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Income Shocks and Conflict

Evidence from Nigeria

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Abstract

This paper extends the micro evidence on the impact of income shocks on civil conflict using data across Nigerian states over the past decade. The paper uses an innovative empirical strategy matching household survey, oil production, and domestic and international price data to capture three separate channels linking income changes to conflict. Price increases of consumed items have a significant conflict-inducing effect consistent with the hypothesis that they reduce real incomes and thus the opportunity cost of fighting. Failure to include this consumption impact severely biases (toward zero) the conflict-reducing effect of price rises of agricultural commodities via production. In addition, oil price hikes increase conflict intensity in oil producing areas, consistent with the "rapacity" hypothesis. However, this effect disappears in the period after the agreement granting amnesty to militant groups in oil-producing areas. The paper also discusses the importance of factors mediating the impact of the shocks on conflict and a number of policy implications following the analysis. Finally, the empirical strategy is employed to unveil a strong relationship between income shocks and violence in the current Boko Haram conflict. The analysis suggests some policy implications, which may be relevant for the Nigerian context and beyond.

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Income Shocks and Conflict: Evidence from Nigeria*

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1. Introduction

To what extent do economic conditions affect the risk and the intensity of civil conflicts? This is one of the most pressing questions in the economics of conflict (Blattman and Miguel, 2010). Much of the recent literature has used changes in international commodity prices to credibly address this question (e.g. Dube and Vargas, 2013; Bruckner and Ciccone, 2010; Bazzi and Blattman, 2014). However the direction of the effects of economic shocks on conflict is contentious. On the one hand, a positive shock may reduce the conflict risk by increasing the opportunity cost of individuals to rebel and/or by increasing the state's ability to repress or buy off rebels (Fearon and Laitin, 2003). On the other hand, a positive shock to a country's resources (e.g. oil discovery) could also raise the value of the state's control to fight over (the so-called 'rapacity' hypothesis). Disentangling these channels is difficult, which may help explain the lack of consensus of the cross-country evidence on the effects of international commodity prices on conflict (e.g. Bruckner and Ciccone, 2010; Bazzi and Blattman, 2014; Calì and Muladbic, 2014). In addition, international prices usually allow us to examine only a relatively small portion of households' production and may only partly transmit to domestic price changes, which are the ones affecting households' income.

Our paper tries to address both issues by examining the relationship between income shocks and conflict across Nigerian states over the past decade. We use an innovative empirical strategy matching household survey, oil production and domestic and international price data to capture three separate channels linking income changes (i.e. household consumption, household production and natural resources wealth) to conflict.[1] In this way, the paper contributes to the empirical literature exploiting the variation across subnational units to identify the effects of exogenous income shocks on conflict (e.g. Dube and Vargas, 2013; Berman and Couttenier, 2014; Maystadt and Ecker, 2014).

Our strategy allows us to make a number of contributions to the literature. First, to the best of our knowledge this is the first paper that measures the effect of price changes on conflict via consumption.[2] We do so by constructing a consumption price index based on exogenous price movements of various goods weighted by their importance in household expenditures at the beginning of the period. Price increases of consumed items turn out to have a significant conflict-inducing effect in Nigeria. In fact, we show that failure to include this consumption impact severely biases (towards zero) the conflict-reducing effect of price increase of produced agricultural commodities. That is an important finding as the literature tends to focus only on the effects of prices of produced goods on conflict.

Second, we add to the evidence distinguishing between the effects of changes in prices of agricultural commodities, which are labor intensive diffused commodities, and prices of point-source capital intensive oil. While Dube and Vargas (2013) focus on the case of exported

[1] In this paper, conflict is defined as the occurrence of various forms of political violence (i.e. battles between the state and armed groups, protests/riots, violence against civilians).

[2] Some papers have tried to model these effects by using international commodity prices weighted by the commodity's share in the imports basket (Arezki and Brückner, 2011; Calì and Muladbic, 2014; Maystadt, Trinh Tan and Breisinger, 2014). However as Bazzi and Blattman (2014) noted these import weights are likely to be more of a reflection of purchases by firms, elites, and governments than actual household consumption.

agricultural commodities, we consider a wide range of commodities produced by the households and mostly sold in local markets. These types of commodities should be more relevant for many countries in SSA, where agricultural income for most households is not related to exports. In addition, we also test for the effect of a policy shock (the amnesty agreement between the state and the rebels in the oil producing Niger Delta region in 2009) on the relationship between the value of oil and conflict intensity. While this relationship was positive and significant between 2004 and 2009, confirming previous evidence on the 'rapacity' hypothesis (Dube and Vargas, 2013), it became insignificant after the amnesty agreement. This finding provides support to the short-run effectiveness of the policy of 'buying off' militants.

Third, in a significant departure from the literature, our (consumption and production) price indices are constructed using an arguably more suitable measure of local price shocks than international commodity prices. The latter have two main limitations. First, they are available only for internationally traded commodities, which often do not include many local products important for consumption and production in developing countries (e.g. yam and cassava in the case of Nigeria). Second, international prices do not account for the price transmission from international to domestic markets, which is often limited. Thus international prices may not accurately measure the size of the price shock at the local level. Our indices improve on both problems by using domestic prices of faraway states, in the spirit of Jacoby (2013). We argue these prices will be exogenous to the conflict in the state in question, so we can use the indices based on them as an instrument for the local price indices. Using this type of instrument, instead of that based on international prices, has important implications for the results.

Fourth, we identify some of the conditions under which these price shocks are particularly prone to conflict. In doing so, we draw from the literature on the drivers of conflict and apply it to the case of Nigeria. Our results suggest that the magnitude of the effects of price shocks, particularly affecting consumption goods and oil, on conflict is amplified in election years. Ethnic divisions and income inequality appear to substantially increase the conflict-inducing effect of the rise in oil prices, but do not affect the other economic shocks we consider. Surprisingly, we also find that a recent history of past conflict does not magnify the effects of price shocks on violent conflict.

Finally, to the best of our knowledge this is the first study to systematically analyze the drivers of conflict in Nigeria using quantitative data. In doing so this paper helps to fill an important gap as Nigeria is the largest country in SSA in terms of population and oil production and is key to the stability of the West African region and possibly of the entire continent.[3] Conflict is prevalent at the local and regional levels and its scale is significant. Nigeria is the African country with the third largest number of conflict episodes in the 2003-2013 period. Importantly for our analysis, Nigeria's conflicts are highly regionalized with different types of conflicts in different regions. The violence from conflict has escalated since 2010 especially through the surge in activities by the Islamic militant group Boko Haram. This has led to the government declaring a state of emergency in the three northeastern states of Adamawa, Borno and Yobe in May 2013. Our analysis provides some preliminary evidence also on the Boko Haram conflict.

[3] For example Nigeria provides one of the largest troop contingents to continental peacekeeping missions.

The paper is organized as follows. The next section reviews the trends and the types of (regional) conflicts in Nigeria over the past decade. Section 3 presents the channels linking price changes to conflict; sections 4 and 5 discuss the data and the empirical methods; section 6 presents the results; and section 7 concludes.

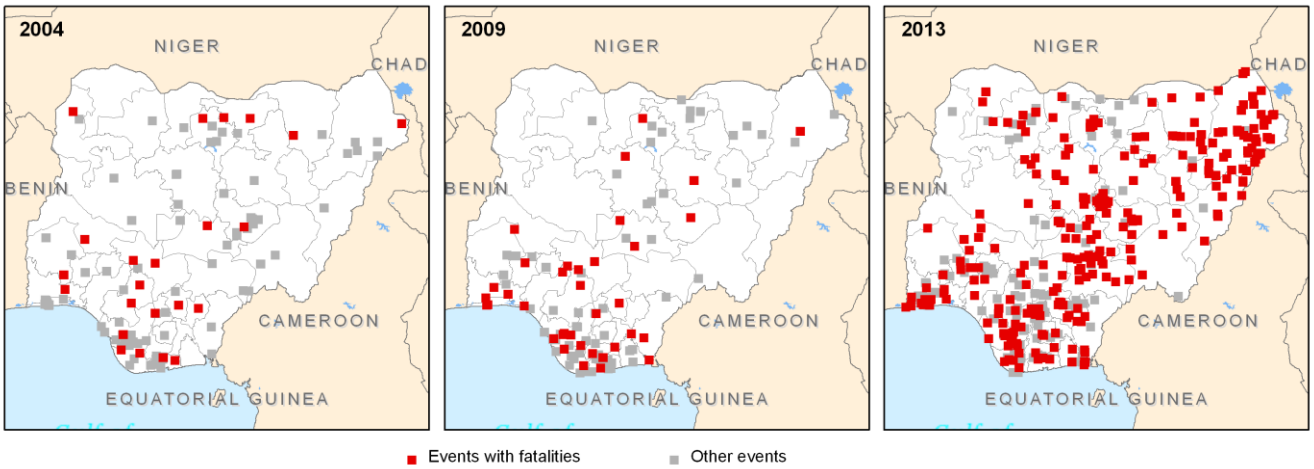
2. Nigeria's civil conflicts in the past decade

Although it is not considered officially fragile according to the World Bank and the regional development banks, Nigeria has had a recent history of acute conflict-related violence. According to the Armed Conflict Location and Events Dataset (ACLED), Nigeria has been the third most violent, and suffered the fourth-highest deaths from conflict, among African countries in the last ten years (2003-2013). While the country has not experienced a full-blown civil war and the state's monopoly on the use of force does not appear to be challenged during the period of our analysis, local conflicts have been a major challenge for the country's development over the past decades.

The violence has varied substantially both across space and over time. As figures 1, 2 and 3 show, conflict in Nigeria is highly regionalized. Different types of violence (battles, protests, riots, and violence against civilians) are dominant in different areas, and the underlying determinants of the conflicts are also different. The figures help identify what can be called four "geographies of conflict": the North, the Niger delta, the Middle Belt and the urban areas.

These conflicts have important common underlying traits, rooted in dysfunctional public institutions and social and economic marginalization (Joab-Peterside et al., 2012). However the regional and spatial contexts have also played a fundamental role in shaping the particular forms and dynamics of violent conflict in each case.

Figure 1: The geography of conflict in Nigeria (2004-13)

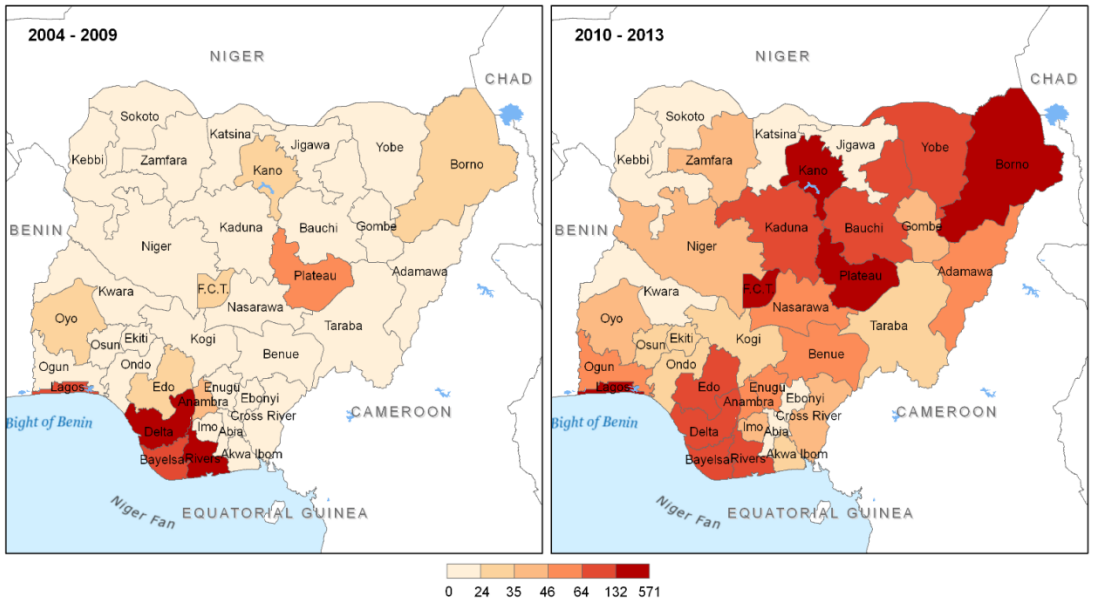


Note: conflict events are all events recorded by ACLED which involve any form of political violence (i.e. battles, protests/riots and violence against civilians). Source: Authors' elaboration on ACLED

Violence in the so-called middle belt, and particularly in Plateau state, has been mainly in the form of communal violence in the past decade. While much of the recent violence has been attributed to religious, ethnic or geographic divisions, unequal access to land appears to be a core driver of the conflict in the middle belt.[4] In Kwara state for instance, the conflicts in Offa/Erin Ile can be attributed to disputes over land ownership and grazing rights.[5] In other states, minor disputes have escalated owing to improper handling. One example is the conflict in Ekiti State over the permanent site of a social amenity within the neighboring towns of Ise and Emure Ekiti.

Violence has increased since 2010 (figures 1, 2 and 3), particularly in the northeastern parts of the country, in large part due to the activities of the Islamic militant group Boko Haram. Indeed, the government declared a state of emergency in the three most northeastern states of Borno, Yobe and Adamawa in May 2013. These areas also experienced some of the greatest intensification in conflict in the country (figures 2 and 3). However, other parts of the country, particularly the middle belt states of Plateau, Kano and Kaduna, have also experienced an intensification of longstanding conflicts.

Figure 2: Conflict intensity across states in Nigeria



Note: conflict events are all events recorded by ACLED which involve any form of political violence (i.e. battles, protests/riots and violence against civilians). The darker the color the higher the number of (any) conflict events in the period. Source: Authors' elaboration on ACLED.

In addition, political demonstrations (particularly on fuel subsidies and corruption) mainly in urban areas have increased in recent years and have expressed themselves in violence. In Abuja

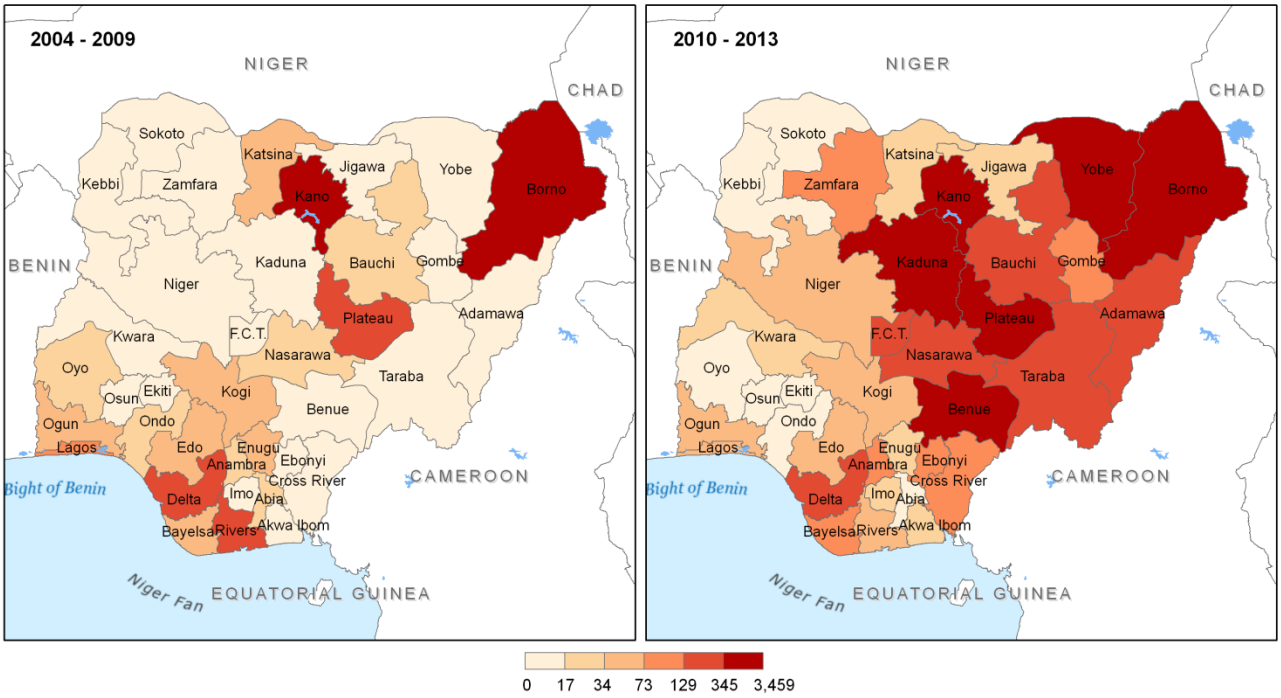
[4] The land rights related to indigenous rights are of particular concern for Fulani pastoralist in Plateau (and other states) as pastoralists by definition do not own the land their herds graze upon when they are on the move. Expanding cities and agriculture in addition to the uttermost Northern pastoralist routes become irregularly dry, has led the Fulani pastoralist to clash with, often indigene farmers. This is not exclusive to Plateau State as the recent violent spats in 2013 in Benue State sadly accentuate (Human Rights Watch, 2013).

[5] There was tension in the state in October 2013 following bloody clashes between Fulani herdsmen and Yoruba inhabitants at Alapa/Onire in Asa Local Government Area of the state.

and Lagos, over 40% of conflict activity is made up of rioting or protesting. Over the course of the data set (1997-2013), over one-third of riot and protest events have involved violence (ACLED, 2013).

At the same time, conflict in other areas of the country has subsided. In particular, violence by the rebel groups in the Niger Delta states, which was among the most violent parts of the country in the 2000s, was significantly reduced after the agreement of 2009, whereby the state provided amnesty for local militants along with a disarmament, demobilization, rehabilitation and reintegration (DDRR) program. Under the amnesty, which ran from August to October 2009, militants who handed in their weapons were pardoned for their crimes, trained in nonviolence, and offered vocational training in various activities in Nigeria or overseas. After attending nonviolence training they are paid US$410 per month until they find work. Just over 26,000 young militants took the amnesty package (Irin, 2011b). While this agreement has been criticized for failing to address the root causes of conflict, and for promoting 'warlordism', it has reduced conflict in the short run (Sayne, 2013).

Figure 3: Number of fatalities across states in Nigeria



Note: the darker the color the higher the number of fatalities in the period. Source: Authors' elaboration on ACLED.

Despite these differences across the geographies of conflict in Nigeria, there exists a degree of commonality across them: from crises of authority, from patterns of human insecurity and socioeconomic exclusion, and from a deep generational crisis of youth. States, markets and institutions have often failed to provide security, justice, services and economic opportunities for citizens, all essential elements in ensuring the state's stability (World Bank, 2011). While unstable, this system is able to reproduce itself through state coercion and through networks of patrimonialism and rent-seeking elites (Joab-Peterside et al., 2012). The former is guaranteed by the ability and willingness of the security forces to intervene and to 'restore order'; the latter

enable the state institutions to selectively mollify dissent and manufacture consent by ensuring networked access to and control over state (oil) revenues.

The subsequent analysis hinges on these structural factors to examine how economic shocks – spurred by exogenous price changes - have affected the ebbs and flows of the conflicts. This is an important complement to the analyses of the more structural determinants of violence in Nigeria, as it allows us to identify possible measures that can help reduce the violence intensity at least in the short run. In addition it sheds light on the importance of the economic factors, which the World Bank (2011) considers as one of the three main drivers of conflict in fragile countries.

3. Income shocks and conflict: Mechanisms

There are at least three main mechanisms through which price changes can affect political instability. First, the shock can change an individual's real income, for example by reducing the price of a good that the individual produces or consumes. A decline in an individual's real income can reduce the opportunity cost of engaging in conflict, thus increasing the potential for using violence to address tensions within society. Second, civil conflicts are also fought over the control of valuable economic resources, i.e. the 'prize' of conflict. To the extent that price swings affect the potential value of these resources, these changes may also affect the incentive for fighting. The higher the value of the prize, the higher is the incentive for fighting. Third, if the state is able to extract the value of these resources, increases in this value can also raise fiscal revenues. As civil conflicts usually involve a confrontation between the state and groups of citizens, such revenues could be used by the state to repress rebellions or to 'buy-off' the rebels.

3.1. Opportunity cost

In order to illustrate the opportunity cost mechanism, consider the following simple formulation of a household's real income as total income divided by the average price level faced by the household:

$$y_i = \frac{\sum_{j=1}^{N} q_j^i p_j^{S_i} + W_i + O_i}{\sum_{j=1}^{N} c_j^i p_j^{S_i}} \qquad (1)$$

where q is household i's quantity of good j produced and sold on the market (for all the possible N goods j), p is the price of j in the state S where i resides; W is wage income and O is any other non-labor income; and c is the share of good j purchased for consumption in total household's expenditures. For households that do not produce any goods, all q terms would be zero. Even for households that do produce goods, q is likely to be zero for most j goods, as households typically specialize in the production of only a few goods. The denominator is the average of the prices of all goods purchased by the household weighted by the importance of each good in the basket.

Other things being equal any change in the price of good r p_r would impact either the numerator or the denominator or both according to the household's consumption and production basket. Even a household that produces and sells r on the market could also purchase r for consumption if there is a mismatch in the timing of production and consumption and the good

cannot be stored.[6] For any household (dropping the superscript *i* to save clutter), we have that $\frac{\partial y}{\partial p_r} = \frac{q_r E_{(-r)} - c_r I_{(-r)}}{(c_r p_r + E_{(-r)})^2}$, where $E_{(-r)}$ and $I_{(-r)}$ are respectively the household's price component of all items but *r* and the household's income from all sources but production of *r*.[7] The direction of the effect of the price change on real income depends on the relative importance of *r* in the household's production and consumption baskets ($\frac{\partial y}{\partial p_r} > 0 \Rightarrow \frac{q_r}{I_{(-r)}} > \frac{c_r}{E_{(-r)}}$).[8]

To the extent that changes in real income translate into changes in the opportunity cost of participating in conflict, price changes of consumed and/or produced goods should affect conflict intensity. Indeed, within-country evidence consistently shows that changes in incomes in a region have a negative association with conflict intensity in that region (Dube and Vargas, 2013; Berman and Couttenier, 2014; Maystadt and Ecker, 2014).[9] While the evidence so far has focused on the (nominal) income side of the equation, the discussion here clarifies why it is important to model the effects of commodities' price changes on conflict via both nominal income (the numerator) and the cost of living (the denominator). In the empirical analysis below we do that by computing two price indices that separately capture the effects on conflict via the production and the consumption channel in equation (1).

3.2. 'Rapacity' vs. state deterrence effect

The prices of commodities can also affect the incentive for fighting by changing the amount of resources that can be siphoned through violence. This is particularly the case for so-called 'point-source' commodities such as oil, which is a contestable, highly valuable, capital-intensive and geographically-concentrated resource (Dal Bó and Dal Bó, 2011 and Dube and Vargas, 2013).[10] Indeed much of the civil unrest in the Niger Delta has been linked to the desire of rebels to appropriate part of the value of the oil production (Asuni, 2009). That spurred substantial 'oil bunkering' activity, the process of illegally tapping an oil pipeline and extracting oil onto a barge. Estimates suggest that the oil stolen in this way may be as high as 5-10% of Nigeria's total national production (Asuni, 2009). Violent confrontations emerged between armed groups for the control of the bunkering, as well as between armed groups and the army.

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[6] As we will see below, this issue is less relevant for our empirical implementation as we aggregate household consumption and production at the state level, thus purchase and sell of the same good coexist.

[7] In particular $E_{(-r)} = \sum_{j \neq r} c_j p_j$ and $I_{(-r)} = \sum_{j \neq r} q_j p_j + W + O$.

[8] That is the basic insight also when allowing for household's consumption response to relative price changes. In that case $\frac{\partial y}{\partial p_r} = \frac{q_r E_{(-r)} - \left(q_r p_r^2 \frac{\partial c_r}{\partial p_r}\right) - \left(I_{(-r)} p_r \frac{\partial c_r}{\partial p_r}\right) - c_r I_{(-r)}}{(c_r p_r + E_{(-r)})^2}$. As expected this expression is more positive (or less negative) than the previous one as both $-\left(q_r p_r^2 \frac{\partial c_r}{\partial p_r}\right) \geq 0$ and $-\left(I_{(-r)} p_r \frac{\partial c_r}{\partial p_r}\right) \geq 0$ since $\frac{\partial c_r}{\partial p_r} \leq 0$. These two terms reflect the adjustment in expenditure on *r* that households make in response to the price changes.

[9] Blattman and Annan (2014) also confirm this evidence at the individual level by finding that Liberian post-combatants targeted by a successful agricultural training and input program were less likely to engage with mercenary recruiters when war erupted nearby.

[10] At the other end of the spectrum, 'diffuse' commodities (often agricultural commodities) are produced over wide areas, labor intensive, and more difficult (though not impossible) to control.

As oil extraction is capital-intensive, increases in the price of oil are likely to have relatively muted wage effects, while they would increase the return to predation activities. That is different to the effect of price changes of agricultural commodities which are produced and/or consumed by the households and which directly affect their real income but not the returns to predation. Using a 2x2 Hecksher-Ohlin model, Dal Bó and Dal Bó (2011) show these contrasting effects of price changes of labor vis-à-vis capital intensive commodities on the incentive to fight. In the empirical analysis we use exogenous changes in the value of the oil production (relative to the local economy) to test for this 'rapacity' effect of oil prices on conflict.

The 'prize' mechanism is part of the explanation for the eruption and/or the escalation of violence in many modern conflicts. The evidence in support of the prize effect of point-source commodity prices is more robust within countries (Maydstadt et al., 2014; Dube and Vargas, 2013; Bellows and Miguel, 2009) than across them (Lin and Michaels, 2014 vis-à-vis Cotet and Tsui, 2013 and Bazzi and Blattman, 2014). One reason for these mixed results could be that increases in the value of disputable resources can also generate higher fiscal revenues. The state could use these revenues to strengthen its military capacity to repress rebel groups' activities and/or to buy off support, thus favoring political stability. These contrasting effects of point-source commodities may be difficult to disentangle, especially across countries.

In order to test for the importance of this mechanism in Nigeria, we exploit the timing of the amnesty and DDRR program for the Niger Delta militants. This agreement represents a marked shift in the government's policy vis-à-vis the militant groups. Up to that point the counter-insurgency strategy had mainly consisted of military repression, most notably through the creation of the Joint Task Force (JTF), composed of troops of the army, navy, air force and the mobile police. However reports suggest that the deployment of the JTF was ineffective at quelling the violence and in fact may have even escalated the conflict as some military took part in the illicit oil trade and reports of extortion, rape, and intimidation of the populace by the security forces strengthened the armed groups' recruitment (Rosenau et al., 2009; Asuni, 2009). We test for a change in relation between the oil price variable and conflict after the introduction of the new policy in 2009, which shifted the use of part of the oil revenues from funding armed repression to funding the program for the rehabilitation and reintegration of the militants.[11]

4. Data and variables

The data on conflict used in this study are from Version 4 (1997 – 2013) of the ACLED (Armed Conflict Location & Event Data Project). ACLED Version 4 data cover all countries on the African continent from 1997. ACLED definitions mainly concern actors and events. ACLED collects and codes reports from the developing world on civil and communal conflicts, militia interactions, violence against civilians, rioting, and protesting. ACLED covers both activity that occurs within and outside the context of a civil war. For each conflict event, the data contain

[11] The reintegration package includes a temporary government stipend for individual ex-militants as well as relevant training in existing businesses and formal education, which should provide the tools for the individuals to transition to the labor market. Concerns remain on the extent to which the program has been successful in enabling this transition.

information on the geographic coordinates, along the administrative unit of the location, the day, the actors involved, the type, the number of fatalities (if any) and the description. This enables us to construct time varying state-wise conflict intensity measures by aggregating different events at the state-year level.

The main sources of information for the data come from local, regional, national and continental media. These are checked and eventually supplemented by consistent NGO reports especially in hard to access cases. In addition Africa-focused news reports and analyses are integrated to supplement daily media reporting. The result is the most comprehensive and wide-reaching source material presently used in disaggregated conflict event coding. As with all conflict data however caution is needed in interpreting the data as the scope for measurement error is substantial.

The calculation of consumption and production price indices is essential to the model estimation. While there are a number of surveys in Nigeria, we use the Nigeria Living Standards Survey (NLSS) 2003/2004. This is the first survey of the income and expenditure patterns of Nigerian households with sufficient data to analyze conflict over time.[12] Before describing the survey itself, we summarize the methodology used in calculating the price indices.

4.1. Price indices

The consumption price index *CI* for state s at time t is constructed as a geometric average of prices weighted by the budget shares (computed from the 2003/04 NLSS):

$$CI_{st} = \left[\prod_{j=1}^{N}\left((p_{jst})^{Exps\hbar r_{sj}^{2003}}\right)\right] \times \frac{\sum_{j=1}^{N} Exptot_{sj}^{2003}}{TotExp_{s}^{2003}} \qquad (2)$$

where p_{jst} is the price of good j in state s at time t and $Expshr^{2003}$ is the share of *j* in total expenditures in 2003/04 across households in *s* on all the *N* items for which price data are available. In this way the sum of the shares always equal to 1. As we can only match a subset of consumed items with prices (see table A1 in the Appendix for the list of all items matched), we scale this index by the importance of those expenditure items (*ExpTot*) in total household expenditures in the state *TotExp* (the latter term).[13]

The main advantage of the geometric over the arithmetic average is that it allows the index to incorporate some substitution effect across commodities as relative prices change. This type of formulation is common in the literature on commodity prices and conflict (e.g. Arezki and Bruekner, 2011; Bazzi and Blattman, 2014; Calì and Mulabdic, 2014).

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[12] The Living Standard Measurement Survey for Nigeria 2010/2011 is not appropriate for the purpose of our analysis for two reasons: the survey is only representative at the geo-political zone and not at the state level, and the period 2010/2011 covers periods after the Niger Delta conflict but before the core of the Boko Haram crisis.

[13] Available domestic price data will need to be matched with food and non-food items in the survey in order to estimate the indices. Items not matched will not be used in the indices but will all contribute to the weight as described.

The domestic price data come from Nigeria's National Bureau of Statistics (NBS), which collect monthly data for 143 food and nonfood items by state in both rural and urban areas. The price data we use cover 2000 to 2010.[14] Our analysis relies on the urban data, assuming that rural prices will be a markup / discounted value of the urban prices. The rural data are not used because the Nigerian classification of the areas into urban and rural has not been updated since 1991, and thus they are not representative of the current division in urban and rural. We use two approaches to determine which price index from the NBS data is matched to which production or consumption item from the household survey. The first is a narrow price match, where the good is matched to price data with exactly the same name. However, the limited number of items in the price data means that relying on a narrow price match alone could exclude potentially important consumption items that have no exact match in the price data. The second approach is a broad price match, where the price of a food crop is also applied to products which are complements of or derived from that food crop (e.g., the price of cassava is used for its extract gari).[15] Appendix Table A2 reports the value of the scaling factor for both consumption and production indices by state for the narrow and broad matches.

We construct the production price index in a similar fashion to the consumption price index with the difference that we use the underlying bundle of produced goods to weigh the prices:

$$PI_{st} = \left[\prod_{j=1}^{K}\left((p_{jst})^{Prodshr_{sj}^{2003}}\right)\right] \times \frac{\sum_{j=1}^{K} Prodtot_{sj}^{2003}}{TotInc_{s}^{2003}} \qquad (3)$$

where *Prodshr* is the share of good *j* in the total value of households' sales of own produced goods in state s. We consider here only the products between 1 and K for which price data are available in state *s* (thus the shares sum to 1). Finally *TotInc* is the total household income from all sources in the state. Similarly to the consumption price index, the latter term scales the index by the importance of those items produced and sold by the households (*Prodtot*) in total household income in the state *TotInc*.

Because the prices may refer to different units of measurement of the commodities, in order to standardize them, we normalize the price of every commodity to 100 in 2003 and then construct the price index on the basis of the normalized series.

The variation in these price indices across states comes from both the different changes in state-level prices over time and the initial difference in consumption and production baskets. While we focus on the former below, figures A1 and A2 in the Appendix illustrate the latter, by focusing on the two most important consumption items in Nigeria, beans and rice. The variation in production and consumption is large. For example in Benue and Ebonyi rice accounts for over

[14] Though another batch of data is available for 2010 to 2013, there are a number of inconsistencies in the data that makes it difficult to use at this point. The NBS changed methodology of data collection for the prices in those periods and some of the prices were totally different when compared to the 2000 – 2010 data set. Also the items in the 2010 to 2013 data sets were different with more items included and disaggregated.

[15] The broad matching procedure relies on subjective judgments, based on our understanding of the country and the consumption items.

30% of total household production while in Ondo is less than 3%. Similarly rice constitutes over 10% of total expenditures in Sokoto but only 2% in Kwara. A similar degree of variation exists for beans as well.

As explained above, oil plays a key role in Nigerian conflict, especially in the Niger Delta states. To test for its direct effect on conflict via the rapacity hypothesis, we construct an oil price index by interacting the oil production value in 2003 with the international oil price ($P_{st}^{oil} = oil_s \times oilpr_t$). We use oil production data published in the Nigerian National Petroleum Coporation (NNPC) Annual Statistical Bulletin. However, because this data is only reported at the oil well level and not at the state level, we had to systematically map the oil wells to a state. To do that we use a combination of online google search and geo-mapping using longitude and latitudes of the oil well mapped to the state.

The oil index variable should be exogenous to conflict. First, Nigeria is a price taker in the international oil market as it is a small producer (Nigeria produced approximately 2.8% of world oil production 2012).[16] In addition, oil production at the beginning of the period should not be influenced by subsequent conflict, especially as we control for past conflict level (in case there is persistence over time). Given the absence of GDP data by state we normalize the production by state-wise receipts of Value Added Tax (VAT) in 2003 (Source: NBS, 2010). The VAT is a tax levied on products and services, based on the contribution to output at each stage of production. Thus low levels of VAT receipts indicate low levels of economic activity, and vice versa.

4.2. Survey description and summary

The survey was designed to collect household characteristics such as demography, education, health, and migration, for the purpose of poverty analysis. The survey covered the urban and rural areas of all the 36 States of the Federation and the Federal Capital Territory. Ten Enumeration Areas (EAs) were studied in each of the States every month while 5 EAs were covered in Abuja. Information on food expenditure and production by 18770 households was considered.

Part B of the questionnaire asked respondents questions on household's consumption, including both expenditures and agricultural activities at the household level. Household expenditure is categorized into non-food and food expenses.[17] The former is in turn divided into frequently and less frequently purchased items.

Table 1 shows that the mean per capita food expenditure is highest in the South South and South East regions, which house the major oil producing wells. The South East region had mean total per capita expenditure of N 45,216, which is well above the national average. However, the more urban South West region had the highest levels of per capita noon-food expenditures.

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[16] http://www.eia.gov/countries/country-data.cfm?fips=NI. Accessed April 29, 2014.

[17] The expenditure on food by household is a sum of expenditure on each individual food item over 6 visits. That is, aggregation of the response to the question, "How much was spent on … since my last visit?"

The agricultural production section of the survey collects information on agricultural income and assets; land, livestock and equipment; harvest and disposal of crops; seasonality of sales and purchases (key staples only); and other agricultural income (both in cash and kind). Information on the production of agricultural food is collected at a different frequency. Information on household produce sales during the last 12 months is collected for certain items, such as staple grains, field crops and cash crops, including the value of sales from hunting, honey, fruit/berries, milk, other dairy products, eggs, hides, wool and skin, and mushrooms output. On the other hand, for roots, fruits, vegetables, and other crops harvested piecemeal, respondents are asked how much the household sold in the past two weeks. We converted these two week estimates to a yearly value of sales.[18]

Table 1: Household per capita expenditure on food and non-food by zone

	Per Capita Food Expenditure	Per Capita Non- Food Expenditure	Total Per Capita Expenditure
South South	17,287	19,199	36,486
South East	22,314	22,902	45,216
South West	16,533	26,696	43,229
North Central	14,740	15,067	29,806
North East	15,364	12,171	27,535
North West	16,907	11,176	28,083
National	17,094	18,506	35,600

Source: National Bureau of Statistics (2004)

5. Empirical framework

We use these indices in the regression framework to measuring the impact of price shocks on conflict. The basic specification reads as follows:

$$C_{srt} = \alpha_{rt} + \beta_1 CI_{st-1} + \beta_2 PI_{st-1} + \beta_3 P^{oil}_{st-1} + \beta_4 P^{oil}_{st-1} \times d_{2009} + \mathrm{A}Z_s + \mathrm{B}X_{st} + \varepsilon_{st} \qquad (4)$$

where C is a measure of conflict (e.g. number of conflict episodes, number of violent episodes, number of conflict-related fatalities), P^{oil} is the oil price index, d_{2009} is a post-2009 dummy which captures the period after the amnesty deal between the state and the militant groups in the Niger Delta; Z and X are vectors of time invariant and time varying state-level covariates of conflict respectively, α are region-time fixed effects, which capture any time varying effect in each of the six macro-regions in Nigeria.

[18] One way of converting this is to multiply the two week estimate by 26 to get a total of 52 weeks' value of sale. However, inconsistency in the values reported for cassava, yam and plantain, which reported data on both two weeks and annual sales, shows that multiplication of the two weeks value by 26 is not a consistent estimate of the yearly value. We therefore elected to predict the yearly value produced by each household, by applying an average of the relationships between the yearly value and the two weeks value reported for cassava, yam and plantain to the other items.

The nature of the data on conflict makes applying an ordinary linear regression model problematic. The conflict measures are all positive integers, so they will likely exhibit non-normal distribution. This is confirmed by a summary of the state-year conflict measures (Table 2). The number of conflict events in a year and number of conflict events with fatalities range from 0 to 118 and 0 to 79, respectively. There are only an average of 6.9 and 2.2 conflict events and conflict events with fatalities per year.

The Poisson and Negative Binomial models are the two commonly used models for this kind of data characteristic (count data), because they ensure a positive conditional mean of the conflict variables. The Poisson model has the advantage that it does not require that the data be distributed Poisson for it to be used – that is, the model requires a weaker distributional assumption than the negative binomial model. However, the negative binomial model is designed to handle over-dispersion in our data and will lead to higher efficiency in estimation.

Table 2: Summary statistics of the dependent variables (2004-11)

Variable	Obs	Mean	Std. Dev.	Min	Max	% of Zeroes
Nr. of fatalities from conflict episodes	296	18.4	85.5	0	1001	41.6
Nr. of conflict events in a year	296	6.9	12.7	0	118	21.3
Number of conflict events with fatalities	296	2.2	6.0	0	79	41.6

Source: ACLED

Within the negative binomial model option in STATA, we use the population-averaged (PA) option that relaxes the assumption of independence to allow for different correlations over time of the conflict. The relaxation of this assumption is useful for the purpose of our analysis so the influence of conflict in 2003 is not restricted to be the same on all the other years. The other two options, Random effect (RE) and fixed effect (FE), do not adequately capture our data and impose additional structure on the data that cannot be validated. Also, they attempt to model over dispersion rather than capturing fixed effects at the state level and tend to cause convergence issues given the size of our data.

One may argue that unobserved characteristics of the states can potentially bias the estimates when state fixed effects are not controlled for. For example, that may be the case if the initial composition of consumption and production baskets is correlated with unobserved characteristics of the states which also affect the propensity for conflict. We employ a variety of controls to attenuate this concern. First we use region-time effects, which capture any time varying factors in each of the six Nigerian regions. This is an important control as many of the cultural and socio-economic traits as well as the geo-climatic areas in the country are defined at the regional level. In addition, this control captures changes over time that are common across states within a region.

Second, we use a large variety of state-level controls. The vector Z includes variables measured at the beginning of the period of analysis (from the NBS), i.e. population, population density, and measures of poverty and inequality, including the headcount poverty rate, poverty gap

and the Gini index of inequality. Z also includes the cost of travelling to Lagos (Nigeria's main trading center), the number of conflict events between 1997 and 2003, and ethnic variables. Ideally we would use measures of ethnic divisions traditionally used in the conflict literature, such as ethnic fractionalization (Alesina et al., 2003) and polarization (Montalvo and Reynal-Querol, 2005). However in the absence of state-level data on the ethnic composition of the population, the next best variable we can construct is a dummy for whether there are more than two ethnic minorities in the state.[19]

We also construct two time-varying ethnic measures of the relation between the state's dominant ethnic group(s) and the ethnic group holding the presidency, which are included in X. The first (*president*) equals 1 if the ethnicity of the nation's president is the same as that of one of the state's dominant groups. This variable captures the idea that federal policies towards the states may be driven, in part, by ethnic allegiance which can attenuate conflict in that region. The second is a dummy variable for those states in which the president variable equals 1 and which have only one dominant ethnic group. This allows us to differentiate the *president*'s effect between these two types of states.

5.1. Endogeneity of price indices

Importantly, state-level prices are likely to be endogenous to the conflict measure in the state. For instance, high levels of conflict may reduce local production, and if markets are imperfectly integrated across space, this may boost local prices. Conflict may also reduce local demand, which would have an opposite effect on prices. This endogeneity would bias the relationship between the price indices and conflict. We instrument for the price index variables to address this issue.

We propose four sets of indices - two for the consumption and two for the production indices - as instruments. These indices are constructed in the same way as *CI* and *PI*, but using prices which are arguably exogenous to the conflict at the state level. The first set of price indices is the standard one based on international prices that the literature usually employs as a direct regressor in the absence of domestic price data (e.g. Bazzi and Blattman, 2014; Dube and Vargas, 2013). The instrument is constructed as follows:

$$C_{st}^{Intl} = \left[\prod_{j=1}^{I}\left(p_{jt}^{Intl}\right)^{Exps\hbar r_{sj}^{2003}}\right] \times \frac{\sum_{j=1}^{I} Exptot_{sj}^{2003}}{TotExp_{s}^{2003}} \qquad (5)$$

where p_{jt}^{Intl} is the international price of good j at time t. This approach has several difficulties. Replacing domestic with international prices requires changing the set of goods included in the index. The range of goods for which international prices are available (from 1 to *I*) is more limited than the N or K goods included in equations (2) and (3). International prices are available only for internationally-traded commodities, which often do not include many local products important for consumption and production in Nigeria (e.g. yam and cassava). Appendix Table A3 lists the

[19] We also tried a dummy for whether the state has more than one dominant ethnic group, but its effect was never significant in explaining conflict.

matched items between international prices and survey data. This matching is more limited than with domestic prices, i.e. the scaling term for these instruments is smaller than in the *CI* and *PI* in equation (1). The same applies to the *PI* instrument as well. Moreover, international prices do not account for the price transmission from international to domestic markets, which is often limited. Thus international prices may not provide an ideal representation of the size of the price shock at the local level.

We propose another set of instruments to address both issues. The instruments are constructed using domestic prices of faraway states, following the same logic of Jacoby (2013) for changes in rice prices in Indian districts. The price data for the other Nigerian states should reflect exogenous international price changes, their transmission to the domestic market, and shifts in demand and supply in the large domestic market outside of the particular state. Including the prices of states which are further than 11 hours by vehicle from the state in question should relieve the concerns about the exogeneity of the instruments. Indeed it is plausible to assume that conflict intensity in state X may not have much impact in states that are on the other side of the country.[20]

A possible remaining concern about the exogeneity of such instrument is in that specific states may be price makers in Nigeria for specific commodities. In particular if a state is a relatively large producer or consumer of a particular commodity, the conditions in that state may affect the prices of that commodity everywhere in the country. Two factors reduce the severity of this concern reinforcing the claim of exogeneity of the instrument. First, the high intra-national barriers to trading in Nigeria (Atkin and Donaldson, 2014) suggest that the domestic market is not well integrated. Second, the household survey data which we use in the analysis suggests that no state appears to be a key producer or consumer in any of the main commodity markets. The share of production value by an individual state in total domestic consumption is generally low and in no instance higher than 13% for any of the major commodities in the sample (Tables A3 and A4). However, for consumption value, Kaduna and Kano have larger shares. For robustness check we exclude these two states in the calculation of both consumption and production index. As shown below our results are still robust to this specification.

For each state *s*, we compute the weighted average of prices of states located beyond a certain travel distance (*D*) to the capital of state *s* – weighted by the inverse of *D*:

$$p_{jst}^{other} = \sum_{m=1}^{N_s} \frac{1}{D_m} \times p_{jmt} \qquad (6)$$

where p_{jmt} is the price of *j* in state *m* at time *t* for all the N_s states whose capital is located beyond 11 hours travel distance. The eleven hours threshold is based on both the mean and median bilateral distance between the state capitals. We argue that this threshold excludes all the states that are close to the state's geopolitical zone of influence. On average, about 10 states are included on the basis of this threshold. Differently from Jacoby (2013), we penalize far away state's prices,

[20] As stated earlier in section 2 on conflict background in Nigeria, conflict in Nigeria are largely regionalized and 11 hours travel time will takes you outside a particular region.

conditional on being more than 11 hours away, by applying the inverse distance weight. This ensures that within the set of states beyond 11 hours, those relatively closer to the state in question have a greater weight.[21]

We then replace the p_{jst} in equation (2) with p_{jst}^{other} to obtain the instrument CI_{st}^{oth}. We also do the same for *PI*. Note that the rest of equation (2) is unchanged, as the goods *j* are the same in equations (5) and (2) since the price data come from the same source (Nigeria Bureau of Statistics). That is, of course, the case for both the narrow and the broad matching of goods between the price and the survey data. It is also the case for the production indices defined in equation (3).

Following Cameron and Trivedi (2013), we use these instruments to extract the endogenous component of *CI* and *PI* through the first stage regressions. We use the instruments in separate regressions:

$$CI_{srt} = \alpha_{rt} + \delta_1^{oth} CI_{st}^{oth} + \delta_2^{oth} PI_{st}^{oth} + \delta_3 P_{st}^{oil} + \delta_4 P_{st}^{oil} \times d_{2009} + Z_s + X_{st} + \mu_{st} \qquad (7)$$
$$PI_{srt} = \alpha_{rt} + \delta_1^{intl} CI_{st}^{oth} + \delta_2^{intl} PI_{st}^{oth} + \delta_3 P_{st}^{oil} + \delta_4 P_{st}^{oil} \times d_{2009} + Z_s + X_{st} + \nu_{st} \qquad (8)$$

$$CI_{srt} = \alpha_{rt} + \delta_1 CI_{st}^{intl} + \delta_2 PI_{st}^{intl} + \delta_3 P_{st}^{oil} + \delta_4 P_{st}^{oil} \times d_{2009} + Z_s + X_{st} + \mu_{st} \qquad (7')$$
$$PI_{srt} = \alpha_{rt} + \delta_1 CI_{st}^{intl} + \delta_2 PI_{st}^{intl} + \delta_3 P_{st}^{oil} + \delta_4 P_{st}^{oil} \times d_{2009} + Z_s + X_{st} + \nu_{st} \qquad (8')$$

and retrieve the respective estimated residual components of the price indices $\widehat{\mu_{srt}^{oth}}$ and $\widehat{\nu_{srt}^{oth}}$ from equations (7) and (8) or $\widehat{\mu_{srt}^{intl}}$ and $\widehat{\nu_{srt}^{intl}}$ from equations (7') and (8'). These should contain the endogenous component of CI_{srt} (Cameron and Trivedi, 2013). We then add these endogenous components of *CI* and *PI* to equation (4), which becomes (when using the domestic price indices of faraway states as instruments):

$$C_{srt} = \alpha_{rt} + \beta_1 CI_{st-1} + \beta_2 PI_{st-1} + \beta_3 P_{st-1}^{oil} + \beta_4 P_{st-1}^{oil} \times d_{2009} + \mathrm{A}\, Z_s + \mathrm{B}\, X_{st} + \widehat{\mu_{srt}^{oth}} + \widehat{\nu_{srt}^{oth}} + \varepsilon_{st} \qquad (4')$$

The coefficients of CI and PI should not suffer from endogenity bias as the residuals from the first stage will purge the endogenous component of the price indices. This formulation ensures the computation of consistent standard errors (Cameron and Trivedi, 2013). The signs of the residuals (not reported in the tables but available upon request) confirm the direction of the endogeneity bias, that is negative for *CI* and positive for *PI*. In other words, by reducing the demand for products, conflict reduces the prices of consumed goods and thus it generates a spurious negative correlation between *CI* and conflict. The opposite is true for *PI*. Therefore in both cases the endogeneity biases the *CI* and *PI* coefficient towards zero.

As it turns out, the international price indices have a relatively weak predictive power for *CI* and *PI* because of the different composition of the items' basket and the limited transmission of

[21] The results do not change without weights. We also experiment with different distance thresholds, i.e. 3, 4, 6 and 7 hours obtaining similar results (results available upon request).

international commodity prices to the Nigerian market. This limited transmission is shown for two important consumed and produced commodities (maize and imported rice) in figures A1 and A2 in the Appendix. The figures show that the pattern of state-level endogenous prices over 2003-10 is closer to that of exogenous state-level prices (computed on the basis of faraway states) than to that of international prices.[22] However, the international price indices are useful, since (unlike the domestic price indices) they are available through 2013.

6. Results

Table 3 presents the summary statistics for the regressors in the analysis for the 2004-11 period.

Table 3: Summary statistics of the regressors (2004-11)

	Obs	Mean	SE	Min	Max
CI	296	77.40	23.98	21.92	137.72
PI	296	66.28	26.67	21.19	138.08
CI_{NAR}^{oth}	296	87.44	24.46	45.27	143.69
PI_{NAR}^{oth}	296	75.76	25.62	28.62	127.31
CI_{BR}^{oth}	296	70.55	27.18	23.42	142.07
PI_{BR}^{oth}	296	83.22	25.41	27.30	149.43
CI_{NAR}^{Intl}	296	69.43	21.34	30.18	132.61
PI_{NAR}^{Intl}	296	56.33	13.00	31.43	84.29
Oil index	296	60.27	155.41	0	925.30
President	296	0.28	0.45	0	1
Pop (2003) ln	296	8.15	0.40	7.25	9.15
Pop dens. (2003) ln	296	5.26	0.89	3.93	7.90
Past conflict event	296	29.86	49.31	2	264
Past fatalities	296	202.46	344.81	1	1892
Past event with fat.	296	17.19	29.59	1	156
Past battle events	296	12.76	21.52	1	99
Past protest	296	5.70	10.20	0	60
Past civil. violence	296	10.84	18.35	0	103
Poverty gap 2003	296	18.46	11.07	5	54
Headcount Poverty 2003	296	48.78	17.90	21	87
Multiple dominant groups dummy	296	0.32	0.47	0	1
Ethnic minorities>2	296	0.68	0.47	0	1

Table 4 presents the results of the baseline specification in equation (3'). To check the possible omitted variable bias across price indices, we first employ a parsimonious specification

[22] A similar pattern is available for other main commodities for which both domestic and international prices are available, such as bean (figures available upon request).

with only the (narrow version of) *PI* along with the residual $\widehat{v_{srt}^{oth}}$ (from the first stage using the other states' prices index) and the full set of controls. The result in column (1) shows no significant impact of *PI* on conflict events in Nigeria. That is the case also when we add the oil index along with its post-2009 interaction (column 2). The signs of the oil variables support both the 'rapacity' and the state capacity hypotheses. The oil index has a positive and significant effect on the number of conflict events the following year, in line with the 'rapacity' hypothesis: exogenous increases in the value of oil raise the incentive for fighting in the production areas. On the other hand, this effect disappears after the amnesty deal in 2009, confirming that the deal was effective in curbing violence in the Niger Delta states. The statistically insignificant association between the oil price index and conflict intensity after 2009 is consistent with the idea that the oil funds may have been used to demobilize militants in these areas thus countering the 'rapacity' effect from oil price increases (Sayne, 2013).

Table 4: The impact of price shocks on conflict events in Nigeria (2004-11)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable	Any event	Any event	Any event	Any event	Any event	Any event
Instruments	PI_{NAR}^{oth}	PI_{NAR}^{oth}	$CI_{NAR}^{oth}, PI_{NAR}^{oth}$	$CI_{BR}^{oth}, PI_{BR}^{oth}$	$CI_{NAR}^{Intl}, PI_{NAR}^{Intl}$	$CI_{BR}^{Intl}, PI_{BR}^{Intl}$
CI_{NAR} (t-1)			0.052***		0.053*	
			(0.013)		(0.030)	
PI_{NAR} (t-1)	0.054	0.024	-0.047***		-0.001	
	(0.053)	(0.052)	(0.012)		(0.025)	
Oil ind. (t-1)		0.002**	0.003***	0.003***	0.003***	0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Oil ind. (t-1) x post-09		-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CI_{BR} (t-1)				0.038***		0.078*
				(0.011)		(0.043)
PI_{BR} (t-1)				-0.036***		-0.008
				(0.01)		(0.026)
Marginal effects: change in number of conflict events caused by a 10% increase in price index						
CI			2.97	2.31	2.83	4.51
PI		-	-2.30	-1.86	-0.05	-0.39
Oil ind.		0.01	0.14	0.15	0.12	0.14
Oil ind. x post-09		-0.02	-0.02	-0.02	-0.02	-0.02

*Dependent variable is the number of any conflict events in the state in year t; all regressions include residuals from the first stage regressions of the endogenous price index on the excluded instruments as a control with appropriate standard errors (clustered at the state level) calculated; *, **, *** indicate statistical significance at the 10, 5, and 1 percent level, respectively. Data are for 37 states for 8 years (2004-11). All regressions include year and region effects as well as region-year effects and various controls (the log of population in 2003, the log of population density in 2003, the number of conflict events in 1997-2003, the poverty gap and headcount poverty in 2003, a dummy for multiple dominant ethnic groups, a dummy for more than 2 ethnic minorities, a dummy for whether the federal president is of the same ethnicity as the dominant group in the state and the interaction between this variable and the multiple dominant groups dummy). The models are estimated through the population-averaged negative binomial estimator for panel data.*

We further check the impact of the amnesty deal on conflict through a placebo test using other years (2007 and 2008) as interactions instead of 2009. The results (Table A5 in the Appendix) show that in 2009 there is the most significant break the oil price index-conflict intensity relation. Indeed the oil price index keeps exerting a positive effect on conflict after both 2007 and 2008.[23] This result provides further support that the 2009 amnesty deal was responsible for the disappearance of any significant oil-conflict relation.

Adding the *CI* along with its residual $\widehat{\mu_{srt}^{oth}}$ to the model makes the *PI* negative and significant at the 1% level (column 3). This suggests that failure to include this consumption impact severely biases (towards zero) the conflict-reducing effect of increases in prices of agricultural commodities produced by the households. The issue here is that the prices used in construction of the production index involve goods that are both consumed in, and produced by, households. Thus increases in *PI* may raise real incomes (and thus the opportunity cost of fighting) for households that are predominantly affected through the goods they produce, and lower real incomes for households that are predominantly affected through the goods they consume. Once we control for this (positive) consumption effect through *CI*, we are able to isolate the true (negative) production effect of PI on conflict. This is an important finding, as the literature has atypically focused solely on the impact of prices of produced goods on conflict, thus potentially suffering from an important omitted variable bias. This may also help explain the lack of consensus on the effects of agricultural commodity prices on conflict.

The effect of CI is positive and significant in line with the idea that increases in the price of commodities heavily consumed reduce real incomes and increase the propensity to engage in conflict.

These results are robust to using the *PI* and *CI* constructed through the broad matching of the items (column 4).[24] However, the results for production are not robust to using the *PI* corrected via the international prices instrument whether through the narrow (column 5) or the broad matching (column 6). On the other hand, the result for *CI* holds (although the significance is lower) and the coefficient is very close to the narrow *CI* coefficient (cfr. columns 3 and 5), while in the broad case the coefficient corrected through the international prices instrument is larger (cfr. columns 4 and 6). The weaker results for *PI* with international prices suggest that the two problems described above (limited transmission of international to domestic prices and limited number of items matched) in using international prices to capture price shocks at the local level may be relevant in the case of Nigeria for the commodities produced by the households.[25] The oil index coefficients are unaffected by the use of international prices for *CI* and *PI*.

While we do not report the results when we drop Kaduna and Kano (the two states with the highest shares of consumption), the estimates are consistent and robust to our main results. We

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[23] The test of the sum of the of the parameters of the oil price index and the interactions post 2008 or post 2009 shows a Chi square of about 15 with one degrees of freedom highlighting that the sum of the parameters are significantly different from zero. On the other hand the sum for 2009 is not significantly different from zero

[24] In this case we correct them through the PI_{NAR}^{oth} and CI_{NAR}^{oth} instruments.

[25] Indeed in parallel preliminary work we document the limited pass-through from international to domestic prices in Nigeria for various agricultural items.

should note however that the estimate on PI was weaker excluding those states. This may be because Kaduna and Kano are the major business hubs in the northern part of Nigeria and getting a result similar to assuming 100% pass through (Columns 5 and 6 of Table 4) when we remove those states makes sense.

Also, while we do not report the coefficients of the control variables (full results are available upon request), an interesting result is that the ethnicity of the president matters in determining the level of conflict in the states. When the president's ethnicity is the same as that of the dominant group in a state, conflict intensity subsides in that state, confirming the importance of ethnic allegiance in state politics. This result is weaker for those states with more than one dominant ethnic group.

The lower part of Table 4 presents the estimates similar to the marginal effect of the impact of consumption, producer and oil prices on the likelihood of conflict. For ease of interpretation, what we present is by how many conflict events is either reduced or increased when the variables are increased by 10%. For instance, we find that a 10% increase in consumption prices generates three additional conflict events in the following year, while a 10% increase in production price reduces conflict events by about 2.3 (using the coefficients in column 3). By contrast, the influence of a 10% increase in the oil index only increases conflict by about 0.14 – for conflict to increase by one due to an increase in the oil price index, it will have to be a 100% increase in the index. This smaller average effect is at least in part due to two factors. First the effect only applies to a few states (in the Niger Delta); thus the average across states is lower. Second the oil price index varies more than the production and consumption price indices, thus a 10% variation is smaller relative to the other indices.

In Table 5 we check the robustness of the results to various issues. In column (1) we use the contemporaneous value of the indices. The effect of the consumption and oil index, but not of the production index or the post-2009 oil effect, are robust to this specification. The latter result is a by-product of the restricted sample, which now only includes one year (instead of two) after the agreement. On the other hand, the weak result for *PI* is more likely to do with the timing of the effect of price changes on conflict, which appear to occur with a lag. Even the contemporaneous prices of consumption goods appear to exert a weaker effect on conflict than their lagged values. In column (2) we include both the contemporaneous and the lagged values, to control for potential negative autocorrelation of prices over time periods (Bazzi and Blattman, 2014). Once again the results for consumption and the oil index (as measured by the sum of the contemporaneous and the lagged coefficients) are robust to this specification, while the cumulative effect of PI is not significant. The results are also robust to the inclusion of the lagged unemployment rate as a further control, which however makes the PI coefficient less significant (column 3).

In columns (4) and (5) we regress the conflict variable directly on the two sets of instruments. Once again, the effects on conflict survive for consumption but not for production. The CI effect is weaker with the international price instrument, consistent with the limited ability of this instrument to capture shocks at the local level.

Overall these results suggest important effects of consumption, production and oil prices on conflict events, although production effects are somewhat less robust than the others.

Table 5: The impact of price shocks on conflict in Nigeria (2004-11), robustness

	(1)	(2)	(3)	(4)	(5)
Method	Nbreg	Nbreg	Nbreg	Nbreg	Nbreg
Period	2004-10	2004-10	2004-11	2004-11	2004-11
Instruments	$CI_{NAR}^{oth}, PI_{NAR}^{oth}$	$CI_{NAR}^{oth}, PI_{NAR}^{oth}$	$CI_{NAR}^{oth}, PI_{NAR}^{oth}$		
CI_{NAR} (t)	0.024*	-0.021			
	(0.012)	(0.034)			
PI_{NAR} (t)	-0.010	0.035			
	(0.011)	(0.043)			
CI_{NAR} (t-1)		0.079	0.066**		
		(0.053)	(0.031)		
PI_{NAR} (t-1)		-0.049	-0.032		
		(0.070)	(0.054)		
CI_{NAR}^{oth} (t-1)				0.051***	
				(0.009)	
PI_{NAR}^{oth} (t-1)				0.015	
				(0.012)	
CI_{NAR}^{Intl} (t-1)					0.013*
					(0.008)
PI_{NAR}^{Intl} (t-1)					-0.001
					(0.024)
Oil ind. (t)	0.003***	0.001			
	(0.001)	(0.001)			
Oil ind. (t-1)		0.002***	0.003***	0.002***	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)
Oil ind. (t) x post-09	-0.001				
	(0.001)				
Oil ind. (t-1) x post-09			-0.003***	-0.004***	-0.003***
			(0.001)	(0.001)	(0.001)
Controls	YES	YES	YES	YES	YES
Observations	259	259	296	296	296
CI+ CI (t-1)		0.058**			
PI+ PI (t-1)		-0.014			
Oil + Oil(t-1)		0.003***			

*Dependent variable is the number of any conflict events in the state in year t; all regressions include residuals from the first stage regressions of the endogenous price index on the excluded instruments as a control with appropriate standard errors (clustered at the state level) calculated; *, **, *** indicate statistical significance at the 10, 5, and 1 percent level, respectively. Data are for 37 states for 8 years (2004-11). All regressions include year and region effects as well as region-year effects. The models are estimated through the population-averaged negative binomial estimator for panel data.*

Table 6: The impact of price shocks on various types of conflict in Nigeria (2004-11)

	(1) CI_{NAR}^{oth} PI_{NAR}^{oth}	(2) CI_{BR}^{oth} PI_{BR}^{oth}	(3) CI_{NAR}^{Intl} PI_{NAR}^{Intl}	(4) CI_{NAR}^{oth} PI_{NAR}^{oth}	(5) CI_{BR}^{oth} PI_{BR}^{oth}	(6) CI_{NAR}^{Intl} PI_{NAR}^{Intl}	(7) CI_{NAR}^{oth} PI_{NAR}^{oth}	(8) CI_{BR}^{oth} PI_{BR}^{oth}	(9) CI_{NAR}^{Intl} PI_{NAR}^{Intl}	(10) CI_{NAR}^{oth} PI_{NAR}^{oth}	(11) CI_{BR}^{oth} PI_{BR}^{oth}	(12) CI_{NAR}^{Intl} PI_{NAR}^{Intl}	(13) CI_{NAR}^{oth} PI_{NAR}^{oth}
	Events with fatalities			Battle events			Protests/riots			Violence against civilians			Fatalities
CI_{NAR} (t-1)	0.059***		0.063*	0.054***		0.017	0.080		-0.002	0.038**		0.033	0.068***
	(0.016)		(0.033)	(0.015)		(0.034)	(0.058)		(0.041)	(0.016)		(0.032)	(0.013)
PI_{NAR} (t-1)	-0.027**		0.008	-0.043***		0.012	-0.025		0.029	-0.034**		-0.020	-0.021**
	(0.011)		(0.023)	(0.014)		(0.028)	(0.107)		(0.026)	(0.014)		(0.024)	(0.009)
CI_{BR} (t-1)		0.042***			0.044***			0.040***			0.029**		
		(0.014)			(0.012)			(0.014)			(0.014)		
PI_{BR} (t-1)		-0.014			-0.036**			-0.032**			-0.027**		
		(0.012)			(0.012)			(0.014)			(0.012)		
Oil ind. (t-1)	0.003***	0.003***	0.003***	0.004***	0.003*	0.003***	0.000	0.000	-0.001*	0.003***	0.003***	0.003***	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Oil ind. (t) x post-09	-0.004***	-0.004***	-0.004***	-0.004**	-0.004**	-0.004***	-0.003	-0.003	-0.003*	-0.002**	-0.002**	-0.002***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)

*All regressions include residuals from the first stage regressions of the endogenous price index on the excluded instruments as a control with appropriate standard errors (clustered at the state level) calculated; *, **, *** indicate statistical significance at the 10, 5, and 1 percent level, respectively. Data are for 37 states for 8 years (2004-11). All regressions include year and region effects, as well as region-year effects and a full set of controls as in Tables 4 and 5. The models are estimated through the population-averaged negative binomial estimator for panel data.*

In table 6 we check to what extent these results apply also to other conflict measures using the categorization of the ACLED data into various types of conflict. All the effects appear to apply to all types of conflict events, including events that result in fatalities, battle events, protests and riots, and violence against civilians. The consumption and oil price effect, but not the production price effect, also are robust to using the number of fatalities as the dependent variable (column 13).[28]

This analysis also shows an important dichotomy in the effect of the price shocks. While the effect of CI is particularly large for protests/riots (although its standard errors are large for the narrow CI and PI), oil price shocks have no effect on this type of conflict event (and that is the only type of conflict event which oil does not affect). This result is in line with the hypothesis that oil extraction spurred a type of violence mainly organized around militant groups, which was unrelated to popular protests.

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[28] Note we are unable to run the model with fatalities using indices based on broad matching and on international prices due to lack of convergence.

6.1. Heterogeneity of the effects

These price shocks appear to be important determinants of conflict on average across Nigerian states. However states may be vulnerable to the same shocks to different degrees. In particular, the presence of deep-seated roots of conflict is usually a necessary condition for any economic shock, including prices, to have an impact on violence. A better understanding of what conditions matter in this respect could help direct policy interventions to address the vulnerability to increases in conflict from trade shocks. We use a series of interaction terms in order to test for some of this heterogeneity of the price effects on conflict across states. We interact each of the three trade variables with some potentially important factors that may drive conflict resilience to the shocks in the Nigerian context.

We use three types of factors that have been identified as important to mediate the effect of trade shocks on conflict, i.e. politics, conditions affecting the transmission of prices, and issues that affect grievances (Calì and Muladbic, 2014). The role of politics is represented by the interaction between a dummy variable for an election year and the price shock. As in other African countries (Ksoll et al., 2010), elections are perilous times in Nigeria.

The degree of transmission of international prices to the domestic markets is measured by the distance to Lagos, interacted with CI and PI. Intra-national trade costs are high in Nigeria (Atkin and Donaldson, 2014). As Lagos is the largest market and the international gateway for the country's trade, distance to Lagos could affect the extent to which exogenous price shocks translate at the local level. We do not follow the same procedure for the oil index, as price transmission should not be an issue for oil.

Data availability allows us to construct more variables to capture the extent to which grievances mediate the impact of price shocks on conflict. Among the factors affecting grievances, ethnic divisions feature prominently in African conflicts and in Nigeria in particular (NNoli, 2003). We test for the role of ethnic divisions in mediating the impact of price shocks on conflict by interacting the three variables used so far as controls with the price indices. These are the president variable, a dummy for more than two ethnic minorities, and a dummy for multiple dominant ethnic groups in the state.

We use poverty measures, including the poverty gap, the poverty headcount, the Gini index of inequality, and the unemployment rate (all computed at the beginning of the period in 2003/04) to reflect the potential for economic conditions contributing to grievances. Finally, we use the level of past conflict intensity to generate three interaction terms. The level of past conflict is an important predictor of future violence by generating grievances (World Bank, 2011), a finding that has been confirmed in this analysis as well.

We run the baseline regression as in column (3) table 4 adding three interaction terms from an individual mediating factor (one for each price shock) at a time. We use the different types of conflict as dependent variable. The results of this analysis are presented in table 7, which reports only the coefficient of the interaction terms from the separate regressions along with their degree of significance. Various findings emerge. First the magnitude of the price effects on conflict is amplified in election years, especially the consumption and oil shock. Second, the effects of the production price shocks on conflict events and battle events (but not of

protests) are reduced the further one moves away from Lagos. Third, various factors related to grievances significantly magnify the conflict-inducing effect of a rise in the price of oil. That is particularly the case for ethnic factors and economic inequality.

Table 7: Mediating factors affecting the impact of price shocks on conflict

	Any events	Events with fat.	Battles	Protests and riots	civ. violence
election x CI (t-1)	0.034**	0.034**	0.030*	-0.003	0.030**
election x PI (t-1)	-0.023	-0.036**	0.010	-0.024	-0.049***
election x Oil Ind (t-1)	0.002***	0.002	0.001	0.002	0.002**
cost_lagos x CI (t-1)	-0.000	0.000	-0.001	-0.001**	-0.000
cost_lagos x PI (t-1)	0.001**	0.000	0.001**	-0.001**	0.001
president x CI (t-1)	-0.001	-0.019	-0.018	0.006	0.020
president x PI (t-1)	-0.002	0.008	0.009	-0.015	-0.013
president x Oil Ind (t-1)	-0.002	-0.000	-0.003***	0.002*	-0.001
unem03 x CI (t-1)	-0.000	-0.001	-0.001	-0.000	-0.000
unem03 x PI (t-1)	0.001	0.001	0.001	0.001	0.001
unem03 x Oil Ind (t-1)	-0.000	-0.000	-0.000	0.000**	-0.000
mult_domin x CI (t-1)	-0.016	0.022	0.003	-0.002	-0.006
mult_domin x PI (t-1)	-0.008	-0.035**	-0.039	-0.015	-0.015
mult_domin x Oil Ind (t-1)	0.003***	0.002**	0.004***	0.001	0.003***
many_minor x CI (t-1)	-0.011	0.029	-0.002	-0.045	0.009
many_minor x PI (t-1)	0.007	-0.027	-0.000	0.022	-0.000
many_minor x Oil Ind (t-1)	0.004***	0.002***	0.005***	0.001	0.004***
pov03 x CI (t-1)	0.000	-0.000	-0.000	0.000	0.000
pov03 x PI (t-1)	-0.000	0.000	-0.000	-0.000	-0.000
pov03 x Oil Ind (t-1)	-0.000	-0.000	-0.000	-0.000	-0.000
gini03 x CI (t-1)	-0.270**	-0.223	-0.187	-0.072	-0.708***
gini03 x PI (t-1)	0.256*	0.270	0.184	0.070	0.729***
gini03 x Oil Ind (t-1)	0.038***	0.046***	0.063***	0.002	0.030***
Past conflict x CI (t-1)	-0.000	-0.000	-0.001**	0.002*	-0.001
Past conflict x PI (t-1)	-0.000	-0.000	0.001*	-0.003**	0.001
Past conflict x Oil ind (t-1)	-0.000	-0.000	-0.000	-0.000***	0.000

*The table reports the coefficients of the interaction terms between the price indices and various conditioning factors obtained from different regressions; all regressions include residuals from the first stage regressions of the endogenous price index on the excluded instruments as a control with appropriate standard errors (clustered at the state level) calculated; *, **, *** indicate statistical significance at the 10, 5, and 1 percent level respectively (based on adjusted standard errors). Data are for 37 states for 8 years (2004-11). All regressions include year and region effects, as well as region-year effects and a full set of controls as in Tables 4 and 5. The models are estimated through the population-averaged negative binomial estimator for panel data.*

On the other hand, and more surprisingly, most past conflict events do not magnify the effects of price shocks on conflict. Past protests are an exception (i.e. the impact of price shocks on protests is higher in states with a past history of protests). In addition, neither unemployment nor poverty appears to mediate the effects of price shocks.

6.2. The Boko Haram conflict

As noted above, the most devastating Nigerian conflict in recent years has been associated with Boko Haram. According to the International Crisis Group (2014), Boko Haram (usually translated loosely as "Western education is forbidden") emerged in the early 2000s, initially as a nonviolent Islamic movement in Northern Nigeria, under the leadership of the charismatic cleric Mohammed Yusuf. The group has consistently demanded the establishment of an Islamic state in the north with strict adherence to Sharia law as it "believes that corrupt, false Muslims control northern Nigeria" (p. i).

The clashes between the group – which wanted to change the political and religious order of the region - and the police started in 2009 and quickly escalated into an armed insurrection, which was crushed by the state forces. Hundreds of Boko Haram's members were killed and the group's principal mosque was destroyed. Yusuf was captured by the army, handed over to the police and shortly thereafter extra-judicially executed in public (International Crisis Group, 2014; Nossiter and Kirkpatrick, 2014). This spurred the retaliation of Boko Haram, which went underground and a year later launched attacks on police stations and military barracks, explicitly in revenge for the killings of Yusuf and his comrades (International Crisis Group, 2014).

However the attacks continued to escalate, including attacks against civilians. As a response the Nigerian government assembled a joint task force of military and police units to battle Boko Haram and declared a "state of emergency" in three northeast states—Borno, Yobe, and Adamawa—in May 2013. However, that has not seemed to reduce the violence, which included the murder of 65 students at the agricultural college in Yobe state in September 2013, chainsaw beheadings of truck drivers, and the killing of hundreds on the roads of northern Nigeria (Council of Foreign Relations, 2014). Most recently the abduction of 200 schoolgirls in Borno state spurred a worldwide wave of condemnation of the group.

While the conflict has a religious dimension, analysts suggest that grievances, including poor governance and social, economic and political marginalization, and the consequent poverty and unemployment that they have caused, are fundamental drivers of the increased militant activities of Boko Haram (Irin, 2011a, International Crisis Group, 2014).[29] Economic grievances may have facilitated the recruitment of Boko Haram, which incentivized poor youth to join their ranks by offering food, shelter and other forms of assistance not provided by the government (Copeland, 2013).

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[29] In an interview with Irin Human Rights Watch researcher Eric Guttschuss noted that "Boko Haram is essentially the fallout of frustration with corruption and the attendant social malaise of poverty and unemployment." Similarly Paul Lubeck, a professor at the University of California, Santa Cruz, who studies the group, argues in an interview that Boko Haram tapped into growing anger among northern Nigerians at their poverty and lack of opportunity (Nossiter and Kirkpatrick, 2014).

We use our empirical strategy to test to what extent income shocks explain the surge in the Boko Haram conflict since 2010. In order to do that we construct the weights of the price indices on the basis of the 2008/09 Nigerian household survey, which is closer in time to the period of analysis relative to the 2003/04 survey. As state-level domestic prices are available to us only until 2010, we cannot compute *CI* and *PI* based on domestic prices. As an alternative we construct the price indices using directly the international prices as in equation (4) but using the 2008/09 data to construct the weights.

These measures are likely to be exogenous as international prices are arguably exogenous to local level conditions and as the weights are based on production and consumption baskets before the start of the period of analysis. These measures are close to those used by Dube and Vargas (2013) and Bazzi and Blattman (2014).

Table 8: Summary statistics for the Boko Haram conflict measures, 2010-13

	Obs	Mean	Std. Dev.	Min	Max
All states					
Boko Haram (BH) event	148	5.5	23.2	0	194
Non BH event	148	13.7	15.3	0	74
BH fatality event	148	4.1	19.1	0	171
Non BH fatality event	148	5.4	7.9	0	51
Fatalities in BH events	148	35.5	201.1	0	2301
Fatalities in non BH events	148	32.0	78.4	0	621
Northern states					
Boko Haram (BH) event	80	10.2	30.9	0	194
Non BH event	80	13.5	16.4	0	74
BH fatality event	80	7.6	25.5	0	171
Non BH fatality event	80	6.6	9.8	0	51
Fatalities in BH events	80	65.6	270.6	0	2301
Fatalities in non BH events	80	47.1	102.3	0	621

Source: Authors' elaboration on ACLED data

In addition from the ACLED database, we compute the state-wise yearly number of conflict events, number of conflict events with fatalities and number of fatalities related to Boko Haram.[30] The summary statistics of these variables show the severity of this conflict in the context of the overall country in the period 2010-13, especially in the Northern regions (Table 8). On average 30% of all conflict episodes in the period were related to Boko Haram and over half of the conflict-related fatalities. The Boko Haram conflict varies in intensity more than the other conflict as shown by the comparatively larger standard deviation and ranges of the Boko Haram vs. non Boko Haram conflict measures. Indeed the figures are starker for the Northern states, where the Boko Haram conflict is concentrated.

[30] A conflict event involves Boko Haram is one of the two actors is defined as Boko Haram in the ACLED data.

The results of the analysis – presented in Table 9 - suggest that income shocks via both consumption and production price changes do exert an important influence on the intensity of the Boko Haram conflict. The direction of the effects is consistent with that of the previous analysis, although this time the impact of production shock on conflict events is larger than consumption.

On average a 10% reduction in the value of the production index in a year leads to 2.38 additional conflict events involving Boko Haram in the following year, while the same reduction in consumption prices leads to 0.95 fewer events (column 1). The effects are even larger (3.7 and 2.5 respectively for *PI* and *CI*) when considering only the three Northern regions where Boko Haram activities are concentrated: production (column 2). These results are even more striking, considering that the data on international prices may not reflect accurately local market conditions as argued above. On the other hand, the oil index does not bear any significant relation with Boko Haram conflict activities (column 1).

Interestingly, neither consumption nor production price indices appear to be associated with non Boko Haram conflict events either in the full sample (columns 3) or in the Northern regions (column 4). This suggests that income shocks, at least driven by consumption and production price changes, appear to matter for current conflicts in Nigeria mainly through the Boko Haram insurgency. On the other hand, the oil index is associated with a reduction in non Boko Haram conflict (column 1), confirming our previous results for the post-2009 period.

Table 9: The impact of price shocks on the Boko Haram conflict (2010-13)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Region	All	North	All	North	North	North	North	North
Dep. variable	BH event	BH event	Non BH event	Non BH event	BH fat. event	Non BH fat. event	BH fatalities	Non BH fatalities
CI_{NAR}^{Intl} *(t-1)*	0.046**	0.067***	-0.013	0.014	0.116***	0.010	0.078***	-0.025
	(0.020)	(0.018)	(0.011)	(0.013)	(0.018)	(0.016)	(0.024)	(0.022)
PI_{NAR}^{Intl} *(t-1)*	-0.105**	-0.093**	-0.003	0.008	-0.024	-0.000	0.020	0.050
	(0.043)	(0.043)	(0.018)	(0.023)	(0.026)	(0.023)	(0.038)	(0.034)
Oil ind. (t-1)	0.001		-0.001***					
	(0.002)		(0.000)					
Observations	148	80	148	80	80	80	80	80
Nr. of states	37	20	37	20	20	20	20	20

*Robust standard errors in parentheses; *, **, *** indicate statistical significance at the 10, 5, and 1 percent level, respectively. All regressions include year and region effects as well as region-year effects and a full set of controls as in Tables 4 and 5. The models are estimated through the population-averaged negative binomial estimator for panel data.*

In columns 5-8 we check whether these effects apply also when considering the conflict events with at least one fatality and the number of fatalities. As these variables have a larger share of zeros than conflict events, we can only apply the negative binomial estimator to the

restricted sample of the three northern regions.[31] The conflict inducing effects of increases in the consumption basket price carry through also for these measures of violence while that is not the case for the prices of the production basket, which becomes insignificant. The effect of CI is substantial: a 10% increase in CI in a state generates an additional 3.3 Boko Haram conflict events with at least one fatality (column 5) and an additional 18.8 fatalities in that state. These are large figures considering that in the northern states the average number of Boko Haram events with fatalities and of fatalities in these events are 7.6 and 65.6. On the other hand, the CI and PI coefficients remain insignificant for the non Boko Haram conflict (columns 6 and 8).

These results confirm the view that the Boko Haram conflict has an important economic dimension, which affects the intensity of the militants' activities. They are consistent with the view that changes in incomes affect the propensity of the local populations to support the Boko Haram insurgency and/or the ability of Boko Haram to recruit fighters. This opportunity cost story seems to be even more relevant than for the other current conflicts in Nigeria.

7. Conclusions

Do income shocks affect conflict? We have addressed this question by analyzing the short-term effects of price shocks on conflicts across Nigerian states in the past decade. Our analysis is better placed at identifying the extent to which changes in income affect the ebbs and flows of conflict. In this way it complements analyses that look at the more structural determinants of the conflict. Our results show that price changes are important determinants of conflict through consumption and production. In particular, hikes in consumption prices have a conflict-inducing effect, while the opposite is true for production prices. Both results are consistent with the opportunity cost hypothesis of conflict. Importantly, not including consumption effects, which previous studies usually do not consider, severely biases the estimation of the production effect as well.

Increases in the international price of oil, the most important Nigerian export, raise the level of conflict in oil-producing regions in line with the 'rapacity' theory. However, this effect disappears when considering the period of time after the amnesty deal was signed between the state and the militant groups in the Niger Delta, suggesting that the state may have been able to use oil revenues to temporarily pacify the region.

These effects apply to all types of conflict events, including events with fatalities, battles, protests, and events with violence against civilians. In addition the magnitude of the price effects on conflict is amplified in election years, especially the consumption and oil shocks. Similarly, oil shocks are amplified in states with many ethnic minorities, with more than one dominant ethnic group and with high economic inequality. The effects of the shocks on protests are also reduced the further one moves away from Lagos, consistently with more limited transmission of the shock in more remote locations.

We also found that both production and consumption shocks have had a major impact on the intensity of the Boko Haram conflict since 2010, while they did not affect much the other

[31] The estimation does not achieve convergence in the whole sample.

conflicts during the same period. That is consistent with the view that economic grievances are part of the reasons behind the Boko Haram insurgency.

These findings may bear a number of important policy implications. First, in conflict prone environments it is important to assist populations to cope with consumption and production shocks to avert negative political externalities. There are various options to do that, including for instance targeted transfers, price subsidies and even temporary trade insulation. A discussion of the relative merits of the different options is beyond the scope of the paper, but the evidence suggests that targeted transfers appear to be a useful policy tool to shelter poorer households from adverse consumption and production price shocks (Anderson et al., 2013; Attanasio et al., 2013).

Second, to the extent that the oil rent is appropriable through fighting, the management of oil revenues is a key tool to prevent conflict in oil-rich fragile countries. This points towards the need to deepen our understanding of conflict-sensitive institutions of oil management.

Third, our findings do suggest that in the case of Nigeria the state has been more successful in quelling the conflict by using the oil revenues to demobilize and trying to reintegrate the insurgents rather than to fight them. However there are questions about the long-term sustainability and the incentives generated by this strategy. On the one hand, the amnesty and the DDRR program were never intended to address the larger structural problems, e.g. youth unemployment, ineffective and corrupt public institutions, and human and ecological insecurity (Joab-Peterside et al., 2012). The program was rather a means to pacify the region temporarily so as to provide the room for maneuvering to address these more structural issues. In the absence of a strategy to address these issues, civil unrest is likely to resume and the program risks ending up providing perverse incentives to the population (i.e. militancy may eventually be rewarded). In the absence of more evidence from other contexts, the external validity of this finding is unclear. However it may be worth considering this option as a temporary tool to create the conditions to address the structural determinants of conflict.

Finally, our analysis suggests the importance of undertaking a within-country rather than a cross-country analysis to understand the possible conflict risks associated with different income shocks. On the one hand, such analysis allows us to model more shocks, which often occur simultaneously and with different effects. On the other hand, it also enables us to understand the conditions under which these shocks are particularly risky for conflict.

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Appendix 1: Items matching between price and household survey data

Table A1: Matching between survey items and domestic prices

Broad Consumption			Narrow Consumption		
A2 non food freq matched	**A1 matched non food less freq**	**Food**	**A2 non food freq matched**	**A1 matched non food less freq**	**Food**
Gas for cooking	Cotton	Guinea corn	Gas for cooking	Cotton	Guinea corn
Kerosene	Silk	Millet	Kerosene	Silk	Millet
Washing powder	Handloom (aso_oke)	Maize (white)	Washing powder	Handloom (aso_oke)	Maize (white)
Matches	Ankara	Maize (yellow)	Matches	Ankara	Maize (yellow)
Toilet paper	Polyester material	Rice (local)	Toilet paper	Polyester material	Rice (local)
Candles	Wool	Rice (agric)	Candles	Wool	Rice (agric)
Pain killers	Other clothing material	Rice (imported)	Pain killers	Other clothing material	Rice (imported)
Antibiotics	Men tailoring	Maize flour	Antibiotics	Shoes Leather	Bread
Anti-malaria medicines	Women tailoring	Biscuits	Anti-malaria medicines	Sandals Leather	Buns
Petrol	Boys tailoring	Yam Flour	Petrol	Shoes Canvas	Yam Flour
Other (rail, air)	Girls tailoring	Cassava flour	Other (rail, air)	Sandals rubber	Cassava flour
Books, magazines, etc	Suits	Plantain flour	Books, magazines, etc	Other footwear	Plantain flour
Writing & drawing	Other ready-made clothing	Corn flour	Writing & drawing	Basic Rent	Corn flour
	Hand-woven cloth	Cassava		Mattress, pillow	Cassava
	Blouses, shirts	Cocoyam		Refridgerators	Plantain
	Boys dress	Plantain		Electric Iron	Yam
	Men dress	Yam		Tyres	Fufu
	Girls dress	Fufu		Battery	Gari (white)
	Shoes Leather	Gari (white)		TV sets, video	Other starchy products
	Sandals Leather	Gari (yellow)			White bean
	Shoes Canvas	Cassava (akpu)			Moimoi
	Sandals rubber	Brown beans			Akara
	Other footwear	White bean			Groundnuts
	Basic Rent	Moimoi			Other pulses
	Mattress, pillow	Akara			Kulikuli
	Refridgerators	Groundnuts			Dawadawa
	Electric Iron	Kulikuli			Palm nut
	Tyres	Kola nut			Cashew nut
	Battery	Groundnut oil			Coconut oil
	TV sets, video	Palm kernel oil			Groundnut oil
		Red palm oil			Palm kernel oil
		Magarine			Red palm oil
		Vegetable oil			Shear butter
		Banana			Magarine

	Orange	Vegetable oil
	Orange juice	Avocado pear
	Chicken	Banana
	Agric eggs	Mango
	Local eggs	Pineapple
	Other eggs (not chicken)	Pineapple juice
	Milk powder	Orange
	Baby milk	Orange juice
	Smoked fish	Other fruit (not canned)
	Dried fish	Fruit canned
	Beef (fresh cattle)	Fruits juice
	Corned beef	Chicken
	Garden eggs	Duck
	Okro fresh	Guinea Fowl
	Okro dry	Other poultry
	Onions/shallot	Agric eggs
	Pepper green	Local eggs
	Tomatoes	Other eggs (not chicken)
	Tomato puree	Fresh milk
	Coffee	Milk powder
	Chocolate drinks	
	Tea	
	Other food items	
	Malt drinks	
	Minerals	
	Beer (local/imported)	
	Stout (local/imported)	
	Palm Wine	
	Other wine (local/imported)	
	Other alcoholic beverage	
	Cigarette	
	Pepper	

Table A2: Percentage expenditure and production merged by state

State	% of Total Exp. Matched Narrow	% of Total Exp. Matched Broad	% of Total prod. Matched Narrow	% of Total prod. Matched Broad
Abia	53.2455	55.9737	0.4565	0.5000
Adamawa	61.1469	63.7800	0.4667	0.5111
Akwa Ibom	52.0054	54.1582	0.4651	0.5116
Anambra	57.5641	61.3373	0.4783	0.5000
Bauchi	60.9677	64.0052	0.5385	0.5641
Bayelsa	62.5000	64.0851	0.5152	0.5758
Benue	54.3033	56.1817	0.5116	0.5349
Borno	55.9343	60.6061	0.5128	0.5385
Cross-rive	52.2466	54.1623	0.4545	0.4773
Delta	63.8527	66.2442	0.4054	0.4595
Ebonyi	61.9289	63.9594	0.4667	0.5111
Edo	59.7893	63.5874	0.4324	0.4595
Ekiti	63.4338	65.7929	0.4872	0.5128
Enugu	59.7952	62.7684	0.4889	0.5111
Gombe	61.4429	64.8947	0.4884	0.5349
Imo	55.0372	57.9898	0.4545	0.5000
Jigawa	56.6094	66.3900	0.5000	0.5278
Kaduna	61.0935	63.5499	0.4889	0.5333
Kano	63.7941	69.9496	0.4524	0.5000
Katsina	51.1571	55.7856	0.5116	0.5349
Kebbi	61.0268	65.2244	0.5143	0.5429
Kogi	63.4422	69.7236	0.5116	0.5581
Kwara	47.8157	52.3799	0.5263	0.5789
Lagos	51.1937	54.0241	0.5000	0.5294
Nassarawa	62.8445	65.7846	0.4565	0.5000
Niger	63.9581	66.4974	0.5588	0.5882
Ogun	55.8953	57.7191	0.5429	0.5714
Ondo	65.6560	66.6110	0.5000	0.5263
Osun	49.7748	59.2342	0.5263	0.5526
Oyo	55.3316	62.8739	0.5135	0.5135
Plateau	64.0244	67.5087	0.5000	0.5227
Rivers	59.8634	61.3050	0.4706	0.5000
Sokoto	62.9969	66.2589	0.5405	0.5676
Taraba	52.9840	54.1485	0.4889	0.5111
Yobe	64.8601	67.5255	0.5588	0.5882
Zanfara	59.1468	62.8108	0.5000	0.5476
FCT	59.2188	61.3188	0.5366	0.5854

Source: Authors' elaboration on NLSS 2003/04

Table A3: Broad matching of international price data with survey items

Consumption International		Production Intl
Akara	Groundnut oil	Cocoa
Baby milk	Groundnuts	Coconut
Banana	Maize (white)	Coffee
Beef (fresh cattle)	Maize (yellow)	Cotton
Bread	Maize flour	Kernel
Brown beans	Milk powder	Rubber
Bush meat	Moimoi	Wood
Cassava	Orange	G'nut/Peanut
Cassava (akpu)	Orange juice	Maize
Cassava flour	Palm kernel oil	Rice
Chicken	Red palm oil	Millet
Cigarette	Rice (agric)	Guinea Corn
Coconut oil	Rice (imported)	Beans
Coffee	Rice (local)	Tobacco
Cooked rice/stew	Smoked fish	Bananas
Crabs/lobsters	Suya beans	Oil Palm
Dried fish	Tobacco (processed)	Oranges
Fish fresh	Vegetable oil	Cassava
Fish frozen	White bean	Yam
Fresh milk	Yam	palm wine
Fried fish	Yam Flour	milk
Gari (white)		
Gari (yellow)		
Gari and soup		

Table A4: Share of single state of overall production - Top 10 states by major commodities (2003/04)

Rankings	State	beans	State	maize	State	millet	State	rice	State	yam
1	Katsina	2.35	Ogun	4.95	Sokoto	12.93	Benue	2.60	Benue	1.42
2	Bauchi	2.11	Katsina	4.83	Kano	10.80	Niger	0.90	Enugu	1.13
3	Jigawa	1.82	Anambra	4.69	Katsina	10.68	Taraba	0.88	Edo	1.02
4	Kano	1.79	Delta	4.66	Yobe	8.68	Kaduna	0.76	Ondo	0.83
5	Gombe	1.70	Kaduna	4.08	Bauchi	6.36	Bauchi	0.65	Cross-rive	0.82
6	Kebbi	1.66	Oyo	3.55	Borno	6.24	Katsina	0.54	Oyo	0.76
7	Borno	1.60	Taraba	3.03	Niger	5.67	Nassarawa	0.41	Nassarawa	0.73
8	Sokoto	1.15	Rivers	2.83	Kaduna	5.06	Borno	0.39	Rivers	0.73
9	Yobe	1.14	Akwa Ibom	2.12	Gombe	4.98	Adamawa	0.33	Abia	0.68
10	Niger	0.90	Imo	1.99	Kebbi	4.86	Ebonyi	0.29	Kaduna	0.65

Source: Authors' elaboration on NLSS 2003/04

Table A4: Share of single state of overall consumption - Top 10 states by major commodities (2003/04)

Rankings	State	beans	State	maize	State	millet	State	rice	State	yam
1	Kano	10.53	Kaduna	13.64	Kano	27.85	Kaduna	5.29	Oyo	11.36
2	Katsina	4.08	Oyo	7.55	Sokoto	8.86	Niger	3.44	Ondo	5.27
3	Jigawa	2.61	Katsina	6.13	Katsina	8.46	Borno	3.18	Rivers	5.24
4	Borno	2.38	Taraba	2.31	Borno	6.07	Katsina	2.54	Edo	4.68
5	Niger	2.28	Anambra	1.92	Kebbi	5.47	Benue	2.46	Kaduna	4.46
6	Bauchi	1.80	Ogun	1.11	Bauchi	5.46	Bauchi	2.11	Abia	4.14
7	Sokoto	0.98	Imo	0.72	Yobe	5.20	Nassarawa	1.26	Enugu	3.51
8	Gombe	0.87	Akwa Ibom	0.59	Kaduna	4.09	Adamawa	1.00	Cross-rive	1.76
9	Yobe	0.61	Rivers	0.41	Niger	3.64	Ebonyi	0.94	Benue	1.66
10	Kebbi	0.44	Delta	0.28	Gombe	2.10	Taraba	0.79	Nassarawa	1.07

Source: Authors' elaboration on NLSS 2003/04

Table A5: Placebo and Chi square test of the impact oil index and amnesty program

	Post-2007	Post-2008	Post-2009
Oil ind. (t-1) (A)	0.004***	0.002**	0.003***
	(0.001)	(0.001)	(0.001)
Oil ind. (t) x post-X (B)	-0.002**	0.002	-0.003***
	(0.001)	(0.002)	(0.001)
Chi square test of (A)+(B)	0.002***	0.004***	0.000

The dependent variable is the number of any conflict events in the state in year t; all regressions include residuals from the first stage regressions of the endogenous price index on the excluded instruments as a control with appropriate standard errors (clustered at the state level) calculated; *, **, *** indicate statistical significance at the 10, 5, and 1 percent level, respectively. Data are for 37 states for 8 years (2004-11). All regressions include year and region effects as well as region-year effects and various controls (as included in Table 4). The models are estimated through the population-averaged negative binomial estimator for panel data.

Appendix 2: Additional figures

Figure A1: Production by state - beans and rice shares (share in total state's production)

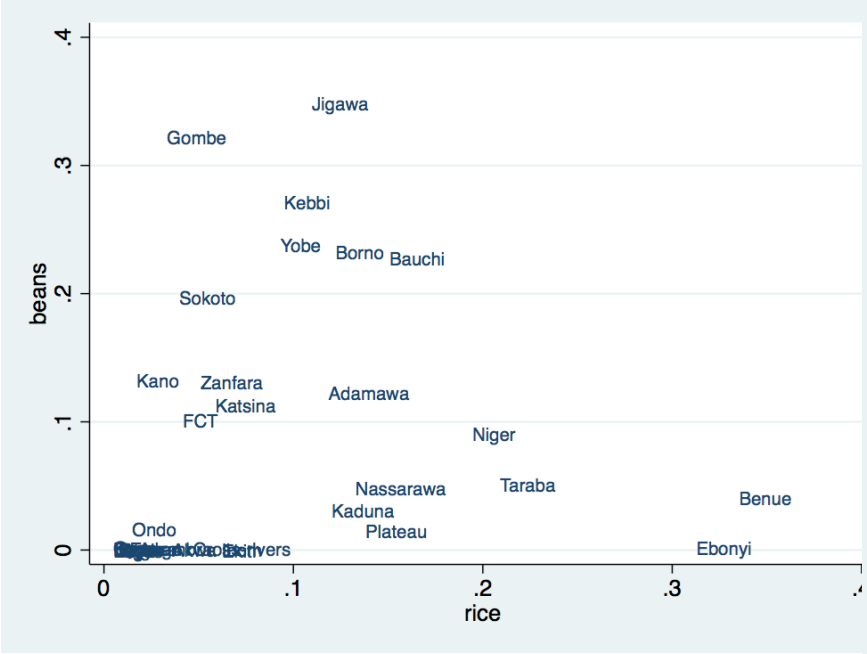
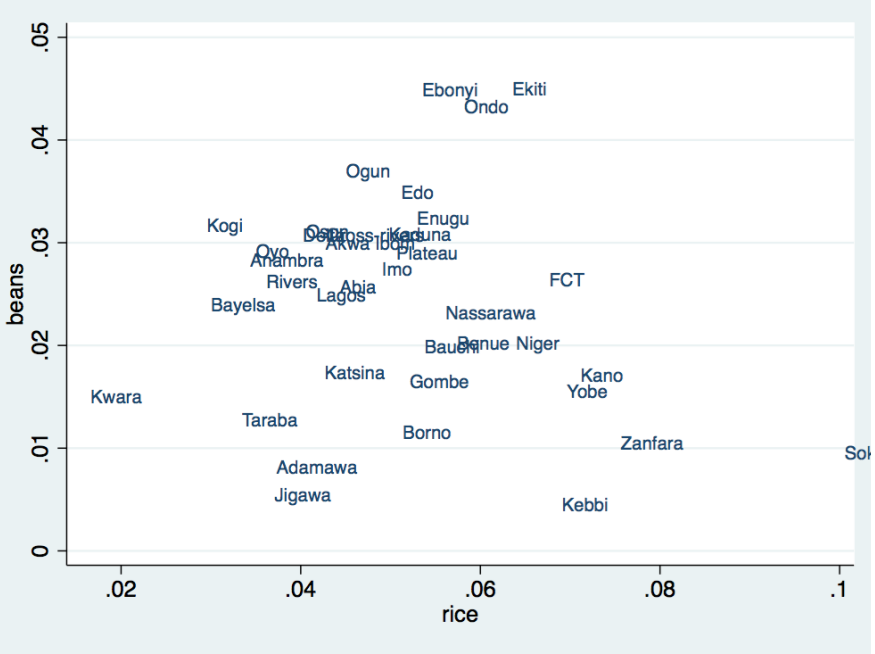
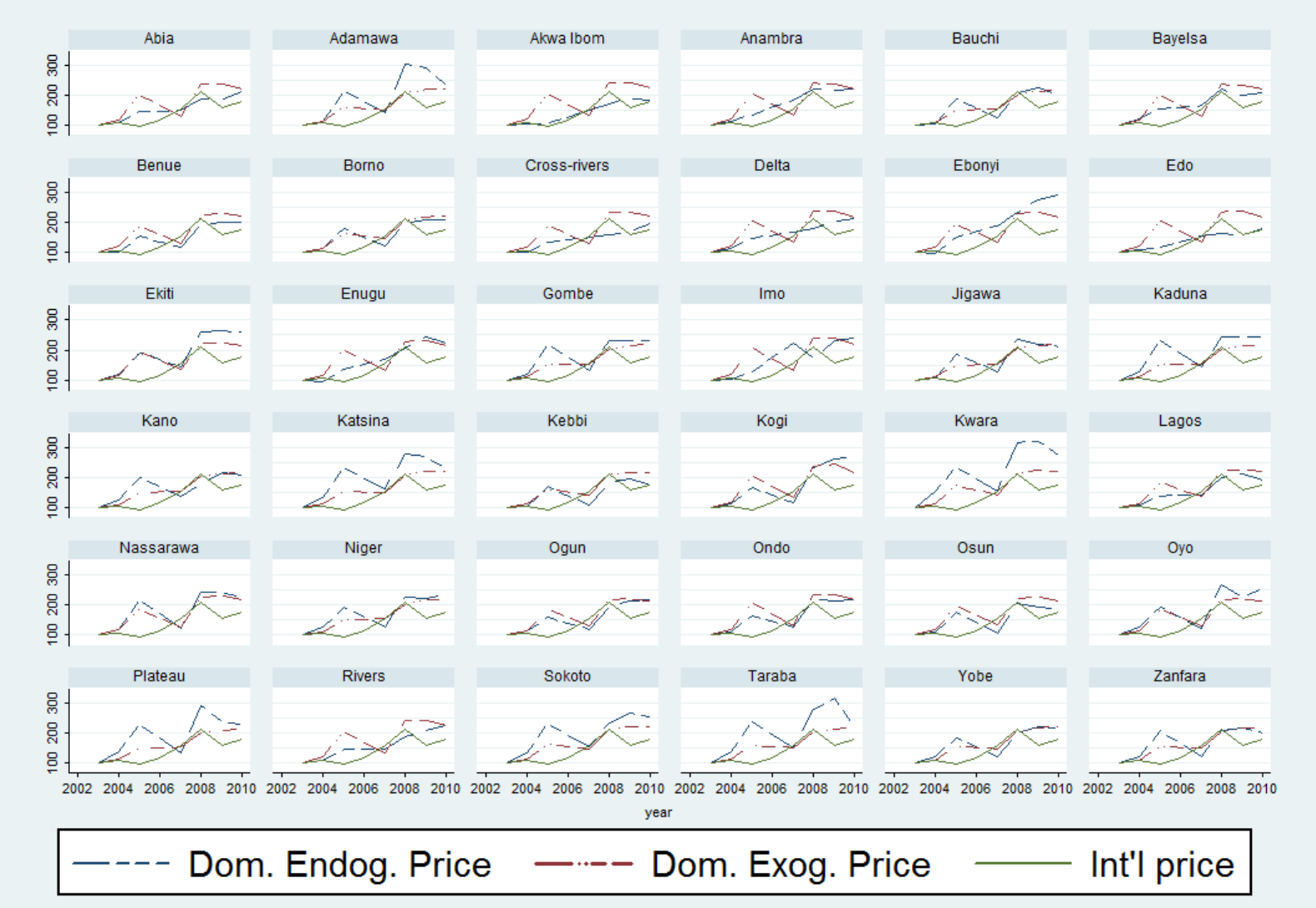


Figure A2: Consumption by state - beans and rice shares (share in total state's expenditures)



Source: Authors' calculation on the basis of the NLSS 2003/04

Figure A3: International and domestic prices of maize across Nigerian states, 2003-10 (Prices = 100 in 2003)



Note: figures for all states but Abuja; source: Authors' elaboration on World Bank pink sheets (for int'l prices) and Nigerian Bureau of Statistics

Figure A4: International and domestic prices of imported rice across Nigerian states, 2003-10 (Prices = 100 in 2003)

Note: figures for all states but Abuja; source: Authors' elaboration on World Bank pink sheets (for int'l prices) and Nigerian Bureau of Statistics