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Weather Shocks and Adoption of Labor-Saving and Land-Augmenting Technology

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INTRODUCTION

In many rural areas in sub-Saharan Africa, farming households' welfare depend heavily on rainfall. We explore smallholder farming households' behavior towards weather shocks in a context where agriculture is the primary source of income.

There is evidence in the literature that negative weather shocks could induce a farmer to reduce farm investments for an increase in savings and spendings on off-farm businesses to smooth household consumption during expected difficult periods, which could ultimately decrease the adoption of farm technology.

Hence, one question that arises is: do smallholder farmers prefer investing more in technology that increase land productivity or in technology that saves labor? The objective of this study is therefore to examine the budget-constrained and risky decision making of smallholder farmers in choosing between labor-saving technology and land-augmenting technology when facing weather shocks.

Understanding the direction of this relationship helps explain the role of weather shocks in the allocation of farm production factors in developing countries.

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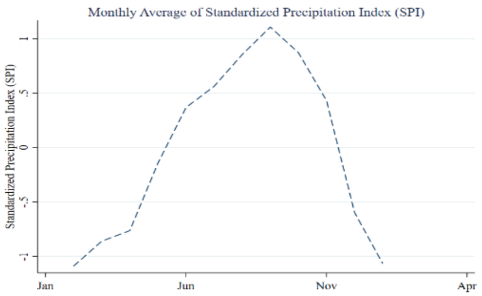
DATA & METHODS

Two waves of plot level data for 5,856 Nigerian farming households serve as the basis of empirical analysis. Weather data including monthly temperature and precipitations (at the state level) were collected from ERA-Interim database.



Our empirical model is specified as follows:

$$Y_{ist} = \alpha + \beta_1 Shock_{st} + \beta_2 Temp_{st} + \beta_3 X_i + \theta_s + \delta_t + \varepsilon_{ist}$$

where,

- Y_{ist} equals 1 if the technology is used in the past 12 months and 0 otherwise, for household i, in state s.
- $Shock_{st}$ is our variable of interest and is defined as the number of months in the past 12 months prior to the survey for which the standardized precipitation index (SPI) is less than or equal to -1.
- X_i includes household controls such as age, gender, education level of head, and family size. $Temp_{st}$ is average temperature in past 12 months, and θ_s, δ_t are state and year fixed-effects.
- ε_{ist} is the idiosyncratic error term

RESULTS

Table 1. Drought shock effects on technology adoption

	Animal traction	Equipment /machine	Improved seeds	Pesticide	Fertilizer	Irrigation
Drought Shock	0.0491***	-0.0707***	-0.00473	0.0283*	0.0353**	0.0225**
	(0.00699)	(0.00887)	(0.00695)	(0.0159)	(0.0166)	(0.00953)
Household controls	Yes	Yes	Yes	Yes	Yes	Yes
Mean temperature	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Plot FE	Yes	Yes	Yes	Yes	Yes	Yes
Mean	0.23	0.23	0.93	0.16	0.42	0.02
[Std. Dev.]	[0.42]	[0.42]	[0.25]	[0.36]	[0.49]	[0.13]
R-squared	0.654	0.461	0.241	0.225	0.298	0.0534
F-statistic	5.790	67.06	5.475	9.745	51.91	2.221
Obs.	14210	14210	13857	14282	14175	14007

Notes. All dependent variables are binary. Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

CONCLUSIONS

Farmers are more likely to use animal traction and less likely to use farm equipment during drought events. This latter result suggests that farmers may not be able to afford renting farm equipment during drought periods. We also find that farmers are more likely to invest in technology that improves or augments land productivity (fertilizer).