Food Fights: Global Food Prices, Real Income and Local Conflict in Africa

Eoin McGuirk       Marshall Burke
Brown              Stanford

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Introduction: on the economic causes of conflict

Civil conflict is a pervasive, persistent and costly impediment to economic development in Africa (Blattman & Miguel 2010)
Introduction: on the economic causes of conflict

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Identification problems
Introduction: on the economic causes of conflict

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Identification problems

- Weather
  (e.g., Miguel, Satyanath & Sergenti 2004; Harari & La Ferrara 2014)

- Exports
  (e.g., Collier & Hoeffler 2004; Besley & Persson 2008; Bazzi & Blattman 2014; Berman & Couttenier 2015; Dube & Vargas 2013; Bruckner & Ciccone 2010)
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Distinguishing mechanisms
- Depends on source of variation, level of (dis)aggregation
Food prices, real income and conflict

What is the causal impact of food price changes on conflict in Africa?
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**Production side:** share of primary sector is larger in Africa than in any other region

- Higher prices for farmers ought to increase their opportunity cost of joining rebel groups
Food prices, real income and conflict

However...

Hendrik Houthakker: ”Of all the empirical regularities observed in economic data, Engel’s Law is probably the best established.”

**Figure**: Food expenditure and GDP per cap (van Weezel 2014)
Food prices, real income and conflict

However...

**Figure:** Food price index and social unrest (Lagi et al. 2011)
Food prices, real income and conflict

What is the causal impact of food price changes on conflict in Africa?

**Production side**: share of primary sector is larger in Africa than in any other region

**Consumption side**: share of food expenditure is larger in Africa than any other region

- Food prices are associated with social unrest, “food riots”

Literature suggests that food price changes have heterogenous effects on real income and violent conflict.
Food prices, real income and conflict

Our aim: identify separate producer and consumer effects of food price changes on violent conflict events in Africa at the 0.5 degree cell level
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Challenges:

- Local price data is endogenous (and hard to find)
- Disaggregating consumer and producer effects within countries
Food prices, real income and conflict

Our aim: identify separate producer and consumer effects of food price changes on violent conflict events in Africa at the 0.5 degree cell level

**Challenges:**

- Local price data is endogenous (and hard to find)
- Disaggregating consumer and producer effects within countries

**Approach:** combine five types of data to create price indices:

1. International food prices
2. What crops are produced where
3. What crops are consumed where
4. Trade shares (by crop & country)
5. Cell characteristics: urbanization, distance to markets
Data

**Conflict 1: ACLED – Armed Conflict Location and Event Data Project (Raleigh et al. 2014)**

- Geo-referenced political violence events from 1997-2013
- 8 event types, incl. unorganized riots, protests, criminal violence, as well as violence against civilians and battles between organized actors
- Event locations assigned to 0.5 × 0.5 degree grid cells
- Event time assigned to years
- = 1 if any conflict event in a given cell-year
- $N = 173893$, mean $= 0.072$, s.d. $= 0.25$
Data

ACLED 2005

ACLED 2009

ACLED 2013
Data

**Conflict 2: UCDP Georeferenced Event Dataset (Sundberg et al. 2011)**

- Actors are organized
- Events feature at least one fatality
- All actors have crossed 25 death threshold in any year of the series
- Dichotomized in same manner as Acled
- $N = 225038$, mean $= 0.027$, s.d. $= 0.16$
Data

- **Conflict**: ACLED and UCDP
- **Food prices**: IMF Financial Statistics. International dollar denominated prices for 13 crops
  - Aggregate to share of 0.5deg cell covered by given crop
- **Consumption shares**: FAO food balance sheets
  - Estimated average calories per capita consumed of given crop per country-year
  - Use series mean to generate time-invariant weights for each crop
- **Trade weights**: FAO country-crop specific production + trade data
  - Use series mean to generate time-invariant weights for each crop
- **Cell characteristics**:
  - Global Rural-Urban Mapping Project, Columbia
  - Distance to city and port, urbanization statistics
Data

Observations are at the cell-year level (10229 per year)

- **Producer price** in cell $i$ at year $t$:

\[
P_{ict}^p = \sum_{j=1}^{n} \left( P_{jt} \times \frac{imp_{jc} + exp_{jc}}{prod_{jc}} \times \lambda_{jic} \right)
\]

- **Consumer price** in country $c$ at year $t$:

\[
P_{ct}^c = \sum_{j=1}^{n} \left( P_{jt} \times \frac{imp_{jc} + exp_{jc}}{prod_{jc}} \times \theta_{jc} \right)
\]
Prices

Constructed consumer and producer prices correlated, but not perfectly so.
Theoretical predictions

First, some common theories on how price changes may affect civil conflict

Opportunity cost: Violent conflict is more likely when the opportunity cost of soldiering is lower. E.g., climate shocks reduce the cost of recruiting affected farmers. Harari and La Ferrara (2014); Miguel et al. (2004)

State capacity: Violent conflict is more likely when the government lacks the resources to deter it. Fearon (2003)

State-as-prize: Violent conflict is more likely when the spoils of appropriation increase in value. Dal Bo & Dal Bo (2011); Dube and Vargas (2013)
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Theoretical predictions

This is an incomplete framework for this analysis

Consider consumption side:
Opportunity cost?
Requires idiosyncratic shock that increases relative wage in predatory sector
Food price increase is a correlated shock – relative wage largely unchanged
Exception: those who are shifted beneath minimum consumption threshold

State as prize?
Agricultural gains unlikely to accrue to state (compared to extractive commodity rents, e.g.)

State capacity?
Possible that fixed-wage government security officials could reduce labor supply following real income shock caused by higher food prices
Theoretical predictions

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Theoretical predictions

Food price changes can affect different types of violence in different ways

**Consumer effects:**

1. **Type 1 riot (+)**
   Usually unorganized urban demonstrations, perpetrated by net-consumers with a view to provoking change in government policy to lower prices (World Bank 2014). Violence can be initiated by civilians or government.

2. **Type 2 riot (+)**

3. **Threshold effect (+)**
   Marginal households shifted beneath minimum consumption threshold more likely to be recruited by armed groups.

4. **State capacity (+)**
   Reduction in labor supply from government security officials following real income shock (McGuirk & Burke 2015).
Theoretical predictions

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Food price changes can affect different types of violence in different ways

**Consumer effects:**

1. Type 1 riot (+)
2. Type 2 riot (+)
3. Threshold effect (+)
4. State capacity (+)

**Producer effects:**

1. Opportunity cost (−)
   Higher prices for farmers increase opportunity cost of entering predatory sector
Theoretical predictions

Food price changes can affect different types of violence in different ways.

**Consumer effects:**
1. Type 1 riot (+)
2. Type 2 riot (+)
3. Threshold effect (+)
4. State capacity (+)

**Producer effects:**
1. Opportunity cost (−)
   Higher prices for farmers increase opportunity cost of entering predatory sector
2. Type 2 riot (+)

McGuirk & Burke, 2015, Food Fights.
Empirical approach

We begin by estimating:

\[ ACLED_{ict} = \beta_1 P^c_{ct} + \beta_2 P^p_{ict} + \delta_t \gamma_c + \eta_i + \epsilon_{ict} \]  

(1)

\[ UCDP_{ict} = \beta_3 P^c_{ct} + \beta_4 P^p_{ict} + \delta_t \gamma_c + \eta_i + \nu_{ict} \]  

(2)

McGuirk & Burke  Food Fights. ABCA, 2015
Empirical approach

We begin by estimating:

$$ACLED_{ict} = \beta_1 P^c_{ct} + \beta_2 P^p_{ict} + \delta_t \gamma_c + \eta_i + \epsilon_{ict}$$ (1)

$$UCDP_{ict} = \beta_3 P^c_{ct} + \beta_4 P^p_{ict} + \delta_t \gamma_c + \eta_i + \nu_{ict}$$ (2)

**ACLED regression:**

$\beta_1 > 0$ (type 1, type 2, threshold; state capacity)

$\beta_2$ ambiguous (type 2 vs opportunity cost)
Empirical approach

We begin by estimating:

\[
ACLED_{ict} = \beta_1 P_{ct}^c + \beta_2 P_{ict}^p + \delta_t \gamma_c + \eta_i + \epsilon_{ict} \tag{1}
\]

\[
UCDP_{ict} = \beta_3 P_{ct}^c + \beta_4 P_{ict}^p + \delta_t \gamma_c + \eta_i + \nu_{ict} \tag{2}
\]

**ACLED regression:**
- \( \beta_1 > 0 \) (type 1, type 2, threshold; state capacity)
- \( \beta_2 \) ambiguous (type 2 vs opportunity cost)

**UCDP regression:**
- \( \beta_3 > 0 \) (threshold; state capacity)
- \( \beta_4 < 0 \) (opportunity cost)
### Table: Acled conflict and food prices in Africa

<table>
<thead>
<tr>
<th></th>
<th>(1) ACLED</th>
<th>(2) ACLED</th>
<th>(3) ACLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer price</td>
<td>0.0001***</td>
<td>0.0001***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td></td>
</tr>
<tr>
<td>Producer price</td>
<td></td>
<td>0.0038***</td>
<td>0.0034***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0011)</td>
<td>(0.0011)</td>
</tr>
<tr>
<td>Consumer price std. % effect</td>
<td>9.7</td>
<td>8.2</td>
<td></td>
</tr>
<tr>
<td>Producer price std. % effect</td>
<td>8.5</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>158270</td>
<td>173893</td>
<td>158270</td>
</tr>
<tr>
<td>R squared</td>
<td>0.397</td>
<td>0.399</td>
<td>0.397</td>
</tr>
<tr>
<td>Cell FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Country time trend</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Table: UCDP conflict and food prices in Africa

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Consumer price</td>
<td>-0.0000</td>
<td>0.0000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td></td>
</tr>
<tr>
<td>Producer price</td>
<td>-0.0021**</td>
<td>-0.0022***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0009)</td>
<td>(0.0008)</td>
<td></td>
</tr>
<tr>
<td>Consumer price std. % effect</td>
<td>-1.2</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Producer price std. % effect</td>
<td>-12.6</td>
<td>-12.8</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>204820</td>
<td>225038</td>
<td>204820</td>
</tr>
<tr>
<td>R squared</td>
<td>0.287</td>
<td>0.290</td>
<td>0.288</td>
</tr>
<tr>
<td>Cell FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Country time trend</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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## Results

### Table: Year fixed effects

<table>
<thead>
<tr>
<th></th>
<th>(1) ACLED</th>
<th>(2) UCDP</th>
<th>(3) ACLED</th>
<th>(4) UCDP</th>
<th>(5) ACLED</th>
<th>(6) UCDP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer price</strong></td>
<td>0.0001***</td>
<td>0.0000</td>
<td>0.0001</td>
<td>-0.0000</td>
<td>0.0002***</td>
<td>-0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
<td>(0.0001)</td>
<td>(0.0000)</td>
<td>(0.0001)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td><strong>Producer price</strong></td>
<td>0.0034***</td>
<td>-0.0022***</td>
<td>0.0035***</td>
<td>-0.0022***</td>
<td>0.0030***</td>
<td>-0.0023***</td>
</tr>
<tr>
<td></td>
<td>(0.0011)</td>
<td>(0.0008)</td>
<td>(0.0011)</td>
<td>(0.0008)</td>
<td>(0.0010)</td>
<td>(0.0009)</td>
</tr>
</tbody>
</table>

|                |           |          |           |          |           |          |
| **Consumer price std. % effect** | 8.2  | 1.5 | 8.6 | -9.3 | 16.2 | -5.1 |
| **Producer price std. % effect** | 7.6 | -12.8 | 7.8 | -13.0 | 6.7 | -13.4 |

|                | 158270   | 204820   | 158270   | 204820   | 148960   | 195510   |
| **Observations** |          |          |          |          |          |          |
| **R squared**    | 0.397    | 0.288    | 0.403    | 0.289    | 0.407    | 0.304    |
| **Cell FE**      | Yes      | Yes      | Yes      | Yes      | Yes      | Yes      |
| **Country time trend** | Yes | Yes | Yes | Yes | Yes | Yes |
| **Year FE**      | No       | No       | Yes      | Yes      | Yes      | Yes      |
| **Consumption weights** | Fixed | Fixed | Fixed | Fixed | LMA | LMA |

Clustered standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
### Results

**Table: Cell-level interactions**

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<tbody>
<tr>
<td>Consumer price</td>
<td>0.0001 (0.0001)</td>
<td>0.0001 (0.0001)</td>
<td>0.0002** (0.0001)</td>
</tr>
<tr>
<td>Consumer price * %Urban area</td>
<td>0.0052*** (0.0009)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer price * Urban pop.</td>
<td></td>
<td>0.0000*** (0.0000)</td>
<td></td>
</tr>
<tr>
<td>Consumer price * Dist. to city</td>
<td></td>
<td>-0.0001* (0.0001)</td>
<td></td>
</tr>
<tr>
<td>Consumer std. eff. at 5th Pctile</td>
<td>6.3</td>
<td>8.1</td>
<td>14.9</td>
</tr>
<tr>
<td>Consumer std. eff. at median</td>
<td>6.3</td>
<td>8.1</td>
<td>10.8</td>
</tr>
<tr>
<td>Consumer std. eff. at 95th Pctile</td>
<td>24.0</td>
<td>11.2</td>
<td>4.5</td>
</tr>
<tr>
<td>Producer std. eff. at 5th Pctile</td>
<td>3.9</td>
<td>7.6</td>
<td>8.0</td>
</tr>
<tr>
<td>Producer std. eff. at median</td>
<td>3.9</td>
<td>7.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Producer std. eff. at 95th Pctile</td>
<td>3.1</td>
<td>7.4</td>
<td>-11.8</td>
</tr>
<tr>
<td>Observations</td>
<td>158168</td>
<td>158270</td>
<td>158270</td>
</tr>
<tr>
<td>R squared</td>
<td>0.405</td>
<td>0.403</td>
<td>0.403</td>
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## Results

### Table: Lagged prices

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<tr>
<td></td>
<td>ACLED</td>
<td>UCDP</td>
</tr>
<tr>
<td><strong>Consumer price</strong></td>
<td>-0.0000</td>
<td>-0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td><strong>Consumer price, t-1</strong></td>
<td>0.0001**</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0001)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td><strong>Consumer price, t-2</strong></td>
<td>0.0001*</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0000)</td>
</tr>
<tr>
<td><strong>Producer price</strong></td>
<td>0.0003</td>
<td>-0.0018</td>
</tr>
<tr>
<td></td>
<td>(0.0017)</td>
<td>(0.0014)</td>
</tr>
<tr>
<td><strong>Producer price, t-1</strong></td>
<td>0.0024</td>
<td>0.0011</td>
</tr>
<tr>
<td></td>
<td>(0.0024)</td>
<td>(0.0021)</td>
</tr>
<tr>
<td><strong>Producer price, t-2</strong></td>
<td>0.0023</td>
<td>-0.0026</td>
</tr>
<tr>
<td></td>
<td>(0.0019)</td>
<td>(0.0021)</td>
</tr>
<tr>
<td><strong>Sum of consumer effects</strong></td>
<td>0.0002</td>
<td>0.0000</td>
</tr>
<tr>
<td><strong>p-value</strong></td>
<td>0.000</td>
<td>0.515</td>
</tr>
<tr>
<td><strong>Sum of producer effects</strong></td>
<td>0.0050</td>
<td>-0.0034</td>
</tr>
<tr>
<td><strong>p-value</strong></td>
<td>0.000</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Consumer price std. % effect</strong></td>
<td>13.9</td>
<td>2.9</td>
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<td>11.2</td>
<td>-20.0</td>
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<td><strong>Observations</strong></td>
<td>158270</td>
<td>195510</td>
</tr>
<tr>
<td><strong>R squared</strong></td>
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<td>0.302</td>
</tr>
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McGuirk & Burke

Food Fights. ABCA, 2015
## Results

**Table: Separate food and cash crops (with lags)**

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<td>0.0002</td>
<td>0.0000</td>
</tr>
<tr>
<td>p-value</td>
<td>0.000</td>
<td>0.518</td>
</tr>
<tr>
<td>Sum of producer food effects</td>
<td>0.0065</td>
<td>-0.0034</td>
</tr>
<tr>
<td>p-value</td>
<td>0.000</td>
<td>0.027</td>
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<tr>
<td>Sum of producer cash effects</td>
<td>-0.0029</td>
<td>-0.0037</td>
</tr>
<tr>
<td>p-value</td>
<td>0.370</td>
<td>0.151</td>
</tr>
<tr>
<td>Consumer price std. % effect</td>
<td>14.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Producer food price std. % effect</td>
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<td>-17.0</td>
</tr>
<tr>
<td>Producer cash price std. % effect</td>
<td>-2.7</td>
<td>-9.2</td>
</tr>
<tr>
<td>Observations</td>
<td>158270</td>
<td>195510</td>
</tr>
<tr>
<td>R squared</td>
<td>0.399</td>
<td>0.302</td>
</tr>
</tbody>
</table>

McGuirk & Burke  
Food Fights. ABCA, 2015
### Results

#### Table: Onset and Ending

<table>
<thead>
<tr>
<th></th>
<th>(1) ACLED ONSET</th>
<th>(2) ACLED END</th>
<th>(3) UCDP ONSET</th>
<th>(4) UCDP END</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer price</strong></td>
<td>0.0000**</td>
<td>-0.0010***</td>
<td>-0.0000</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0003)</td>
<td>(0.0000)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td><strong>Producer price</strong></td>
<td>0.0031***</td>
<td>0.0055**</td>
<td>-0.0010*</td>
<td>0.0103</td>
</tr>
<tr>
<td></td>
<td>(0.0010)</td>
<td>(0.0027)</td>
<td>(0.0006)</td>
<td>(0.0066)</td>
</tr>
<tr>
<td><strong>Consumer std. % effect</strong></td>
<td>6.6</td>
<td>-13.8</td>
<td>-2.8</td>
<td>-0.7</td>
</tr>
<tr>
<td><strong>Producer std. % effect</strong></td>
<td>13.0</td>
<td>2.1</td>
<td>-10.9</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Observations</strong></td>
<td>152880</td>
<td>10970</td>
<td>202298</td>
<td>5352</td>
</tr>
<tr>
<td><strong>R squared</strong></td>
<td>0.171</td>
<td>0.481</td>
<td>0.126</td>
<td>0.442</td>
</tr>
</tbody>
</table>
## Results

**Table:** Onset & ending, separate food and cash crops

<table>
<thead>
<tr>
<th></th>
<th>(1) ACLED ONSET</th>
<th>(2) ACLED END</th>
<th>(3) UCDP ONSET</th>
<th>(4) UCDP END</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer price</strong></td>
<td>0.0000***</td>
<td>-0.0010***</td>
<td>-0.0000</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0000)</td>
<td>(0.0003)</td>
<td>(0.0000)</td>
<td>(0.0004)</td>
</tr>
<tr>
<td><strong>Producer food price</strong></td>
<td>0.0042***</td>
<td>0.0039</td>
<td>-0.0010</td>
<td>0.0125*</td>
</tr>
<tr>
<td></td>
<td>(0.0011)</td>
<td>(0.0024)</td>
<td>(0.0007)</td>
<td>(0.0066)</td>
</tr>
<tr>
<td><strong>Producer cash price</strong></td>
<td>-0.0023</td>
<td>0.0211**</td>
<td>-0.0010</td>
<td>-0.0176</td>
</tr>
<tr>
<td></td>
<td>(0.0022)</td>
<td>(0.0090)</td>
<td>(0.0010)</td>
<td>(0.0234)</td>
</tr>
</tbody>
</table>

| **Consumer std. % effect** | 6.7 | -13.5 | -2.8 | -1.0 |
| **Producer food std. % effect** | 15.2 | 1.2 | -9.3 | 3.2 |
| **Producer cash std. % effect** | -4.1 | 3.3 | -4.5 | -2.2 |

**Observations** 152880 10970 202298 5352  
**R squared** 0.171 0.482 0.126 0.442
Summary

Consumer price:
- Higher food prices for consumers increase the incidence, onset and duration of unorganized violence in Africa.
- This violence is concentrated in urban areas: at the 95th percentile, a unit standard deviation increase in food prices raises the risk of conflict incidence by 24%.
- Consumer prices have no effect on violence between organized groups.

Producer price:
- Higher prices for producers lower the incidence, onset and duration of violence between organized actors.
- A unit standard deviation increase lowers the onset risk of organized violence by 10.9%.
- Higher food crop prices raise the onset risk of unorganized violence.
- Higher cash crop prices reduce the duration of unorganized violence.
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Conclusions

- Evidence of Type 1 food riots in urban areas
- Evidence of Type 2 food riots (“rapacity effect”) in producer cells
- Evidence of opportunity cost mechanism in producer cells
- Next step: linking four rounds of Afrobarometer data at the village-month level to improve understanding of mechanisms