# The threat of oil shocks to food security in Sub-Saharan Africa

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# Outline

# The oil-food market nexus

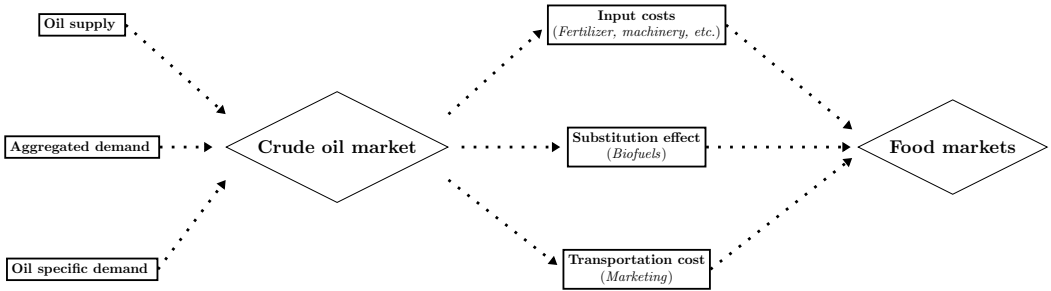


Figure 1: Transmission flow from oil shocks to food prices

# Research gaps & questions

**What we do know...**

- **Oil markets drive food markets** in HIC and globally (e.g. Serra and Zilberman, 2013)
- Even more so after biofuel emergence
- **Aggregated-demand** shocks (before biofuels) and **oil-specific demand** shocks drive food (Wang et al., 2014)
- **Oil-supply shocks negligible** (competitive market) (Kilian, 2009; Wang et al., 2014)

**What we do not know...**

- Is this also true for **non-HIC countries**?
- How do global oil shocks affect local **food prices in SSA**?

# Econometric model

- Extended oil market model (Kilian, 2009; Wang et al., 2014)

$$\begin{aligned} y_t &= \nu_t + A_1 y_{t-1} + \ldots + A_p y_{t-p} + u_t, \\ &= \nu_t + A_1 y_{t-1} + \ldots + A_p y_{t-p} + \mathrm{B}\varepsilon_t, \\ \Leftrightarrow \quad A(L) y_t &= \nu_t + \mathrm{B}\varepsilon_t, \qquad t = 1, ..., T, \end{aligned} \tag{1}$$

$y_t = (\Delta q_t =$ log change in average global **crude oil production**,
$x_t =$ global **economic activity** index,
$p_t =$ log of the real **price of crude oil** (USD),
$c_t =$ detrended log of real **price of corn** (domestic currency))

- Identification of structural shocks by **independent components** (Matteson and Tsay, 2017)

# Data

- Corn prices from FAO-GIEWS
- Most representative markets
- Selected based on availability

- Monthly, Jan 2006 - Jun 2019

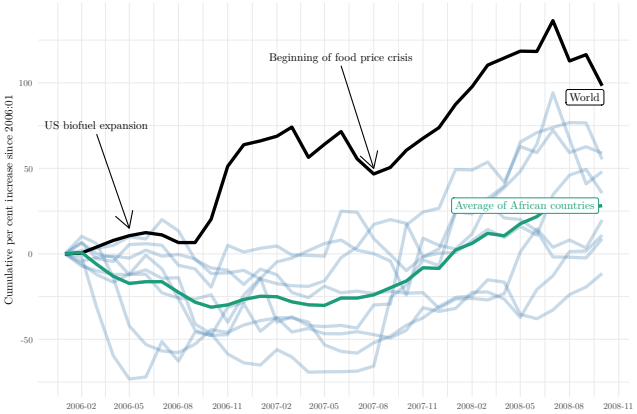


Figure 2: Cumulative percentage growth of real global corn prices vs real SSA corn prices

# Results

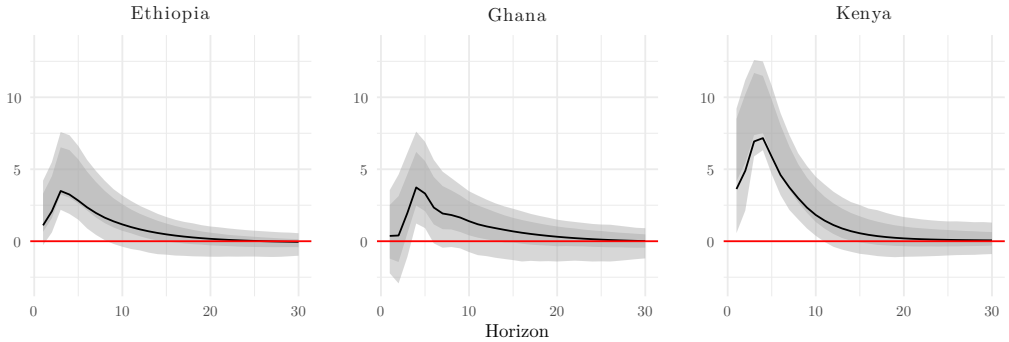


Figure 3: Impulse response functions

# Examples of supply-shock response in time

*Oil supply shocks:*

- **Libyan Revolution**
  Jan-May 2011
  $\downarrow$ 3.6%
- **Sanctions against Iran**
  Mar-Jun 2012
  $\downarrow$ 0.8%

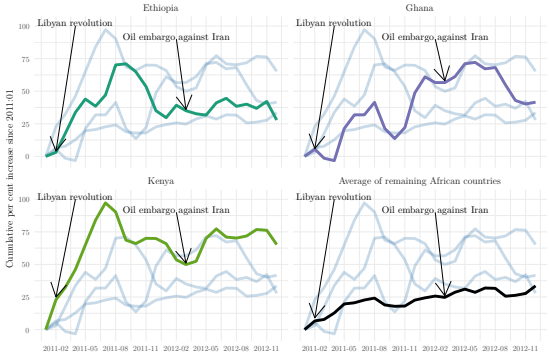


Figure 4: Cumulative per cent changes of food prices

# Contributors to food price surges in Kenya

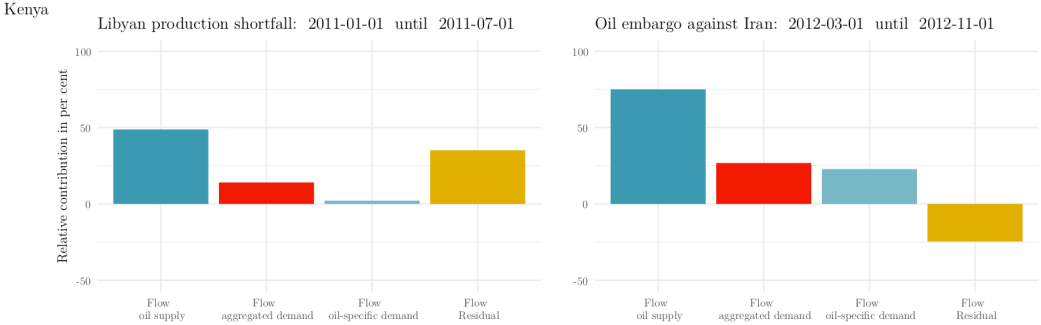


Figure 5: Relative contribution to cumulative change in domestic corn prices in Kenya, based on HD

# Why do some SSA corn markets respond to oil-supply shocks?

- Transport costs
- Food distribution systems (Infrastructure, government intervention)
- Oil (Fuel) distribution systems (Tender systems)
- Natural and/or strategic reserves

# Conclusions & policy implications

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- Food markets in developing countries are likely to respond more heterogeneously to oil shocks
- Ensuring **stable energy supplies & distribution** is key to stabilize food prices
- **Renewables?**

# Thank you for your attention!

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# Backup material

Independence criterion (minimize):

$$\mathcal{U}_T(\varepsilon_{t,1}, \ldots, \varepsilon_{t,K}) = T \cdot \sum_{k=1}^{K-1} \mathcal{V}^2(\varepsilon_{t,k}, \varepsilon_{t,k^+}). \tag{2}$$

Table 1: Significant response directions to oil market shocks of African corn prices relative to global corn prices. An increase of local corn prices relative to global corn prices at the 5% (10%) significance level is indicated by '++' ('+'). A decrease of local corn prices relative to global corn prices at the 5% (10%) significance level is indicated by '– –' ('–'). Significance is obtained from bootstrapped IRFs.

| | **Oil-supply shock** | **Aggregated-demand shock** | **Oil-specific demand shock** |
|---|---|---|---|
| Chad | 0 | 0 | 0 |
| Ethiopia | ++ | 0 | 0 |
| Ghana | 0 | – | – – |
| Kenya | ++ | 0 | – – |
| Mozambique | 0 | – | 0 |
| Nigeria | 0 | ++ | – |
| Tanzania | 0 | 0 | – |
| Zambia | 0 | – | – |

Table 2: Contribution of oil-supply shocks to $h$-step ahead FEVD of local corn prices in SSA markets and world markets.

| | $h = 1$ | $h = 10$ | $h = 30$ | $h = \infty$ |
|---|---|---|---|---|
| Chad | 1 | 3.1 | 4.6 | 4.6 |
| Ethiopia | 1.6 | 12.9 | 13 | 13.1 |
| Ghana | 0.2 | 8.8 | 8.8 | 8.8 |
| Kenya | 20.9 | 52.3 | 47.7 | 46.5 |
| Mozambique | 0.1 | 3 | 3.2 | 3.2 |
| Nigeria | 1.1 | 1 | 1.5 | 1.7 |
| Tanzania | 0.5 | 1.6 | 1.7 | 1.7 |
| Zambia | 3.2 | 2.3 | 2.5 | 2.5 |
| World | 8.7 | 6.2 | 4.9 | 4.9 |

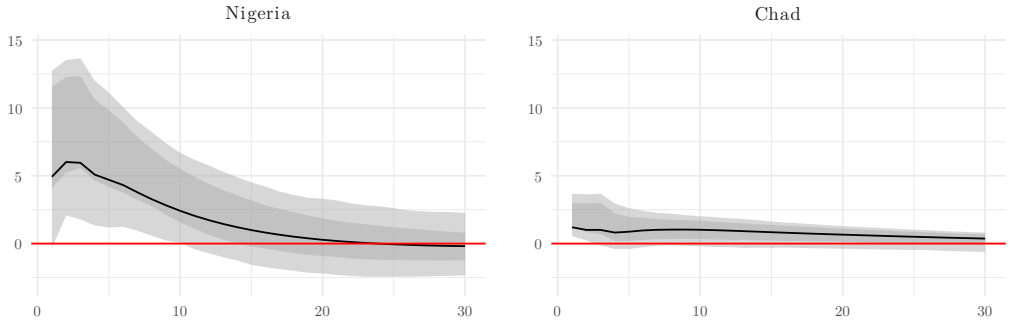


Figure 6: The left panel shows the response of the corn price in Nigeria to a positive aggregated-demand shock and right panel shows the response of the corn price in Chad to a positive oil-specific demand shock joint with 68% and 90% confidence bands obtained from 2,000 bootstrap iterations.

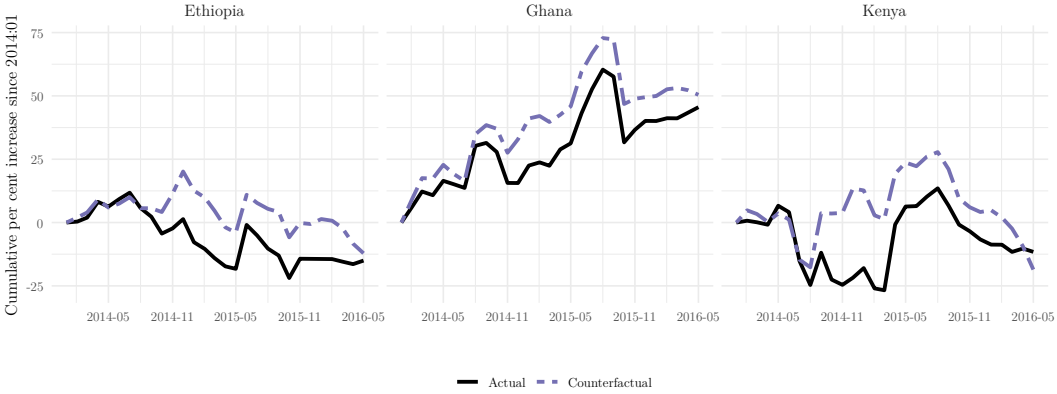


Figure 7: Comparison of cumulative percentage growth of real corn prices in Ethiopia, Ghana and Kenya since January 2014 with and without effects from shale oil boom and expansion of production capacity in the Middle East.

# Why do SSA corn markets respond to oil-supply shocks?

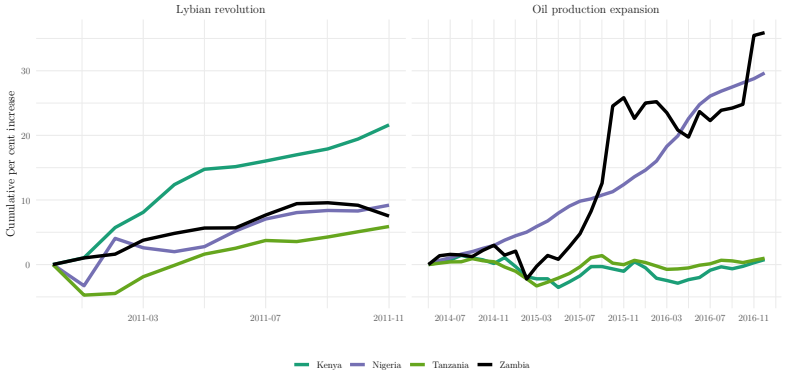


Figure 8: Comparison of cumulative percentage growth in transportation costs (consumer price index in the transportation sector, national statistics offices)

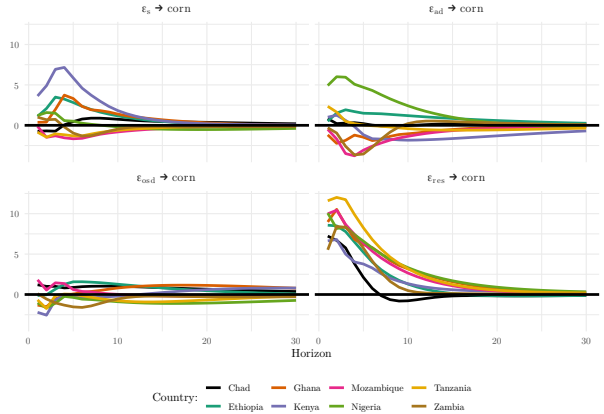


Figure 9: Point estimates of corn price reactions in Africa to different types of oil shocks and a non-oil related shock to corn price.

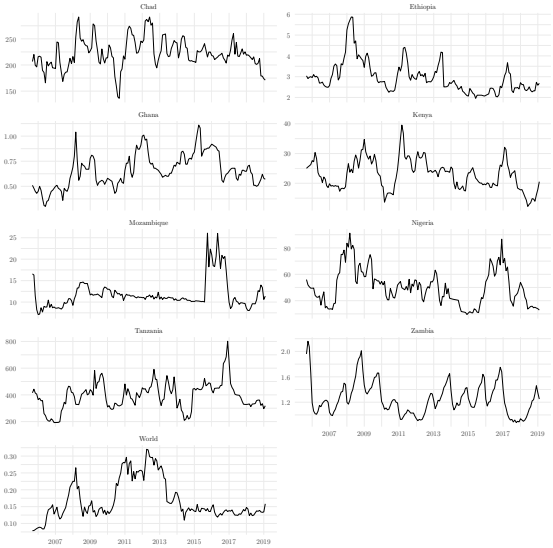


Figure 10: Real corn price series in domestic currency. World prices are given in US Dollars.

# Conditional forecasts

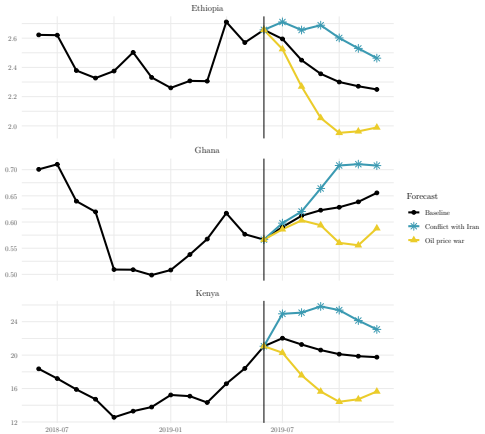


Figure 11: Alternative forecast scenarios for local real corn prices in domestic currencies. The vertical lines represent the beginning of the forecast periods.

Table 3: Test results on kurtosis and skewness of the estimated structural shocks. Values in parentheses denote $p$-values.

| | | $\hat{\varepsilon}_1$ | $\hat{\varepsilon}_2$ | $\hat{\varepsilon}_3$ | $\hat{\varepsilon}_4$ |
|---|---|---|---|---|---|
| 2*Chad | Kurtosis: | 3.07 (0.85) | 4.60 (0.00) | 3.41 (0.26) | 4.21 (0.01) |
| | Skewness: | 0.17 (0.38) | −0.50 (0.01) | −0.47 (0.02) | 0.33 (0.08) |
| 2*Ethiopia | Kurtosis: | 2.98 (0.96) | 4.58 (0.00) | 3.50 (0.15) | 8.01 (0.00) |
| | Skewness: | 0.23 (0.23) | −0.40 (0.04) | −0.46 (0.02) | −0.72 (0.00) |
| 2*Ghana | Kurtosis: | 2.60 (0.26) | 3.68 (0.05) | 3.89 (0.02) | 5.23 (0.00) |
| | Skewness: | 0.27 (0.16) | −0.30 (0.11) | −0.45 (0.02) | −0.31 (0.10) |
| 2*Kenya | Kurtosis: | 2.82 (0.62) | 3.52 (0.13) | 4.30 (0.00) | 3.76 (0.04) |
| | Skewness: | 0.21 (0.26) | −0.13 (0.49) | −0.71 (0.00) | −0.09 (0.62) |
| 2*Mozambique | Kurtosis: | 3.74 (0.04) | 4.73 (0.00) | 3.40 (0.24) | 8.36 (0.00) |
| | Skewness: | 0.19 (0.32) | −0.66 (0.00) | −0.52 (0.01) | 1.10 (0.00) |
| 2*Nigeria | Kurtosis: | 2.98 (0.96) | 4.52 (0.00 | 3.56 (0.12) | 4.03 (0.01) |
| | Skewness: | 0.17 (0.34) | −0.40 (0.04) | −0.41 (0.03) | −0.17 (0.38) |
| 2*Tanzania | Kurtosis: | 2.57 (0.22) | 3.68 (0.05) | 3.29 (0.43) | 4.77 (0.00) |
| | Skewness: | 0.26 (0.26) | −0.14 (0.45) | −0.47 (0.02) | 0.41 (0.03) |
| 2*Zambia | Kurtosis: | 3.04 (0.91) | 4.20 (0.01) | 3.54 (0.1) | 3.14 (0.70) |
| | Skewness: | 0.21 (0.27) | −0.48 (0.01) | −0.49 (0.02) | −0.48 (0.01) |