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Effects of smallholder diversification on rural household maize security in Kenya

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Introduction

- Market-oriented economic and policy reforms in Kenya have been aimed at spurring agricultural transformation
- Increasing urban population and rural population densities
- Climate change has led to increased incidences of rainfall stress
- Many rural households are diversified in crop, agricultural and livelihoods
- How has this influenced household maize security situation in rural Kenya

Objectives

To determine the welfare effect of crop, agricultural and livelihood diversification on rural smallholder household food security in the presence of rainfall stress

- Determine the effect of smallholder diversification on rural household maize security in the presence of rainfall stress and policy reforms
- Examine heterogeneity in household maize security between land rich and land-poor

Method

AR(1) Dynamic Panel Data Model

$$y_{it} = \alpha y_{i,t-1} + \beta' x_{it}^{*} + \eta_i + \upsilon_{it}$$
$$= \theta x_{it} + \eta_i + \upsilon_{it}$$

Empirical model

$$FS_{it} = FS'_{i,t-1}\alpha + X'_{it}\beta + D'_{it}\varphi + \omega'_{it}\delta + \pi'_{it}\sigma + \eta_i + \upsilon_{it}$$

Diversification Index

$$D_{it,k} = 1 - \sum_{a=1}^{N} \left(S_{at,k}\right)^2, and$$

$$\sum_{a=1}^{N} \left(S_{at,k}\right) = 1$$

Marginal effect of smallholder diversification

$$\frac{\partial W}{\partial D} = \varphi + +\omega'\sigma$$

Data

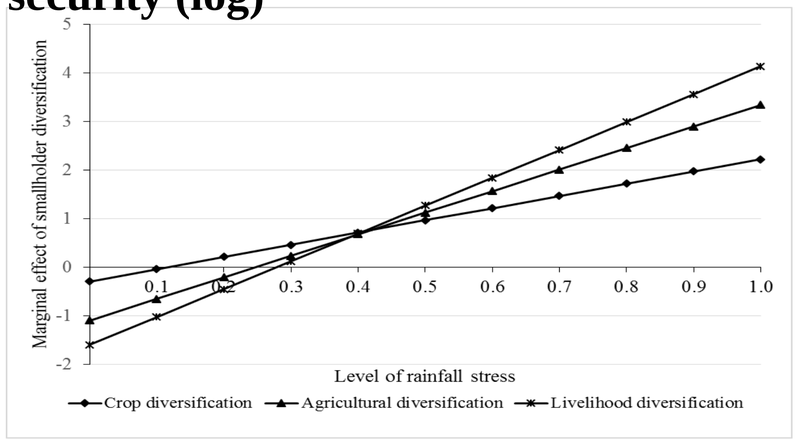
- Four-period household panel data of 1,243 rural farm households, 2000 – 2010
- Rainfall data 1999 -2010

Results

DPD regression of effect of smallholder diversification on maize security

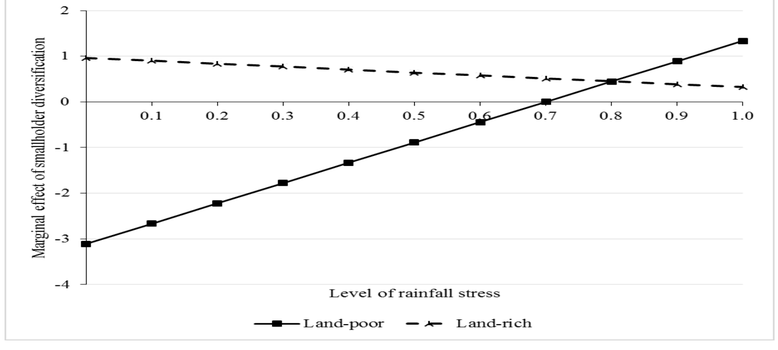
VARIABLES	Model with Crop diversification	Agricultural diversification	Livelihood diversification
Lagged log of maize calories (kcal/day/ae)	0.0063	0.0033	0.0071
	(0.0057)	(0.0063)	(0.0064)
Log of acreage cultivated (acres)	0.1821**	0.2209**	0.2214**
	(0.0778)	(0.0872)	(0.0905)
Log of Maize acreage (acres)	0.1424***	0.1682***	0.1369***
	(0.0354)	(0.0408)	(0.0411)
Log of real household net assets (Ksh/ae)	0.1113**	0.0969*	0.1341**
	(0.0446)	(0.0513)	(0.0527)
Log of real household income (Ksh/ae)	-0.2391*	-0.3889**	-0.3041**
	(0.1277)	(0.1524)	(0.1452)
Crop commercialization index	1.2112***	1.2762***	1.0274***
	(0.3385)	(0.3262)	(0.3366)
Rainfall stress	-1.4382**	-2.7352**	-3.6054***
	(0.7302)	(1.0916)	(1.2268)
Diversification index	-0.2938	-1.0968*	-1.6009**
	(0.3913)	(0.6008)	(0.6816)
Rainfall stress * diversification index	2.5146**	4.4332***	5.7321***
	(1.1061)	(1.5947)	(1.8539)
Log of main season total rainfall (mm)	0.0184	0.0510	0.0359
	(0.0628)	(0.0695)	(0.0715)
Gender of household head (1=male)	-0.1152	-0.1619	-0.1671
	(0.0893)	(0.0999)	(0.1045)
Age of household head (years)	0.0042	0.0045	0.0067
	(0.0039)	(0.0041)	(0.0045)
Education level of household head (years)	-0.0062	-0.0028	-0.0032
	(0.0063)	(0.0068)	(0.0068)
Household size	-0.1620***	-0.1777***	-0.1681***
	(0.0188)	(0.0213)	(0.0211)
Year > 2004	0.0462	0.0315	0.0090
	(0.0440)	(0.0475)	(0.0490)
Constant	5.7188***	6.7048***	6.6281***
	(0.7555)	(1.0068)	(0.9689)
Number of obs	2,826	2,826	2,826
Number of households	1,032	1,032	1,032

Marginal effect of smallholder diversification on household maize security (log)



- At lower rainfall stress levels, crop diversification enhances hh maize security than agricultural or livelihood diversification
- At higher rainfall stress, livelihood diversification enhances hh maize security
- At stress levels =40%, no difference in the effect of crop, agricultural or livelihood diversification on hh maize security

Heterogeneity in the marginal effect based on land size



Conclusions

- Smallholder diversification may be a strategy to mitigate household maize insecurity in the presence of rainfall stress
- Hence need for better rainfall forecasting