (11)	ACLED_Violence (12)
APP Index	-0.0189*** (0.004)	-0.0189*** (0.004)	-0.0151** (0.005)	-0.0150*** (0.005)	0.0275*** (0.004)	0.0223*** (0.004)	0.0298*** (0.006)	0.0283*** (0.006)	-0.0070 (0.005)	-0.0108** (0.005)	-0.0197*** (0.007)	-0.0183*** (0.007)
Drought SPEI GS	0.0038*** (0.001)	0.0038*** (0.001)	0.0024 (0.002)	0.0023 (0.002)	0.0035*** (0.001)	0.0036*** (0.001)	0.0068*** (0.002)	0.0068*** (0.002)	0.0026*** (0.001)	0.0026*** (0.001)	0.0005 (0.002)	0.0007 (0.002)
CP Index	0.0247** (0.011)	0.0246** (0.011)	0.0330*** (0.013)	0.0330** (0.013)	-0.0224** (0.010)	-0.0267*** (0.010)	-0.0106 (0.011)	-0.0114 (0.011)	0.0179*** (0.012)	0.0157*** (0.012)	0.0307*** (0.014)	0.0311*** (0.014)
Urban	-0.0106** (0.005)	-0.0131 (0.008)	-0.0103 (0.008)	-0.0104 (0.008)	0.0498*** (0.010)	-0.1418*** (0.022)	-0.1329*** (0.021)	-0.1333*** (0.021)	0.0421*** (0.010)	-0.0925*** (0.021)	-0.0816*** (0.021)	-0.0817*** (0.021)
CP Index x Urban	0.0007 (0.003)	0.0007 (0.003)	-0.0001 (0.003)	-0.0000 (0.003)	0.0704*** (0.007)	0.0704*** (0.007)	0.0628*** (0.007)	0.0628*** (0.007)	0.0628*** (0.007)	0.0518*** (0.007)	0.0454*** (0.007)	0.0455*** (0.007)
APP Index x Excluded groups			-0.0392*** (0.008)	-0.0298*** (0.008)			-0.0099 (0.008)	-0.0103 (0.008)			-0.0108 (0.009)	-0.0099 (0.009)
Drought SPEI GS x Excluded groups			0.0074*** (0.002)	0.0073*** (0.002)			-0.0018 (0.002)	-0.0019 (0.002)			0.0040** (0.002)	0.0040** (0.002)
CP Index x Excluded groups			-0.0011 (0.004)	0.0009 (0.004)			0.0013 (0.004)	0.0016 (0.004)			0.0173*** (0.005)	0.0176*** (0.005)
APP Index x Monopoly groups			-0.0878** (0.038)	-0.0880** (0.038)			-0.0346* (0.021)	-0.0344 (0.021)			-0.1435*** (0.044)	-0.1439*** (0.044)
Drought SPEI GS x Monopoly groups			-0.0056 (0.005)	-0.0055 (0.005)			-0.0127 (0.029)	-0.0124 (0.029)			0.0320 (0.022)	0.0320 (0.022)
CP Index x Monopoly groups			0.0240** (0.011)	0.0241** (0.011)			0.0236** (0.011)	0.0236** (0.011)			0.0707*** (0.015)	0.0712*** (0.015)
APP Index x Ethnic Fraction.			0.0456*** (0.015)	0.0456*** (0.015)			-0.0076 (0.018)	-0.0076 (0.018)			0.0655*** (0.020)	0.0655*** (0.020)
Drought SPEI GS x Ethnic Fraction.			-0.0063 (0.004)	-0.0063 (0.004)			-0.0168*** (0.004)	-0.0168*** (0.004)			0.0006 (0.004)	0.0006 (0.004)
CP Index x Ethnic Fraction.			0.0116 (0.008)	0.0116 (0.008)			0.0176** (0.009)	0.0176** (0.009)			-0.0045 (0.009)	-0.0045 (0.009)
APP Index x Ethnic Polariz			0.0240*** (0.008)	0.0240*** (0.008)			-0.0024 (0.010)	-0.0024 (0.010)			0.0336*** (0.011)	0.0336*** (0.011)
Drought SPEI GS x Ethnic Polariz			-0.0030 (0.002)	-0.0030 (0.002)			-0.0077*** (0.002)	-0.0077*** (0.002)			0.0003 (0.002)	0.0003 (0.002)
CP Index x Ethnic Polariz			0.0068* (0.004)	0.0068* (0.004)			0.0086* (0.005)	0.0086* (0.005)			-0.0045 (0.005)	-0.0045 (0.005)
Observations	134,672	134,672	107,488	107,488	134,672	134,672	107,488	107,488	134,672	134,672	107,488	107,488
Unconditional_Probability_Conflict %	2.180%	2.180%	2.420%	2.420%	2.618%	2.618%	2.985%	2.985%	3.740%	3.740%	4.192%	4.192%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP-GRID dataset (UCDP-Incidence) and ACLED riots (Riots) and violence against civilians (Violence) dataset. The Agricultural Price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CPI Index) coefficients displayed capture the sum of price impacts at t-1 and t-2. LPM estimations. Cooley (2008) standard errors in parentheses, allowing for spatial correlation within a 100km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, *p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017), in both cases at t, t-1 and t-2. Urban is the percentage of a given cell area classified as urban by PRIO-GRID database.

TABLE A15: FACTOR CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. CONFLICT INTENSITY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
UCDP FACTOR CONFLICT												
APP Index	-0.1531*** (0.029)	-0.1286*** (0.031)	-0.1144*** (0.028)	-0.1048*** (0.040)	-0.1704*** (0.031)	-0.1672*** (0.034)	-0.1776*** (0.034)	-0.1609*** (0.032)	-0.1491*** (0.030)	-0.1727*** (0.042)	-0.1474*** (0.029)	-0.1678*** (0.042)
Drought SPEI GS	0.0148 (0.009)	0.0060 (0.010)	0.0126 (0.011)	-0.0130 (0.018)	0.0173* (0.009)	0.0066 (0.010)	0.0173* (0.009)	0.0060 (0.010)	0.0157 (0.011)	-0.0141 (0.020)	0.0156 (0.011)	-0.0158 (0.020)
CP Index		0.3435*** (0.093)		0.4389*** (0.113)		0.3336*** (0.094)		0.3318*** (0.094)		0.4363*** (0.113)		0.4352*** (0.113)
APP Index x Excluded groups			-0.0916** (0.028)	-0.1055*** (0.052)					-0.1341*** (0.035)	-0.1542*** (0.057)	-0.1253*** (0.034)	-0.1447*** (0.057)
Drought SPEI GS x Excluded groups			0.0167 (0.014)	0.0495** (0.019)					0.0201 (0.014)	0.0515*** (0.019)	0.0197 (0.014)	0.0513** (0.019)
CP Index x Excluded groups				-0.0536* (0.029)						-0.0592** (0.028)		-0.0576*** (0.028)
APP Index x Monopoly groups			0.3592* (0.213)	-0.0972 (0.166)					0.3506 (0.213)	-0.1008 (0.165)	0.3494 (0.166)	-0.1026 (0.166)
Drought SPEI GS x Monopoly groups			-0.0671*** (0.025)	0.0340 (0.025)					-0.0665*** (0.025)	0.0340 (0.026)	-0.0665*** (0.026)	0.0340 (0.026)
CP Index x Monopoly groups				0.0542 (0.066)						0.0401 (0.067)		0.0422 (0.067)
APP Index x Ethnic Fraction.					0.1512** (0.062)	0.2285** (0.098)			0.3023*** (0.082)	0.4753*** (0.122)		
Drought SPEI GS x Ethnic Fraction.					-0.0195 (0.025)	-0.0085 (0.018)			-0.0318 (0.021)	-0.0001 (0.023)		
CP Index x Ethnic Fraction.						0.0894* (0.089)				0.0536 (0.051)		
APP Index x Ethnic Polariz.							0.0776** (0.036)	0.1039*** (0.054)			0.1492*** (0.046)	0.2361*** (0.067)
Drought SPEI GS x Ethnic Polariz.							-0.0103 (0.011)	-0.0020 (0.009)			-0.0161 (0.011)	0.0514 (0.012)
CP Index x Ethnic Polariz.								0.0515** (0.021)				0.0262 (0.026)
Observations	170,112	139,136	170,112	110,000	169,488	138,592	169,488	138,592	169,488	109,968	169,488	109,968
Unconditional_mean	0.109	0.086	0.109	0.101	0.113	0.086	0.110	0.086	0.110	0.101	0.110	0.101
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is the number of events observed in a cell during a given year, following the definition of UCDP conflict database (#EVENTS INTENSITY), The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2.

TABLE A16: OUTPUT CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES, RIOTS INTENSITY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots	#events Riots
APP Index	0.1140*** (0.027)	0.1472*** (0.032)	0.1404*** (0.035)	0.2049*** (0.055)	0.0479* (0.029)	0.0862** (0.037)	0.0523* (0.029)	0.0898** (0.038)	0.0805** (0.032)	0.0666 (0.062)	0.0832** (0.032)	0.0574 (0.066)
Drought SPEI GS	0.0234 (0.015)	0.0749** (0.034)	0.0216 (0.016)	0.0231 (0.0223)	0.0367** (0.017)	0.1103*** (0.042)	0.0371** (0.017)	0.1104*** (0.042)	0.0321* (0.017)	0.0298 (0.023)	0.0327* (0.017)	0.0270 (0.022)
CP Index		-0.5700*** (0.1213)		-0.4065*** (0.125)		-0.5864*** (0.118)		-0.5854*** (0.118)		-0.3265*** (0.101)		-0.3124*** (0.100)
APP Index x Excluded groups			-0.0550** (0.027)	-0.0117 (0.056)					-0.1276*** (0.038)	-0.0907 (0.062)	-0.1134*** (0.036)	-0.0854 (0.060)
Drought SPEI GS x Excluded groups			-0.0058 (0.010)	0.0248 (0.019)					0.0031 (0.011)	0.0274 (0.020)	-0.0025 (0.011)	0.0278 (0.020)
CP Index x Excluded groups				-0.1279** (0.057)						-0.1051** (0.044)		-0.1031** (0.045)
APP Index x Monopoly groups			-0.1764** (0.075)	-0.6774* (0.378)				-0.1950** (0.082)	-0.5873 (0.077)	-0.1968** (0.360)	-0.5944 (0.077)	(0.361)
Drought SPEI GS x Monopoly groups			0.0680 (0.098)	3.5608** (1.550)					0.0687 (0.098)	3.6121** (1.570)	-0.0689 (0.098)	3.6129** (1.570)
CP Index x Monopoly groups				1.5961** (0.772)						1.507** (0.749)		1.5164** (0.753)
APP Index x Ethnic Fraction.					0.3526*** (0.093)	0.3480** (0.156)			0.4978*** (0.123)	0.9088*** (0.319)		
Drought SPEI GS x Ethnic Fraction.					-0.0949** (0.041)	-0.2410*** (0.071)			-0.0651 (0.052)	-0.0954** (0.048)		
CP Index x Ethnic Fraction.					0.1296 (0.129)	0.1296 (0.129)				-0.4034 (0.335)		
APP Index x Ethnic Polariz.							0.1809*** (0.047)	0.1802** (0.082)			0.2470*** (0.060)	0.5151*** (0.183)
Drought SPEI GS x Ethnic Polariz.							-0.0518** (0.022)	-0.1287*** (0.037)			-0.0525** (0.023)	-0.0263 (0.030)
CP Index x Ethnic Polariz.								0.0596 (0.069)				-0.2707 (0.199)

Observations 170,112 139,136 170,112 110,000 169,488 138,592 169,488 169,488 138,592 169,488 109,968 169,488 109,968

Unconditional_mean_events 0.104 0.116 0.134 0.134 0.105 0.116 0.105 0.105 0.116 0.105 0.134 0.105 0.134

Cell FE YES YES YES YES YES YES YES YES YES YES YES YES YES

Year FE NON YES YES NON YES NON YES NON YES NON YES NON YES YES

Country x year FE YES NON YES YES NON YES YES NON YES NON YES NON YES NON YES

Country-specific time trend NON YES YES NON YES YES YES YES YES YES YES YES YES YES

Notes: The dependent variable is the number of events observed in a cell during a given year, following the definition of ACLED riots database (#EVENTS RIOTS). The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t , $t-1$, and $t-2$. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t , $t-1$ and $t-2$.

TABLE A17: OUTPUT CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES, VIOLENCE AGAINST CIVILIAN INTENSITY

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	#events	#events	#events	#events	#events	#events	#events	#events	#events	#events	#events	#events
	Violence	Violence	Violence	Violence	Violence	Violence	Violence	Violence	Violence	Violence	Violence	Violence
ACLED CONFLICT												
APP Index	-0.1277*** (0.028)	-0.1275*** (0.034)	-0.0647** (0.031)	-0.1112*** (0.041)	-0.1814*** (0.036)	-0.1965*** (0.043)	-0.1845*** (0.036)	-0.1984*** (0.044)	-0.1290*** (0.035)	-0.2227*** (0.050)	-0.1312*** (0.035)	-0.2301*** (0.049)
Drought SPEI GS	-0.0112 (0.008)	0.0014 (0.008)	-0.0128 (0.010)	-0.0114 (0.011)	-0.0071 (0.009)	0.0120 (0.009)	-0.0068 (0.009)	0.0110 (0.009)	-0.0083 (0.011)	-0.0076 (0.015)	-0.0081 (0.011)	-0.0100 (0.014)
CP Index		0.5992*** (0.115)		0.7623*** (0.137)		0.5653*** (0.115)		0.5688*** (0.273)		0.7537*** (0.139)		0.7699*** (0.138)
APP Index x Excluded groups			-0.1472*** (0.037)	-0.1191 (0.075)					-0.2260*** (0.046)	-0.1991** (0.080)	-0.2156*** (0.081)	-0.1944** (0.081)
Drought SPEI GS x Excluded groups			0.0134 (0.009)	0.0147 (0.014)					0.0185 (0.009)	0.0174 (0.014)	0.0181** (0.009)	0.0169 (0.015)
CP Index x Excluded groups				0.0234 (0.048)						0.0097 (0.046)		0.1739 (0.0482)
APP Index x Monopoly groups			0.3389 (0.281)	-0.1074 (0.132)					0.3240 (0.281)	-0.1011 (0.131)	0.3207 (0.281)	-0.1048 (0.131)
Drought SPEI GS x Monopoly groups			-0.0512 (0.039)	0.4437*** (0.161)					-0.0540 (0.039)	0.4450*** (0.163)	-0.0503 (0.039)	0.4598*** (0.163)
CP Index x Monopoly groups				0.1925** (0.098)					0.1561 (0.097)		0.1621* (0.097)	
APP Index x Ethnic Fraction.				0.3008*** (0.103)		0.3839** (0.159)			0.5529*** (0.128)	0.7776*** (0.191)		
Drought SPEI GS x Ethnic Fraction.				-0.0324 (0.022)		-0.0761*** (0.025)			-0.0484** (0.021)	-0.0324 (0.026)		
CP Index x Ethnic Fraction.						0.2948*** (0.794)				0.1377* (0.835)		
APP Index x Ethnic Polariz.				0.1751*** (0.060)				0.2235*** (0.082)			0.2973*** (0.072)	0.4405*** (0.102)
Drought SPEI GS x Ethnic Polariz.				-0.01821 (0.012)				-0.0371*** (0.012)			-0.0255** (0.011)	-0.0102 (0.013)
CP Index x Ethnic Polariz.								0.1365*** (0.513)				0.3467 (0.059)
Observations	170,112	139,136	170,112	110,000	169,488	138,592	169,488	138,592	169,488	109,968	169,488	109,968
Unconditional Mean	0.147	0.128	0.147	0.145	0.148	0.124	0.148	0.124	0.148	0.145	0.148	0.145
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is the number of events observed in a cell during a given year, following the definition of ACLED violence database (#EVENTS VIOLENCE). The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing or spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include interactions between the log of oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017), in both cases at t, t-1 and t-2.

TABLE A18: FACTOR CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. BASE CROPS: M3 DATA.

UCDP FACTOR CONFLICT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
APP Index	-0.0047 (0.004)	-0.0078** (0.004)	0.0009 (0.004)	-0.0073 (0.005)	-0.0059 (0.005)	-0.0168*** (0.005)	-0.0064 (0.005)	-0.0166*** (0.006)	-0.0020 (0.005)	-0.0197*** (0.007)	0.0022 (0.005)	-0.0198*** (0.007)
Drought SPEI GS	0.0033*** (0.001)	0.0033*** (0.001)	0.0026* (0.001)	0.0022 (0.002)	0.0035** (0.001)	0.0027** (0.001)	0.0034*** (0.001)	0.0026** (0.002)	0.0029* (0.002)	0.0018 (0.002)	0.0028* (0.002)	0.0016 (0.002)
CP Index		-0.0127 (0.013)		-0.0029 (0.015)	-0.0077 (0.012)			-0.0081 (0.012)		0.0033 (0.014)		0.0025 (0.014)
APP Index x Excluded groups			-0.0146*** (0.004)	-0.0079 (0.007)					-0.0173*** (0.004)	-0.0114 (0.007)	-0.0169*** (0.004)	-0.0103 (0.007)
Drought SPEI GS x Excluded groups			0.0031* (0.002)	0.0047** (0.002)					0.0035** (0.002)	0.0051** (0.002)	0.0034** (0.002)	0.0051** (0.002)
CP Index x Excluded groups				-0.0054 (0.005)						-0.0053 (0.005)		-0.0056 (0.005)
APP Index x Monopoly groups			0.0180 (0.012)	0.0372*** (0.014)					0.0163 (0.012)	0.0319** (0.014)	0.0161 (0.012)	0.0321** (0.014)
Drought SPEI GS x Monopoly groups			-0.0040* (0.002)	-0.0036 (0.004)					-0.0040* (0.002)	-0.0032 (0.004)	-0.0040* (0.002)	-0.0032 (0.004)
CP Index x Monopoly groups				-0.0131 (0.016)						-0.0116 (0.017)		-0.0120 (0.017)
APP Index x Ethnic Fraction.					0.0079 (0.009)	0.0511*** (0.013)			0.0223** (0.009)	0.0626*** (0.014)		
Drought SPEI GS x Ethnic Fraction.					-0.0011 (0.004)	0.0030 (0.004)			-0.0032 (0.004)	0.0009 (0.002)		
CP Index x Ethnic Fraction.						-0.0250*** (0.009)				-0.0092* (0.005)		
APP Index x Ethnic Polariz.							0.0058 (0.005)	0.0275*** (0.007)			0.0126** (0.005)	0.0324*** (0.008)
Drought SPEI GS x Ethnic Polariz.							-0.0004 (0.002)	0.0018 (0.002)			-0.0014 (0.002)	0.0002 (0.002)
CP Index x Ethnic Polariz.								-0.0119** (0.005)				-0.0090* (0.005)
Observations	138,216	113,048	138,216	89,375	137,709	112,606	137,709	112,606	137,709	89,349	137,709	89,349
Unconditional	2.414%	2.057%	2.414%	2.269%	2.422%	2.065%	2.422%	2.065%	2.422%	2.269%	2.422%	2.269%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	NON	NON	YES	NON	NON	NON	NON	NON	NON	NON	NON

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP incidence database (INCIDENCE), The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CPI Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2. Years: 2001-2013.

TABLE A19: OUTPUT CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. BASE CROPS: M3 DATA.

	Riots (1)	Riots (2)	Riots (3)	Riots (4)	Riots (5)	Riots (6)	Riots (7)	Riots (8)	Riots (9)	Riots (10)	Riots (11)	Riots (12)
ACLED CONFLICT												
APP Index	0.0316*** (0.004)	0.0285*** (0.005)	0.0240*** (0.004)	0.0144** (0.006)	0.0289*** (0.005)	0.0392*** (0.006)	0.0292*** (0.005)	0.0397*** (0.006)	0.0231*** (0.005)	0.0247** (0.007)	0.0235*** (0.005)	0.0256*** (0.007)
Drought SPEI GS	0.0033*** (0.001)	0.0044*** (0.001)	0.0010 (0.001)	0.0024 (0.002)	0.0021* (0.001)	0.0070*** (0.002)	0.0018 (0.001)	0.0067*** (0.001)	0.0018 (0.001)	0.0062*** (0.002)	0.0016 (0.001)	0.0058*** (0.002)
CP Index	-0.0480*** (0.017)	-0.0580*** (0.015)	-0.0580*** (0.015)	-0.0580*** (0.015)	-0.0199 (0.016)	-0.0199 (0.016)	-0.0199 (0.016)	-0.0582*** (0.015)	-0.0180 (0.016)	-0.0180 (0.016)	-0.0185 (0.016)	-0.0185 (0.016)
APP Index x Excluded groups			0.0067* (0.004)	0.0010 (0.007)					0.0062 (0.004)	0.0026 (0.007)	0.0065* (0.004)	0.0023 (0.007)
Drought SPEI GS x Excluded groups			-0.001 (0.001)	0.0010 (0.002)					0.005 (0.002)	0.0005 (0.002)	0.0003 (0.002)	0.0005 (0.002)
CP Index x Excluded groups.				-0.0020 (0.005)						-0.0028 (0.005)		-0.0031 (0.005)
APP Index x Monopoly groups			0.1233*** (0.019)	0.2086*** (0.051)					0.1228*** (0.019)	0.2268*** (0.051)	0.1230*** (0.019)	0.2274*** (0.051)
Drought SPEI GS x Monopoly groups			-0.0024 (0.006)	0.0146 (0.031)					-0.0024 (0.006)	0.0166 (0.031)	-0.0023 (0.006)	0.0168 (0.031)
CP Index x Monopoly groups			-0.1496*** (0.042)	-0.1496*** (0.042)					-0.1699*** (0.041)	-0.1699*** (0.041)	-0.1698*** (0.041)	-0.1698*** (0.041)
APP Index x Ethnic Fraction.					0.0131 (0.010)	-0.0662*** (0.016)			0.0044 (0.011)	-0.0540*** (0.017)		
Drought SPEI GS x Ethnic Fraction.					-0.0079* (0.004)	-0.0241*** (0.005)			-0.0073* (0.004)	-0.0206*** (0.006)		
CP Index x Ethnic Fraction.					0.0638*** (0.011)	0.0638*** (0.011)				0.0440*** (0.012)		
APP Index x Ethnic Polariz.							0.0063 (0.006)	-0.0375*** (0.009)			0.0012 (0.006)	-0.0317*** (0.009)
Drought SPEI GS x Ethnic Polariz.							-0.0033 (0.002)	-0.0117*** (0.002)			-0.0028 (0.002)	-0.0095*** (0.003)
CP Index x Ethnic Polariz.								0.0348*** (0.005)			0.0238*** (0.006)	0.0238*** (0.006)
Observations	138,216	113,048	138,216	89,375	137,709	112,606	137,709	112,606	137,709	89,349	137,709	89,349
Unconditional Probability Riots %	2.817%	2.968%	2.817%	3.409%	2.826%	2.978%	2.826%	2.977%	2.826%	3.408%	2.826%	3.408%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of ACLED riots database (RIOTS), The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2. Years: 2001-2013.

TABLE A20: OUTPUT CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. BASE CROPS: M3 DATA.

	Violence (1)	Violence (2)	Violence (3)	Violence (4)	Violence (5)	Violence (6)	Violence (7)	Violence (8)	Violence (9)	Violence (10)	Violence (11)	Violence (12)
ACLED CONFLICT												
APP Index	0.0224*** (0.005)	0.0225*** (0.005)	0.0167*** (0.005)	0.0078 (0.006)	0.0112*** (0.005)	0.0181*** (0.006)	0.0120** (0.006)	0.0198*** (0.006)	0.0104* (0.006)	0.0020 (0.008)	0.0111** (0.006)	0.0042 (0.008)
Drought SPEI GS	-0.0001 (0.001)	0.0036*** (0.001)	-0.0023 (0.002)	0.0009 (0.002)	-0.0005 (0.001)	0.0034** (0.001)	-0.0001 (0.001)	0.0037*** (0.001)	-0.0020 (0.002)	0.0011 (0.002)	-0.0017 (0.002)	0.0016 (0.002)
CP Index	-0.0873*** (0.018)	-0.0873*** (0.018)	-0.0638*** (0.017)	-0.0638*** (0.017)	-0.0883*** (0.015)	-0.0883*** (0.015)	-0.0891*** (0.015)	-0.0891*** (0.015)	-0.0629*** (0.017)	-0.0629*** (0.017)	-0.0637*** (0.017)	-0.0637*** (0.017)
APP Index x Excluded groups			-0.0027 (0.005)	0.0074 (0.009)					-0.0052 (0.005)	0.0058 (0.009)	-0.0066 (0.005)	0.0068 (0.009)
Drought SPEI GS x Excluded groups			0.0060*** (0.002)	0.0080*** (0.003)					0.0063*** (0.002)	0.0081*** (0.003)	0.0063*** (0.002)	0.0080*** (0.003)
CP Index x Excluded groups				0.0019 (0.006)						0.0002 (0.006)		0.0006 (0.006)
APP Index x Monopoly groups			0.0825*** (0.018)	0.1540*** (0.043)					0.0790*** (0.018)	0.1566*** (0.043)	0.0792*** (0.016)	0.1571*** (0.043)
Drought SPEI GS x Monopoly groups			-0.0040 (0.005)	0.0327 (0.024)					-0.0041 (0.005)	0.0332 (0.024)	-0.0040 (0.005)	0.0332 (0.024)
CP Index x Monopoly groups				-0.1081*** (0.036)						-0.1147** (0.036)		-0.1144*** (0.036)
APP Index x Ethnic Fraction.					0.0388*** (0.012)	0.0176 (0.017)			0.0442*** (0.005)	0.0288 (0.012)		
Drought SPEI GS x Ethnic Fraction.					-0.0004 (0.004)	-0.0015 (0.004)			-0.0034 (0.004)	-0.0007 (0.005)		
CP Index x Ethnic Fraction.					0.0022* (0.012)					0.0031 (0.012)		
APP Index x Ethnic Polariz.							0.0194*** (0.007)	0.0049 (0.009)			0.0208*** (0.007)	0.0094 (0.010)
Drought SPEI GS x Ethnic Polariz.							-0.0015 (0.002)	-0.0018 (0.002)			-0.0029 (0.002)	-0.0014 (0.003)
CP Index x Ethnic Polariz.								0.0133** (0.006)				0.0026 (0.006)
Observations	127,584	106,197	138,216	89,375	137,709	112,606	137,709	112,606	137,709	89,349	137,709	89,349
Unconditional Probability_Violence %	4.180%	3.805%	4.180%	4.262%	4.195%	3.820%	4.195%	3.820%	4.195%	4.262%	4.195%	4.263%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of ACLED riots database (Violence). The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2. Years: 2001-2013.

TABLE A21: ACLED FACTOR CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. BASE CROPS: BATTLES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ACLED BATTLES												
APP Index	-0.0159*** (0.004)	-0.0137*** (0.004)	-0.0120*** (0.004)	-0.0102*** (0.005)	-0.0189*** (0.005)	-0.0164*** (0.005)	-0.0192*** (0.004)	-0.0166*** (0.005)	-0.0154*** (0.004)	-0.0168*** (0.006)	-0.0157*** (0.004)	-0.0174*** (0.006)
Drought SPEI GS	-0.0000 (0.001)	0.0015 (0.001)	-0.0018 (0.001)	0.0006 (0.002)	-0.0006 (0.001)	0.0018 (0.002)	-0.0005 (0.001)	0.0018 (0.001)	-0.0020 (0.001)	0.0005 (0.002)	-0.0019 (0.002)	0.0002 (0.002)
CP Index	0.0012 (0.012)	0.0012 (0.012)	0.0012 (0.012)	0.0192 (0.014)	0.0003 (0.012)	-0.0003 (0.012)	-0.0005 (0.014)	-0.0005 (0.014)	0.0210 (0.014)	0.0210 (0.014)	0.0210 (0.014)	0.0211 (0.014)
APP Index x Excluded groups			-0.0052 (0.005)	-0.0108 (0.010)					-0.0090 (0.006)	-0.0152 (0.010)	-0.0088 (0.010)	-0.0153 (0.010)
Drought SPEI GS x Excluded groups			0.0040** (0.002)	0.0006 (0.002)					0.0039** (0.002)	0.0006 (0.002)	0.0040** (0.002)	0.0006 (0.002)
CP Index x Excluded groups				0.0168*** (0.005)						0.0165*** (0.005)		0.0167*** (0.005)
APP Index x Monopoly groups			-0.1701*** (0.043)	-0.2202*** (0.050)					-0.1702*** (0.042)	-0.2190*** (0.050)	-0.1706*** (0.042)	-0.2193*** (0.050)
Drought SPEI GS x Monopoly groups			0.0072 (0.005)	0.0749*** (0.021)					0.0073 (0.005)	0.0753*** (0.022)	0.0074 (0.005)	0.0753*** (0.022)
CP Index x Monopoly groups				0.0726*** (0.016)						0.0703*** (0.016)		0.0703*** (0.016)
APP Index x Ethnic Fraction.			0.0174 (0.013)	0.0156 (0.018)					0.0287** (0.014)	0.0451** (0.020)		
Drought SPEI GS x Ethnic Fraction.			0.0033 (0.004)	-0.0028 (0.004)					0.0010 (0.004)	0.0004 (0.005)		
CP Index x Ethnic Fraction.				0.0161* (0.009)						-0.0033 (0.009)		
APP Index x Ethnic Polariz.							0.0108 (0.007)	0.0098 (0.010)			0.0165** (0.008)	0.0264** (0.011)
Drought SPEI GS x Ethnic Polariz.							0.0016 (0.002)	-0.0010 (0.002)			0.0003 (0.002)	0.0011 (0.002)
CP Index x Ethnic Polariz.								0.0091* (0.005)				-0.0022 (0.005)
Observations	170,112	139,136	170,112	110,000	169,488	138,592	169,488	138,592	169,488	109,968	169,488	109,968
Unconditional_Probability_Battles %	3.876%	3.351%	3.876%	3.812%	3.890%	3.364%	3.890%	3.364%	3.890%	3.813%	3.890%	3.813%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES
Country x year FE	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON
Country-specific time trend	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES	NON	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of ACLED battles database (BATTLES). The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing or spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2.

TABLE A22: CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. SPATIAL SPILLOVERS

Type of CONFLICT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	UCDP-Incidence	UCDP-Incidence	UCDP-Incidence	ACLED-Riots	ACLED-Riots	ACLED-Riots	ACLED-Violence	ACLED-Violence	ACLED-Violence
small APP Index	-0.0181*** (0.004)	-0.0141*** (0.005)	-0.0139*** (0.005)	0.0272*** (0.004)	0.0342*** (0.006)	0.0340*** (0.006)	-0.0059 (0.005)	-0.0160** (0.006)	-0.0157** (0.006)
Drought SPEI GS	0.0030*** (0.001)	0.0011 (0.002)	0.0009 (0.002)	0.0028*** (0.001)	0.0055*** (0.001)	0.0051*** (0.002)	0.0011 (0.001)	-0.0028 (0.002)	-0.0027 (0.002)
CP Index	0.0177 (0.011)	0.0344*** (0.013)	0.0252** (0.013)	-0.0247*** (0.010)	-0.0099 (0.011)	-0.0094 (0.011)	0.0177 (0.012)	0.0318*** (0.013)	0.032*** (0.013)
APP Index in neighbouring cells	0.0006 (0.005)	-0.0044 (0.006)	-0.0044 (0.006)	-0.0011 (0.005)	-0.0017 (0.006)	-0.0016 (0.006)	-0.0036 (0.007)	-0.0096 (0.008)	-0.0095 (0.008)
Drought SPEI GS in neighbouring cells	0.0012 (0.003)	0.0008 (0.004)	0.0020 (0.004)	0.0011 (0.003)	0.0019 (0.004)	0.0018 (0.004)	0.0008 (0.004)	0.0040 (0.005)	0.0041 (0.005)
APP Index x Excluded groups	-0.0269*** (0.008)	-0.0264*** (0.008)	-0.0264*** (0.008)	0.0272*** (0.008)	0.0342*** (0.008)	0.0340*** (0.008)	-0.0059 (0.008)	-0.0111 (0.009)	-0.0101 (0.009)
Drought SPEI GS x Excluded groups	0.0076*** (0.002)	0.0075*** (0.002)	0.0075*** (0.002)	0.0028*** (0.002)	0.0055*** (0.002)	0.0051*** (0.002)	0.0011 (0.002)	0.0068*** (0.002)	0.0067*** (0.002)
CP Index x Excluded groups	-0.0030 (0.004)	-0.0030 (0.004)	-0.0029 (0.004)	0.0030 (0.004)	0.0005 (0.004)	0.0010 (0.004)	0.0010 (0.004)	0.0155*** (0.005)	0.0159*** (0.005)
APP Index x Monopoly groups	-0.0885** (0.038)	-0.0887** (0.038)	-0.0887** (0.038)	-0.0511** (0.021)	-0.0511** (0.021)	-0.0508** (0.021)	-0.0608** (0.021)	-0.1542*** (0.044)	-0.1546*** (0.044)
Drought SPEI GS x Monopoly groups	-0.0019 (0.004)	-0.0019 (0.004)	-0.0019 (0.004)	0.0028 (0.004)	0.0028 (0.004)	0.0029 (0.004)	0.0029 (0.004)	0.0421* (0.022)	0.0420* (0.022)
CP Index x Monopoly groups	0.0245** (0.011)	0.0245** (0.011)	0.0245** (0.011)	0.0370*** (0.011)	0.0370*** (0.011)	0.0370*** (0.011)	0.0370*** (0.011)	0.0798*** (0.015)	0.0805*** (0.015)
APP Index x Ethnic Fraction.	0.0379** (0.015)	0.0379** (0.015)	0.0379** (0.015)	-0.0087 (0.018)	-0.0087 (0.018)	-0.0087 (0.018)	0.0700*** (0.020)	0.0700*** (0.020)	0.0700*** (0.020)
Drought SPEI GS x Ethnic Fraction.	-0.0039 (0.004)	-0.0039 (0.004)	-0.0039 (0.004)	0.0207** (0.009)	0.0207** (0.009)	0.0207** (0.009)	0.0004 (0.004)	0.0004 (0.004)	0.0004 (0.004)
CP Index x Ethnic Fraction.	0.0108 (0.007)	0.0108 (0.007)	0.0108 (0.007)	0.0195** (0.008)	0.0195** (0.008)	0.0195** (0.008)	-0.0029 (0.010)	-0.0029 (0.010)	0.0362*** (0.011)
APP Index x Ethnic Polariz.	-0.0014 (0.002)	-0.0014 (0.002)	-0.0014 (0.002)	-0.0067*** (0.002)	-0.0067*** (0.002)	-0.0067*** (0.002)	-0.0067*** (0.002)	-0.0067*** (0.002)	0.0019 (0.002)
Drought SPEI GS x Ethnic Polariz.	0.0066 (0.004)	0.0066 (0.004)	0.0066 (0.004)	0.0066 (0.004)	0.0066 (0.004)	0.0066 (0.004)	0.0093** (0.005)	0.0093** (0.005)	-0.0047 (0.005)
CP Index x Ethnic Polariz.	139,136 2.168%	109,968 2.434%	109,968 2.434%	139,136 2.696%	109,968 3.100%	109,968 3.100%	139,136 3.949%	109,968 4.236%	109,968 4.236%
Observations	139,136	109,968	109,968	139,136	109,968	109,968	139,136	109,968	109,968
Unconditional_Probability_Conflict	YES	YES	YES	YES	YES	YES	YES	YES	YES
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP-GED database (UCDP-INCIDENCE) and ACLED riots (RIOTS), and violence against civilians (VIOLENCE) database. The Agricultural price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CPI Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 220km radius and for five periods of correlation. p-values are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2. Neighbouring indexes are the average contiguity AAP Index and the drought SPEI Growing season in degree 1 and degree 2 neighbouring cells.

TABLE A23: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES: SPATIAL AND SERIAL CORRELATIONS, STANDARD ERRORS ANALYSIS

Type of CONFLICT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	UCDP_Incidence	UCDP_Incidence	UCDP_Incidence	ACLED_Riots	ACLED_Riots	ACLED_Riots	ACLED_Violence	ACLED_Violence	ACLED_Violence
APP Index	-0.0181	-0.0140	-0.0138	0.0272	0.0343	0.0338	-0.0059	-0.0158	-0.0154
Standard error 55km, Time: 2 years	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.006)	(0.006)
Standard error 55km, Time: Infinite	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.006)	(0.006)
Standard error 1000km, Time: 2 years	(0.005)	(0.007)	(0.007)	(0.006)	(0.007)	(0.008)	(0.007)	(0.009)	(0.009)
Standard error 1000km, Time: Infinite	(0.005)	(0.007)	(0.007)	(0.006)	(0.008)	(0.008)	(0.007)	(0.009)	(0.009)
Drought SPEI GS	0.0030	0.0011	0.0008	0.0028	0.0055	0.0050	0.0011	-0.0029	-0.0029
Standard error 55km, Time: 2 years	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Standard error 55km, Time: Infinite	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Standard error 1000km, Time: 2 years	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)
Standard error 1000km, Time: Infinite	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.003)
CP Index	0.0250	0.0348	0.0344	-0.0247	-0.0099	-0.0135	0.0176	0.0316	-0.0322
Standard error 55km, Time: 2 years	(0.009)	(0.011)	(0.011)	(0.009)	(0.009)	(0.010)	(0.010)	(0.012)	(0.012)
Standard error 55km, Time: Infinite	(0.009)	(0.011)	(0.011)	(0.009)	(0.009)	(0.010)	(0.010)	(0.012)	(0.012)
Standard error 1000km, Time: 2 years	(0.021)	(0.023)	(0.023)	(0.019)	(0.019)	(0.019)	(0.023)	(0.025)	(0.025)
Standard error 1000km, Time: Infinite	(0.021)	(0.023)	(0.023)	(0.019)	(0.019)	(0.019)	(0.023)	(0.025)	(0.025)
Observations	139,136	109,968	109,968	139,136	109,968	109,968	139,136	109,968	109,968
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial and serial correlation. The table is the same as Table 3, Table 4, and Table 5 (columns (2), (10) and (12)) of main text, except that we allow different radius and time periods of spatial and serial correlation. The Agricultural price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t , $t-1$, and $t-2$. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t , $t-1$ and $t-2$.

TABLE A23: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES: SPATIAL AND SERIAL CORRELATIONS.

Type of CONFLICT	UCDP_Incidence (1)	UCDP_Incidence (2)	UCDP_Incidence (3)	ACLED_Riots (4)	ACLED_Riots (5)	ACLED_Riots (6)	ACLED_Violence (7)	ACLED_Violence (8)	ACLED_Violence (9)
APP Index x Excluded groups									
Standard error 55km, Time: 2 years	-0.0269 (0.007)	-0.0269 (0.007)	-0.0265 (0.007)	-0.0286 (0.007)	-0.0095 (0.007)	-0.0111 (0.008)	-0.0101 (0.008)		
Standard error 55km, Time: Infinite	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)		
Standard error 1000km, Time: 2 years	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.013)	(0.013)		
Standard error 1000km, Time: Infinite	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.013)	(0.013)		
Drought SPEI GS x Excluded groups									
Standard error 55km, Time: 2 years	0.0076 (0.002)	0.0076 (0.002)	0.0076 (0.002)	-0.0007 (0.002)	-0.0008 (0.002)	0.0068 (0.002)	0.0067 (0.002)		
Standard error 55km, Time: Infinite	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		
Standard error 1000km, Time: 2 years	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)		
Standard error 1000km, Time: Infinite	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)		
CP Index x Excluded groups									
Standard error 55km, Time: 2 years	-0.0030 (0.003)	-0.0030 (0.003)	-0.0029 (0.003)	0.0006 (0.003)	0.0010 (0.003)	0.0154 (0.004)	0.0158 (0.004)		
Standard error 55km, Time: Infinite	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)		
Standard error 1000km, Time: 2 years	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.008)	(0.007)		
Standard error 1000km, Time: Infinite	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)	(0.007)		
APP Index x Monopoly groups									
Standard error 55km, Time: 2 years	-0.0885 (0.032)	-0.0885 (0.032)	-0.0887 (0.032)	-0.0512 (0.028)	-0.0509 (0.028)	-0.1549 (0.041)	-0.1553 (0.041)		
Standard error 55km, Time: Infinite	(0.032)	(0.032)	(0.032)	(0.028)	(0.028)	(0.041)	(0.041)		
Standard error 1000km, Time: 2 years	(0.034)	(0.034)	(0.034)	(0.023)	(0.023)	(0.042)	(0.042)		
Standard error 1000km, Time: Infinite	(0.032)	(0.032)	(0.032)	(0.023)	(0.023)	(0.037)	(0.037)		
Drought SPEI GS x Monopoly groups									
Standard error 55km, Time: 2 years	-0.0019 (0.003)	-0.0019 (0.003)	-0.0019 (0.003)	0.0028 (0.003)	0.0030 (0.003)	0.0423 (0.022)	0.0422 (0.022)		
Standard error 55km, Time: Infinite	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.022)	(0.022)		
Standard error 1000km, Time: 2 years	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.021)	(0.021)		
Standard error 1000km, Time: Infinite	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.031)	(0.031)		
CP Index x Monopoly groups									
Standard error 55km, Time: 2 years	0.0245 (0.009)	0.0245 (0.009)	0.0245 (0.009)	0.0371 (0.010)	0.0372 (0.010)	0.0798 (0.014)	0.0805 (0.014)		
Standard error 55km, Time: Infinite	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.014)	(0.014)		
Standard error 1000km, Time: 2 years	(0.015)	(0.015)	(0.015)	(0.016)	(0.016)	(0.025)	(0.025)		
Standard error 1000km, Time: Infinite	(0.015)	(0.015)	(0.015)	(0.017)	(0.017)	(0.025)	(0.025)		
APP Index x Ethnic Fraction.									
Standard error 55km, Time: 2 years	0.0379 (0.014)	0.0379 (0.014)	0.0379 (0.014)	-0.0087 (0.017)	-0.0087 (0.017)	0.0699 (0.019)	0.0699 (0.019)		
Standard error 55km, Time: Infinite	(0.014)	(0.014)	(0.014)	(0.017)	(0.017)	(0.019)	(0.019)		
Standard error 1000km, Time: 2 years	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.022)	(0.022)		
Standard error 1000km, Time: Infinite	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)	(0.025)	(0.025)		
Drought SPEI GS x Ethnic Fraction.									
Standard error 55km, Time: 2 years	-0.0039 (0.004)	-0.0039 (0.004)	-0.0039 (0.004)	-0.0153 (0.004)	-0.0153 (0.004)	0.0041 (0.004)	0.0041 (0.004)		
Standard error 55km, Time: Infinite	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)		
Standard error 1000km, Time: 2 years	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)		
Standard error 1000km, Time: Infinite	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)		
CP Index x Ethnic Fraction.									
Standard error 55km, Time: 2 years	0.0108 (0.006)	0.0108 (0.006)	0.0108 (0.006)	0.0207 (0.008)	0.0207 (0.008)	-0.0035 (0.009)	-0.0035 (0.009)		
Standard error 55km, Time: Infinite	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.009)	(0.009)		
Standard error 1000km, Time: 2 years	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.012)	(0.012)		
Standard error 1000km, Time: Infinite	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)	(0.012)	(0.012)		
APP Index x Ethnic Polariz.									
Standard error 55km, Time: 2 years	0.0195 (0.008)	0.0195 (0.008)	0.0195 (0.008)	-0.0031 (0.009)	-0.0031 (0.009)	0.03621 (0.011)	0.03621 (0.011)		
Standard error 55km, Time: Infinite	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.011)	(0.011)		
Standard error 1000km, Time: 2 years	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)		
Standard error 1000km, Time: Infinite	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)		
Drought SPEI GS x Ethnic Polariz.									
Standard error 55km, Time: 2 years	-0.0014 (0.002)	-0.0014 (0.002)	-0.0014 (0.002)	-0.0068 (0.002)	-0.0068 (0.002)	0.0020 (0.002)	0.0020 (0.002)		
Standard error 55km, Time: Infinite	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)		
Standard error 1000km, Time: 2 years	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)		
Standard error 1000km, Time: Infinite	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)		
CP Index x Ethnic Polariz									
Standard error 55km, Time: 2 years	0.0066 (0.004)	0.0066 (0.004)	0.0066 (0.004)	0.0093 (0.004)	0.0093 (0.004)	-0.0046 (0.005)	-0.0046 (0.005)		
Standard error 55km, Time: Infinite	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)		
Standard error 1000km, Time: 2 years	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)		
Standard error 1000km, Time: Infinite	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)		
Observations	139,136	109,968	109,968	139,136	109,968	139,136	109,968	109,968	109,968
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: LPM estimations; Conley (2008) standard errors in parentheses, allowing for spatial and serial correlation. The table is the same as Table 3, Table 4, and Table 5 (columns (2), (10) and (12)) of main text, except that we allow different radius and time periods of spatial and serial correlation. The Agricultural price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CPI Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2.

TABLE A24: CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES: ONE DEGREE AGGREGATION

Type of CONFLICT	UCDP_Incidence (1)	UCDP_Incidence (2)	UCDP_Incidence (3)	ACLED_Riots (4)	ACLED_Riots (5)	ACLED_Riots (6)	ACLED_Violence (7)	ACLED_Violence (8)	ACLED_Violence (9)
APP Index	-0.0330*** (0.009)	-0.0224*** (0.011)	-0.0257*** (0.011)	0.0338*** (0.010)	0.0670*** (0.012)	0.0665*** (0.013)	-0.0199* (0.011)	-0.0214 (0.014)	-0.0275* (0.014)
Drought SPEI GS	0.0114*** (0.003)	0.0061 (0.004)	0.0056 (0.004)	0.0171*** (0.003)	0.0186*** (0.004)	0.0176*** (0.004)	0.0080*** (0.003)	0.0066 (0.004)	0.0062 (0.004)
CP Index	0.0314 (0.026)	0.0283 (0.027)	0.0260 (0.027)	-0.0623 (0.027)	-0.0739*** (0.026)	-0.0622*** (0.027)	-0.0208 (0.030)	-0.0286 (0.031)	-0.0260 (0.031)
APP Index x Excluded groups		-0.0112*** (0.005)	-0.0114*** (0.005)		-0.0098* (0.005)	-0.0101* (0.005)		-0.0065 (0.006)	-0.0069 (0.006)
Drought SPEI GS x Excluded groups		0.0035*** (0.002)	0.0035*** (0.001)		-0.0010 (0.001)	-0.0012 (0.001)		0.0018 (0.001)	0.0018 (0.001)
CP Index x Excluded groups		-0.0018 (0.003)	-0.0022 (0.003)		0.0033 (0.003)	0.0038 (0.003)		0.0072*** (0.003)	0.0075*** (0.003)
APP Index x Monopoly groups		-0.1923*** (0.047)	-0.1926*** (0.047)		-0.2250*** (0.045)	-0.2246*** (0.045)		-0.2804*** (0.053)	-0.2837*** (0.053)
Drought SPEI GS x Monopoly groups		0.0109 (0.011)	0.0108 (0.010)		-0.1052** (0.052)	-0.1044* (0.052)		0.0430 (0.042)	0.0424 (0.042)
CP Index x Monopoly groups		0.0544*** (0.017)	0.0525*** (0.017)		0.1755*** (0.024)	0.1750*** (0.024)		0.2056*** (0.030)	0.2071*** (0.030)
APP Index x Ethnic Fraction.		0.0475 (0.030)	0.0475 (0.030)		-0.0522 (0.040)	-0.0522 (0.040)		0.0854*** (0.040)	0.0854*** (0.040)
Drought SPEI GS x Ethnic Fraction.		0.0074 (0.011)	0.0074 (0.011)		-0.0406*** (0.010)	-0.0406*** (0.010)		-0.0762 (0.011)	-0.0762 (0.011)
CP Index x Ethnic Fraction.		-0.0019 (0.019)	-0.0019 (0.019)		0.0795*** (0.022)	0.0795*** (0.022)		-0.0370 (0.023)	-0.0370 (0.023)
APP Index x Ethnic Polariz.			0.0365** (0.018)			-0.0275 (0.022)			0.0662*** (0.024)
Drought SPEI GS x Ethnic Polariz.			0.0055 (0.006)			-0.0232*** (0.006)			-0.0031 (0.006)
CP Index x Ethnic Polariz.			0.0062 (0.011)			0.0450*** (0.013)			-0.0273*** (0.013)
Observations	35,216	35,216	35,216	35,216	35,216	35,216	35,216	35,216	35,216
Unconditional_Probability_Conflict	5.608%	5.608%	5.608%	8.067%	8.067%	8.067%	9.873%	9.873%	9.873%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP-GED database (UCDP_INCIDENCE) and ACLED riots (RIOTS), and violence against civilians (VIOLENCE) database. The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 220km radius and for five periods of correlation. p-values for linear combination are reported in parentheses *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2. Each cell is 110km x 110km at the equator.

TABLE A25: CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES: TWO DEGREE AGGREGATION

Type of CONFLICT	UCDP_Incidence (1)	UCDP_Incidence (2)	UCDP_Incidence (3)	ACLED_Riots (4)	ACLED_Riots (5)	ACLED_Riots (6)	ACLED_Violence (7)	ACLED_Violence (8)	ACLED_Violence (9)
APP Index	-0.0234 (0.021)	0.0141 (0.034)	0.0210 (0.035)	-0.0170 (0.024)	0.0634 (0.040)	0.0503 (0.041)	-0.0491* (0.026)	0.0002 (0.045)	0.0031 (0.047)
Drought SPEI GS	0.0294*** (0.009)	-0.0190 (0.015)	-0.0222 (0.016)	-0.0127 (0.009)	0.0063 (0.015)	0.0022 (0.015)	-0.0001 (0.009)	0.0072 (0.017)	0.0012 (0.0173)
CP Index	-0.0702 (0.070)	-0.1273* (0.075)	-0.1373* (0.075)	-0.0081 (0.069)	-0.0523 (0.076)	-0.0679 (0.078)	-0.1714** (0.080)	-0.2123** (0.088)	-0.2037** (0.089)
APP Index x Excluded groups		-0.0042 (0.003)	-0.0042 (0.003)		-0.0069** (0.003)	-0.0001 (0.003)		0.0003 (0.004)	0.0002 (0.004)
Drought SPEI GS x Excluded groups		0.0044*** (0.002)	0.0046*** (0.002)		0.0008 (0.002)	0.0014 (0.002)		0.0008 (0.002)	0.0008 (0.002)
CP Index x Excluded groups		0.0009 (0.002)	0.0010 (0.002)		-0.0025 (0.002)	-0.0001 (0.002)		0.0028 (0.002)	0.0029 (0.002)
APP Index x Monopoly groups		-0.0859 (0.073)	-0.0781 (0.073)		-0.0895 (0.093)	-0.0784 (0.093)		-0.0572 (0.105)	-0.0568 (0.104)
Drought SPEI GS x Monopoly groups		0.0076 (0.056)	0.0071 (0.051)		-0.2782** (0.108)	-0.1691* (0.108)		-0.1164 (0.122)	-0.1178 (0.122)
CP Index x Monopoly groups		0.1426*** (0.052)	0.0721 (0.053)		0.1467** (0.075)	0.1395* (0.075)		0.2900*** (0.082)	0.2930*** (0.082)
APP Index x Ethnic Fraction.		-0.0383 (0.073)			-0.0927 (0.086)			-0.1416 (0.095)	
Drought SPEI GS x Ethnic Fraction.		0.1101*** (0.038)			-0.0532 (0.036)			-0.0360 (0.039)	
CP Index x Ethnic Fraction.		0.0665 (0.053)			0.1065* (0.063)			0.0377 (0.068)	
APP Index x Ethnic Polariz.			-0.0367 (0.047)			-0.0354 (0.057)			-0.0947 (0.064)
Drought SPEI GS x Ethnic Polariz.			0.0685*** (0.023)			-0.0258 (0.019)			-0.0089 (0.022)
CP Index x Ethnic Polariz.			0.0622* (0.034)			0.0934** (0.038)			0.0015 (0.043)
Observations	8,912	8,176	8,176	8,912	8,176	8,176	8,912	8,176	8,176
UnconditionalProbability_Conflict	12.803%	13.650%	13.650%	21.061%	22.272%	22.272%	22.576%	24.009%	24.009%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP-GED database (UCDP_INCIDENCE) and ACLED riots (RIOTS), and violence against civilians (VIOLENCE) database. The Agricultural price Index (APP Index), the SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 220km radius and for five periods of correlation. p-values for linear combination are reported in parentheses ** p<0.01, * p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2. Each cell is 220km x 220km at the equator.

TABLE A.26: CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. PRICE LAGS

Type of CONFLICT	UCDP Incidence (1)	UCDP Incidence (2)	UCDP Incidence (3)	ACLED_Riots (4)	ACLED_Riots (5)	ACLED_Riots (6)	ACLED_Violence (7)	ACLED_Violence (8)	ACLED_Violence (9)
APP Index	-0.0228*** (0.005)	-0.0373*** (0.006)	-0.0375*** (0.006)	0.0481*** (0.005)	0.0581*** (0.008)	0.0582*** (0.008)	0.0125* (0.007)	-0.0043 (0.009)	-0.0034 (0.009)
Drought SPEI GS	0.0048** (0.001)	0.0001 (0.003)	-0.0001 (0.003)	0.0030** (0.001)	0.0005 (0.002)	0.0002 (0.002)	0.0003 (0.002)	-0.0116*** (0.003)	-0.0112*** (0.003)
CP Index	0.1285** (0.019)	0.1426*** (0.022)	0.1422*** (0.022)	-0.0459*** (0.015)	-0.0335* (0.018)	-0.0328* (0.018)	0.1207*** (0.021)	0.1277*** (0.024)	0.1283*** (0.024)
APP Index x Excluded groups		0.0000 (0.011)	0.0004 (0.010)		-0.0045 (0.011)	-0.0043 (0.011)		0.0028 (0.014)	0.0044 (0.014)
Drought SPEI GS x Excluded groups		0.0167*** (0.003)	0.0167*** (0.003)		0.0040 (0.003)	0.0038 (0.003)		0.0175*** (0.003)	0.0174*** (0.003)
CP Index x Excluded groups		-0.0077 (0.005)	-0.0077 (0.006)		-0.0099* (0.005)	-0.0114** (0.005)		0.0103 (0.007)	0.0107*** (0.007)
APP Index x Monopoly groups		-0.0901** (0.042)	-0.0905** (0.042)		-0.0964*** (0.027)	-0.0960*** (0.027)		-0.1927*** (0.051)	-0.1934*** (0.051)
Drought SPEI GS x Monopoly groups		0.0200*** (0.006)	0.0200*** (0.006)		-0.0063 (0.044)	-0.0062 (0.044)		-0.0232 (0.036)	-0.0234 (0.036)
CP Index x Monopoly groups		0.0536*** (0.011)	0.0538*** (0.011)		0.1100*** (0.022)	0.1102*** (0.022)		0.1143*** (0.022)	0.1151** (0.022)
APP Index x Ethnic Fraction.		0.0786*** (0.020)			-0.0128 (0.026)			0.0903*** (0.029)	
Drought SPEI GS x Ethnic Fraction.		-0.0148** (0.006)			-0.0087 (0.006)			0.0074 (0.006)	
CP Index x Ethnic Fraction.		-0.0128 (0.010)			0.0258* (0.013)			-0.0054 (0.013)	
APP Index x Ethnic Polariz.			0.0431*** (0.011)			-0.0077 (0.014)			0.0447*** (0.016)
Drought SPEI GS x Ethnic Polariz.			-0.0073** (0.003)			-0.0039 (0.003)			0.0030 (0.003)
CP Index x Ethnic Polariz.			-0.0059 (0.005)			0.0112 (0.007)			-0.0063 (0.007)
Observations	139,136	109,968	109,968	139,136	109,968	109,968	139,136	109,968	109,968
Unconditional_Probability_Conflict	2.168%	2.434%	2.434%	2.696%	3.100%	3.100%	3.743%	4.236%	4.236%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP-GED database (UCDP_INCIDENCE) and ACLED riots (RIOTS), and violence against civilians (VIOLENCE) database. The Agricultural price Index (APP Index), the Drought SPEI growing season, and the Consumer Price Index (CPI Index) coefficients displayed capture the sum of price impacts at t, t-1, t-2, t-3, t-4, and t-5. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 110km radius and for five periods of correlation. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017), in both cases at t, t-1, t-2, t-3, t-4, and t-5.

TABLE A27: CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. CONDITIONAL LOGIT

Type of CONFLICT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	UCDP_Incidence	UCDP_Incidence	UCDP_Incidence	ACLED_Riots	ACLED_Riots	ACLED_Riots	ACLED_Violence	ACLED_Violence	ACLED_Violence
APP Index	-0.8749*** (0.258)	-0.5113* (0.285)	-0.4393* (0.268)	0.2589* (0.156)	0.4887 (0.355)	0.4830 (0.369)	-0.3167*** (0.130)	-0.4779* (0.281)	-0.4681 (0.284)
Drought SPEI GS	0.1911 (0.136)	-0.0110 (0.188)	-0.0377 (0.188)	-0.0032 (0.116)	0.2156 (0.141)	0.2095 (0.147)	-0.1897* (0.107)	-0.3319* (0.198)	-0.3164 (0.197)
CP Index	-0.8821 (1.641)	-0.1914 (1.786)	-0.2700 (1.763)	-0.8207 (0.774)	-0.2601 (1.821)	-0.2728 (1.776)	-1.0874* (0.648)	-0.3904 (1.865)	-0.3826 (1.863)
APP Index x Excluded groups		-0.4808 (0.413)	-0.4512 (0.425)		-0.4782 (0.315)	-0.4745 (0.181)		-0.1857 (0.466)	-0.1629 (0.468)
Drought SPEI GS x Excluded groups		0.5482 (0.408)	0.5259 (0.407)		-0.0695 (0.378)	-0.0862 (0.365)		0.2400 (0.307)	0.2514 (0.311)
CP Index x Excluded groups		-0.2146 (0.434)	-0.2246 (0.428)		0.2914 (0.328)	0.2756 (0.323)		0.0018 (0.387)	0.0020 (0.385)
APP Index x Monopoly groups		-2.809*** (1.299)	-2.7472*** (1.316)		-2.3641 (1.649)	-2.3318 (1.627)		-1.6226 (1.560)	-1.6008 (1.594)
Drought SPEI GS x Monopoly groups		-1.5771 (2.267)	-1.7767 (2.366)		0.3102* (0.167)	0.3277* (0.171)		0.6109*** (0.229)	0.6108*** (0.224)
CP Index x Monopoly groups		3.7850*** (0.723)	3.9449*** (0.794)		1.9608*** (0.786)	1.9419*** (0.774)		2.6357*** (0.516)	2.6611*** (0.524)
APP Index x Ethnic Fraction.		0.2238 (1.313)	0.2238 (1.313)		0.0543 (0.599)	0.0543 (0.599)		1.2352* (0.653)	1.2352* (0.653)
Drought SPEI GS x Ethnic Fraction.		0.0387 (0.800)	0.0387 (0.800)		-1.7459*** (0.825)	-1.7459*** (0.825)		0.6749 (0.673)	0.6749 (0.673)
CP Index x Ethnic Fraction.		0.9036 (0.919)	0.9036 (0.919)		-0.0604 (0.679)	-0.0604 (0.679)		-0.1663 (0.566)	-0.1663 (0.566)
APP Index x Ethnic Polariz.			-0.1229 (0.678)			0.05397 (0.384)			0.6331* (0.337)
Drought SPEI GS x Ethnic Polariz.			0.1584 (0.452)			-0.9390* (0.486)			0.2908 (0.361)
CP Index x Ethnic Polariz.			0.6720 (0.532)			0.3899 (0.419)			-0.1154 (0.294)
Observations	17,874	15,516	15,516	20,145	17,730	17,730	29,248	25,056	25,056
Unconditional_Probability_Conflict	2.168%	2.434%	2.434%	2.696%	3.100%	3.100%	3.949%	4.236%	4.236%
Cell FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP-GED database (UCDP_INCIDENCE) and ACLED riots (RIOTS), and violence against civilians (VIOLENCE) database. The Agricultural price Index (APP Index), the drought SPEI growing season, and the Consumer Price Index (CP Index) coefficients displayed capture the sum of price impacts at t, t-1, and t-2. Conditional Logit estimations with fixed effects. Standard errors clustered at the country level. p-values for the linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017), in both cases at t, t-1 and t-2.

TABLE A28: CONFLICT: AGRICULTURAL PRODUCER PRICES, DROUGHT SPEI GROWING SEASON AND CONSUMER PRICES. CLIMATE VARIABLES

Type of CONFLICT	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	UCDP_Incidence	UCDP_Incidence	UCDP_Incidence	ACLED_Riots	ACLED_Riots	ACLED_Riots	ACLED_Violence	ACLED_Violence	ACLED_Violence
APP Index	-0.0173*** (0.004)	-0.0143*** (0.005)	-0.0142*** (0.005)	0.0270*** (0.004)	0.0353*** (0.006)	0.0349*** (0.006)	-0.0060 (0.005)	-0.0149** (0.007)	-0.0145*** (0.007)
Drought SPEI GS	0.0042*** (0.001)	0.0023 (0.002)	0.0021 (0.002)	0.0031*** (0.001)	0.0080*** (0.002)	0.0075*** (0.002)	0.0026*** (0.001)	0.0010 (0.002)	0.0010 (0.002)
CP Index	0.0228** (0.011)	0.0317** (0.013)	0.0314** (0.013)	-0.0207** (0.010)	-0.0047 (0.011)	-0.0043 (0.011)	0.0174 (0.012)	0.0318** (0.014)	0.0323** (0.014)
Drought SPEI	0.0485*** (0.011)	0.0708*** (0.014)	0.0707*** (0.014)	-0.0478*** (0.010)	-0.0460*** (0.012)	-0.0463*** (0.012)	-0.0057 (0.013)	0.0172 (0.016)	0.0171 (0.016)
APP Index x Excluded groups		-0.0296*** (0.008)	-0.0292*** (0.008)		-0.0131* (0.008)	-0.0133** (0.007)		-0.0134 (0.009)	-0.0124 (0.009)
Drought SPEI GS x Excluded groups		0.0082*** (0.002)	0.0081*** (0.002)		-0.0033* (0.002)	-0.0033** (0.002)		0.0034* (0.002)	0.0033 (0.002)
CP Index x Excluded groups		-0.0021 (0.004)	-0.0020 (0.004)		0.0022 (0.004)	0.0026 (0.004)		0.0174*** (0.005)	0.0179*** (0.005)
APP Index x Monopoly groups		-0.0883** (0.037)	-0.0885** (0.038)		-0.0480** (0.021)	-0.0477** (0.021)		-0.1537*** (0.044)	-0.1541*** (0.044)
Drought SPEI GS x Monopoly groups		-0.0042 (0.005)	-0.0042 (0.004)		-0.0081 (0.030)	-0.0080 (0.030)		0.0360 (0.023)	0.0360 (0.023)
CP Index x Monopoly groups		0.0208* (0.011)	0.0208* (0.011)		0.0352*** (0.011)	0.0353*** (0.011)		0.0772*** (0.015)	0.0778*** (0.015)
APP Index x Ethnic Fraction.		0.0459*** (0.015)	0.0459*** (0.015)		-0.0030 (0.018)	-0.0030 (0.018)		0.0696*** (0.020)	0.0696*** (0.020)
Drought SPEI GS x Ethnic Fraction.		-0.0073* (0.004)	-0.0073* (0.004)		-0.0195** (0.009)	-0.0195** (0.009)		-0.0013 (0.004)	-0.0013 (0.004)
CP Index x Ethnic Fraction.		0.0122 (0.008)	0.0122 (0.008)		0.0195** (0.009)	0.0195** (0.009)		-0.0029 (0.009)	-0.0029 (0.009)
APP Index x Ethnic Polariz.		0.0243*** (0.008)	0.0243*** (0.008)						0.0357*** (0.011)
Drought SPEI GS x Ethnic Polariz.		-0.0034* (0.002)	-0.0034* (0.002)						-0.0006 (0.002)
CP Index x Ethnic Polariz.		0.0071* (0.004)	0.0071* (0.004)						-0.0043 (0.005)
Observations	134,208	107,264	107,264	134,208	107,264	107,264	134,208	107,264	107,264
Unconditional_Probability_Conflict	2.186%	2.424%	2.424%	2.731%	2.977%	2.977%	3.794%	4.192%	4.192%
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country-specific time trend	YES	YES	YES	YES	YES	YES	YES	YES	YES

Notes: The dependent variable is a binary variable that takes a value of one for conflicts following the definition of UCDP-GED database (UCDP_INCIDENCE) and ACLED riots (RIOTS), and violence against civilians (VIOLENCE) database. The Agricultural price Index (APP Index), the SPEI growing season, the Consumer Price Index (CPI Index) and the drought SPEI coefficients displayed capture the sum of price impacts at t, t-1, and t-2. LPM estimations. Conley (2008) standard errors in parentheses, allowing for spatial correlation within a 220km radius and for five periods of correlation. p-values for linear combination are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Control variables include the interactions between oil prices and oil dummy indicating the presence of an oil field in a given cell, and the interaction between the log of the price for the main mineral produced in a cell following the approximation of Berman et al. (2017) in both cases at t, t-1 and t-2. We also control for other weather variables as Temperature, the cell-year mean temperature in degrees celsius, and Rainfall, the yearly total amount of precipitation (in millimeter) in the cell.

3 Additional Figures

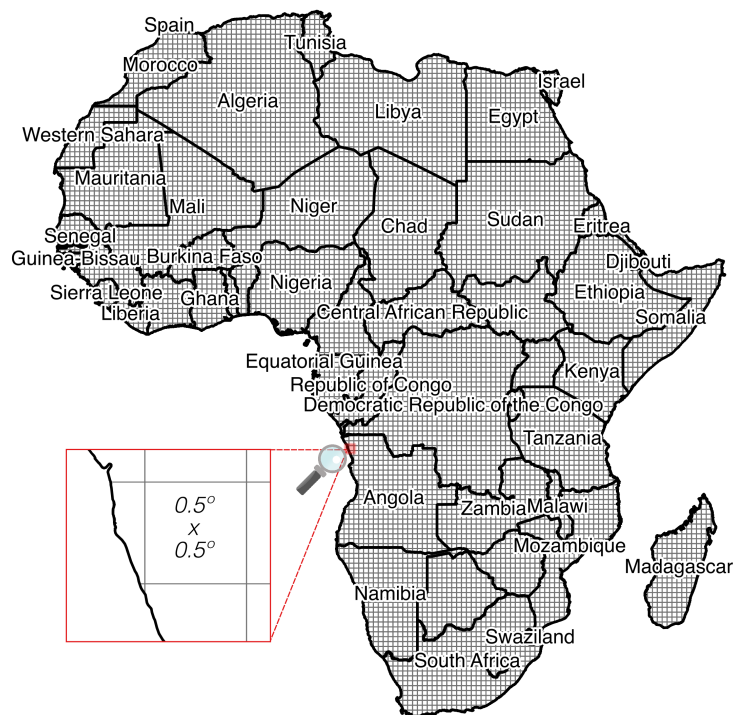


Figure A1: Cells Africa. Source: PRIO-GRID grid structure matched with the African countries by the Global Administrative Unit Layers.

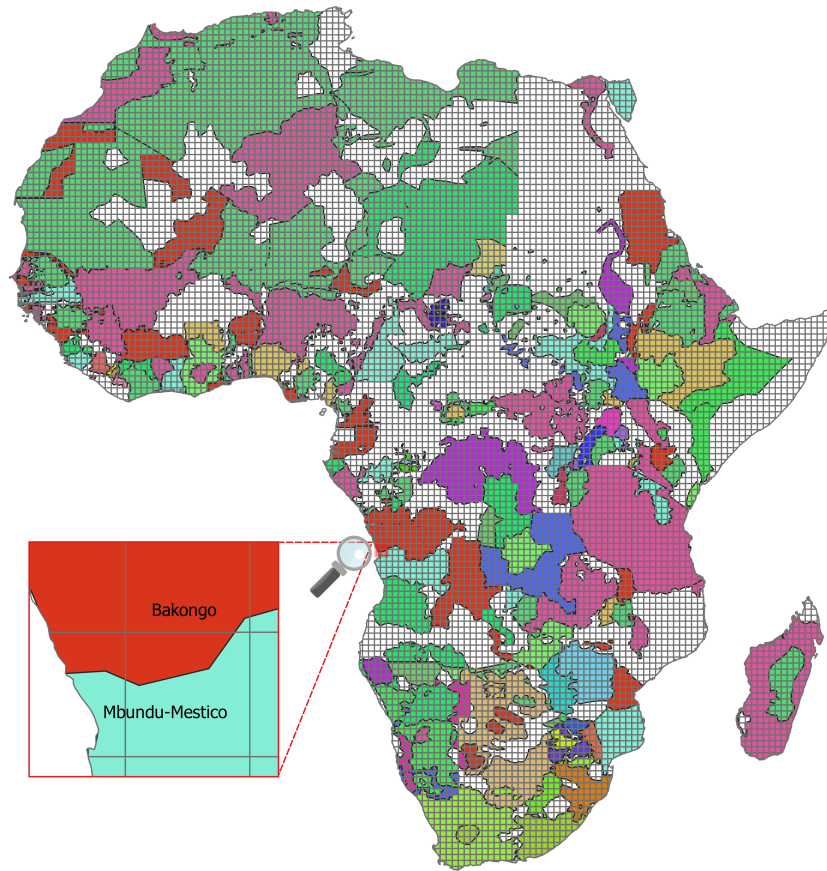


Figure A2: Ethnic groups from Geo-referencing Ethnic Power Relation. Year 1997. Each color represents a settlement group of politically relevant ethnic groups in independent states with more than 500,000 inhabitants from 1946-2009, based on the group list in the Ethnic Power Relations dataset version 2014. The database is filtered by the year 1997.

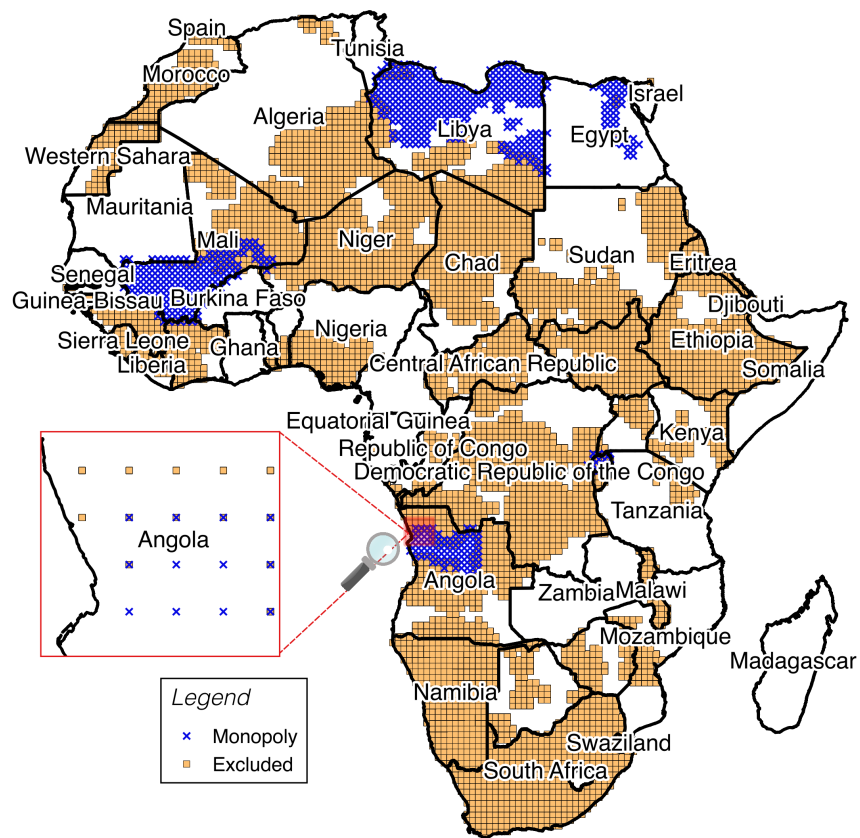


Figure A3: Excluded and monopoly groups. Source: Ethnic Power Relations (EPR) Dataset Core 2014. Year 1997.

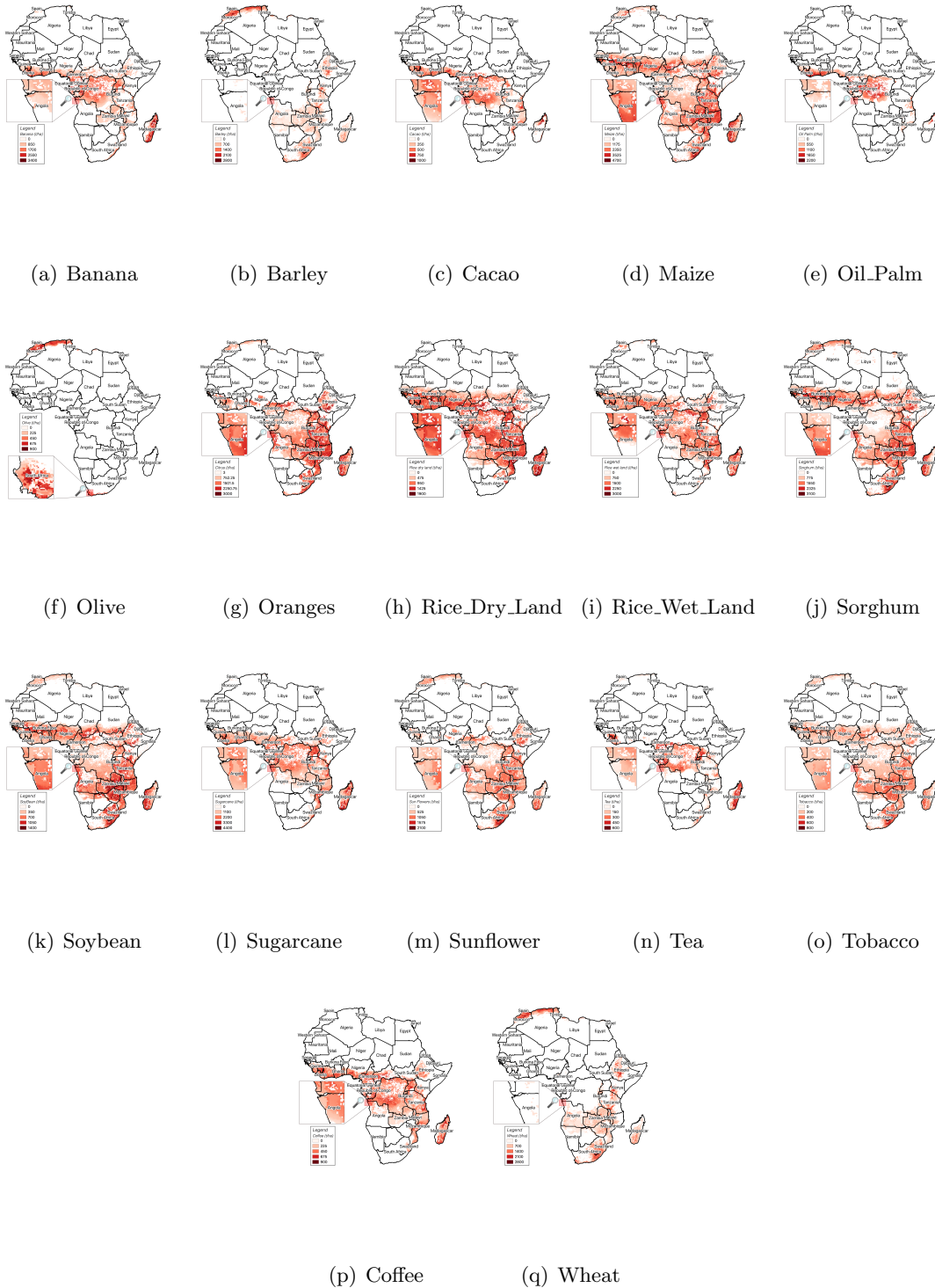


Figure A4: Crops potential production based on the FAO's Global Agro-Ecological Zones (GAEZ).

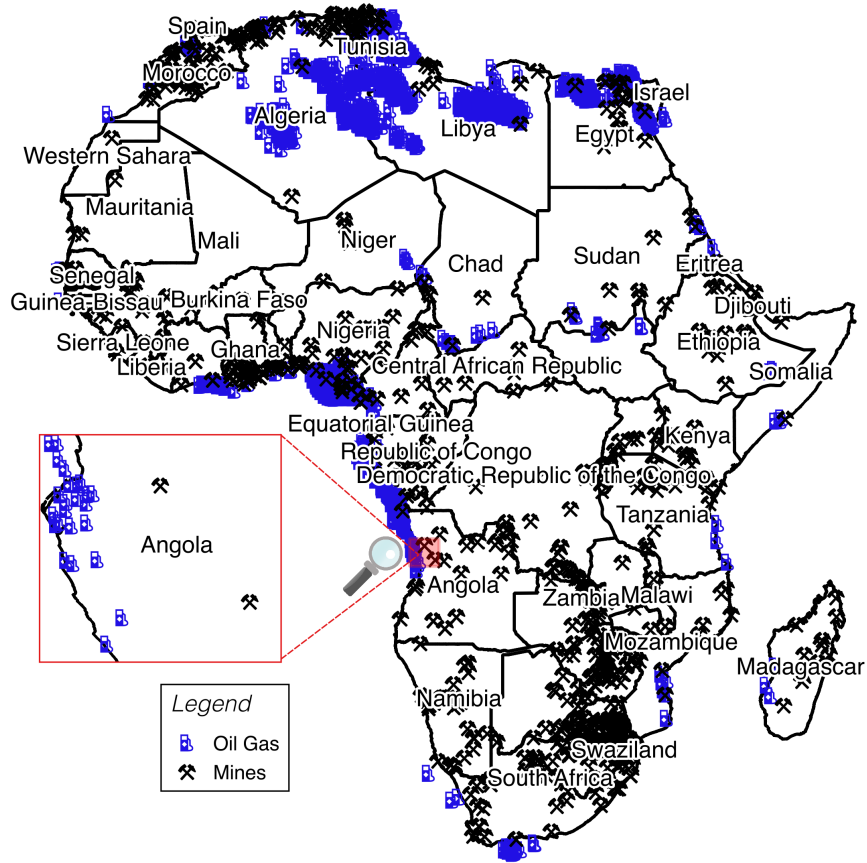
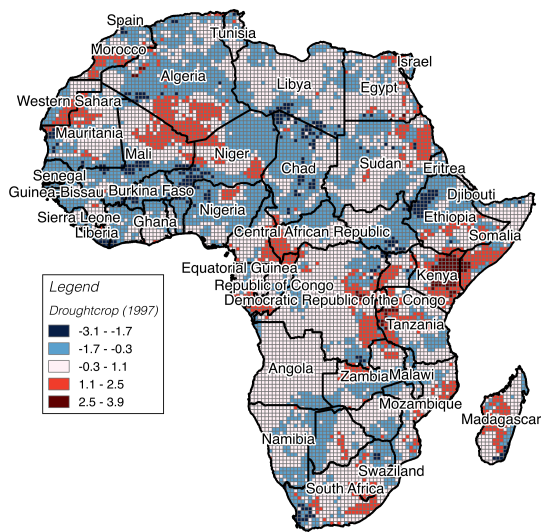
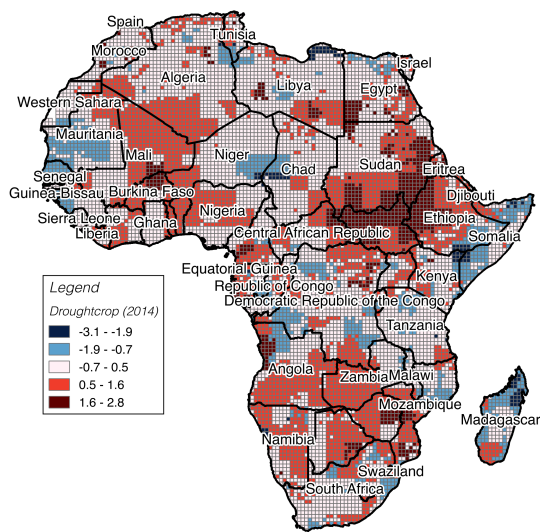


Figure A5: Natural Resources. Sources: Petroleum Dataset v. 1.2 and U.S. Geological Survey (USGS) dataset.

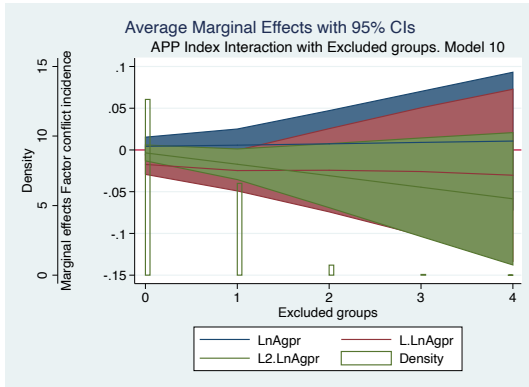


(a) Drought SPEI growing season 1997

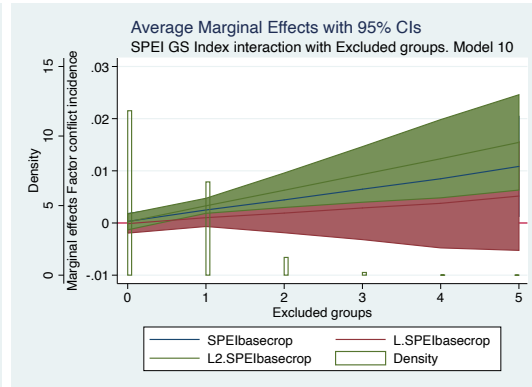


(b) Drought SPEI growing season 2014

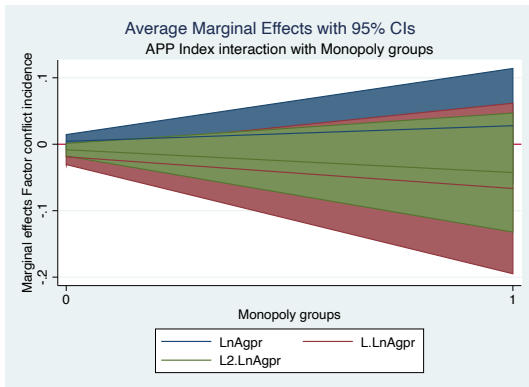
Figure A6: Droughts SPEI growing season. Source: SPEI Global Drought Monitor.



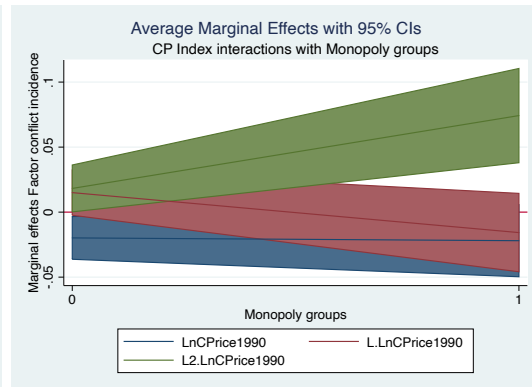
(a) APP index interaction excluded groups



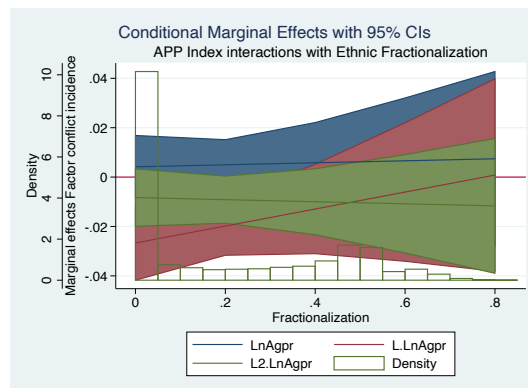
(b) Drought SPEI GS index interaction excluded groups



(c) APP index interaction monopoly groups

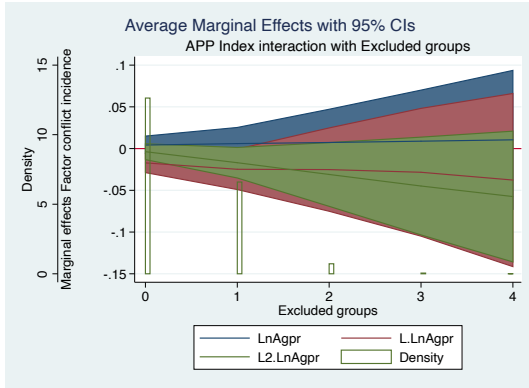


(d) CP index interaction monopoly groups

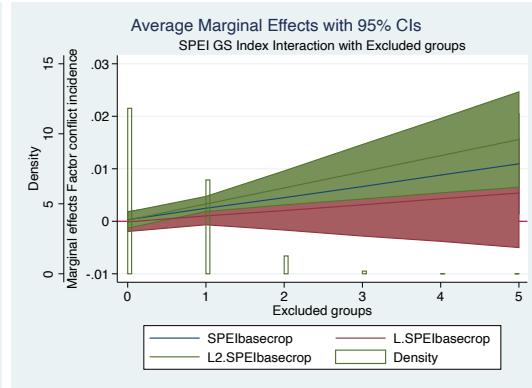


(e) APP index interaction Ethnic fractionalization

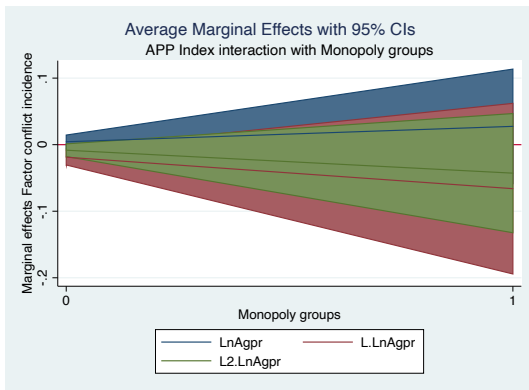
Figure A7: Factor conflict - Significant interaction variables in full model with ethnic fractionalization



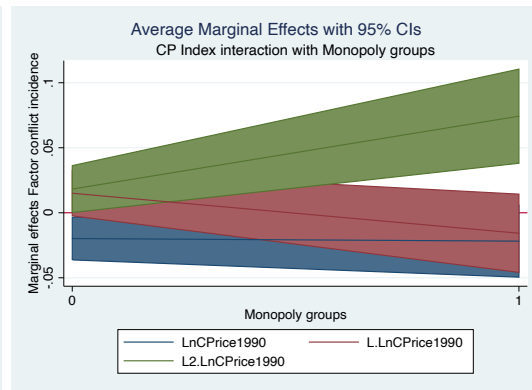
(a) APP index interaction excluded groups



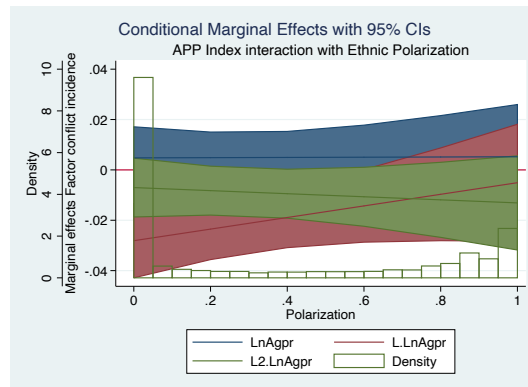
(b) Drought SPEI GS index interaction excluded groups



(c) APP index interaction monopoly groups

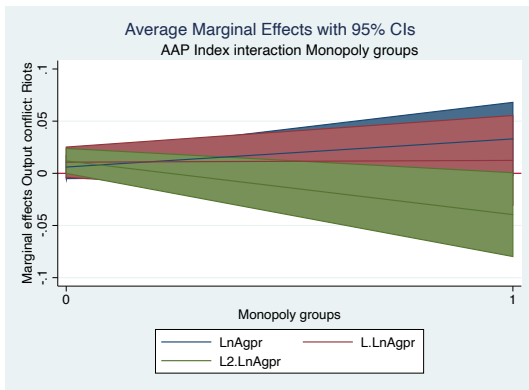


(d) CP index interaction monopoly groups

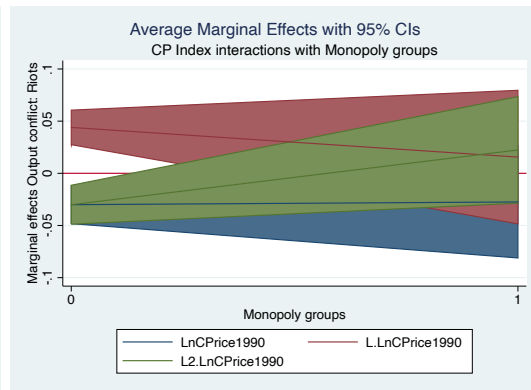


(e) APP index interaction Ethnic Polarization

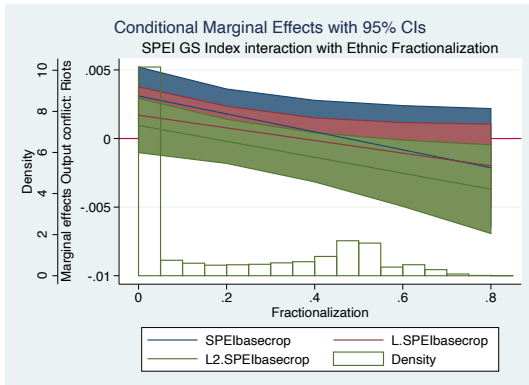
Figure A8: Factor conflict - Significant interaction variables in full model with ethnic polarization



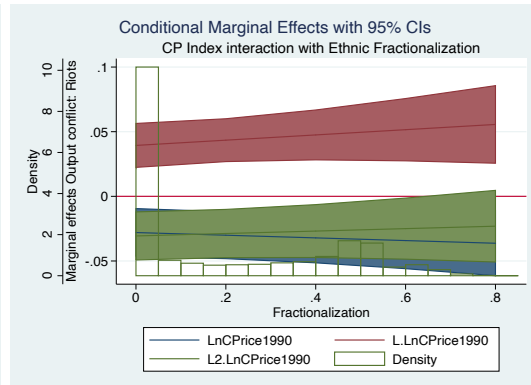
(a) APP index interaction monopoly groups



(b) CP index interaction monopoly groups

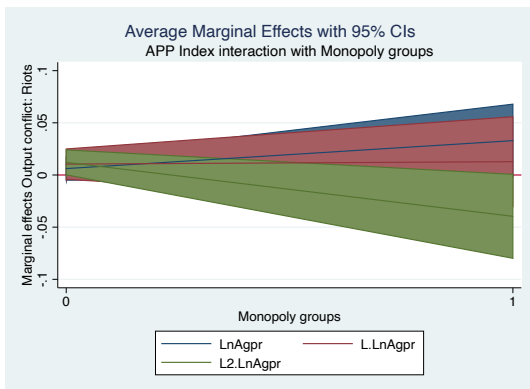


(c) Drought SPEI GS index interaction Ethnic fractionalization

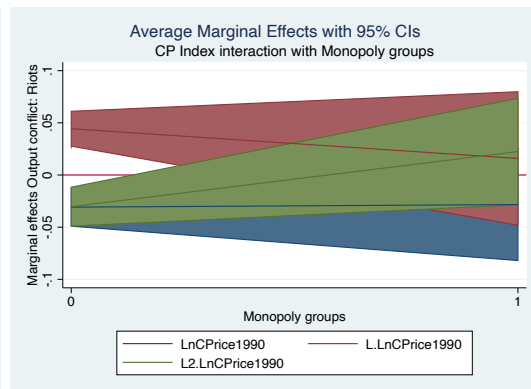


(d) CP index interaction Ethnic fractionalization

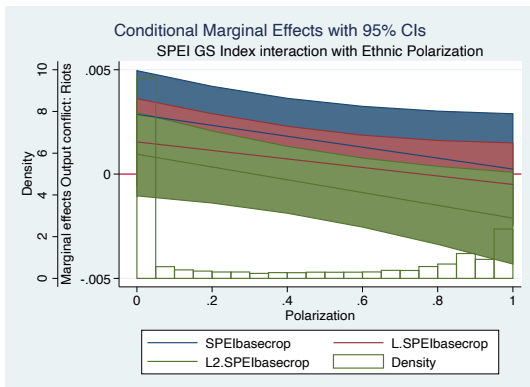
Figure A9: Riots - Significant interaction variables in full model with ethnic fractionalization



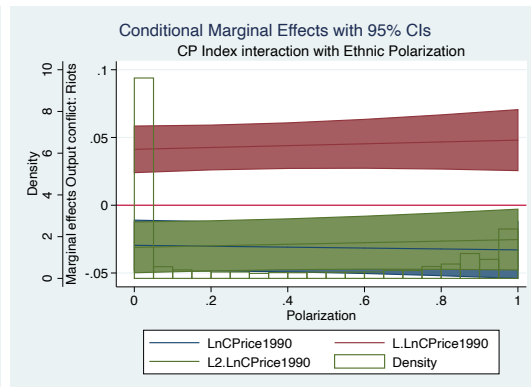
(a) APP index interaction monopoly groups



(b) CP index interaction monopoly groups

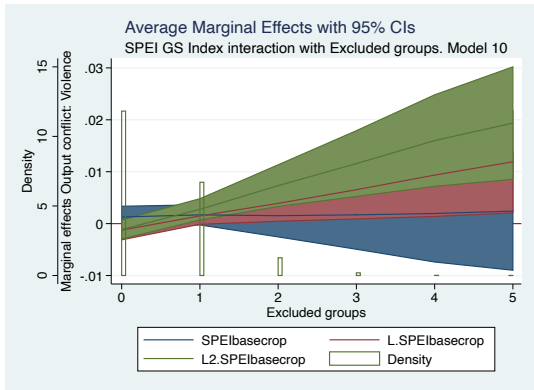


(c) Drought SPEI GS index interaction Ethnic polarization

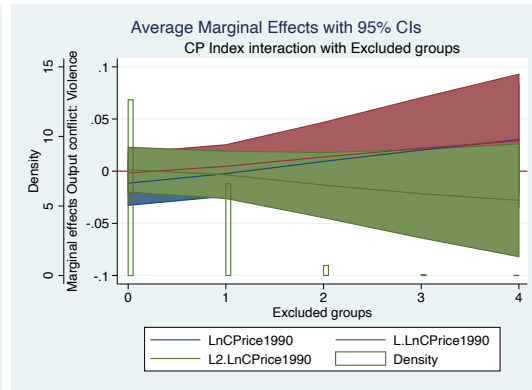


(d) CP index interaction Ethnic polarization

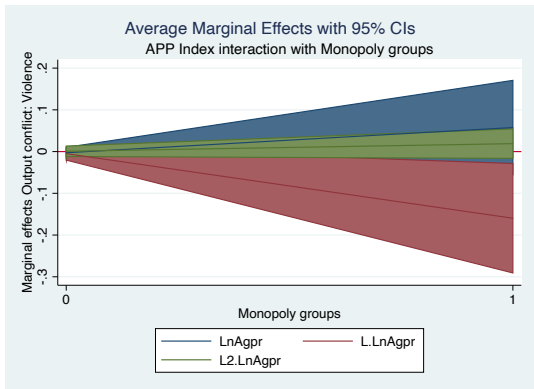
Figure A10: Riots - Significant interaction variables in full model with ethnic polarization



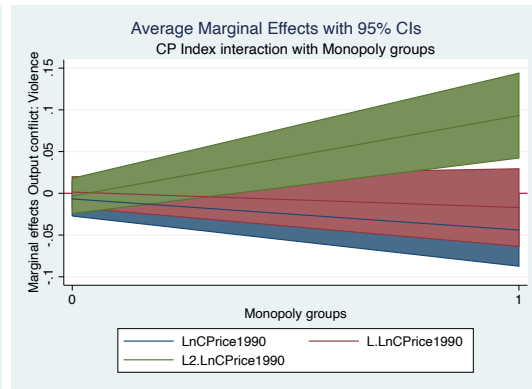
(a) Drought SPEI GS index interaction excluded groups



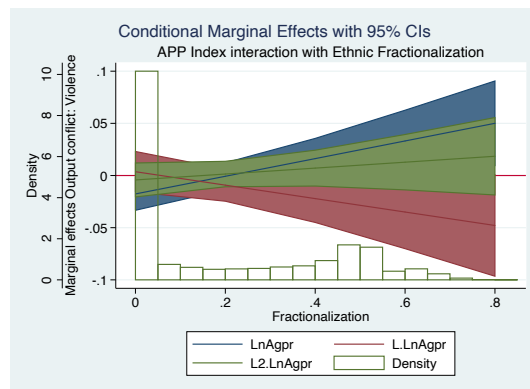
(b) CP index interaction excluded groups



(c) APP index interaction monopoly groups

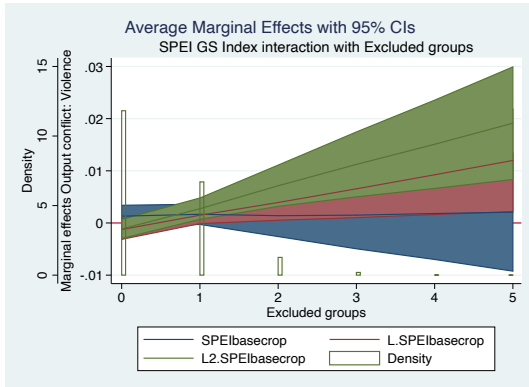


(d) CP index interaction monopoly groups

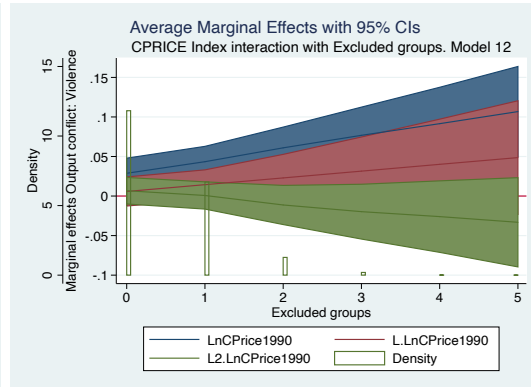


(e) APP index interaction Ethnic fractionalization

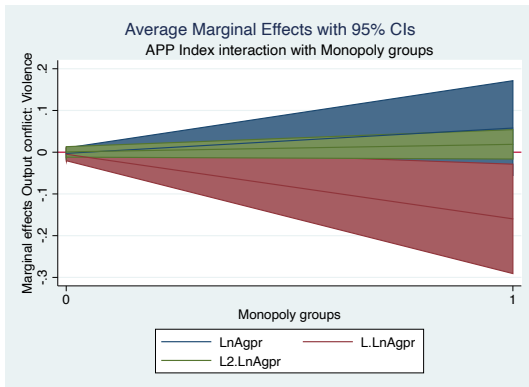
Figure A11: Violence against civilians - Significant interaction variables in full model with ethnic fractionalization



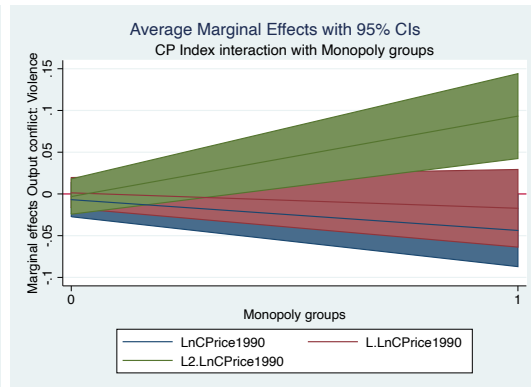
(a) Drought SPEI GS index interaction excluded groups



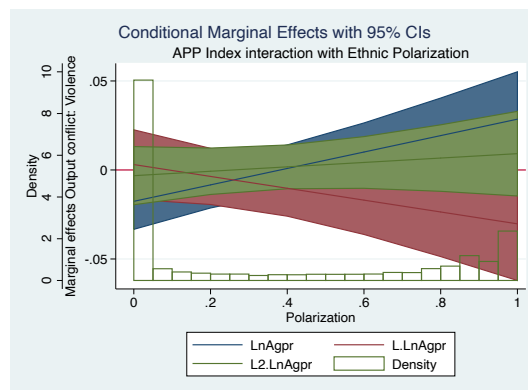
(b) CP index interaction excluded groups



(c) APP index interaction monopoly groups



(d) CP index interaction monopoly groups



(e) APP index interaction Ethnic polarization

Figure A12: Violence against civilians - Significant interaction variables in full model with ethnic polarization