Effects of Weather on Maize Yield in Kenya

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Outline

Introduction

- SSRP project, related to ForPAc project
- Extreme weather $\rightarrow$ disasters (maybe name some years of drought in Kenya??)
  - Early warning systems have been developed
- Goals: Improve early warning systems in Kenya
- Shifting the disaster management from reactive to protective
- Two predominant rainfall regimes in Kenya:
  1. Arid and semi-Arid (ASAL): bi-modal
     - MAM and OND
     - Short and Long rains
  2. non-ASAL: uni-modal
     - March to August
- Perhaps a map of ASAL and non-ASAL

Intro-Approaches

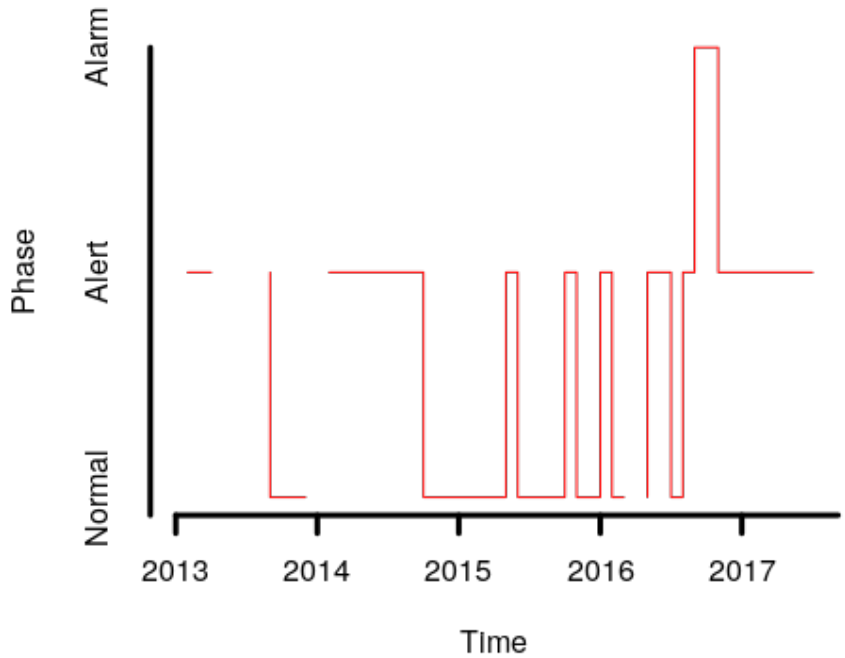
- Various approaches considered including:
  - Relating NDMA Early warning phase classification to weather
  - Relating markets and food prices to weather
  - Relating maize yields to weather to weather
  - Computable general equilibrium (CGE) models

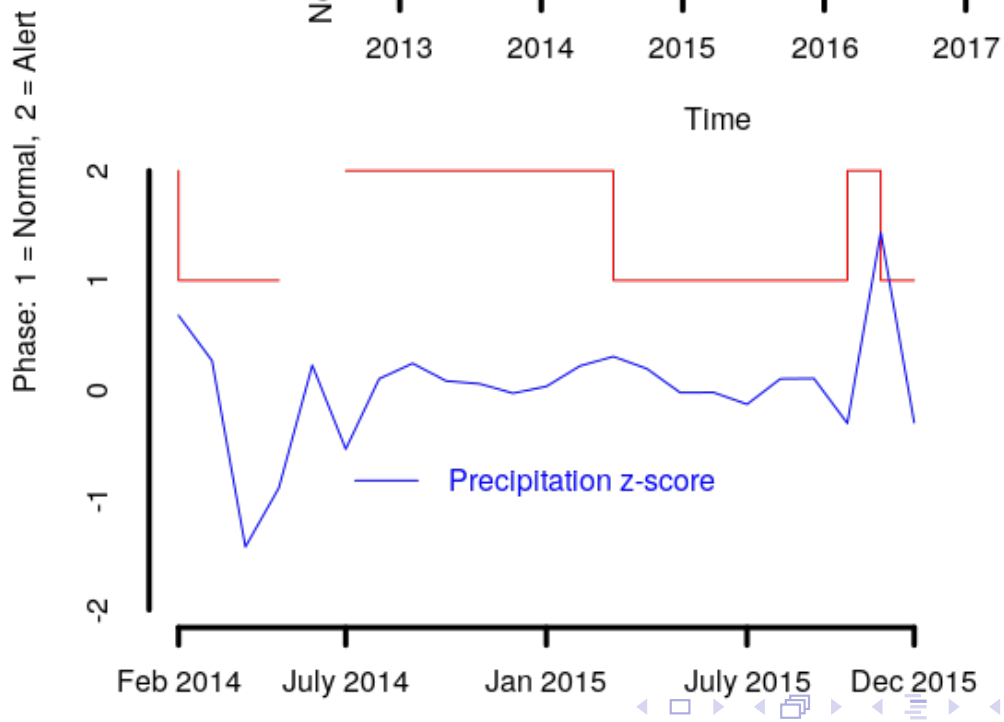
NDMA Early Warning Phase Classification

Example: Kitui county

Normal → Alert → Alarm

- Bulletins for ASAL counties
- Online since 2013
  - But in pdf format
- For county and month





Approach

- Narrowing the research question:
  - Relationship of maize yield and weather in Kenya
    - What is it about weather that causes drought related disasters?
    - Which particular characteristics of weather are the most 'responsible' for drought related disasters?

Sample:

- Panel of 47 counties of Kenya, 1981 – 2017

Data

- Maize yields
  - source: Famine Early Warning Systems Network (FEWS NET)
  - County level, yearly, tonnes per hectare
- Weather:
  - Daily, 0.25° resolution gridded data
  - Precipitation
    - Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS)
  - Temperature
    - Berkeley Earth
  - Aggregation needed to conform with the yield data

Effects of droughts on economy

Computable General Equilibrium (CGE)

- **Robinson et al. (2010)**
  - 5 agro-ecological zones,46 production activities (incl. 35 zone specific agricultural production sectors), 22 commodity groups, 15 primary factors of production

Fixed (inputs)	Determined by model (outputs)
Capital stock	Domestic price of each commodity
Land (by region)	Land allocated across crops
Supply of labor per skill type	Real wages
Foreign capital inflow	Real exchange rate
Trade balance	

- The simulation use a 'balanced' macro closure in which aggregate **investment, government demand, and consumption are fixed shares of total absorption**
- Intermediate inputs into production are determined as fixed shares of the quantity of output

Effects of droughts on economy

Computable General Equilibrium (CGE) Models

- **Willenbockel (2011)**
  - Exploring range of scenarios for food price increase in 2030
    - 1. Baseline 2. Climate change 3. Climate change with adaptation 4. Adaptation only in sub-Saharan Africa
  - Global coverage, set of individual country models, linked through international trade
  - Climate change (incl. drought) modelled as changes in factor productivity (usually negative)

My suggestion - panel estimation

My interest: **Effects of drought on economy in Kenya**

- **Response variable**
  - Volumes of production (crop specific, total)
  - Profit per acre (Deschenes and Greenstone, 2007)
    - (Value of agricultural products - prod. expanses)/acres (crops, pasture, grazing)
- **Units of analysis**
  - Counties in Kenya $\times$ year
- **Explanatory variable of interest**
  - Dummy variable (0/1) drought occurred in a particular county and year or not
  - Several varieties - various specifications of drought:

My idea - panel estimation

$$Y_{i,t} = \alpha_i + \gamma_t + \delta D'_{i,t} + \beta \boldsymbol{X_{i,t}} + \epsilon_{i,t}$$

$Y_{i,t}$	=	Response variable (food production/price), county i in year t
α_i	=	Fixed effects, county i
δ	=	Effect of drought on economy
$D_{i,t}$	=	Indicator variable
		$D = 1$ if drought in county i in year t, $D = 0$ otherwise
β	=	Vector of effects of other covariates
$X_{i,t}$	=	Matrix of values of other covariates in county i in year t
$\epsilon_{i,t}$	=	Error term
γ_t	=	Year specific indicator?

Thank you for attention

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