Crops and Conflict in sub-Saharan Africa

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Abstract

Our study explores whether specific crops are associated with higher levels of conflict across sub-Saharan Africa and if such phenomena can be explained by the "rice theory of culture". The rice theory claims that rice cultivation fosters greater cooperation among people and thereby reduces conflict. We combine 0.5 X 0.5 degree geo-referenced conflict data from the Armed Conflict Location and Event Data Project (ACLED) for the period of 1997-2016, and the Spatial Production and Allocation Model (SPAM) crop data for 2014. We use the proportion of land area dedicated to irrigation technology as an indicator for the level of social cooperation. We also include a wide range of controls such as income, population, ethnicity, country, religion, absolute value of latitude, elevation, ruggedness of terrain, and soil fertility from other datasets available for the region. We use linear probability models and standard errors clustered by grids to estimate our results. We find that contrary to the rice theory of culture, rice cultivation in sub-Saharan Africa is associated with a higher probability of conflict compared not only to wheat, but also to maize, pearl millet, and cassava. In addition, we show that greater area of land dedicated to irrigation technology in the cultivation of maize lowers the probability of conflict. We conclude that maize is to sub-Saharan Africa what rice is to east and south Asia. Therefore greater coordination efforts through cultivation of maize leads to lower probability of conflict in sub-Saharan Africa.

Introduction

The "rice theory of culture" explores whether individuals from regions that cultivated rice historically have evolved to think more holistically or collectively (Talhelm et al., 2014). This theory argues that rice cultivation requires collaboration and cost sharing over irrigation systems as well as coordinated water use, leading to the development of cooperative behavior among rice growers. However, empirical studies (e.g. Tsusaka et al., 2015; von Carnap, 2017) offer mixed validation. To test whether the theory holds for sub-Saharan Africa, we combine detailed geocoded datasets on conflict and crops to examine i) whether particular crops are associated with greater conflict across sub-Saharan Africa and ii) if so, can this be explained by the rice theory of culture?

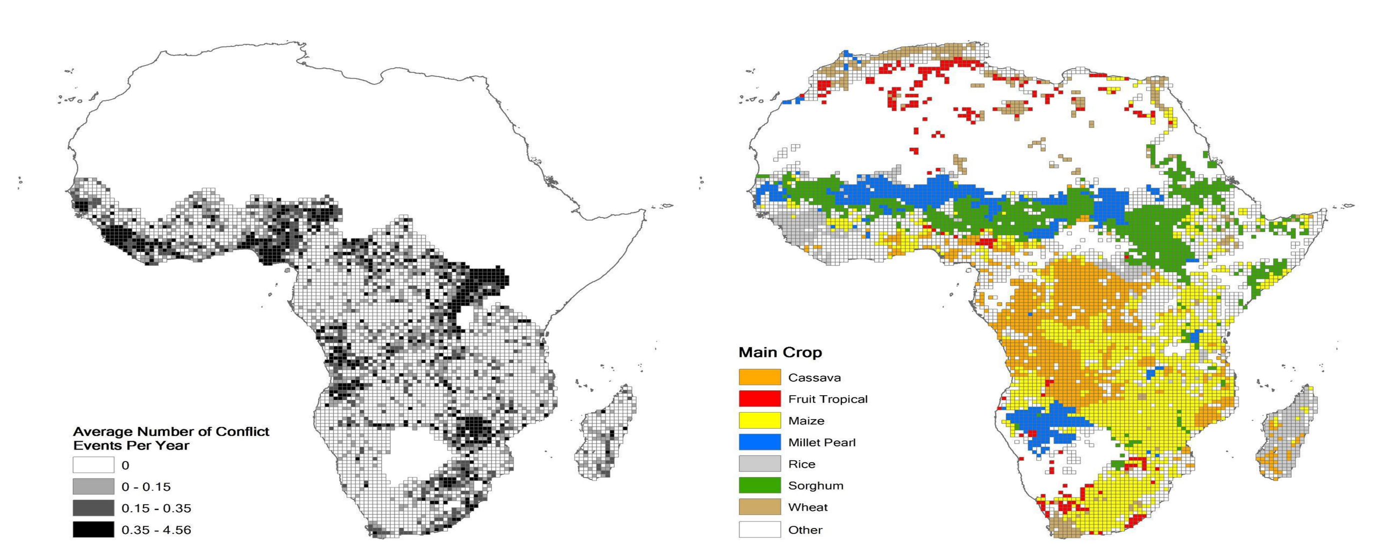

Figure 1. Map of Africa showing distribution conflict and main crops
***Source:* Zhang & Kibriya, 2018**

Estimated Equations

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 Z_i + \varepsilon_i \quad (1)$$

$$Y_i = \alpha + \beta_3 X_{1i} + \beta_4 X_{2i} + \beta_5 Z_i + \varepsilon_i \quad (2)$$

$$Y_i = \alpha + \beta_6 X_{1i} \text{ X } X_{2i} + \beta_7 X_{1i} + \beta_8 X_{2i} + \beta_9 Z_i + \varepsilon_i \quad (3)$$

where,
Y_i : indicator variable for whether grid *i* had any event of political violence
X_{1i} : main crop cultivated in grid *i*
X_{2i} : fraction of total harvested area that uses irrigation technology
Z_i : vector of control variables (e.g. country, ethnic group, religion, GDP per capita, presence of rugged terrain, distance to capital, distance to coast, distance to port, absolute latitude, presence of river, industrial-metals, diamond, petroleum, elevated land, malaria index, population density, nightlight density, presence of missions, railway, etc.)
ε_i : error term in each equation

Data and Methods

Data

- Conflict: 0.5X0.5 degree geocoded data from the Armed Conflict Location and Event Dataset (ACLED) version 7.0 (Raleigh et al., 2010)
- Crops: 0.5X0.5 degree geocoded data from the Spatial Allocation Production Model (SPAM)
- Controls: Precious metals, industrial metals, and diamonds are drawn from the Mineral Resource Data System (U.S. Geological Survey, 1996) by the United States Geological Survey (USGS) and the PRIO Diamond Resources dataset (Gilmore, 2005). Land endowment data, including land area, average elevation, and terrain ruggedness, is collected from the GTOPO30 global digital elevation model (U.S. Geological Survey, 1996)

Estimation Strategy

- Linear probability model with standard errors clustered at the grid level

Results

- Controlling for potential confounders, rice cultivation is associated with a higher probability of conflict compared to other major crops in sub-Saharan Africa (i.e. wheat, maize, pearl millet, sorghum, and cassava)
- This result holds when controlling for the fraction of total harvested land that uses irrigation technology
- Interactions between main crops and fraction of irrigated land show that for maize plantation, the propensity for conflict reduces as the area of land using irrigation technology increases

	(1)		(2)		(3)	
Dependent variable: probability of violence	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Wheat	0.030***	**-0.078*****	0.031	-0.084***	0.043***	-0.116***
Maize	0.016***	**-0.029****	0.001	-0.046***	-0.020***	-0.028
Pearl Millet	-0.028***	**-0.031***	-0.047***	-0.051***	-0.069***	-0.037*
Sorghum	0.047	-0.026	0.030	-0.045**	0.006	-0.032
Cassava	-0.024***	**-0.028****	-0.042***	-0.047***	-0.063***	-0.030*
Fraction of land using irrigation technology			**-0.039*****	**-0.046*****	-0.083***	-0.008
Wheat X Irrigation					-0.018	0.027
Maize X Irrigation					0.049***	**-0.080*****
Pearl Millet X Irrigation					3.028***	9.583
Sorghum X Irrigation					0.122***	12.910
Cassava X Irrigation					0.380	0.027
Controls	No	Yes	No	Yes	No	Yes
Standard errors clustered by grids	No	Yes	yes	yes	no	yes

Notes: The numbers on the columns correspond to the number of the equations. All results shown use a linear probability model. Wheat is used as the base category of main crops. ***, **, and * denote 1, 5, and 10 percent level of significance.

Table 1. Effect of main crops and irrigation on the probability of political violence

Conclusions

- Contrary to the rice theory of culture, it appears that in sub-Saharan Africa wheat cultivation is associated with a lower probability of conflict. Furthermore, it appears that maize, pearl millet, and cassava are also associated with a lower probability of conflict compared to rice
- The greater the area of land dedicated to irrigation technology in the cultivation of maize, the lower the probability of conflict. This is consistent with the notion that irrigation fosters social cooperation and leads to a lower probability of conflict
- While rice is the most important crop for east and south Asia, maize is the dominant crop of at least a quarter of sub-Saharan Africa. Therefore, we conclude that the maize phenomena of sub-Saharan Africa is tantamount to the rice theory for Asia. As a result, greater coordination efforts shown in irrigating and growing maize lowers the probability of conflict in sub-Saharan Africa

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