

# Impact of Land Policies and Women Empowerment on Dietary Diversity and Calorie Intake in Malawi

Zephania Bondera Nyirenda

IFPRI Brownbag Research Seminar

11<sup>th</sup> December, 2019

# Introduction

- ▶ There is a new agenda for agriculture to not only produce enough food but also food of high nutritional quality and diversity.
- ▶ However, high population growth has resulted in land disputes and limited the extent to which agriculture can contribute to nutrition (Place and Otsuka 2001; and Peters and Kambewa, 2007).
- ▶ One solution to ending these conflicts is ensuring land tenure security.
- ▶ Land tenure security is a situation where land owners and users have clearly defined and enforceable land rights whether based on formal law or customary practices.
- ▶ It is known to reduce land conflicts, improve farm productivity, investment and food security (Chirwa, 2008; Holden & Ghebru, 2016; Mendola & Simtowe, 2015).
  - ▶ Thus, land tenure security has significant implications on food and nutrition security (Holden & Ghebru, 2016).
- ▶ Land tenure security increases women's rights and hence nutritional<sup>2</sup> status (USAID, 2016).

# Introduction

- ▶ There is limited empirical evidence on the linkages between land tenure security and food security/nutrition around the world.
  - ▶ There's a disconnect between research, policy and programs on land tenure and food and nutrition security.
    - ▶ Land tenure research does not integrate food security or nutrition elements in data collection systems and vice-versa (Holden and Ghebru, 2016).
- ▶ Studies on land tenure security have ended at linking tenure security to food security without considering nutritional outcomes of households.
- ▶ Mixed evidence on the effect of tenure security on food security;
  - ▶ Some find positive effects while some find that the effects cannot be attributed to tenure security.

# Introduction

- ▶ Studies that have examined the effect on food security have used non-conventional impact evaluation techniques, except for Mendola M, and Simtowe, F. (2013), and Chirwa (2008)
  - ▶ However, both studies did not examine the link between land tenure security and nutrition and did not use nationally representative data.
- ▶ The current study uses nationally representative data and examines the linkages between land tenure security and nutritional outcomes of households.
- ▶ A positive impact of land tenure security on nutrition status of households may influence accelerated implementation of the recently approved Land Laws in Malawi.

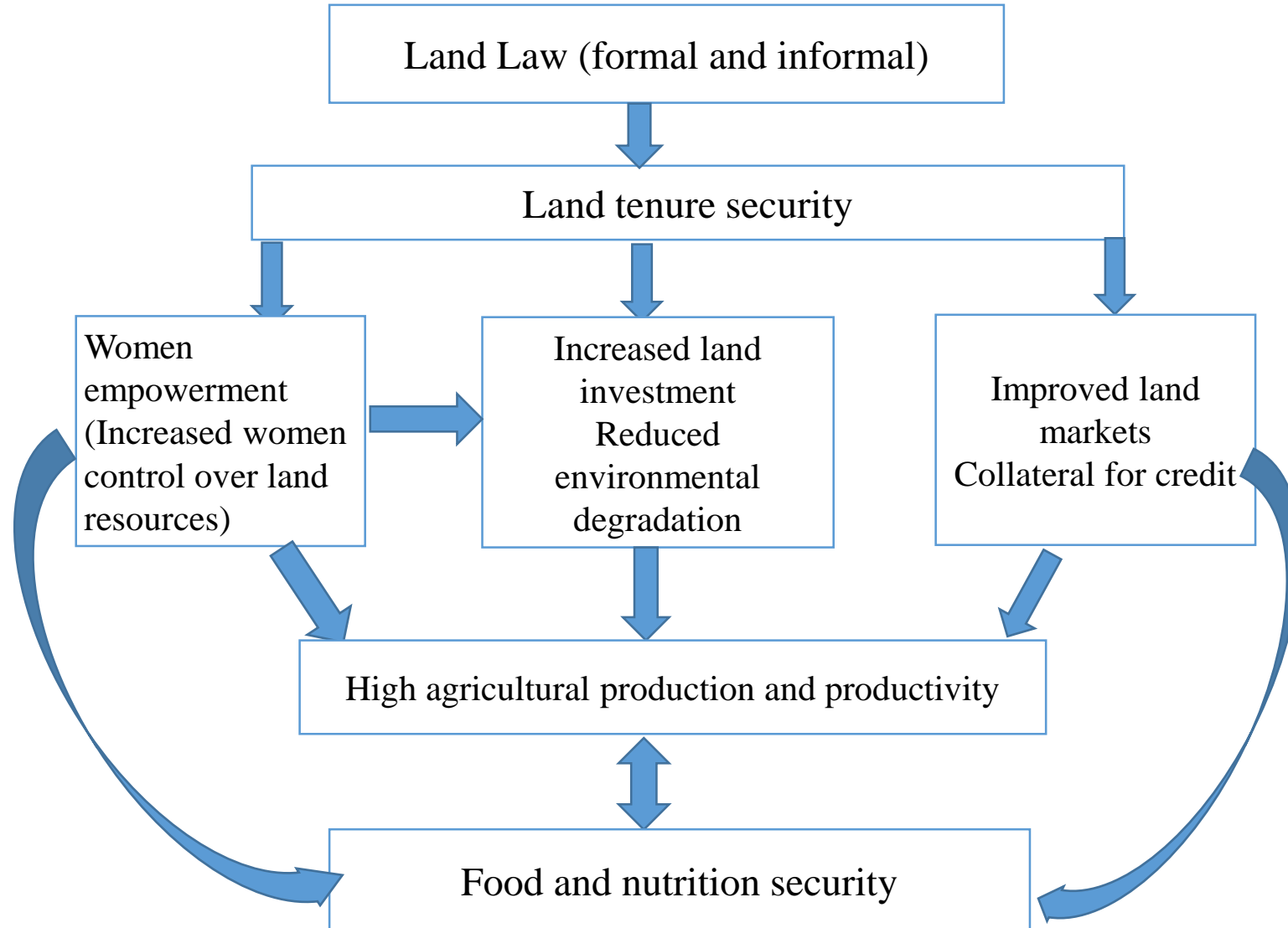
# Evolution of Land Tenure in Malawi

- ▶ In 2016 Government of Malawi enacted 9 land related Laws
  - ▶ Prohibit granting of freeholds
  - ▶ Customary land can now be registered as private land
- ▶ Secure land rights on customary land not yet issued since enactment in 2016
  - ▶ As such, data on farm households with secure land rights granted under the current Law is not available.
  - ▶ Nonetheless, our data shows farmers with some form of documentation of claim (ownership) over land (title deed, land sales receipt, tax receipt and letter from chief).
- ▶ However, some researchers have argued that the presence of title does not make any difference if the absence thereof does not lead to feelings of insecurity among farmers (see Place and Otsuka, 2001; Broegaard, 2005; Ege, 2017)

# Objectives

- ▶ To determine the impact of land tenure security on nutritional outcomes of households (dietary diversity, calorie intake).
- ▶ To determine the impact of women's land tenure security on nutrition status of households (dietary diversity, calorie intake).

# Conceptual Framework



Source: Adapted from Hoddinott (2011); Aberman, Meerman, & Benson, (2015)<sup>7</sup>

# Data

- ▶ Meerman et al (2015) pointed out that the best indicators for measuring nutrition security are at the individual not household level.
  - ▶ However this is not possible because of high cost of collecting indiv. Consumption data.
- ▶ This study uses the Fourth Integrated Household Survey Data (IHS-4) which has detailed consumption data which can be used to estimate dietary diversity and calorie consumption at household level.
- ▶ It also collects information on land tenure, farm practices and on soils (land degradation)
- ▶ The survey also collects detailed information on land tenure security (with specific questions on land acquisition, land ownership, land disposition, and conflicts over land and how they are settled).



# Empirical Strategy

- ▶ Propensity Score Matching (PSM) technique used to take care of potential sources of selection bias
- ▶ First, estimate determinants of household land tenure security using probit

$$T_i = \beta_0 + \beta_i X_i + \varepsilon_i \quad (1)$$

- ▶ Where  $T_i$  is the binary treatment indicator for household  $i$ ,  $X_i$  are observable treatment characteristics,  $\beta_i$  is the parameter estimate, and  $\varepsilon_i$  is the error term.

# Empirical Strategy

- ▶ I estimate the impact of tenure security on crop productivity to understand the causal link between investments on land and crop productivity.
  - ▶  $Y_i = \beta_0 + \beta_1 X_i + \beta_2 T_i + \varepsilon_i$  (2)
- ▶ Since maize is just one crop, I also estimate household crop income using equation (2) to get a better sense of whether tenure security has influence on all crops grown by a household.
- ▶ Then I estimate the impact of land tenure security on dietary diversity, and calorie intake.
- ▶ I apply equations 1 and 2 to first match households on homogenous household characteristic before applying PSM to estimate dietary diversity and calorie intake effects of land tenure security of FHH

# Empirical Strategy

- ▶ PSM fails to take care of unobserved heterogeneity in observations (endogeneity)
- ▶ We apply a 2SLS IV approach to test for endogeneity of treatment and take care of selection bias.
- ▶ Number of years a household has held land was used as an instrument
- ▶ Regressed Treatment on the instrument and other covariates
  - ▶  $T_i = \gamma Z_i + \varphi X_i + u_i$  (3)
- ▶ The fitted values of T are then substituted for Treatment in the outcome equations.
  - ▶  $Y_i = \alpha X_i + \beta(\hat{\gamma} Z_i + \hat{\varphi} X_i + u_i) + \varepsilon_i$  (4)
- ▶ We run formal endogeneity test to determine which models were affected by endogeneity problem using the following steps: This is manual Durbin-Wu-Hausman test for endogeneity.
  1. First, regress T on Z and the other exogenous covariates X, and obtain the residuals  $\hat{u}_i$ . Regress Y on X, Z, and  $\hat{u}_i$ . If the coefficient on  $\hat{u}_i$  is statistically different from zero, unobserved characteristics jointly affecting the treatment T and outcomes Y are significant
- ▶ We also used the “estat endogenous” command in Stata to test for endogeneity

# Results and Discussion

Variable	n	Insecure tenure	Secure tenure	Difference	Insecure	Secure tenure	Difference
		(1)	(2)	(3)	tenure(4)	(5)	(6)
		Mean/proportion		t-statistic	Mean or proportion		t-statistic
Household dietary diversity score (HDD)	9,646	7.27	8.37***	-18.37***	7.23	7.94	-13.66***
Household size	9,646	4.41	4.69***	-4.99***	4.59	4.40	4.41***
Household Kcal per capita per day	8,347	2443.14	2571.86***	-4.0***	2578.86	2417.89	-6.33***
Cultivated land area (acres)	8,789	1.48	1.41	1.943	1.61	1.66	-1.71**
Practice zero or minimum tillage (0/1)	9,606	0.024	0.033***	1.69***	0.03	0.024	1.54*
Practice mulching on plot (0/1)	9,606	0.0039	0.0042	-0.17	0.006	0.004	1.57*
Soil quality (1=good, 2=fair, 3=poor)	9,606	1.63	1.56***	3.65***	1.60	1.63	5.07
Extent of erosion (1=No erosion, 2=low, 3=moderate, 4=high)	9,605	1.67	1.59***	2.9***	1.64	1.65	-0.57
Maize productivity (kg/ha)	8,360	1117.8	1336.7***	-6.96***	1196.45	1119.20	3.18
Female-headed household (0/1)	9,646	0.31	0.22***	7.16***	0.28	0.31	-3.3***
Household real per capita expenditure (MK)	9,485	151,007.2	192,359.8***	-14.69***	173,953.5	150,199.7	11.02***
Household is poor (0/1)	9,646	54.1	37***	11.74***	42.79	54.75	-10.63***
Household is ultra-poor (0/1)	9,646	20.24	12.51***	6.9***	15.08	20.67	-6.29***
Access to credit	9,062	0.23	0.32***	-7.26***	0.29	0.22	6.7***

# Determinants of Household Land Tenure Security

VARIABLES	Formal tenure		Informal tenure	
	treatment coef	se	treatment coef	se
Rural (1=urban, 0=rural)	0.671***	(0.0511)	-0.453***	(0.0486)
Household size	0.0239**	(0.0104)	-0.0289***	(0.00857)
Household head age	0.0133**	(0.00657)	-0.00526	(0.00518)
Household head age squared	-0.000190***	(6.67e-05)	7.60e-05	(5.16e-05)
Household head gender	0.222***	(0.0391)	-0.0555*	(0.0313)
Household head education				
JCE	0.412***	(0.107)	-0.288***	(0.100)
MSCE	0.270	(0.181)	-0.350**	(0.172)
Non-university diploma	0.402*	(0.231)	-0.550**	(0.227)
University diploma, degree	0.890**	(0.449)	-0.770*	(0.459)
Post-grad degree	0.804	(0.534)	-0.171	(0.599)
Access to credit	0.170***	(0.0372)	-0.161***	(0.0319)
Plot area (ha)	-0.0472***	(0.0120)	0.0196**	(0.00930)
Constant	-1.595***	(0.141)	0.860***	(0.114)
Observations	9,619		9,566	

# Impact of Land tenure on Maize Crop productivity

Formal tenure security

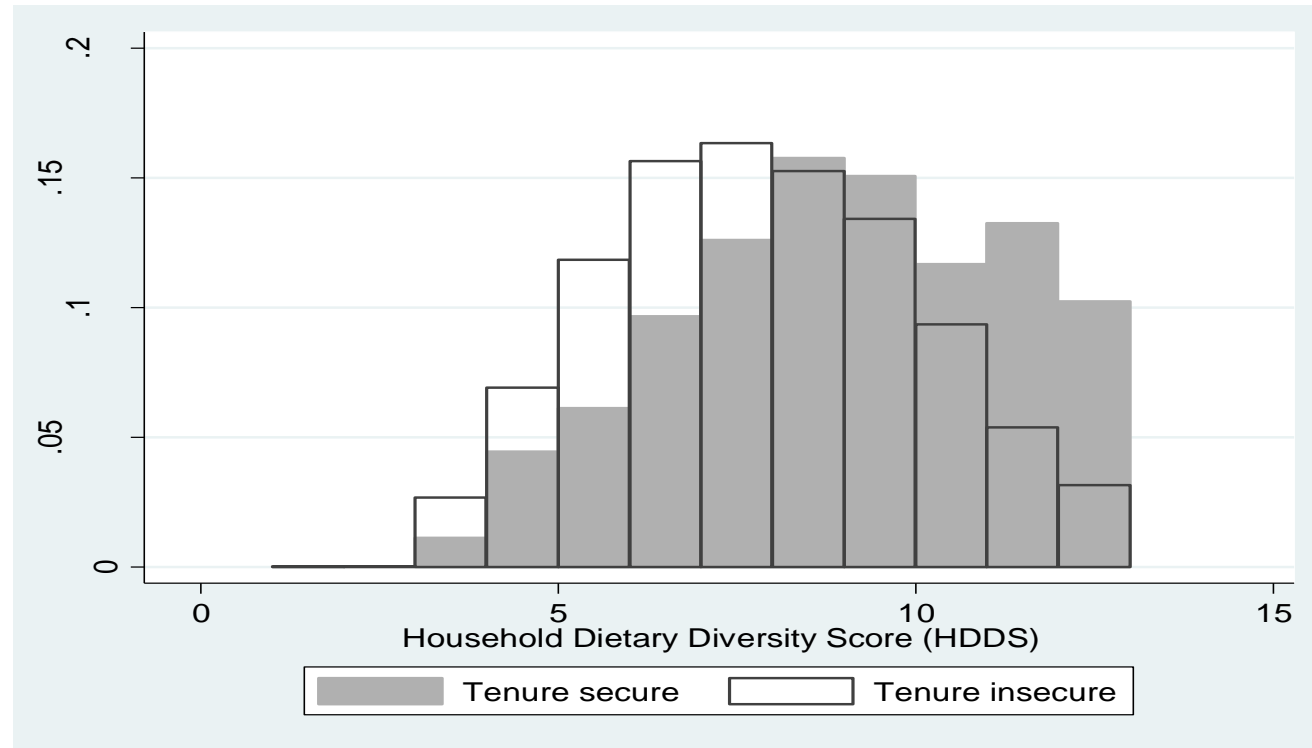
Informal tenure security

Variable	Sample	Treated	Controls	Difference	Treated	Controls	Difference
Maize	ATT	1337.1***	1181.5	155.5***	1089.3	1160.4	-71.1
Productivity (kg/ha)	ATE			107.5			-76.7

# Impact of Land tenure on Crop Income

Variable	Sample	Treated	Controls	Difference	Treated	Controls	Difference
Crop	ATT	63,082.7***	59,746.8	3,335.9	58,146.8	57,070.5	1,076.3
Income (MK)	ATE			10,898.1			-824.2

# Impact of Land Tenure Security on HDDS



Formal tenure security

Informal tenure security

Variable	Sample	Treated	Controls	Difference	Treated	Controls	Difference
HDDS	ATT	8.4***	7.9	0.5***	7.3	7.6	-0.4
	ATE			0.5			-0.4

# Impact of Land Tenure Security on Household Calorie Intake

Variable	Sample	Formal tenure security			Informal tenure security		
		Treated	Controls	Difference	Treated	Controls	Difference
Household per capita kcal per day	ATT	2569.0***	2475.7	93.4**	2403.1	2539.6	-136.4
	ATE			95.0			-128.1



# Determinants of Land Tenure Security among Female Headed Households (FHH)

VARIABLES	Formal tenure security		Informal tenure security	
	Treatment coef	se	Treatment coef	se
Rural (1=urban, 0=rural)	0.798***	(0.104)	-0.445***	(0.0968)
Household size	-0.0229	(0.0219)	-0.0343**	(0.0164)
Household head age	-0.00124	(0.0113)	0.00709	(0.00847)
Household head age squared	-7.01e-05	(0.000113)	-2.43e-05	(8.25e-05)
Household head education				
PSLC	0.274	(0.211)	-0.0328	(0.193)
JCE	-0.222	(0.439)	-0.126	(0.334)
MSCE	0.121	(0.646)	-0.0705	(0.640)
Non-university diploma			-0.157	(0.744)
Marriage system	0.401***	(0.0747)	-0.171***	(0.0622)
Plot area (ha)	-0.0347	(0.0313)	-0.0256	(0.0224)
Access to credit	0.139*	(0.0780)	-0.156**	(0.0618)
Constant	-1.155***	(0.256)	0.644***	(0.197)
Observations	2,900		2,890	

## Impact of Land Tenure Security of FHH on HDDS

Variable	Sample	Formal tenure security			Informal tenure security		
		Treated	Controls	Difference	Treated	Controls	Difference
HDDS	ATT	7.8***	7.3	0.5**	6.8	7.1	-0.3
	ATE			0.6			-0.3

## Impact of Land Tenure Security of FHH on HDDS

Variable	Sample	Formal tenure security			Informal tenure security		
		Treated	Controls	Difference	Treated	Controls	Difference
Household per	ATT	2574.9***	2472.7	102.2	2431.4	2507.0	-75.5
capita kcal per day	ATE			60.5			-68.4

# Regression Approach

- ▶ Endogeneity tests revealed that Treatment was endogenous in the HDDS outcome equation and not in the Household calorie Intake equation.
- ▶ Treatment was also exogenous in the Women tenure security equations (HDDS and Calorie intake)
- ▶ Applied 2SLS-IV regression on HDDS outcome equation
- ▶ Applied OLS on Household calorie intake outcome equation and women tenure security outcome equations (HDDS and Calorie intake).

# Impact of Land Tenure Security on HDDS and Calorie Intake

VARIABLES	(IV)		(OLS)	
	HDDS coef	se	Total calories per capita per day coef	se
Treatment	9.380**	(3.697)	86.63***	(32.93)
Rural (1=urban, 0=rural)	1.686***	(0.172)	538.2***	(43.46)
Household size	0.0428***	(0.0160)	-168.7***	(6.946)
Household head age	-0.00464	(0.0101)	8.218**	(4.156)
Household head age squared	-7.31e-05	(9.94e-05)	-0.0617	(0.0413)
Household head gender	0.486***	(0.0588)	101.0***	(24.79)
PSLC	0.908***	(0.276)	532.7***	(88.88)
JCE	1.347***	(0.359)	295.9**	(149.6)
MSCE	1.276***	(0.477)	70.93	(223.8)
Non-university diploma	2.836**	(1.274)	416.6	(446.1)
University diploma/degree	-0.0530	(1.551)	225.9	(498.9)
Access to credit	0.502***	(0.0644)	196.1***	(26.01)
Plot area (ha)	0.0363**	(0.0159)	28.04***	(6.856)
Constant	6.820***	(0.214)	2,763***	(91.07)
Observations	7,526		8,388	
R-squared	0.005		0.103	

# Women's Land Tenure Security, and HDDS and Calorie Intake

VARIABLES	(OLS)		(OLS)	
	HDDS		Total calories per capita per day	
	coef	se	coef	se
Treatment	0.445***	(0.128)	23.88	(74.01)
Rural (1=urban, 0=rural)	2.073***	(0.151)	658.8***	(92.57)
Household size	0.0361	(0.0242)	-194.3***	(14.08)
Household head age	-0.00462	(0.0122)	9.091	(7.062)
Household head age squared	-8.27e-05	(0.000118)	-0.0826	(0.0686)
PSLC	1.016***	(0.292)	463.7***	(171.9)
JCE	2.005***	(0.501)	407.5	(303.8)
MSCE	0.819	(1.009)	-735.8	(1,052)
Non-university diploma	3.617***	(1.151)	-209.9	(740.4)
University diploma/degree	3.113**	(1.410)	1,434	(1,049)
Marriage system	0.0403	(0.0924)	124.0**	(53.26)
Access to credit	0.622***	(0.0926)	204.2***	(53.17)
Plot area (ha)	0.140***	(0.0323)	60.91***	(17.75)
Constant	6.708***	(0.289)	2,802***	(165.8)
Observations	2,905		2,478	
R-squared	0.145		0.104	

# Conclusions and Policy Implications

- ▶ Tenure Security positively influences adoption of soil and water conservation techniques.
  - ▶ Improved soil fertility, quality and low extent of soil erosion among tenure secure HHDS.
- ▶ Tenure security associated with higher crop productivity.
- ▶ Positive and statistically significant impact of tenure security on HDDS and Calorie intake.

# Conclusions and Policy Implications

- ▶ Positive and statistically significant influence of women's land tenure security on HDDS.
- ▶ Positive but not statistically significant influence of women's land tenure security on household calorie intake
  - ▶ Policies that are targeted at improving household nutrition should have women empowerment at their core.
  - ▶ We can expect registration of customary land under the new Land Laws to significantly accelerate women empowerment and household nutrition in Malawi.
- ▶ Tenure security as defined by formal Law has significant effect on the way households perceive their level of land tenure security and hence provides different development outcomes than the informal definition.

# Acknowledgement

- ▶ Funding for this research came from the Bill and Melinda Gates Foundation through the African Economic Research Consortium (AERC)
  
- ▶ Thank you for your attention