

# Climate Variability and Crop Production in Uganda



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# Objectives

- To assess the magnitude of rainfall and temperature variation in Uganda over the past three decades;
- To examine the cyclic pattern of rainfall and temperature variation in Uganda over the past three decades; and
- To establish the effect of rainfall and temperature variation on crop production in Uganda.

# Data and Methods

The data used in this paper is time-series data of 28 observations ranging from 1981 to 2008.

Variables including rainfall, temperature, cultivated area, output, labour and government budget allocation as a proxy for capital is derived from various sources.

Data on rainfall and temperature were obtained from the Uganda Meteorological department. The weather stations from which monthly and annual data was collected include Masindi, Kampala, Entebbe, Kabale, Gulu, Soroti, Tororo, Mbarara, Kasese and Jinja.

# Model specification

The analysis is based on Engle's (1982) time-varying autoregressive conditional heteroskedasticity (ARCH) model and the subsequent extension to the generalized ARCH (GARCH) by Bollerslev (1986).

The specific equation we estimate is a non-linear production function stated as:

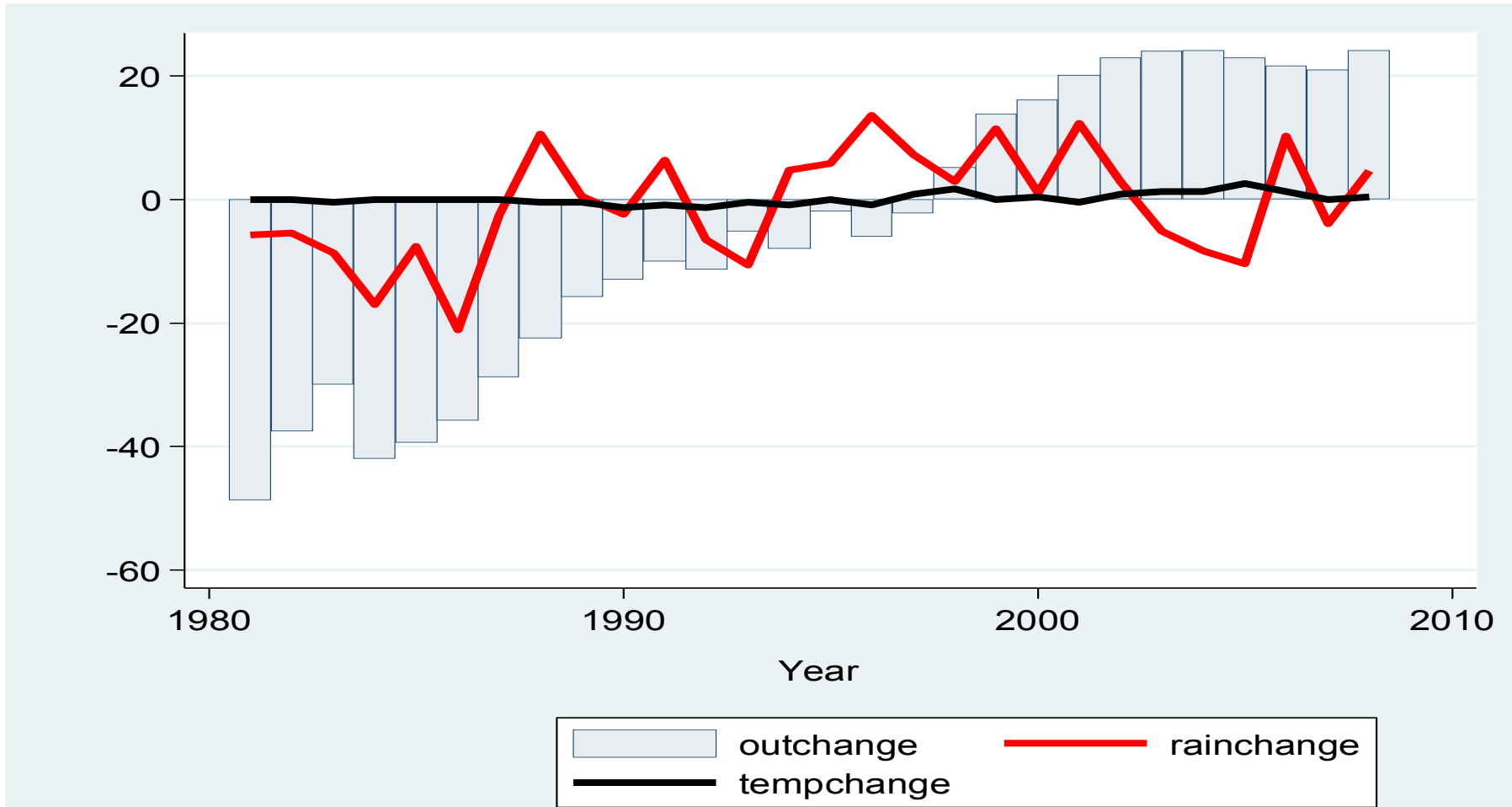
$$y_t = \gamma_0 + \gamma_1 R_t + \gamma_2 T_t + \gamma_4 A_t + \gamma_5 L_t + \gamma_6 K_t + \gamma_7 R_t * R_t + \gamma_8 T_t * T_t + \gamma_9 R_t * T_t + Z_t + \varepsilon_t$$

$$\delta_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \delta_{t-1}^2$$

# Results and Discussion

Variable	Obs	Mean	Min	Max
Rainfall (mm p.a)	28	1251	1032	1447
Temperature (oC)	28	22.6	22.3	23.2
Total crop area (million ha) )	28	5514	3767	7191
Agricultural output (100 Million tonnes)	28	19624	13197	25846
Agriculture Budget (UGX billions)	28	39	38	223.2
Agriculture labour force (Adult pop. in Agric. In Mil)	28	8	5.6	10.6
Reconstruction dummy (Pre 1987 =0; 1987 and after =1)	28	0.79	0	1

# Rainfall and temperature variability and crops' output



# Model specifications

*Production Model: Dependent variable = Output deviation*

	Coefficient	z-Statistic	Prob.
C	-0.086	-1.629	0.103
RAIN_DEV	0.008	3.251	0.001
TEMP_DEV	0.109	3.639	0.000
RAINRAIN_DEV	-0.001	-2.805	0.005
TEMPTEMP_DEV	0.011	0.520	0.603
RAINTEMP_DEV	0.000	-0.082	0.935
AREA_DEV	0.775	6.769	0.000
BUGAGRIC_DEV	0.069	2.057	0.040
LBR_DEV	-0.015	-0.123	0.902
WAR	0.073	1.395	0.163
No of obs.	28		
Adjusted R <sup>2</sup>	0.92		
F-Statistics	28.4		
Prob (F-statistic)	0.000		

# Conclusion

- No significant deviations in rainfall and temperature from the long-term average have been observed. What is observed however, are the continuous cyclic pattern of rainfall and temperature variations.
- The results suggest seasonal variation in rainfall and temperature (which contributes to but is not the same as climate change) appears to be the major natural phenomena affecting agricultural production in Uganda