

Food and Agriculture Organization of the United Nations

Social Protection

From Protection to Production

Livelihoods and Food Security Programme: Baseline data analysis for a LEWIE model

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Alleviating Poverty Worldwide

A quick chronology

- December 2013: LFSP signed by FAO to manage the Agricultural Productivity and Nutrition (APN) component
- February 2015: DFID contracted Coffey International Ltd. (Coffey) as Monitoring, Reporting and Evaluation (MR&E) service provider for LFSP.
- May 2015: main LFSP activities started.
- July 2015-August 2015: LFSP baseline data collection
- November 2015: Coffey baseline report
- March 2016: Baseline data released

LFSP targeting approach

- Categorical: eight districts selected on the basis of poverty levels, food insecurity, stunting prevalence, potential for market development, excluding districts with other major donor-funded programmes related to livelihoods and food security
- Beneficiaries: category B farmers, smallholders in communal areas, who have land and labour. Priority given to households already active in existing farmer associations/groups

Main conclusions from Coffey baseline report

- Food insecurity slightly less widespread than envisaged in the LFSP business case.
- Significant proportion of households receiving food aid
- Limited livelihoods and assets owned, highlighting the importance of investment in community assets
- Agricultural productivity is low, major constraint is access to services (training, inputs, finance)
- Lack of ag extension, but some good ag practices are used by farmers

Objectives of the LEWIE study

1. Statistical comparison of treatment and non-treatment districts
2. Assessment of farmers' classification
3. Estimate of farmers' efficiency
4. Design a Local Economy Wide Impact Evaluation (LEWIE) model and present simulations of impacts of LFSP on key outcomes under alternative scenarios

Are treatment (T) and non-treatment (NT) districts different?

- In terms of socio-demographic characteristics, the two groups are substantially equivalent

	T	NT	Total	Diff	
# members	5.24	5.23	5.24	0.004	
# females	2.62	2.62	2.62	0.003	
# members fit-to-work	2.11	2.05	2.09	0.058	
members >60 years old	0.62	0.73	0.65	-0.111	**
orphan living in the household	0.31	0.37	0.33	-0.06	**
# able-bodied members	2.11	2.09	2.11	0.025	
share of dependents	0.54	0.54	0.54	0.007	
female headed household	0.26	0.3	0.27	-0.043	
age of head of the household	50.83	50.81	50.83	0.021	
Single head (% hh)	0.23	0.28	0.25	-0.05	**
Married head (% hh)	0.74	0.7	0.73	0.041	*
Widow head (% hh)	0.18	0.21	0.19	-0.024	
Head with primary education or above (% hh)	0.89	0.89	0.89	0.004	
Observations	2,526				

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female headed household	0.26	0.3	0.27	-0.043	
age of head of the household	50.83	50.81	50.83	0.021	
Single head (% hh)	0.23	0.28	0.25	-0.05	**
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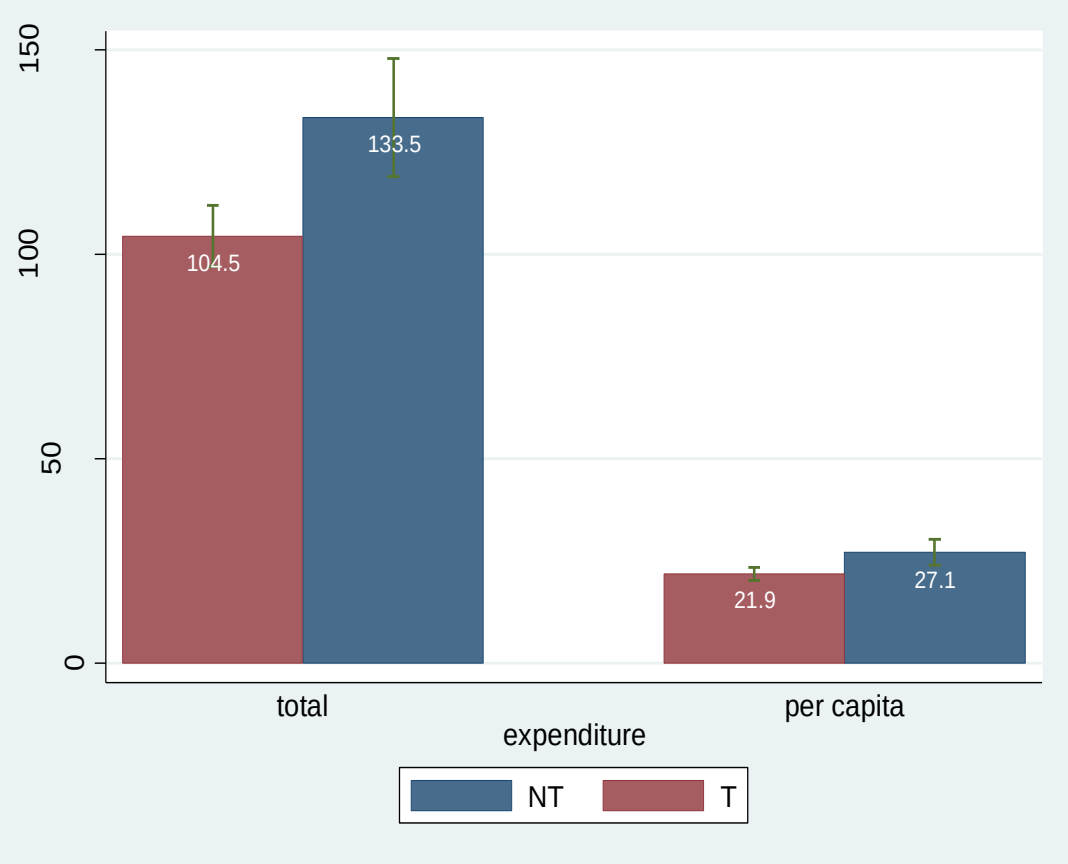
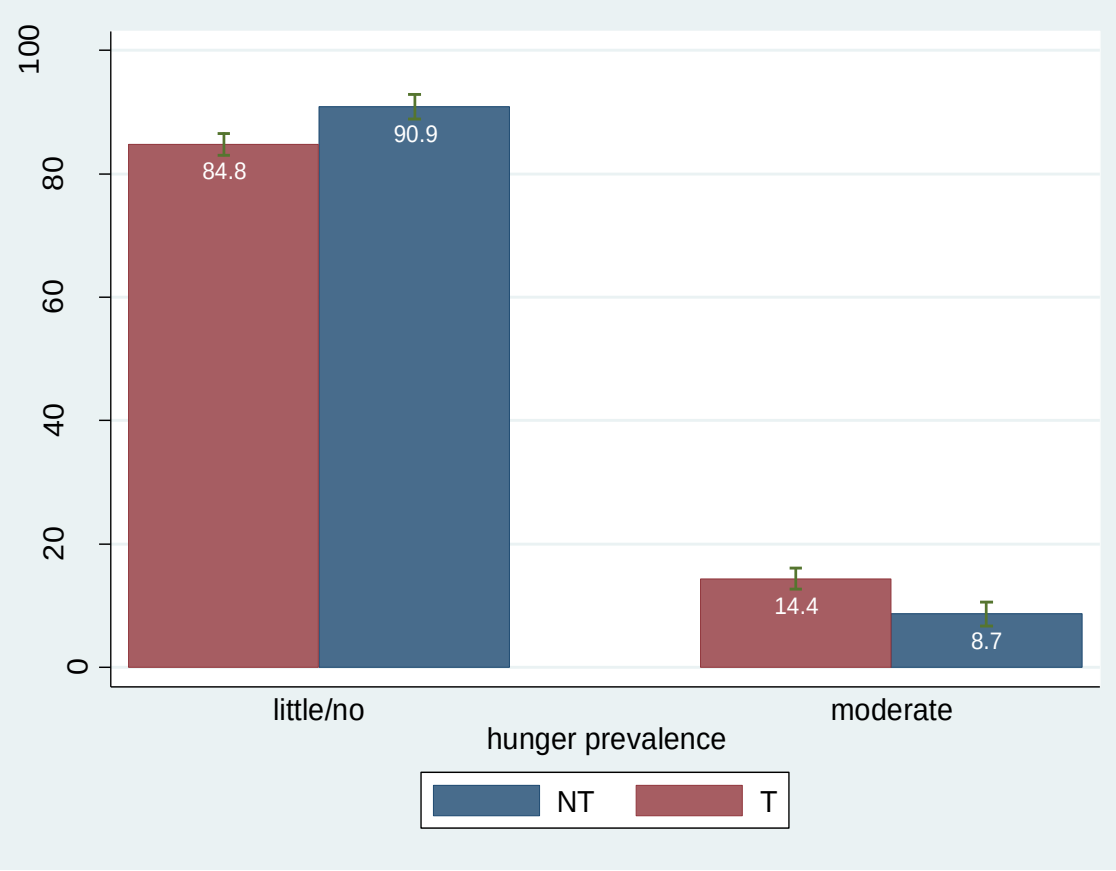
Households in NT districts are slightly better-off than in LFSP areas

They consume more



Suffering less from hunger



Few additional minor differences in relation to livelihoods

a) contract farming is much more widespread in T areas (12% vs. 3%) and the NT areas tend to purchase inputs more frequently than in the T group.

b) Value of sales, value of harvest, livestock and non-farm businesses are not statistically different between areas

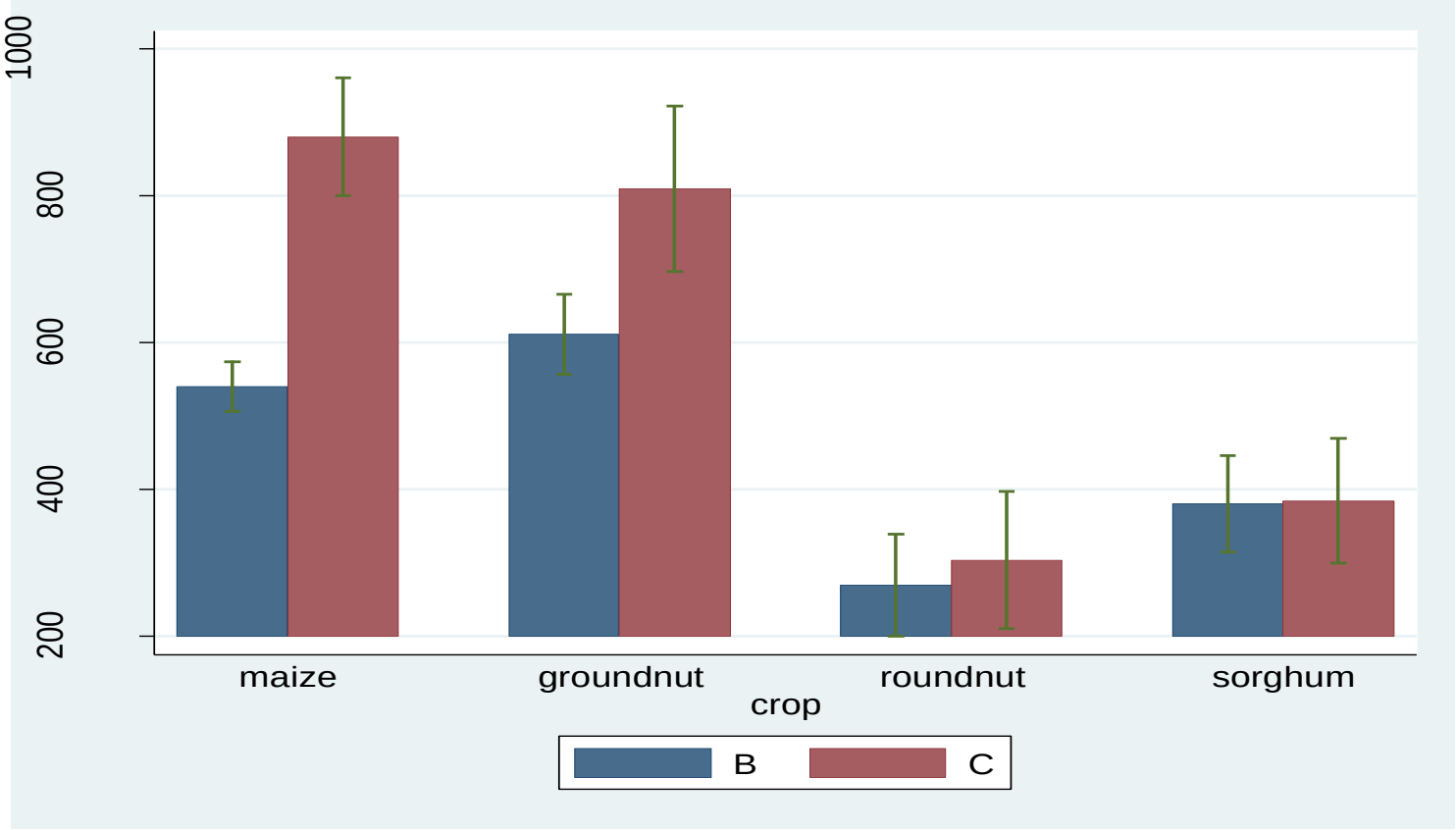
- Need of a robust matching analysis for the LFSP impact evaluation at follow-up.

Farmers' classification

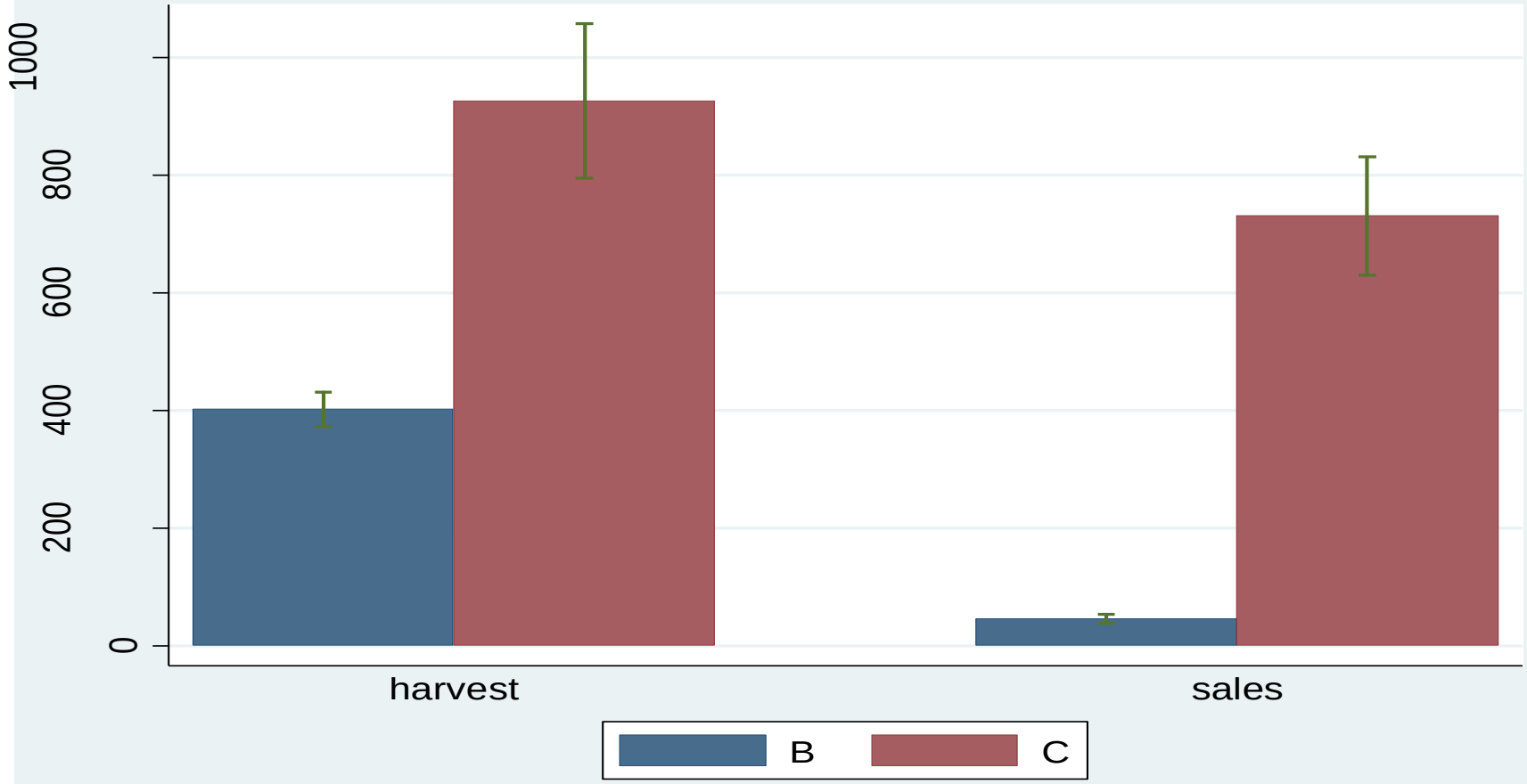
- For the purpose of evaluating the direct impacts of the LFSP we need the target population (the group eligible for the program) → "B" farmers
- "A" & "C" farmers are needed for the LEWIE study (the indirect impacts of the program)
- Unfortunately data on "A" farmers not collected in the baseline survey (three conditioning questions)
- For the LEWIE study, we collected information for "A" farmers from the 2015 ZimVac Rural Livelihood Assessment. Many limitations in doing so, but no alternatives available

“C” farmers are more productive…

- “C” farmers included, though not easy to identify them. We select those with contract farming and selling more than half of their produce.
- Many significant differences between C and B farmers



… Generating more income from crop production

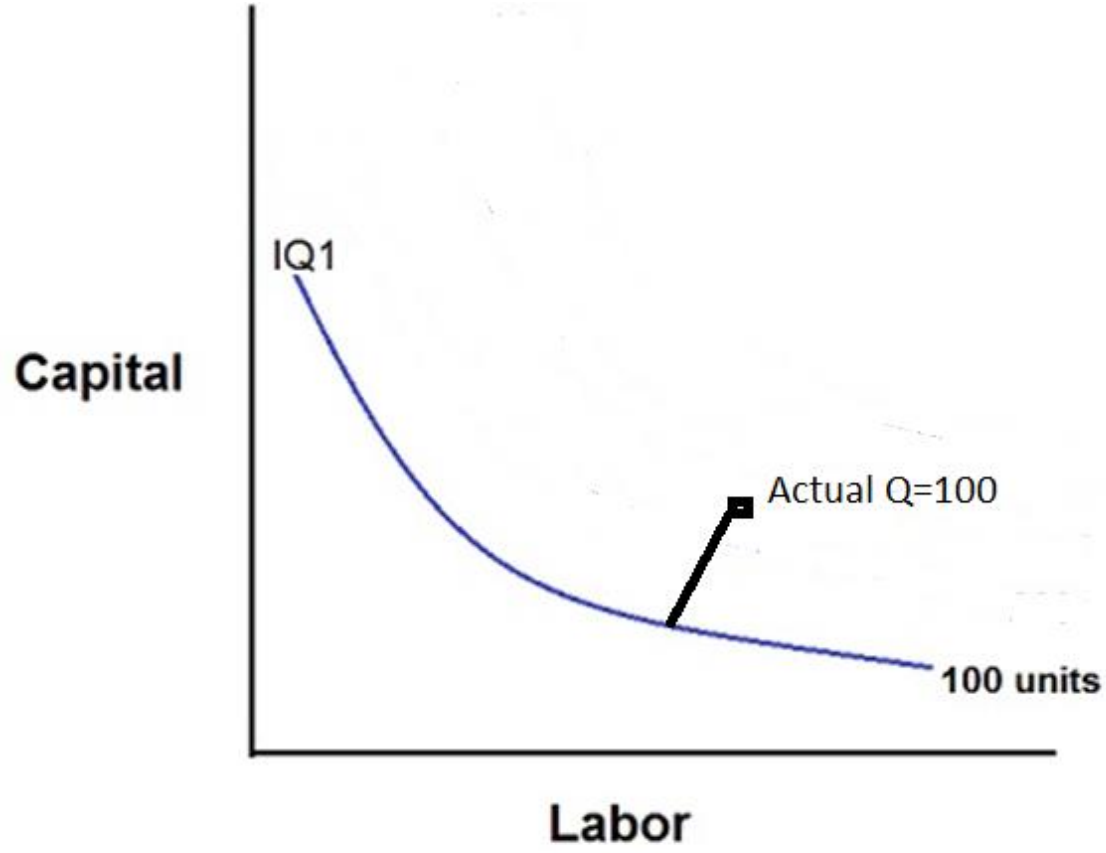


Note: monetary values of previous season

What is farmers' technical efficiency?

- Process of resources allocation
  - The maximum attainable output from given level of inputs or
  - The minimum level of input use in the production of a given level of output
- A relative concept
- Unobservable
- To be estimated econometrically or with linear programming
- We do NOT deal with cost efficiency

Isoquants and efficiency



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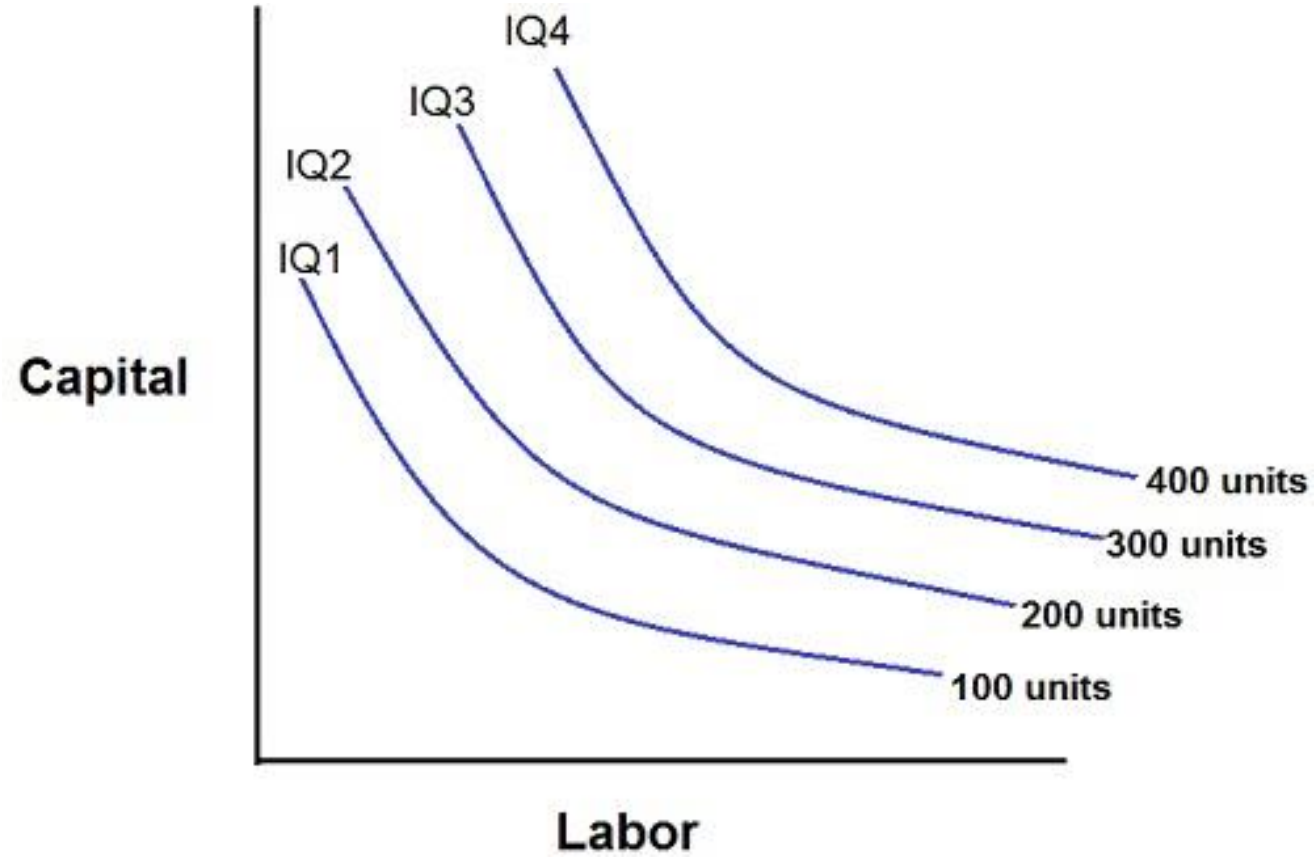


Econometric approach to efficiency estimation

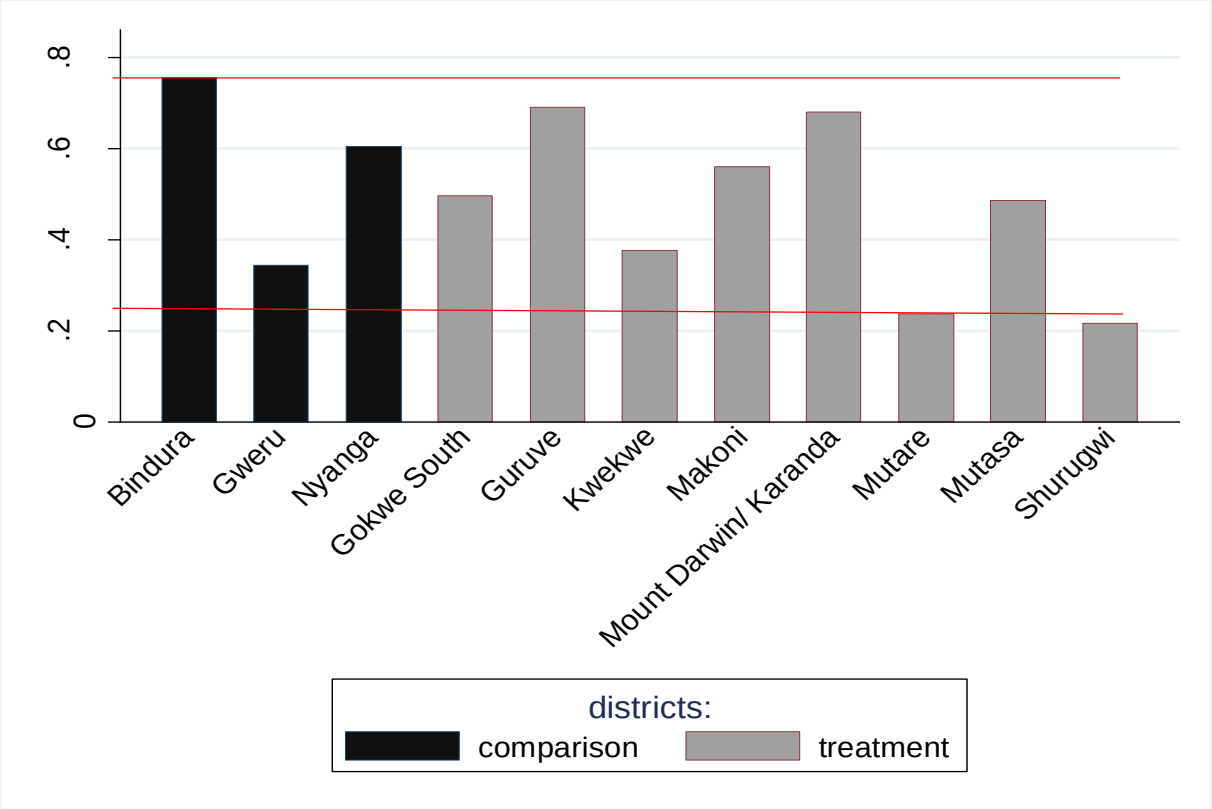
- Stochastic frontier analysis (SFA) for efficiency measurement better suited than Data Envelopment Analysis (DEA) in our context:
  - Include exogenous determinants of inefficiency, variables that are not inputs of production (land, capital, labour, etc.) but affect the productive unit performance
  - Simultaneous estimation of the frontier (the maximum attainable output) and of the inefficiency
- Model technology with a classical production function:
  - 1 Output = Total value of harvest
  - 5 Inputs = land, family labour, hired labour, fertilizers, agricultural assets
- Controlling for other important aspects of production process: use of organic fertilizer, use of herbicides, use of pesticides, hand-weeding

Farmers are estimated to be 49.5% efficient

- On average, no significant differences between T and NT groups, but…

Farmers are estimated to be 49.5% efficient

- On average, no significant differences between T and NT groups, but…
- … lots of heterogeneity across districts



Knowledge is a major determinant of inefficiency

- One additional training activity predicts a significant reduction of inefficiency by 8.7%
- Practicing crop rotation and mulching predict a significant reduction of inefficiency by 47.3 and 25.7%
- No effect from being a B or C farmer
- Unfortunately data do not allow to include relevant structural constraints on services supply (distance to markets/schools/hospitals, access to power grid, etc.)

Conclusions

- The data collection exercise confirms the validity of the original evaluation design
- Sampling revealed lots of heterogeneity among the “B“ farmers, some of them are definitely better-off (“C” farmers)
- “A” farmers not included in the baseline data, for the LEWIE analysis we need other sources
- Econometric analysis reveal high level of farmers’ inefficiencies, which are related to knowledge gaps.
- How can agricultural practices be promoted? Which technology can give best outcomes?

Thank you

Maita zvenyu



Local Economy-wide Impact Evaluation (LEWIE) of the 2015 Zimbabwe Livelihoods and Food Security Programme (LFSP)

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How LFSP Treats Entire Local Economies

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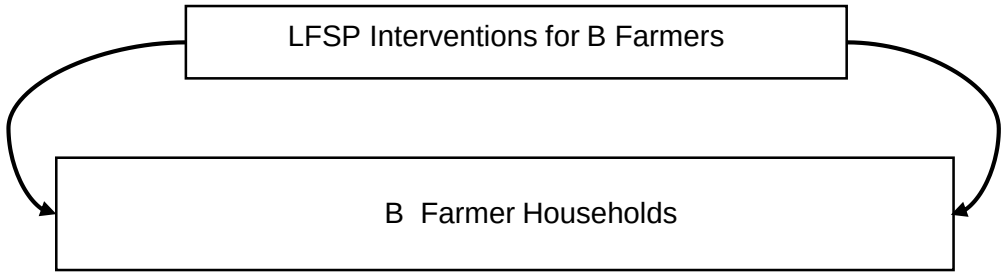
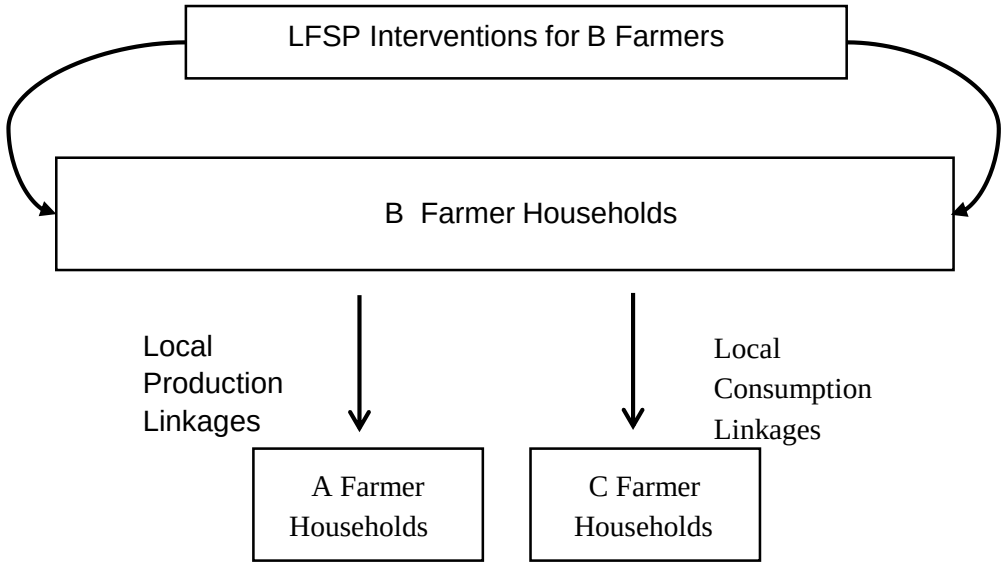


How LFSP Treats Entire Local Economies



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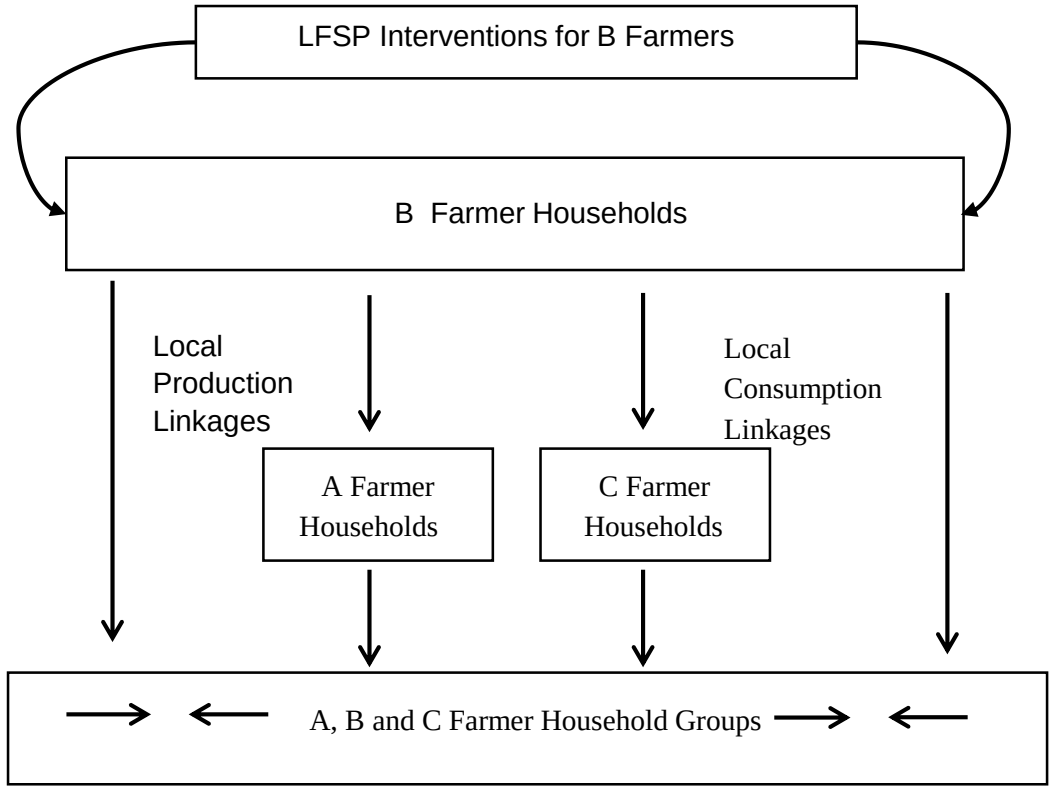

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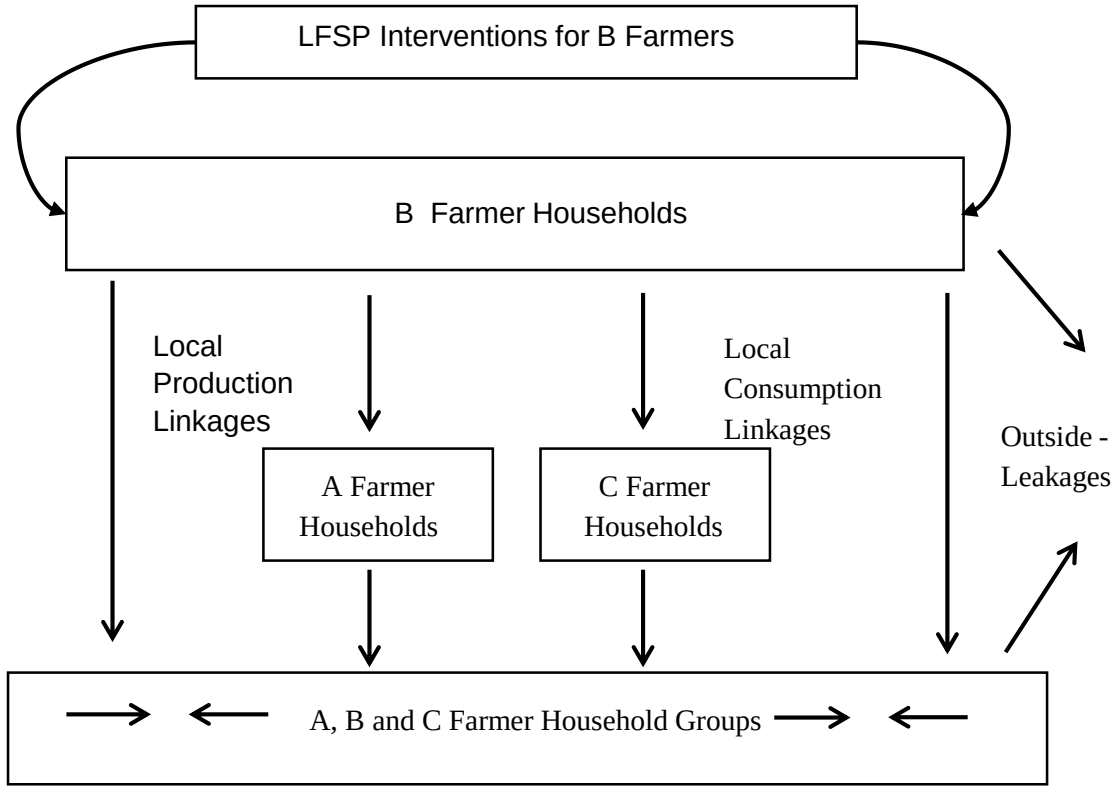


Objective of LEWIE Analysis

- Build a local economy-wide impact evaluation (LEWIE) model to evaluate *ex-ante* the likely impacts of the programme
- Simulate the LSFP's total impact on the local economy
  - Including indirect influences on activities and households not targeted by the programme.
- We used the model to compare the impacts of alternative and combined LFSP interventions.
- This can help us understand the mechanisms by which project impacts are transmitted within treated districts.

Building the LEWIE Model: Production

Input	CRS Cobb-Douglas Crop Production Function Estimates		CRS Cobb-Douglas Livestock Production Function Estimates		CRS Production Function Estimates (from Business Surveys)		
	A & B Farmers	C Farmers	A & B Farmers	C Farmers	Retail	Services	Local Production
Log of Land	0.496***	0.244***	-	-	-	-	-
	-0.046	-0.067					
Log of Labour	0.145***	0.232***	0.153**	0.436***	0.187**	0.365***	0.431***
	-0.047	-0.067	-0.082	-0.0986	-0.078	-0.089	-0.116
Log of Purchased Inputs	0.115***	0.19***	0.307***	0.310***		0.456***	0.276***
	-0.018	-0.019	-0.063	-0.082		-0.05	-0.049
Log of Capital Stock	0.244***	0.334***	0.54***	0.254**	0.813+	0.179+	0.293+
	-0.031	-0.053	-0.075	-0.104			
Controls	X	X	X	X	-	-	-
Constant	-0.076	0.128	2.15***	-2.75***	0.324***	0.231***	-0.093
	-0.289	-0.408	-0.516	-1.01	-0.06	-0.078	-0.081
N	749	1741	2281	236	545	201	234

Notes: * p<0.10, ** p<0.05, *** p<0.01. Standard errors are in parentheses. Production functions are all constrained to constant returns to scale (CRS), non-ag businesses assume CRS and calculate capital as 1-labour-purchased inputs. Crop and livestock production variables are taken from the household survey while the business production function estimates are taken from the business survey. Zimvac data did not have the necessary variables to create production functions thus parameters are taken from B farmers.

Building the LEWIE Model: Household Demands

Budget Item	A Farmers	B Farmers	C Farmers	Budget Item	A Farmers	B Farmers	C Farmers
Local Crops (own hh and other hhs in the village)				Local Services			
Total Annual Expenditures	0.160***	0.045***	0.037***	Total Annual Expenditures	0.100***	0.087***	0.063***
	0	0	0		0	0	0
constant	-102.958*	228.614***	301.982***	constant	-34.763	-47.234***	-14.119
	-0.052	0	0		-0.22	-0.001	-0.457
Local Livestock and Livestock Byproducts (own hh and other hhs in the village)				Locally Produced Non-agricultural Goods			
Total Annual Expenditures	0.009***	0.031***	0.052***	Total Annual Expenditures	0.198***	0.013***	0.023***
	0	0	0		0	0	0
constant	34.289***	99.885***	88.148***	constant	-217.697***	-12.873**	-21.018
	0	0	0		0	-0.019	-0.127
Retail Goods				Imports[+]			
Total Annual Expenditures	0.227***	0.329***	0.242***	Total Annual Expenditures	0.294***	0.441***	0.583***
	0	0	0		0	0	0
constant	196.104***	57.342***	55.808**	constant	166.440**	-254.828***	-410.801***
	0	-0.001	-0.012		-0.025	0	0
Number of observations	184	1,532	595	Number of observations	184	1,532	595
note: *** p<0.01, ** p<0.05, * p<0.1.[1]							
[1] Estimates made with Seemingly Unrelated Regressions of the different expenditure sources on total expenditures for each farmer group							

LEWIE Simulations

1. 12.5% yield increase (what would be needed to raise Group B farmers' crop productivity to the median for all farmers)
2. 60% yield increase (would raise Group B's average yield to Group C's average)
3. 10% increase in purchased inputs
4. 10% increase in crop farmgate prices
5. Various combinations of 1-4.

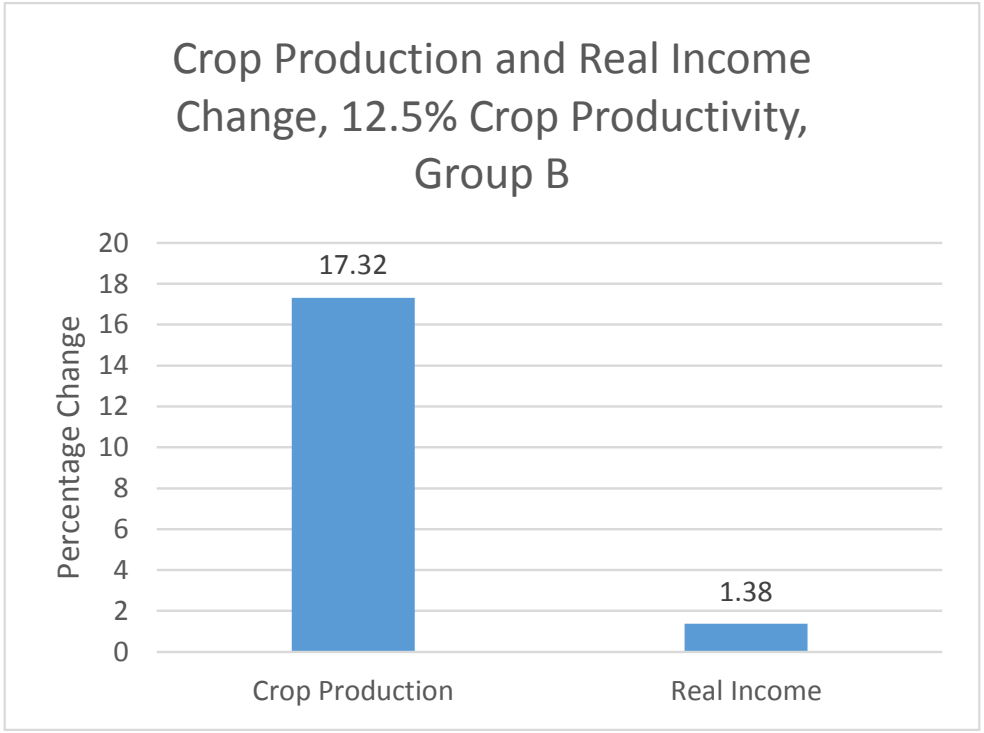
Summary of LEWIE Results:

Lesson 1: Increased Crop Yields Have Big Impacts

Percentage Change	A		B	
	12.5% Yield Increase		60% Yield Increase	
	Impact (%)	Standard Deviation	Impact (%)	Standard Deviation
Real income (Inflation-adjusted)				
Group A	0.28	0.07	1.5	0.42
Group B	1.38	0.06	7.1	0.39
Group C	0.25	0.07	1.29	0.35
Production By Sector (Nominal)				
Crop A	0	0	-0.02	0.01
Crop B	17.32	0.93	89.22	5.96
Crop C	-0.01	0	-0.05	0.02
Livestock A	0.44	0.11	2.27	0.59
Livestock B	0.44	0.11	2.24	0.56
Livestock C	0.36	0.09	1.86	0.46
Retail A	0.89	0.28	4.55	1.49
Retail B	0.84	0.45	4.32	2.37
Retail C	1.01	0.91	5.24	4.86
Services A	0.78	0.07	4.04	0.38
Services B	0.79	0.09	4.07	0.49
Services C	0.79	0.1	4.06	0.53
Non-ag Production A	0.63	0.11	3.26	0.58
Non-ag Production B	0.63	0.09	3.24	0.5
Non-ag Production C	0.64	0.1	3.28	0.55
Wages and Consumer Prices				
Wages	0.02	0	0.09	0.02
CPI A	0.03	0	0.15	0.02
CPI B	0.07	0.01	0.34	0.04
CPI C	0.08	0.01	0.42	0.04

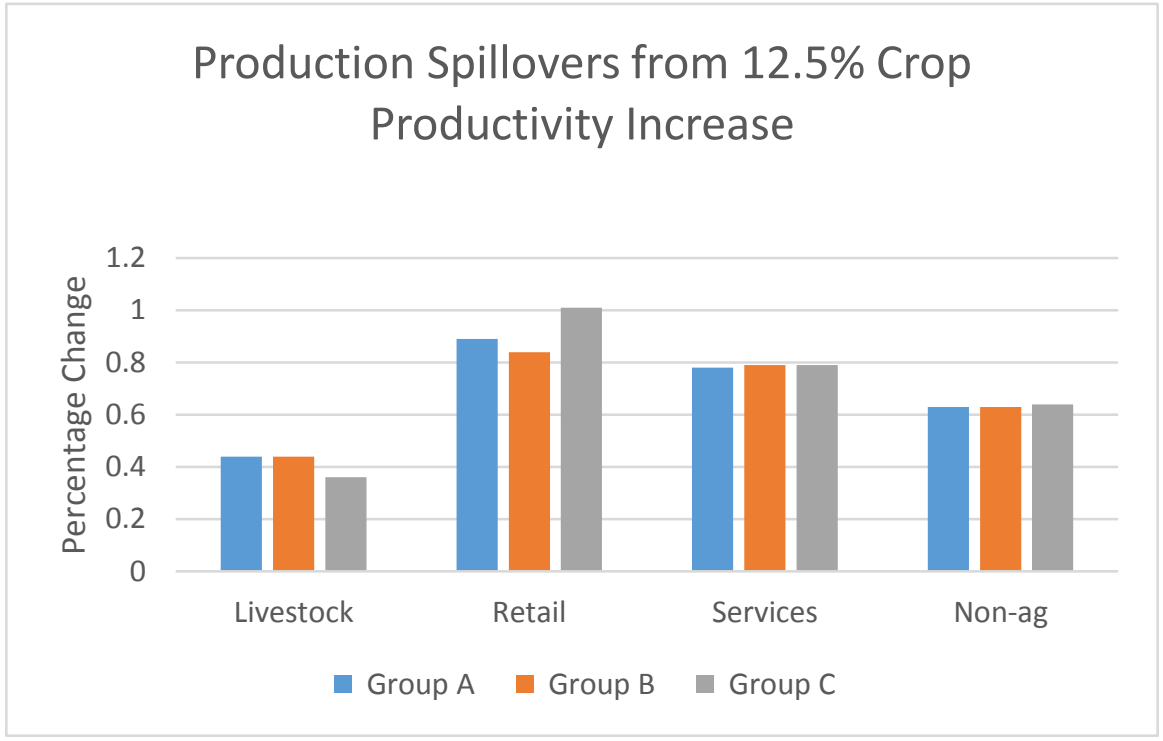
The numbers in the first data column of each vertical panel are percentage impacts, and the numbers in the second data column are standard deviations of these impacts obtained by making random draws from all parameter

A 12.5% Increase in Group B's Crop Productivity Raises Income on B Farms



Note: Results are with access to crop markets

…and It Creates Spillovers to Other Production Activities and Households



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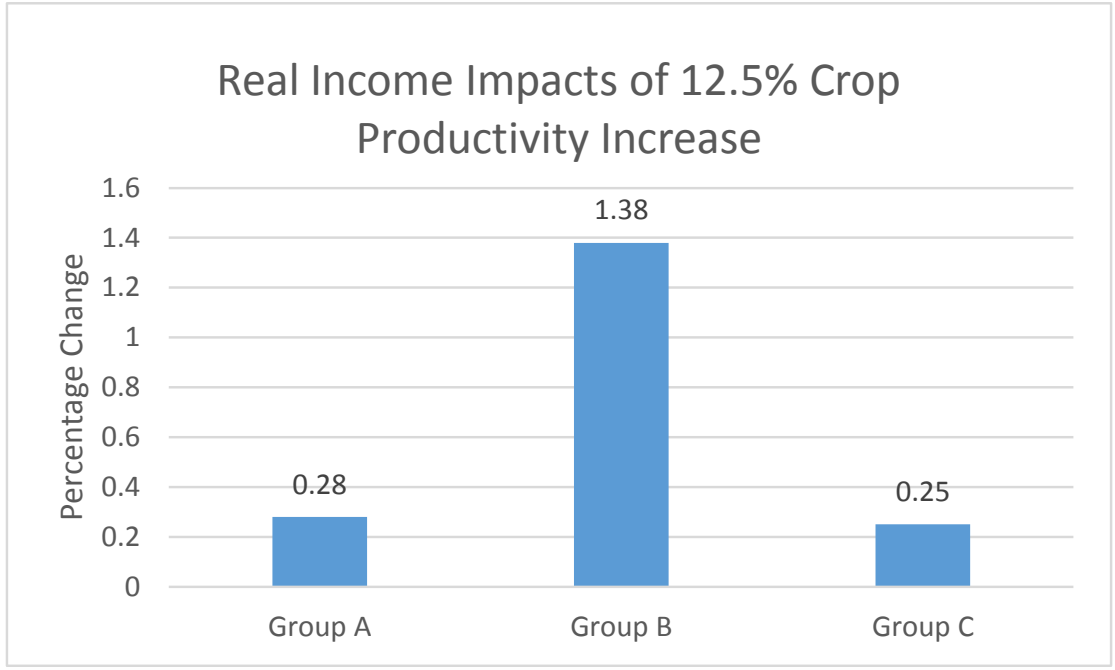
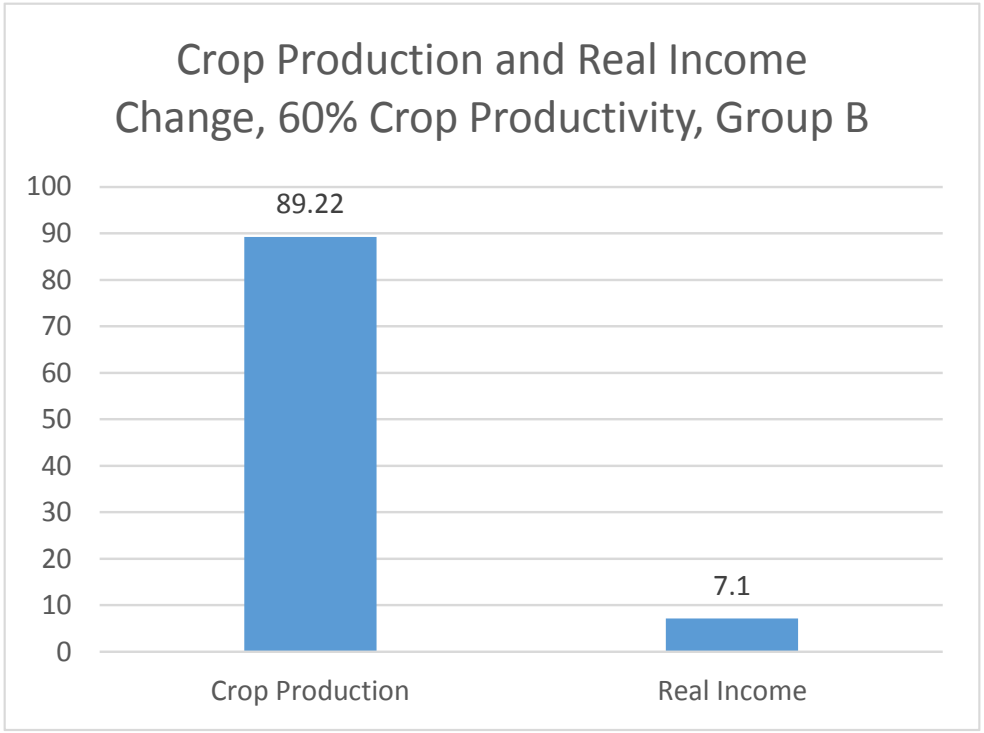
This Increases Other Households' Real Incomes



Note: Results are with access to crop markets

A 60% Increase in Group B's Crop Productivity Has a Much Larger Impact on B Farms



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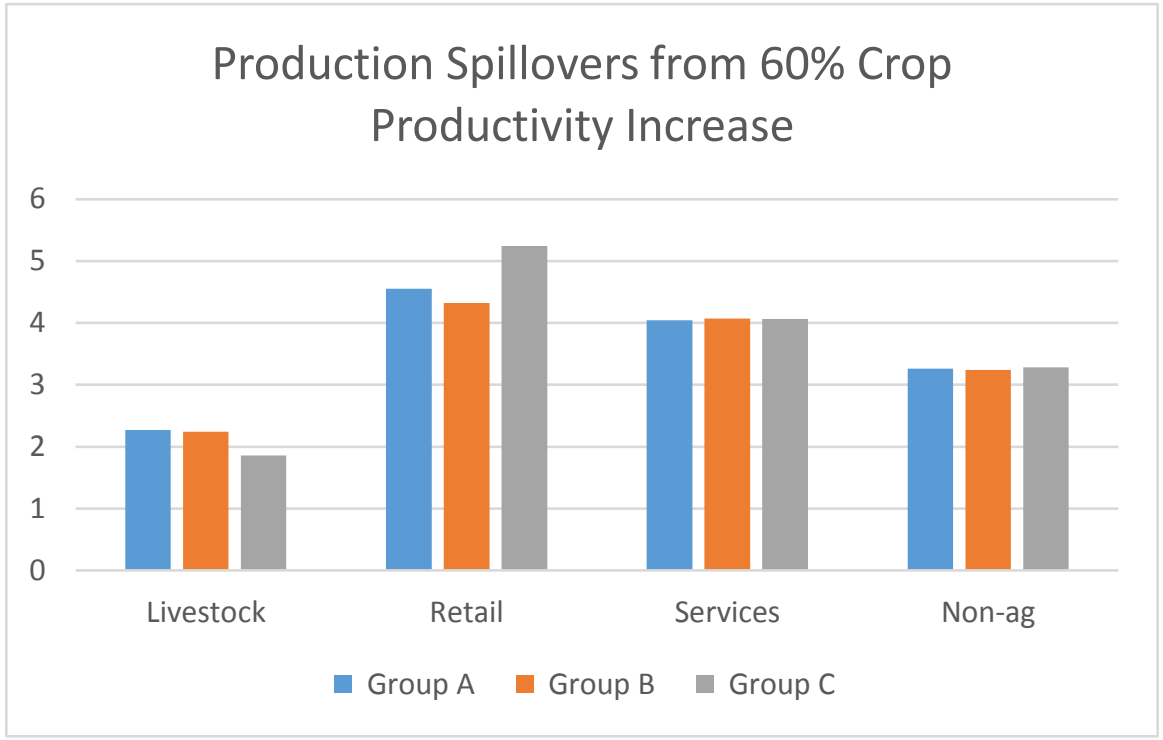
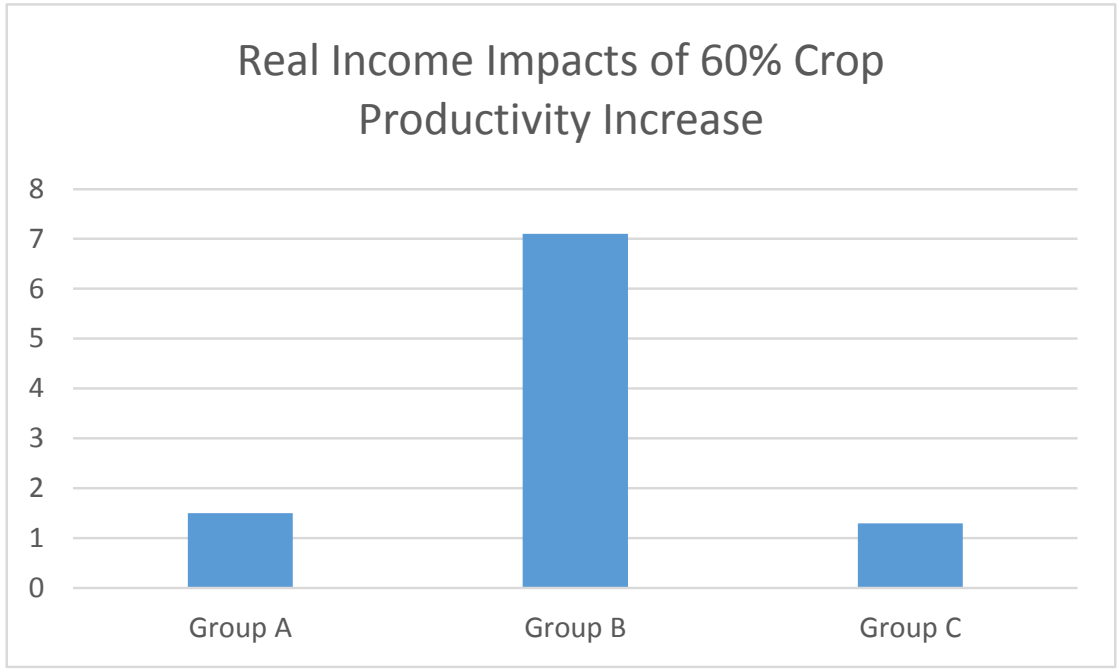
…and It Creates Larger Spillovers to Other Production Activities and Households



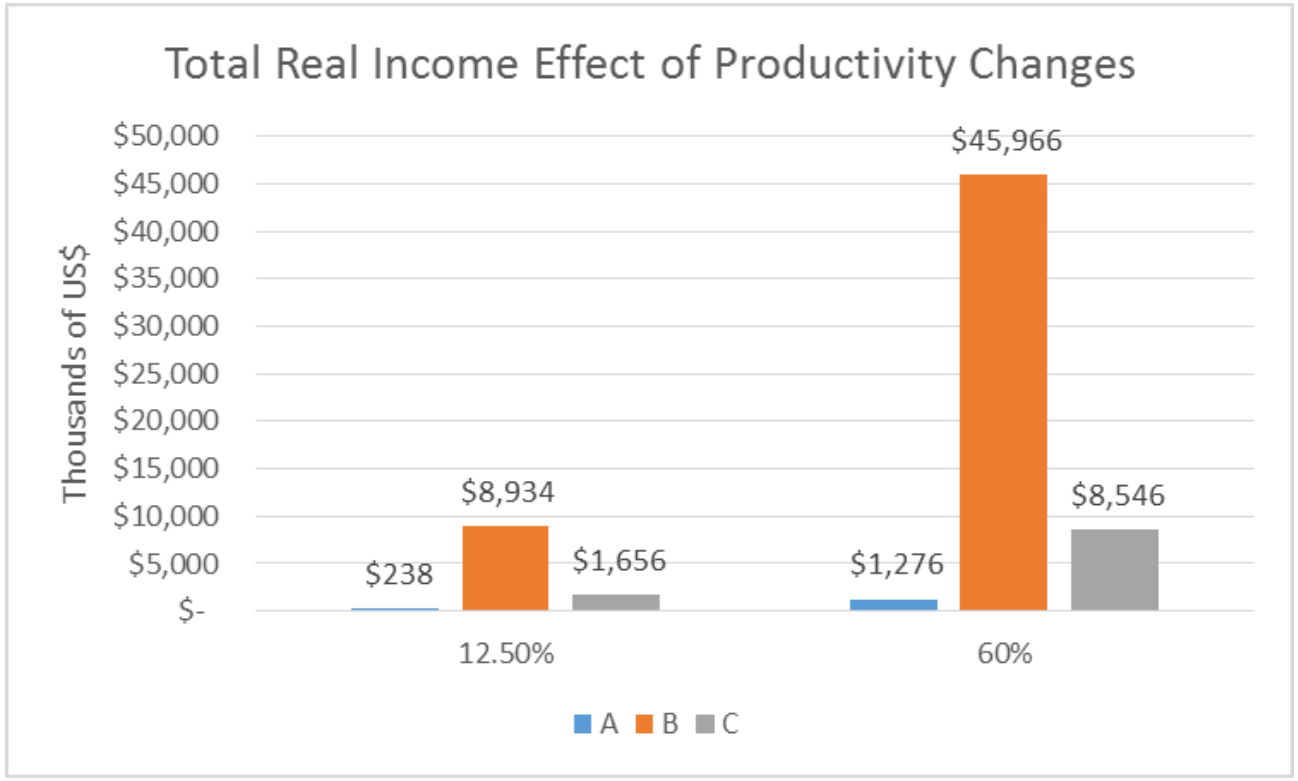
Note: Results are with access to crop markets

…and Larger Increases in Other Households' Real Incomes

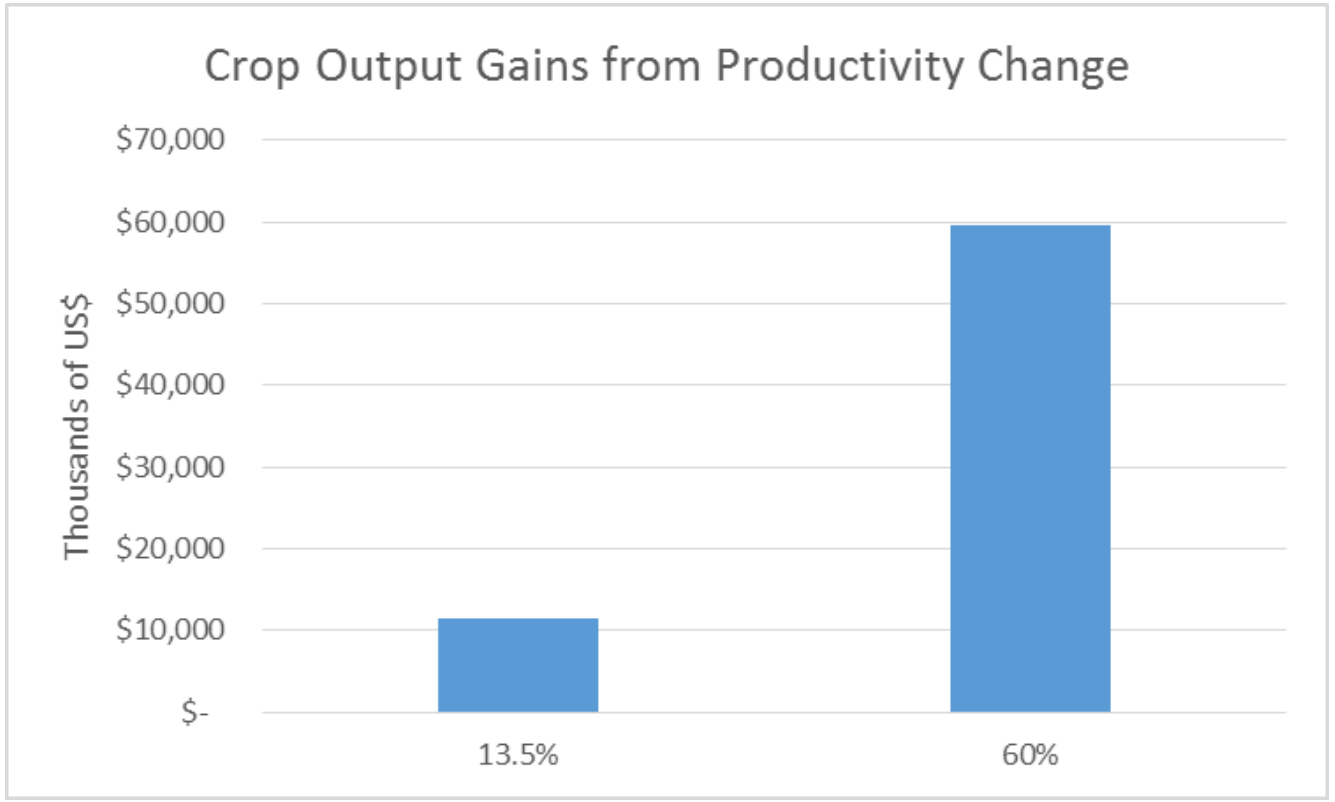


Note: Results are with access to crop markets

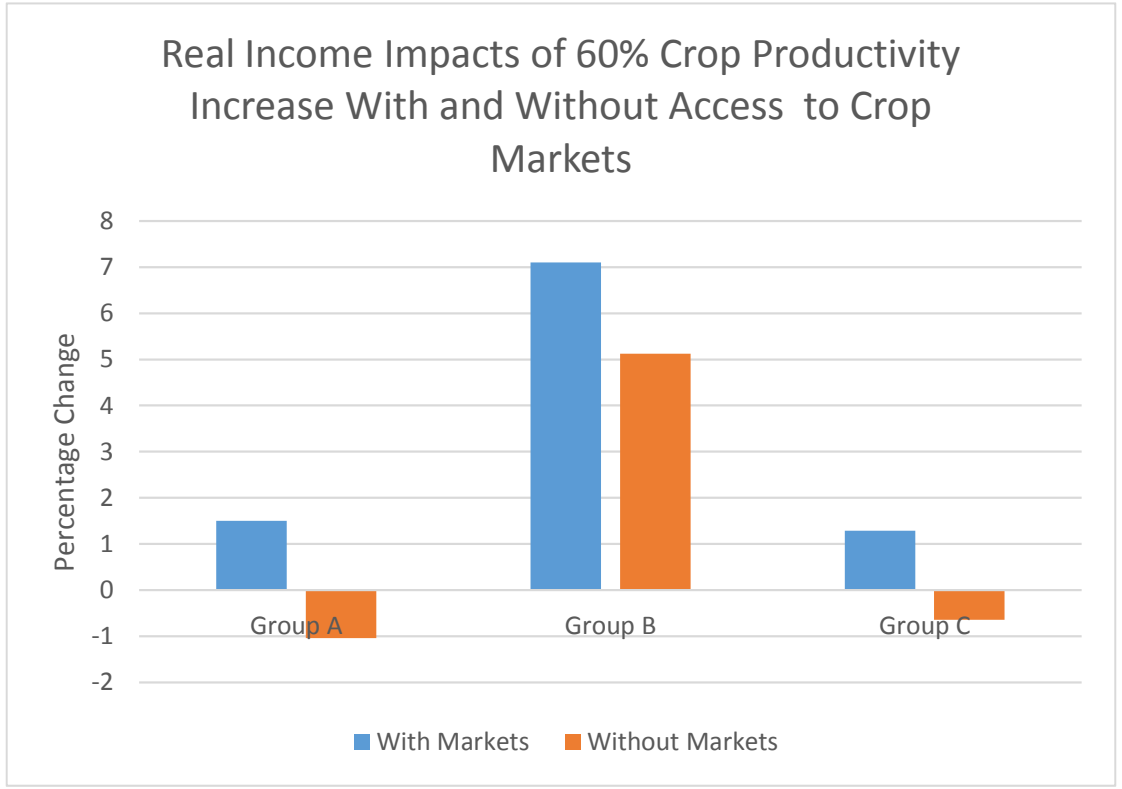
A 60% Rise in Crop Productivity Raises Real Income by US$55.8 Million



Total Crop Output Value Increases by Up to US$59.6 Million



Lesson 2: The Impacts Depend on Having Good Access to Crop Markets

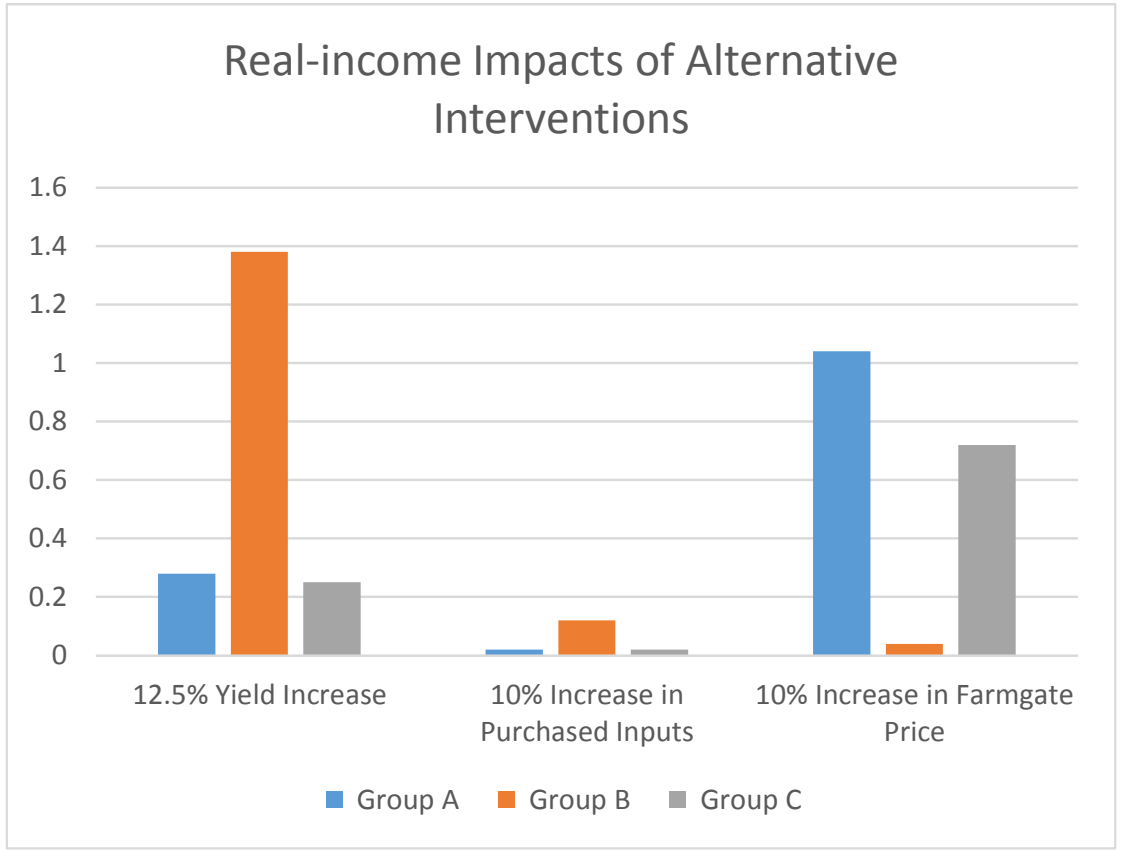


Lesson 3: Increases in Purchased Inputs and Farmgate Price Alone Have Smaller Impacts

Percentage Change	A		A	
	10% Increase in Purchased Inputs		10% Increase in Farmgate Price	
	Impact (%)	Standard Deviation	Impact (%)	Standard Deviation
Real income (Inflation-adjusted)				
Group A	0.02	0.01	1.04	0.14
Group B	0.12	0.02	0.04	0.06
Group C	0.02	0	0.72	0.15
Production By Sector (Nominal)				
Crop A	0	0	1.48	0.46
Crop B	1.3	0.17	1.5	0.54
Crop C	0	0	3.11	0.98
Livestock A	0.04	0.01	0.82	0.23
Livestock B	0.03	0.01	0.77	0.2
Livestock C	0.04	0.01	0.83	0.17
Retail A	0.07	0.02	0.68	0.21
Retail B	0.08	0.04	0.81	0.39
Retail C	0.08	0.06	0.75	0.49
Services A	0.07	0.01	0.75	0.11
Services B	0.07	0.01	0.74	0.13
Services C	0.07	0.01	0.75	0.12
Non-ag Production A	0.06	0.01	0.64	0.12
Non-ag Production B	0.05	0.01	0.58	0.15
Non-ag Production C	0.05	0.01	0.59	0.14
Wages and Consumer Prices				
Wages	0	0	0.05	0.01
CPI A	0	0	1.98	0.09
CPI B	0.01	0	1.3	0.04
CPI C	0.01	0	1.51	0.09

The numbers in the first column are percentage impacts, and the second column reports standard deviations of these impacts obtained by making random draws from all parameter distributions, recalibrating the base model, and repeating each simulation 100 times.

Comparison of Impacts of Interventions on Household Real Incomes



Take-away Conclusions

- Productivity gains from the LFSP have the potential to significantly raise incomes in targeted (Group B) households
- …also in the other households with which they interact in the local economy
- The largest impacts result from crop yield increases when households have access to outside markets for their output
- Relaxing liquidity constraints on input purchases, given technology, has positive but smaller impacts on production and incomes
- Improving access to outside markets is essential to create benefits from productive interventions, both for targeted and non-targeted households
- With market access, technological change that raises crop productivity can generate significant income gains for all groups and positive production spillovers across sectors
- Without access to outside markets, it can have negative impacts on some sectors and some household groups, by putting downward pressure on local crop prices

Implications: Maximising Productivity and Income Gains

- Combining interventions (productivity, commercialisation) will enhance synergies
  - LFSP combines a number of interventions involved in value chains.
  - There is a potential 50% efficiency or total producctivity gain with improved knowledge transfer and adoption of good agricultural practices
- Farmers become more productive when access to purchased inputs is combined with improved technologies, management practices and other interventions
  - Access to finance is necessary but not sufficient to achieve the goals of this project
- The programme should capitalise on abundant labor in rural Zimbabwe
- Increased incomes for B farmers indirectly benefit other households in the same areas, via project spillovers
  - Spillovers could add US$9.8 million to the benefits from productivity gains, alone

Who Made This Study Possible

Justin Kagin, Silvio Daidone, Ervin Prifti, Angelita Ruvalcaba, Robert Pickmans, Santiago Bucaram, Paul Ponce

United Kingdom Department for International Development (DFID)