# Agricultural Trade Openness, Food Security and Civil Unrest

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# 1. Project Summary

The objective of this research is to examine the effect of trade openness on food security and prevent potential conflict. Does agricultural trade stabilize food price in times when weather shocks lead to domestic production shortfall? Does trade increase food security by preventing a high food price? Does that further decrease the likelihood or intensity of civil unrest or conflict? Previous literature has linked high food prices with food insecurity and conflicts. Poor and unemployed farmers are more likely to be forced into protest, strike or civil war because poverty lowers the opportunity cost of rebellion (Bellemare 2015). Preventing and alleviating food price shocks is hence an important part of governments' policy considerations. Trade is just one of these policy tools. Under free trade, the import parity sets an upper limit on the domestic food prices, benefiting the consumers. The export parity sets a lower bound for producer prices so that they can export to get more profits when domestic prices are low (Govereh, Chapotpo and Jayne 2010). Hence, at theoretically countries that engage actively in trade are supposedly affected less if there is a sudden shock in the food prices. As a result, the countries that trade more are supposedly more food secure and are less likely to have a conflict.

The main identification strategy of evaluating the effect of trade openness is through two sets of differential effects: 1. an exogenous weather shock has a larger effect on the prices in countries that are less open to trade. 2. an exogenous weather shock has a bigger effect on the food security and severity of civil unrest in countries that don't rely on trade.

Understanding the nature of food security and conflict is important for political and economic stability. This research aims to shed light on how trade policy can play in a role in stabilizing food prices and preventing conflict.

# 2. Project Description

## *2.1. Literature Review*

Volatile food prices can bring about economic and civil unrest ( Bellemare 2015[2]; Fjelde 2014[4]; Weinberg and Bakker 2015[12]). In developing countries, food spending comprises a large portion of households consumption budget. Households are vulnerable to price hikes for staple commodities. Rising and volatile food prices results in poverty and food insecure. According to the classic theory of conflict, poverty lowers the opportunity cost of insurrection (Bazzi and Blattman, 2014[1]). Poor and unemployed men are more likely to fight, riot, and rebel (World Bank 2012[11]). This link has become one of the most widely accepted facts in the study of social unrest.

The existing literature shows evidence that rainfall and climate shocks increase the risk of conflict onset (Burke et al. 2009[3]; Hsiang, Meng, and Cane 2011[8]). However, the exact mechanism of how rainfall and temperature eventually affect conflict is rather unclear. This research aims to evaluate the potential effect of how the weather shocks affect prices through its negative impact on the major food production and in turn increases the food prices. Despite the strong association between economic variable and conflict, there is endogeneity that requires exogenous shock for identification. Weather shocks are plausible instruments in economies that largely rely on rainfed agriculture (Miguel, Satyanath, and Sergenti 2004[10]). By comparing the differential effect of weather shocks on prices, this research is able to identify the difference in the price response from countries that are distinct in various features. In particular, we are interested in their reliance on agricultural trade and how that changes the food prices and conflicts.

Trade policy in the agricultural sector has been used by many countries as a price stabilizing tool. Various restrictions on exports have been used frequently and repeatedly over the past few decades by many countries in the Sub-Saharan Africa (Govereh, Jayne, and Chapoto, 2008[7]). However, food insecure, rising food prices are still troubling the people in these

countries. Researcher show empirical evidence that trade barriers imposed by governments may not in fact helpful in maintaining stable food prices in the domestic market (Martin and Anderson 2012[9]). To the opposite, unilateral actions on trade restriction often give rise to a "multiplier effect": when a shock drives up the price of food, exporters respond by imposing restrictions while importers wind down protection. The initial shock is exacerbated and leads to even more trade protection(Giordani, Rocha and Ruta 2016[6]). Other studies show that trade can alleviate price surges in times of domestic production shortfall. Participation in free trade can set both a lower bound and a price ceiling for staple prices, that in turn, decrease price volatility (Garca-Germn et al. 2013[5]).

This research aims to provide empirical evidence on the effect of agricultural trade openness by looking at a number of developing countries all over the world that are distinct in geographic location, climate, socioeconomic environment and political institutions. The contribution to the development and conflict literature are as follows. First we provide a trade perspective in explaining how some countries may experience civil unrest and food insecurity than others. Second, we explains the mechanism by steps on how exogenous weather shocks can affect conflict and social stability. In terms of policy implications, this research evaluates the effect of trade policy on domestic conflicts and food security that are of interest to policy makers in the developing world who are actually faced with trade offs between trade policy and domestic subsidy.

## *2.2. Data*

The data used in this project includes the following three categories. First, producer and consumer price measures of the major grains of interest. Major grain (rice, wheat and maize) production and consumption quantities are collected from the Food and Agricultural Organization (FAO). (variable names:ltotal is production quantity of maize+rice+wheat in log forms. lcalory is the calory weighted sum of the production quantity of maize, rice and wheat. Food-cons is the sum of consumption quantity of maize+rice+wheat.) Farm gate price (vari-

able names: lmaize lrice lwheat are the three prices in log form. llc-rice/maize/wheat are price in local currency. ppi-rice/maize/wheat are producer price index. Rice/wheat/maize-world are average annual world prices for these products)and consumption price (Consumer Price Index: logcpipse for general CPI in log form and logcpifood is food CPI in log form) are obtained from FAO and Labour Organization from year 1951 to 2009.

Second, weather shock measures. Currently we are using Global Climate Data (Annual temperature and Precipitation) from University of Delawares Center for Climatic Research from 1951 - 2009. (Variable name: lwtem and lwpre are temperature and precipitation in log forms). More detailed measure on cropland will be used for further study.

Third, conflict measures. The traditional conflict data by a collaboration of Peace Research Institute Oslo (PRIO) and Uppsala University's Uppsala Conflict Data Program (UCDP) from 1951 to 2008 are considered as the default choice since it has been used by several conflict papers in the past (variable name:Any-prio). The data considers the country is in conflict is there are more than 25 death in that year, otherwise, it's considered not in conflict. Despite its wide use, there are limitations to the UCDP/PRIO conflict data. It is relatively a discrete measure of conflict and that conflict that results in 25 death and a thousand death is very much different.

Trade intensity measures: (Import + export)/(production + Import -export) for maize/wheat/rice respectively (variable names:maize/rice/wheat intensity). "Openness" is the sum of maize/wheat/rice for the calculation of the above trade intensity measure.

Policy variables: Wto-status and gatt-status means whether the country is in that organization or not. Apart from the data mentioned above, several control variables are considered to hold constant cross country differences. Controls variable on population, GDP, agricultural share are obtained from the World Development Indicators. Policy distortions on agricultural prices using the "Estimates of Distortions to Agricultural Incentives" data from the World Bank from 1955-2011 are also included in the analysis.

### *2.3. Method*

The estimation of the effect of trade openness on prices and conflict are mainly obtained via a difference in difference setting with continuous treatment (the amount of weather shocks). We do so by comparing the weather shock effects on the treatment group (countries that are more open to trade) to the control group (countries that are less open to trade). In other words, the identification is achieved by comparing the differential effect of exogenous weather shocks on food prices and conflicts between countries that trade more versus those trade less. The hypothesis is that free trade policy lowers the grain prices that are hit by weather induced production shocks. Therefore, if there is a exogenous weather shock that hit a number of countries, it should have a larger effect on the grain prices in countries that are less open to trade. Also, with belief and evidence on the positive correlation of economic poverty and conflict incidence, that weather shock should also have a bigger effect on the number and severity of civil unrest in countries that do not rely on trade.

The method can be summarized into the following sets of regressions:

$$P_{it} = \beta_1 R_{i,t-1} \times open_i + \beta_2 Temp_{i,t-1} \times open_i + \beta_3 Temp_{i,t} + \beta_4 Temp_{i,t-1} + \beta_5 Rain_{i,t} + \beta_6 Rain_{i,t-1} + v_i + t_i + e_{it} \quad (1)$$

$$C_{it} = \gamma_1 R_{i,t-1} \times open_i + \gamma_2 Temp_{i,t-1} \times open_i + \gamma_3 Temp_{i,t} + \gamma_4 Temp_{i,t-1} + \gamma_5 Rain_{i,t} + \gamma_6 Rain_{i,t-1} + v_i + t_i + e_{it} \quad (2)$$

where $P_{it}$ represents the price measure while $C_{it}$ represents the cost measure. $Temp_{i,t}$ and $Rain_{i,t}$ is the mean temperature and rainfall of country i in year t respectively. $Open_i$ is the trade openness measure of country i, which is an average over the study period to avoid sudden changes in policy such as trade liberalization or complete bans on exports. Country-specific and year-specific fixed effects are added to control for heterogeneity and unobserved country-specific effects. The other control variables including GDP, agricultural land area, agricultural GDP can also be added to the equations and interacted with the weather shocks to see if they play a significant role on the price movement or conflict incidence. Time lag in weather variable are used to avoid contemporaneous noise in the current shock and current prices. Country specific time trend are added to remove factors that change over time, including trend in liberalizing trade. Both regressions are weighted by population to control for the difference in the importance of agriculture and domestic food demand across countries.

Multiple measures of openness are used for robustness. One is landlocked or not, since countries that are landlocked. Another is food openness, which is the sum of average imports plus exports of the major grains divided by the average of their domestic consumption. In Figure 1, a histogram of trade openness and landlocked status in presented. We can see that the two measures are correlated: landlocked countries are relatively less open. This

open door for using landlocked status as a instrument variable for openness to deal with the possible endogenous issue of trade openness.

For the conflict measure, the default is in conflict or not, according to PRIO/UCDP data. For the Cline Center SPEED data, we plan to use a number of different measures : Civilian attacks, political attacks(lethal,non-lethal), expression events (small-scale, mass), incidence of protest, etc.

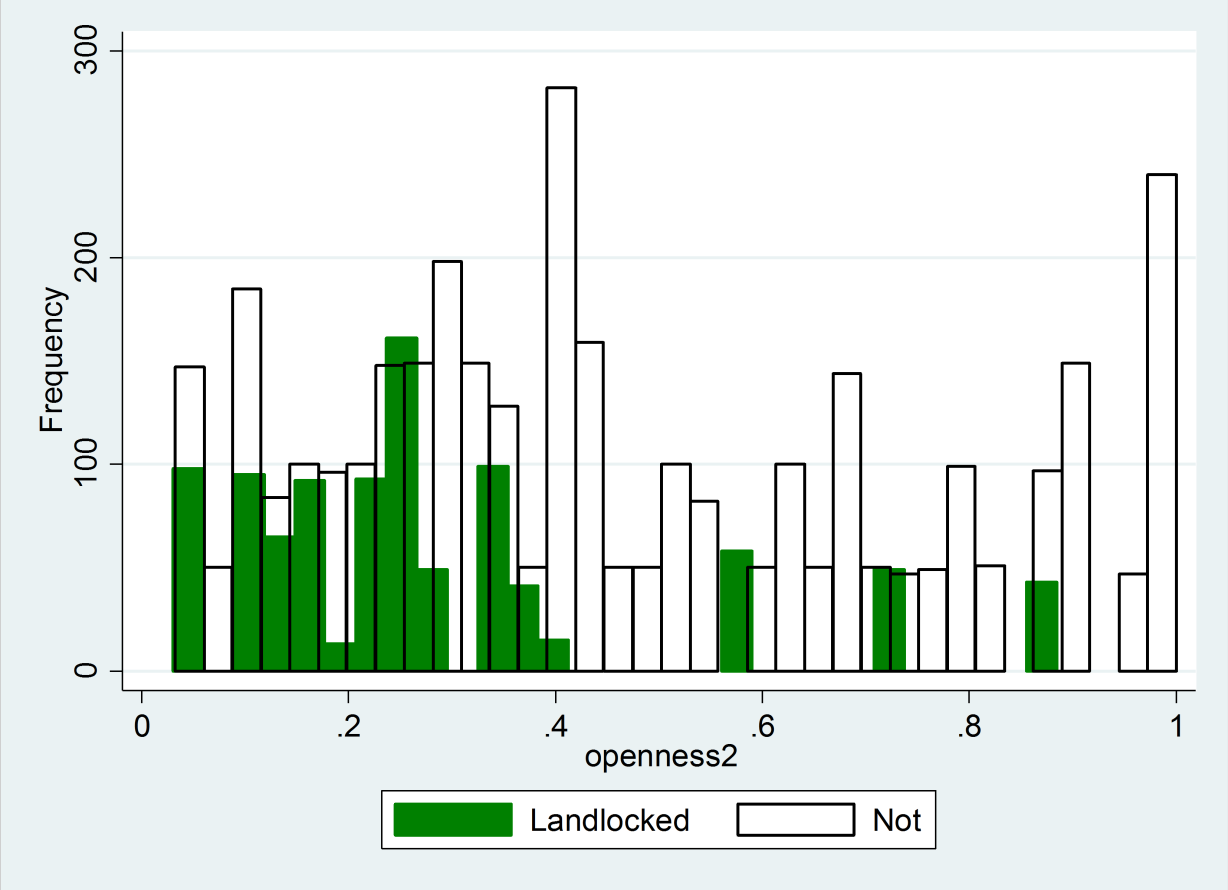


Fig. 1. Openness measure and landlocked status

## *2.4. Conclusion and Broader Impact*

This research aims to assess whether agricultural trade can stabilize food price in times of domestic production shortfall. Further, does trade decrease the likelihood or intensity of civil unrest by preventing a high food price? By comparing the differential effect of exogenous weather shocks on food prices and conflicts between countries that trade more versus those trade less, the paper seek evidence from over 80 developing countries that are dependent on rain-fed agriculture. By making use of SPEED civil unrest event data from automated textual analysis on a large set of events, this research bases its analysis on a richness of information and multiple intensity measures of civil unrests. Understanding the nature and conflict and civil unrest is important for political and economic stability. This research aims to provide evidence on how trade openness and trade policy can be invaluable tools for countries' domestic food security and social well being. Trade barriers in times of domestic production shortfall may not only harms the neighbors and exacerbate the international food crisis, it tends to harm the countries implementing themselves.

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