IS SMALL STILL BEAUTIFUL?
THE FARM SIZE-PRODUCTIVITY RELATIONSHIP REVISITED

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Introduction

- Smallholder farms constitute about 70% of farms in Africa, and majority of them are poor and food insecure

- Based on evidence from Asia, it is generally accepted that a smallholder-led strategy holds the best prospects for achieving structural transformation and mass poverty reduction in Africa

Standard version of the structural transformation model (Mellor, 1976; Johnston and Kilby, 1975)

Farming is the primary source of employment for the majority of the population

*Structural transformation process start with **agricultural productivity growth***

*Smallholders but productive farmers with sufficient land **produce a surplus***

Money from the surplus production stimulates demand for goods and services

This in turn stimulates jobs in various off-farm sectors

Rural-urban migration, and gradual urbanization follows

Slow rate of population growth in rural areas and land consolidation

Agriculture declines in its relative share of total GDP over time

CONCERNS about the viability of a smallholder-led growth strategy in Africa

1. Small-scale farming in Africa has historically provided very LOW RETURNS to labor

2. Mounting POPULATION pressure and shrinking FARM SIZES

3. UNSUSTAINABLE forms of agricultural intensification with population growth

4. Changing FARM STRUCTURE-- rising proportion of land among medium-scale farms (5-100 hectares)
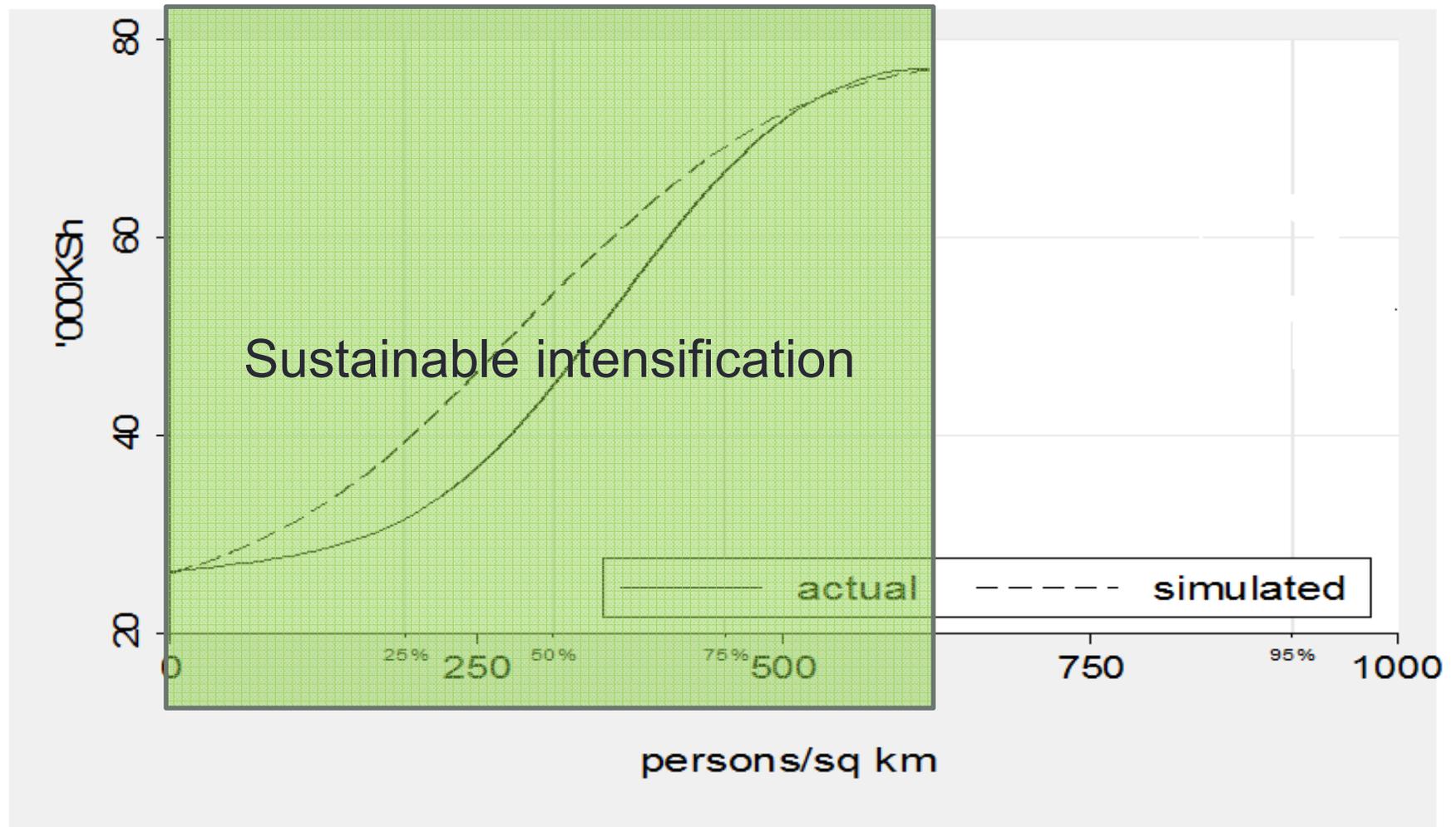
Sub-Saharan Africa: only region of world where rural population continues to rise past 2050

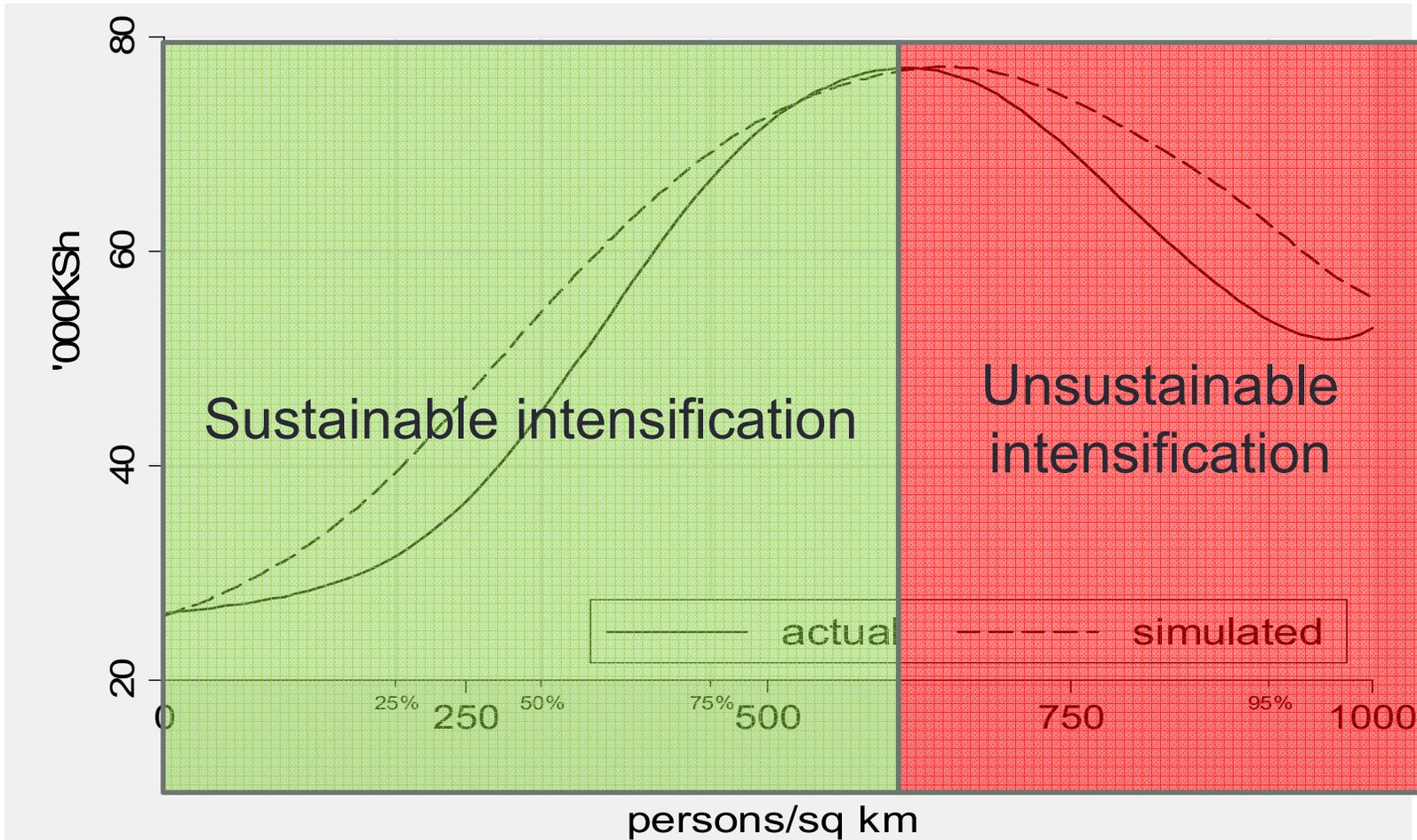**Total Rural Population (millions)**
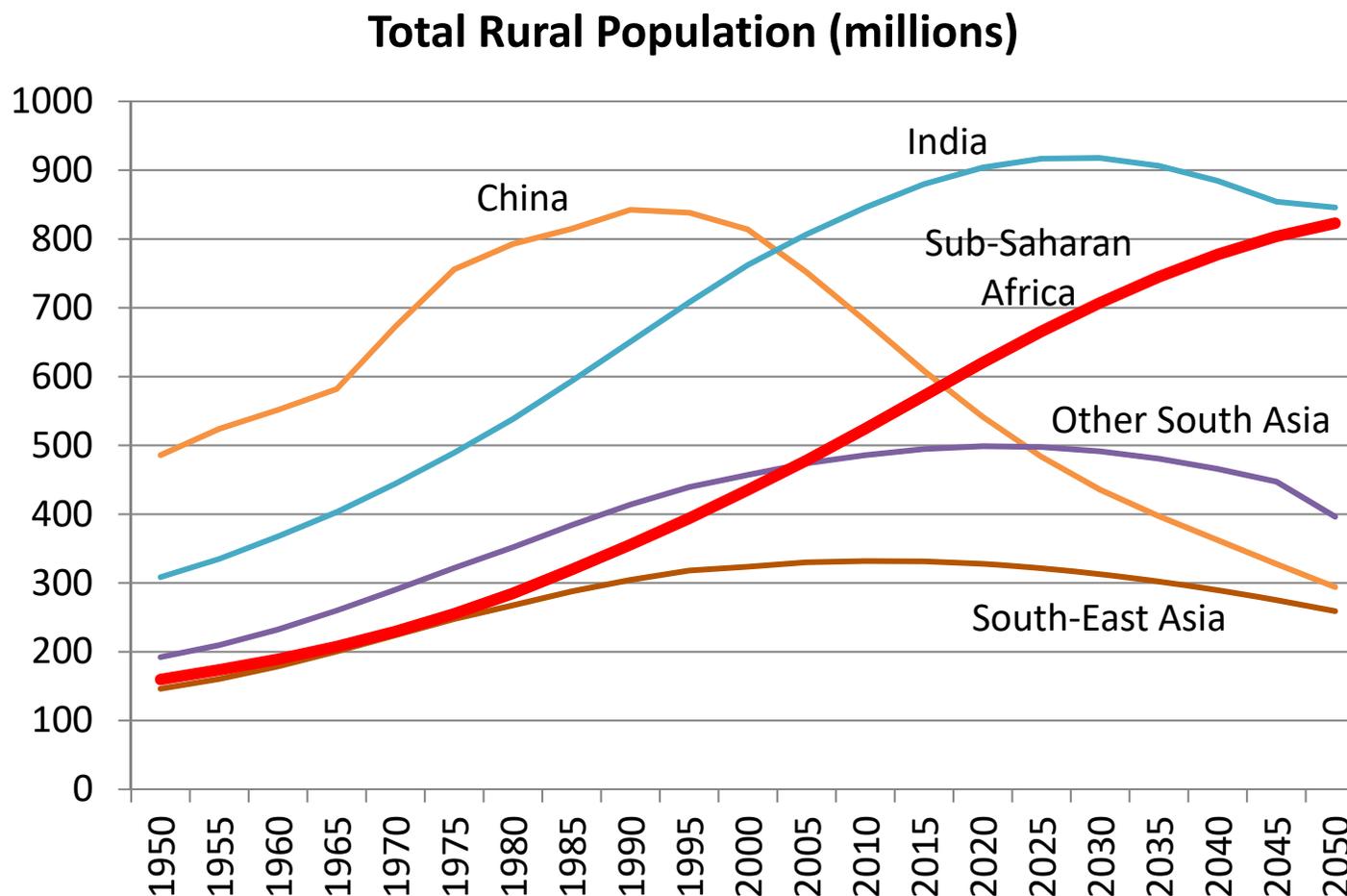
Source: UN 2013

Agricultural intensification- Kenya

Figure 4: Net crop income per hectare cultivated

Intensification tends to plateau at about 500–600 persons/km²

Figure 4: Net crop income per hectare cultivated


Source: Tegemeo Institute Panel Data, Kenya

Changes in farm structure in Tanzania (2008-2012), LSMS/National Panel Surveys

| Farm size	Number of farms (% of total)		% growth in number of farms between initial and latest year	% of total operated land on farms between 0-100 ha		
	2008	2012		2008	2012	
0 – 5 ha	5,454,961 (92.8)	6,151,035 (91.4)	12.8	62.4	56.3	- 6.1%
5 – 10 ha	300,511 (5.1)	406,947 (6.0)	35.4	15.9	18.0	
10 – 20 ha	77,668 (1.3)	109,960 (1.6)	41.6	7.9	9.7	+ 6.1%
20 – 100 ha	45,700 (0.7)	64,588 (0.9)	41.3	13.8	16.0	
Total	5,878,840 (100%)	6,732,530 (100%)	14.5	100.0	100.0	

# Rise of the medium-scale farmers
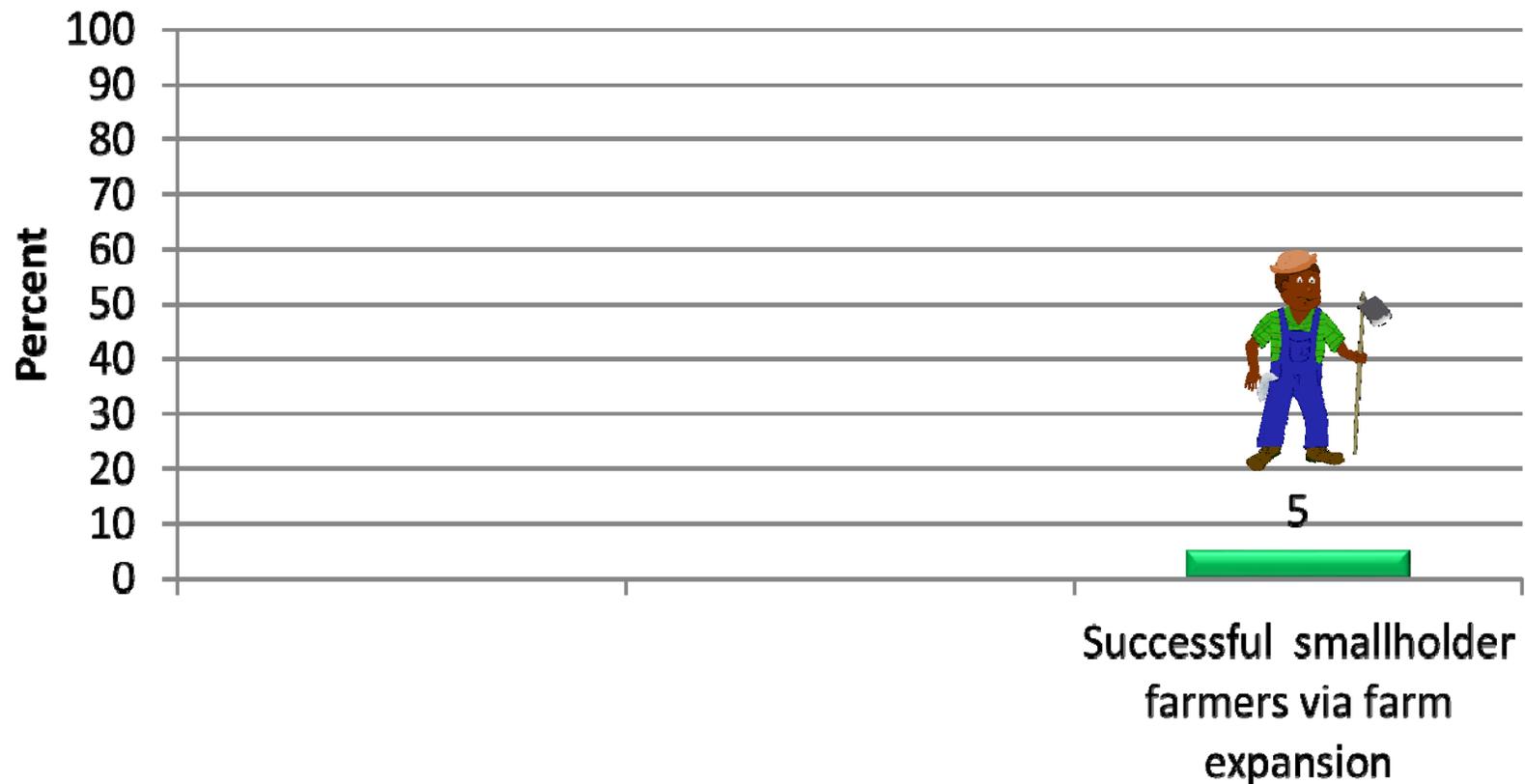
Three sub-categories of medium scale farmers (Kenya, Zambia, Ghana)

Rise of the medium-scale farmers

Three sub-categories of medium scale farmers: Kenya, Zambia, Ghana

35 — "Elite rural based"
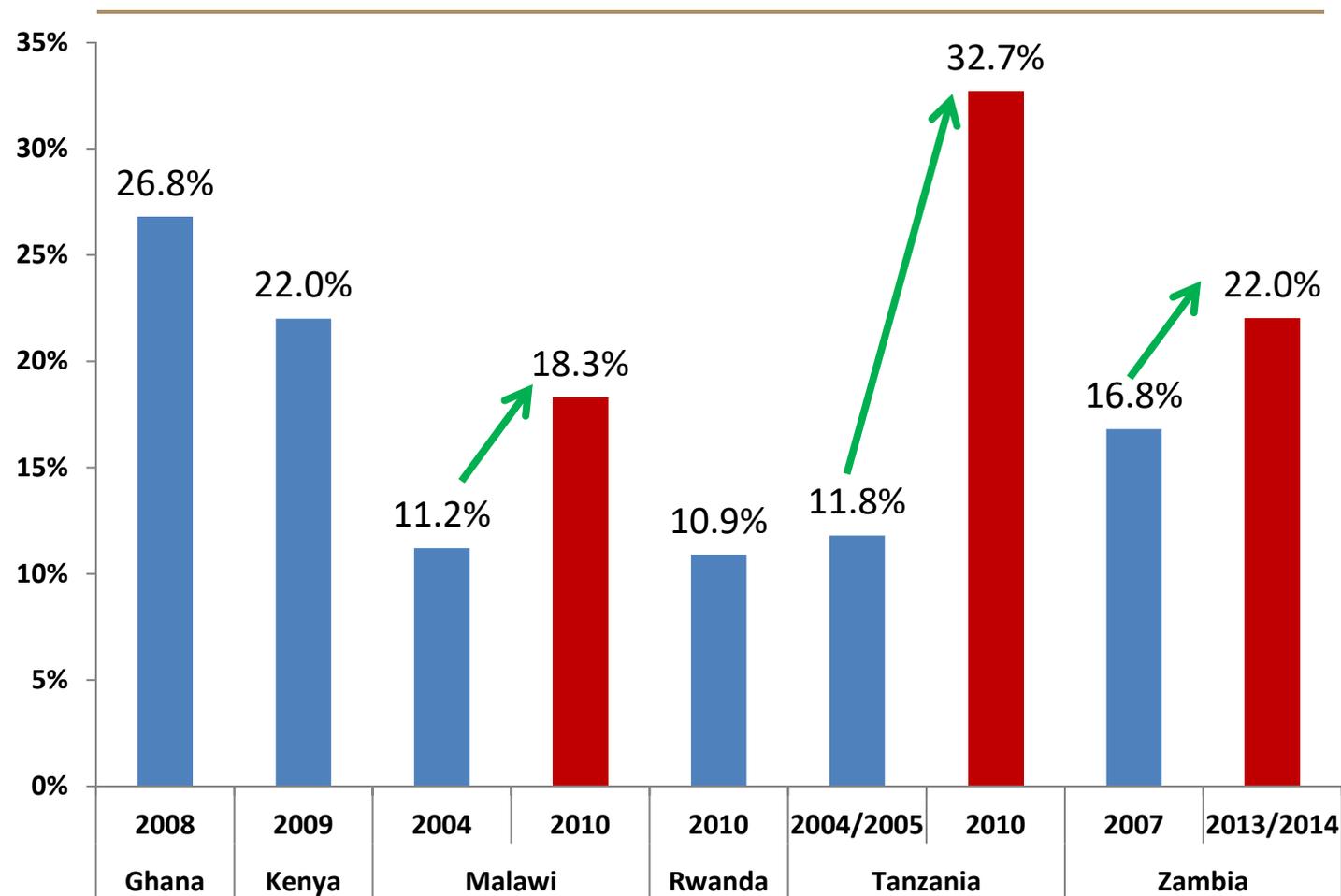
5 — Successful smallholder farmers via farm expansion
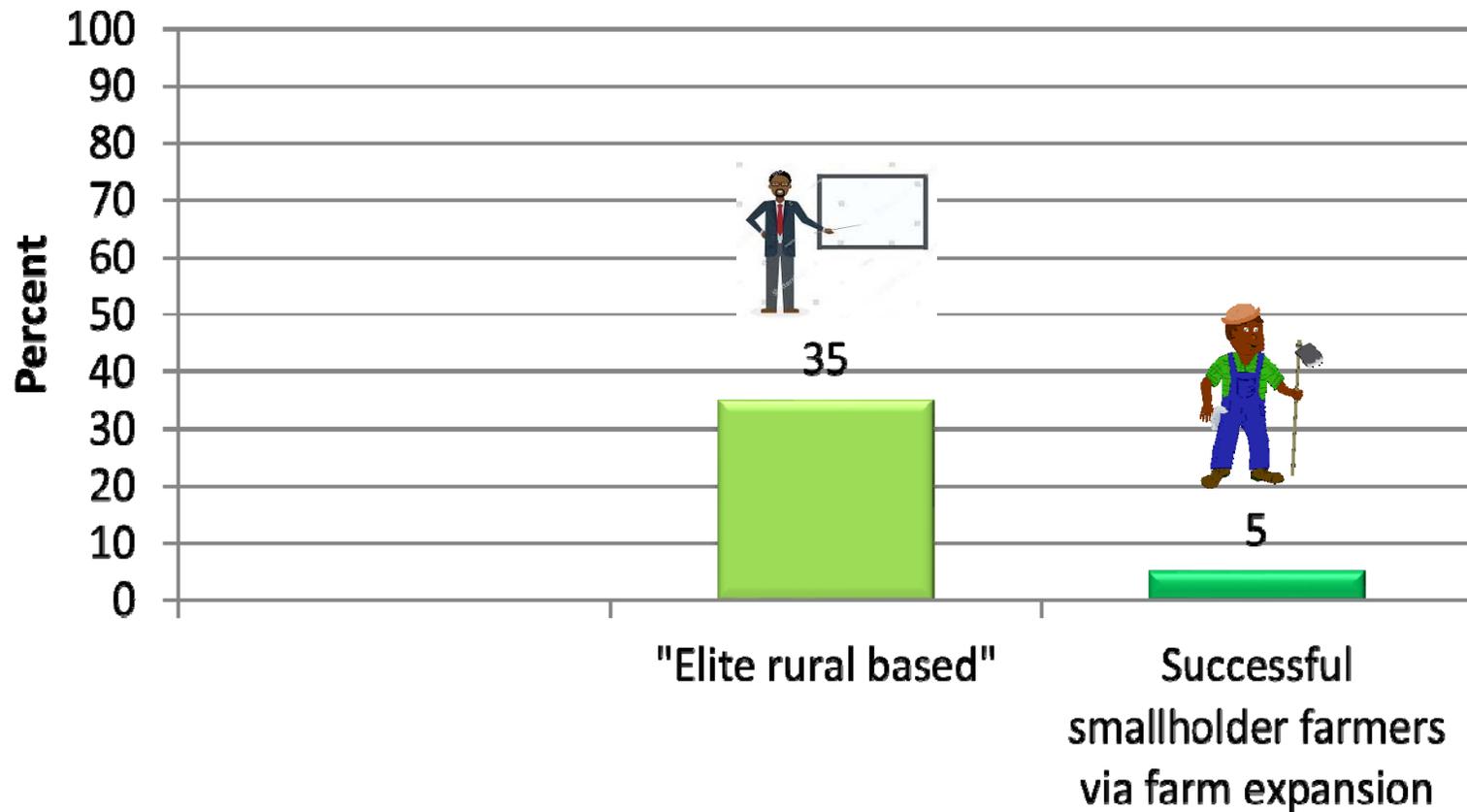
Rise of the medium-scale farmers

Three sub-categories of medium scale farmers: Kenya, Zambia, Ghana
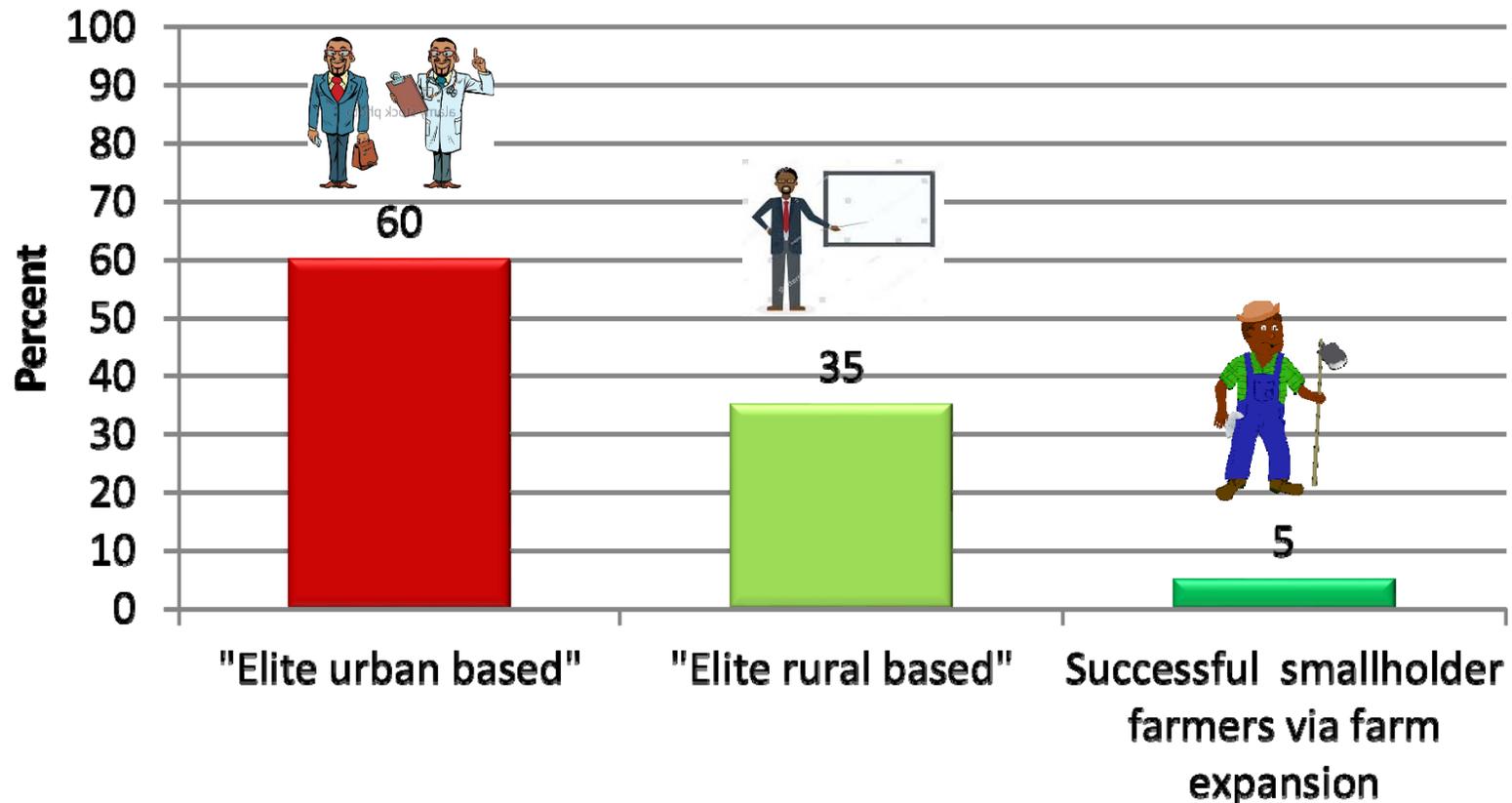
% of National Landholdings held by Urban Households

Source: Demographic and Health Surveys, various years between 2004-2014.

- These CONCERNS seem incongruous, at least on the face of it, with research findings that small farms are relatively more productive than larger farms

- Thus, renewed interest in the Inverse Farm Size-Efficiency Relationship (IR) among development economists

Tests of the IR hypothesis take on even greater policy importance in light of recent studies questioning the viability and even the objectives of promoting small-scale agriculture in Africa

"Favoring small farmers is romantic but unhelpful" [Collier and Dercon, 2014]

Contribution

1. Explore the IR hypothesis over a much wider range of family managed farm ranging between 0 and 100 ha

2. Study is based on a wider set of productivity and profitability measures

3. Account for both variable and fixed costs when computing the cost of production that earlier studies may have overlooked

Methods [I]

- Use neo-classical production function approach

- Farm output or productivity depends on land and labor

  - $Q_i = \alpha + \beta A_i + X\delta + W\tau + Z\pi + \varepsilon_i$

  - Dependent variable (Q_i): measure of agricultural productivity, profitability, return on family labor

    - Gross/net value of output per operated farm size

    - Total factor productivity, computed following Li et al. (2013)

    - Productivity index: gross value of crop output/production costs

    - Gross/net value of output per unit of family labor

  - A_i is the planted area- our variable of interest

Data sources and analysis

- Data came from about 500 households both smallholders and medium-scale farms

- Data analysis:

  - Descriptive,

  - Non-parametric regressions

  - Econometric regressions

Descriptive

&

Econometrics

Results

Bivariate results [I]
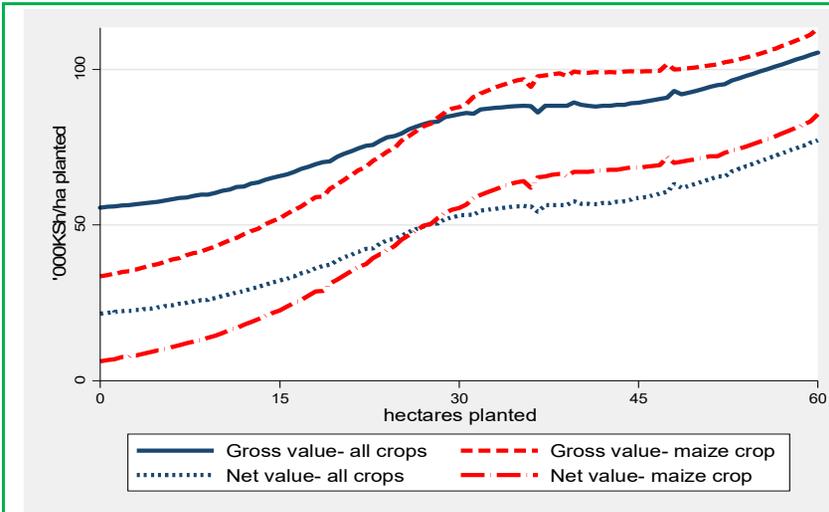
Figure 1: NPR results in the full sample

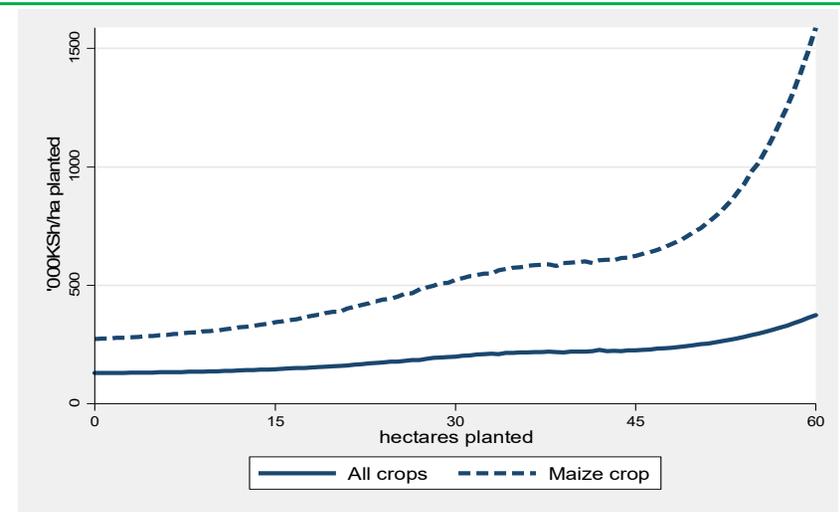**Figure 2(a): Value of crop production/ha planted**

Figure 2(b): Total factor productivity

Figure 2(c): Gross value of crop /total production costs

Figure 2(d): Gross value of crop production per resident adult

Notes: Non-parametric regression using Nadaya-Watson Approach, bandwidth=8

Descriptive results [II]
Figure 2: NPR results in smallholder farms

Figure 2(a): Value of crop production/ha planted
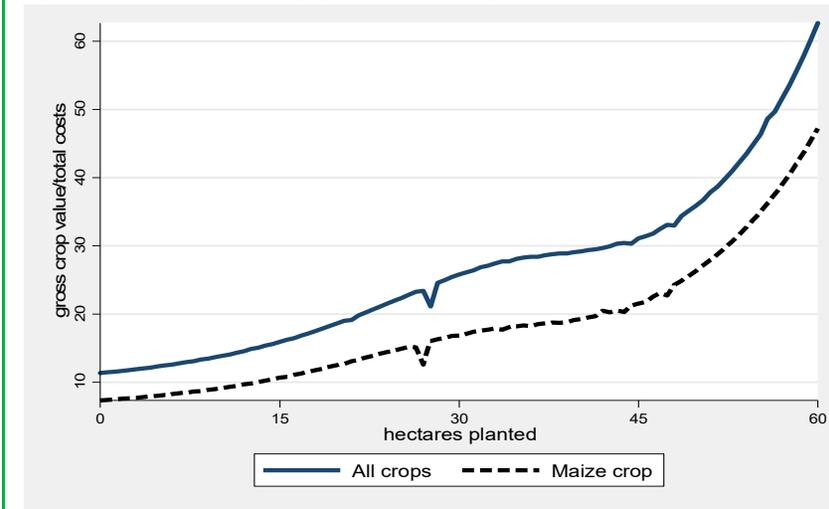
Figure 2(b): Total factor productivity

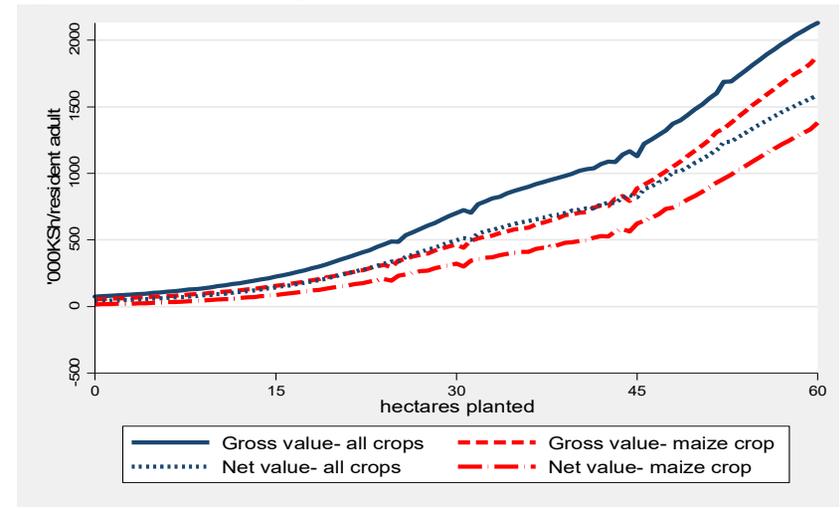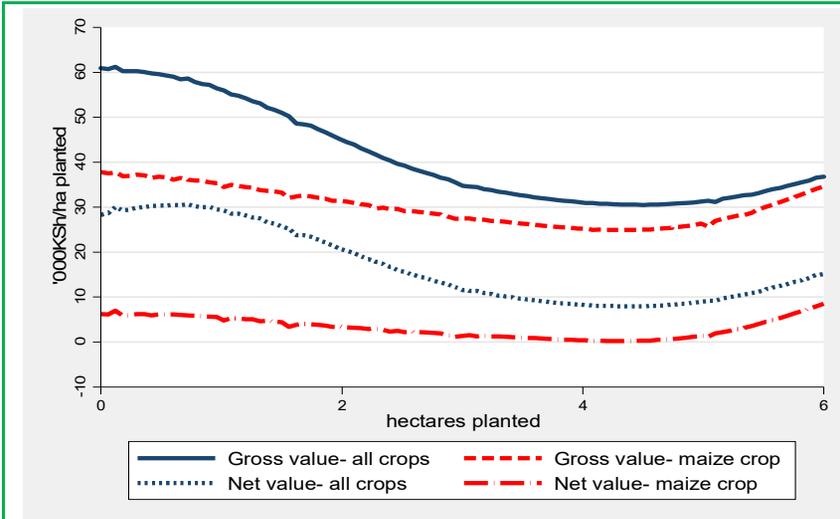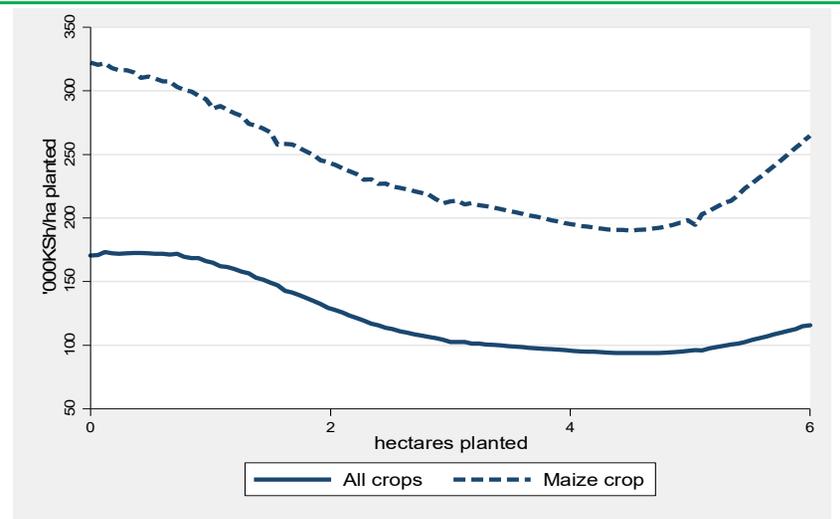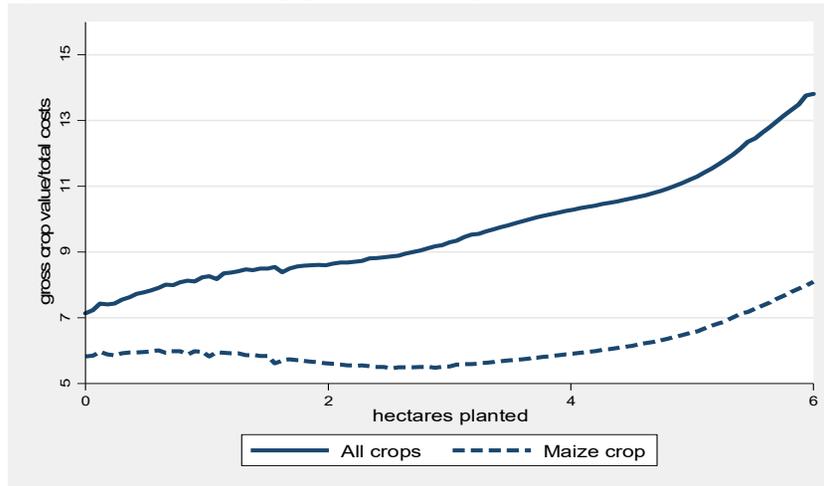**Figure 2(c): Gross value of crop /total production costs**
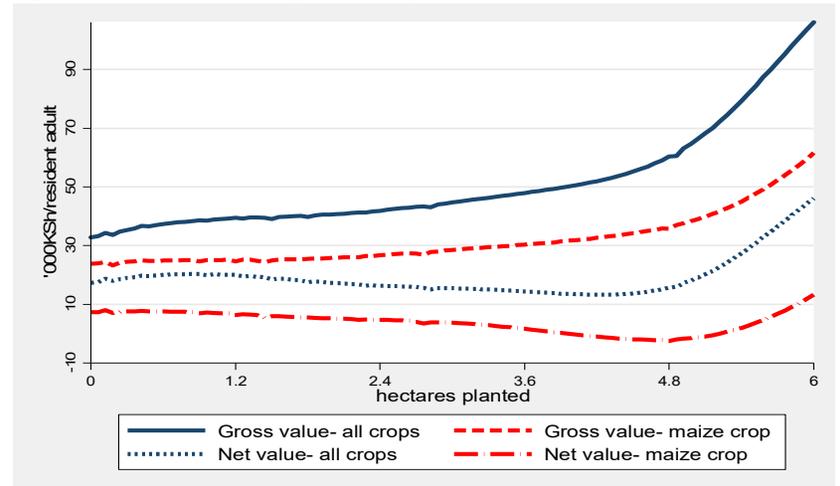
Figure 1(d): Value of crop production per resident adult

Notes: Non-parametric regression using Nadaya-Watson Approach, bandwidth=0.8

Descriptive results [IV]

Figure 4: NPR results of crop production costs
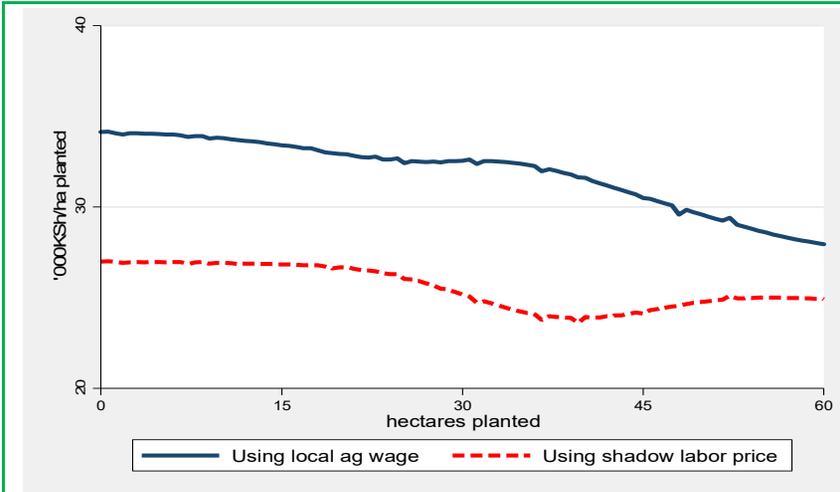
Figure 4(a): Aggregate production costs/ha planted

Figure 4(b): Disaggregated production costs/ha planted

Figure d(c): Labor costs/ha planted
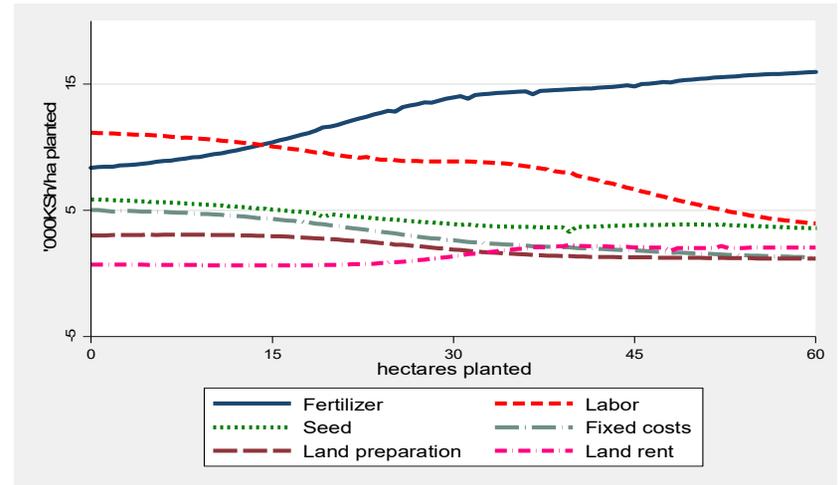
Figure 3(d): Disaggregated labor costs /ha planted

Notes: Non-parametric regression using Nadaya-Watson Approach, bandwidth=8

Econometrics Results

Table 4: OLS Regression Estimation Results of Land Productivity

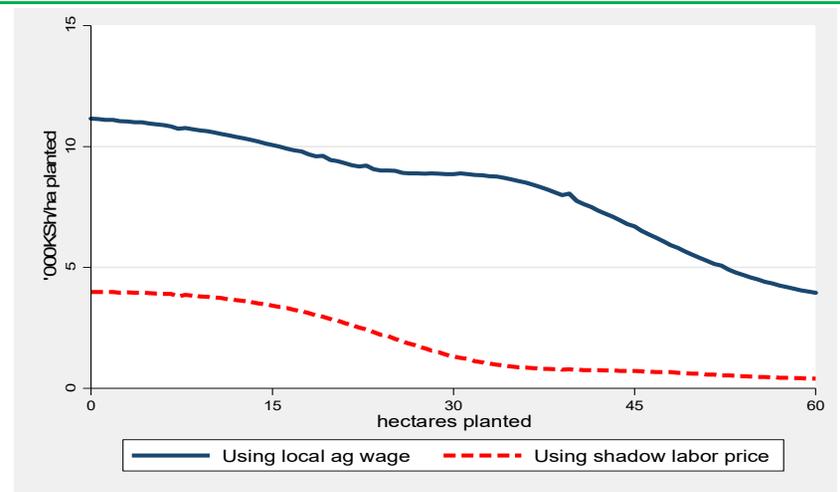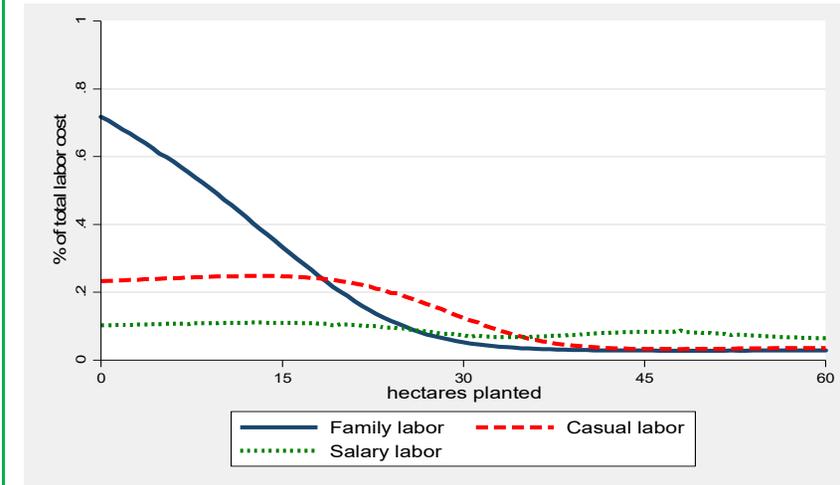| Dependent variable:	Gross value of crop production/ha '000KSh			Net value of crop production/ha '000KSh	
Model:	Model I(a)	Model I(b)	Model I(d)	Model II(a)	Model II(b)
Ha planted	1.61***	0.83***	1.87***	2.41***	2.01***
Sq. ha planted '00	-1.02***	-0.22***	-1.51***	-1.87***	-1.51***
Exogenous variables		YES	YES		YES
Inputs & management practices			YES		
Household location dummies	YES	YES	YES	YES	YES
Sample (1=2012; 0=2010)	-1.02	-10.28	1.24	-4.86	-8.58
_cons	77.62***	-293.34	-107.87*	42.51***	-81.92
Observations	479	479	479	479	479
R Square	0.10	0.17	0.57	0.24	0.28
Turning point (ha)	78.79	187.54	62.12	64.45	66.61

Table 5: OLS Regression Estimation Results of TFP and Productivity Index

Dependent variable:	Total factor productivity '000KSh			Productivity index	
Model:	Model I(a)	Model I(b)	Model I(d)	Model II(a)	Model II(b)
Ha planted (ha)	0.10***	0.07***	0.11***	0.03***	0.03***
Sq. ha planted '000	-0.61***	-0.36***	-0.81***	0.03***	0.03***
Exogenous variables		YES	YES		YES
Inputs & management practices			YES		
Household location dummies	YES	YES	YES	YES	YES
Sample (1=2012; 0=2010)	-0.23	-0.54	-0.05	-0.54	-0.58
_cons	4.32***	-7.25	-1.06	3.29***	0.06
Observations	479	479	479	479	479
R Square	0.18	0.23	0.38	0.20	0.26
Turning point (ha)	81.81	103.13	69.71	-441.77	-515.77

Table 6: OLS Regression Estimation Results of Return on Family Labor

Dependent variable:	Gross value of crop production/ha '000KSh			Net value of crop production/ha '000KSh	
Model:	Model I(a)	Model I(b)	Model I(d)	Model II(a)	Model II(b)
Ha planted (ha)	30.54***	30.52***	30.67***	19.91***	19.74***
Sq. ha planted	0.13***	0.14***	0.13***	0.15***	0.15***
Exogenous variables		YES	YES		YES
Inputs & management practices			YES		
Household location dummies	YES	YES	YES	YES	YES
Sample (1=2012; 0=2010)	16.65	7.18	4.37	3.10	-1.16
_cons	-8.45	-224.50*	-178.77	-7.57	-133.61
Observations	479	479	479	479	479
R Square	0.66	0.67	0.67	0.63	0.64
Turning point (ha)	-114.59	-112.29	-114.91	-67.11	-65.33

Table 7: OLS Regression Estimation Results of Land Productivity- SMALLHOLDER SUB-SAMPLE

Dependent variable	Model	Ha planted (ha)	Sq. ha planted	Exogenous variables	Inputs & management practices	Turning point (ha)
Gross value of crop production per ha planted '000KSh	I(a)	-21.90*	3.72*			
	I(b)	-26.19*	4.36*	yes		3.00
	I(c)	-13.83*	2.48*	yes	yes	2.78
Net value of crop production per ha planted '000KSh	II(a)	-19.95***	3.56***			2.8
	II(b)	-22.35***	3.92***	yes		2.85
Total factor productivity '000KSh	III(a)	-1.41***	0.24***			2.96
	III(b)	-1.58***	0.26***	yes		3.01
	III(c)	-1.13***	0.19***	yes	yes	2.91
Crop productivity index [crop value/total costs]	IV(a)	-1.52***	0.25***			3.08
	IV(b)	-1.55***	0.25***	yes		3.10
	IV(c)	-1.25***	0.20***	yes	yes	3.06
Gross value of crop production/adult person '000KSh	V(a)	11.79***	0.96***			-6.16
	V(b)	10.72***	1.00***	yes		-5.36
	V(c)	11.01**	0.95**	yes	yes	-5.80
Net value of crop production/adult person '000KSh	VI(a)	-2.40**	1.73**			0.69
	VI(b)	-4.28**	2.00**	yes		1.07

Conclusions

1. Small may NOT be necessarily beautiful any more

   - May be farm sizes have become too small and too degraded to generate any meaningful surplus

   - May be medium-scale farms are now able to overcome diseconomies of scale challenges

   - We have reasons to believe that capitalized and educated MS farms are likely to be more productive

2. Production efficiency, while relevant, should not be the ONLY factor in guiding agricultural and land policies

3. Should government policy support small or medium farms?

Conclusions

1. Small may NOT be necessarily beautiful in family managed farms

   - May be farm sizes have become too small

   - May be medium-scale farms are now able to overcome scale challenges

2. Production efficiency, while relevant, should not be the ONLY factor in guiding agricultural and land policies

   - Especially in countries where over 70% of farming households are smallholders and are poor

   - Which scale has the largest multiplier and employment effects?

3. Should government policy support small or medium farms?

Policy implications

1. Production efficiency, while relevant, should not be the ONLY factor in guiding agricultural and land policies

2. All depends on the government's development objective:

3. Should government policy support small or medium farms?

   - All depends on the government's development objective and land resource endowment:

     - Production for domestic food self sufficiency and export market?

     - Broad based growth for reduced food insecurity and poverty reduction?

Thank
You