



WELFARE EFFECTS OF SMALLHOLDER FARMERS' PARTICIPATION IN LIVESTOCK MARKETS IN ZAMBIA

Mary Lubungu

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INDABA AGRICULTURAL POLICY RESEARCH INSTITUTE
LUSAKA, ZAMBIA

Presentation outline

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- Introduction
- Data sources
- Estimation technique
- Results and discussions
- Conclusions

Introduction

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- Demand for livestock/products is increasingly rapidly in developing countries
 - trend expected to continue due to
 - Human population growth, rising incomes, increasing urbanization
- Ideally urban-rural synergies can create markets for smallholder livestock producers thus,
 - Contributing to rural poverty reduction
- Especially that rural poverty rates in Zambia have remained stubbornly high (80%) for more than a decade (CSO, 2009, 2011)

Introduction

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■ Questions

- Does participation in livestock markets improve the smallholder household welfare?
- Are there any biases in the distribution of benefits between poor and better off households?
- Conflicting evidence exist about who derives more income from livestock sales – “better off households or poor households”
 - In Pakistan, Malawi, India, Asia, Latin America, and Philippines -poorer households’ benefit more (Pica-Ciamarra et al., 2011)
 - In Burkina Faso - better off households’ benefit more (Wouterse and Taylor, 2008)

Introduction

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- While these studies present valuable information,
 - none of them has employed econometric techniques
 - their findings are based on bivariate analysis
 - which fails to control for other factors that may affect incomes
 - Failure to control for other factors could potentially lead to biased estimates
- This study provides useful empirical evidence on the potential for livestock market participation
 - to contribute to raising incomes and reducing poverty among smallholder farmers in general
 - and among poor households in particular

Zambia

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- Landlocked
- Population: 13.9 million (64% rural)
- GDP/cap: US\$1,600 (26/47 in SSA)
- Rural poverty rate: 80%
- Agriculture contributes
 - 20% to GDP
 - 85% to labor force
- Single rainy season (Oct.-Apr.)



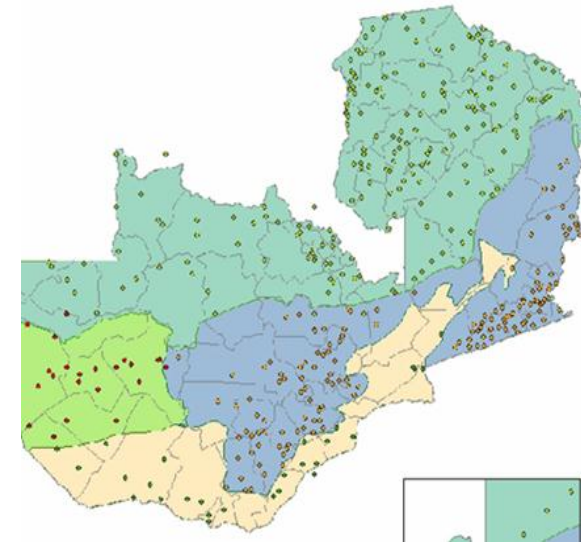
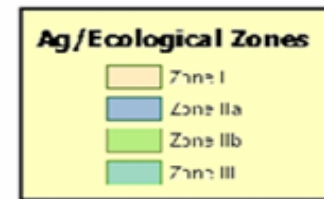
Source: CIA World Factbook

Data

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■ Nationally representative HH survey

- 394 standard enumeration areas (map)
- Smallholder HHs (cultivate <20 ha)
- Farm & non-farm activities, demographics, assets
- **Wave 1:** 2001 (6,922 HHs)
- **Wave 2:** 2004 (5,358 HHs)
- **Wave 3:** 2008 (8,094)
- Treat each survey wave as separate pooled cross sectional data
- **20,435** pooled HHs
- **4,261** (20.8%) HHs owned cattle



Welfare indicators

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- Traditionally, household income or expenditure is used as measure of welfare
 - In developing countries, expenditure is preferred (Meyer and Sullian, 2003; Ravallion, 1992)
 - Due to under reporting of income
 - However, collection of consumption data is costly and datasets are often much smaller
- Accurate estimated income is an important indicator
 - Provide more information about income strategies and inequality (Covarrubias, de la O Campos, and Zezza, 2009)

Welfare indicator used

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- Total household income which includes
 - Crop, livestock and off farm
- Income for 2001 and 2004 were adjusted for inflation using the consumer price index
 - The base period for real income is 2008
- To ensure intra-household comparisons, we adjust the household income by adult equivalent

Estimation of welfare

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- Employed Roy's self selection model (Roy, 1951)
 - Individuals select alternatives that provides greatest utility
- Gain from participation (average treatment effect on the treated)

$$ATT = E(Y_{1i} - Y_{0i} | w_i = 1)$$

- ATT estimated on a sample exhibiting common support
- Matching Techniques
 - Nearest neighbor
 - Stratification
 - Kernel
 - Radius

Estimation the income gap between the poverty class

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- Employed the Blinder-Oaxaca three fold decomposition technique (Jann, 2008)

$$Y^a - Y^b = (\bar{X}^a - \bar{X}^b) \hat{\beta} + \bar{X}^b (\hat{\beta}^a + \hat{\beta}^b) + (\bar{X}^a - \bar{X}^b) (\hat{\beta}^a + \hat{\beta}^b)$$

- The first part of the right hand side is the expected change in the group of poor households mean income if they had endowments of non-poor households
 - The second component measures the expected change in the group of poor households' mean income if they had coefficients of non-poor households
 - The third component accounts for measures in the differences in endowments and coefficients simultaneously
- Selection bias corrected via inverse mills ratio

Results

Summary statistics of selected variables

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	Participation status in cattle markets			Poverty class among participants		
	non-participants	participants		Above poverty line (non-poor)	Below poverty line (poor)	
Value of assets (ZWK)	5,632	15,322	***	27,966	8,558	***
Household income (ZWK)	1,616	2,548	***	5,712	856	***
Crop share of total income	70.63	44.71	***	41.82	46.25	***
Livestock share of total income	6.99	36.15	***	26.19	41.48	***
Off-farm share of total income	22.22	19.14	***	31.98	12.27	***
HCI (%)	31.66	30.71		43.66	23.79	***

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; HCI=household crop commercialization index (gross value of crop sales/gross value of crop production)*100; The 2008 Zambia Kwacha to US\$ exchange rate was 3..829

Source: CSO/MACO/FSRP Supplemental Survey

Estimation of propensity score and balancing tests

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- PS-only covariates significantly correlated with income var were included
- common support requirement satisfied within [0.08191682, 0.92294961]
- balancing test results (next slide) confirm the existence of strong bias for most covariates
- PS matching successfully eliminated this bias as evidenced by the
 - insignificant t -test after matching
 - insignificant likelihood ratio test (Ho: all covariates jointly equal to zero) after matching (10.56, p-value=0.957) ,
 - Which was significant prior to matching (198.11, p-value=0.000)

Balancing Properties of Covariates in Treated and Control Groups (selected vars)

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Covariates	Sample	Mean treated units	Mean control units	% bias between treated and controls	% reduction in bias	H0: Mean(treated) = Mean(control)	
						t	p> t
Number of HH members	Unmatched	8.168	7.290	21.3		6.39	0.000
	Matched	8.168	8.297	-3.1	85.3	-0.64	0.523
Age of household head	Unmatched	51.864	50.163	11.3		3.20	0.001
	Matched	51.864	51.906	-0.3	97.5	-0.07	0.946
Years of schooling of HH head	Unmatched	6.731	5.949	20.1		5.87	0.000
	Matched	6.731	6.795	-1.7	91.7	-0.39	0.695
Number of goats owned	Unmatched	5.245	3.470	20.7		6.58	0.000
	Matched	5.245	5.012	2.7	86.9	0.57	0.567
Landholding size (ha)	Unmatched	5.047	3.995	20.6		6.48	0.000
	Matched	5.047	5.154	-2.1	89.9	-0.43	0.669
HH reporting non-farm income (=1)	Unmatched	0.666	0.591	15.6		4.42	0.000
	Matched	0.666	0.680	-2.8	81.9	-0.68	0.495

Estimates of Average Treatment Effect of Cattle Market Participation on log of Per Capita Household Income

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Matching technique	Number of households.		ATE	Bootstrapped Standard error	t-stat
	Participating group	control group			
Nearest neighbor	1,099	806	0.524	0.062	8.516
Stratification	1,096	3,160	0.549	0.038	14.373
Kernel	1,099	3,137	0.574	0.029	19.865
Radius	1,099	3,157	0.640	0.036	17.540

- All else constant, participation in cattle markets raises per capita household income by about 52-64% on average

Results of Linear Decomposition of Log of Household Income: poor vs. non-poor households

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Panel A: mean predications	Bias unadjusted			Bias adjusted		
	Mean	Robust standard error		Mean	Robust standard error	
Non-poor households	8.302	0.037	***	8.307	0.039	***
Poor households	6.614	0.021	***	6.616	0.022	***
non-poor-poor differential	1.688	0.043		1.691	0.045	***
Panel B: Simultaneous change in endowment and coefficient						
Three-fold endowment	0.455	0.042	***	0.453	0.042	***
Coefficients	1.356	0.053	***	1.360	0.057	***
Interaction	-0.123	0.057	**	-0.123	0.058	**

Note: the difference is between the predicated log of household income of the non-poor and poor households among the participating households only. Significance level *p<0.10, **p<0.05, ***p<0.01

Results of Linear Decomposition of Log of Household Income: poor vs. non-poor households

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- Panel A:
 - absolute value for the antilog of predicated average incomes are poor-ZMK4031.44 (US\$1293.14) and non-poor ZMK 1293.14 (US\$ 337.68) yielding a difference of ZMK2738.30 (US\$715.18)
- Panel B
 - endowment and coefficients are positive and significant suggesting that
 - poor HHs would statistically earn more than non-poor HHs if poor HHs retained their coefficients but had endowments comparable to those of non-poor HHs
 - Similarly, poor HHs would earn significantly more than non-poor HHs if poor HHs retained their endowment but had the coefficients of the non-poor HHs

Summary of the Decomposition Results (as percentages)

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	Bias unadjusted	Bias adjusted
Amount attributable:	-203.7	-123.9
- due to endowments (E):	33.2	33.2
- due to coefficients (C):	-236.8	-157.1
Shift coefficient (U):	372.4	292.7
Raw differential (R) {E+C+U}:	168.8	168.8
Adjusted differential (D) {C+U}:	135.6	135.6
Endowments as % total (E/R):	19.7	19.7
Discrimination as % total (D/R):	80.3	80.3

Note: U = unexplained portion of differential (difference between model constants); D = portion due to discrimination (C+U)
 positive number indicates advantage to non-poor group
 negative number indicates advantage to poor group

- Inter group differences in characteristics or productive differences accounts for 123.9% in favor of poor HHs
- However, productivity difference is not enough to offset the 292.7% advantage in shift coefficient (U)
- Overall, statistical discrimination accounts for 80.3% of the income differential in favor of non-poor households

Conclusion

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- Article determines welfare effects of participation in cattle markets
- Employ propensity score matching and decomposition techniques on
 - nationally representative household survey data from smallholder farmers
- After correction for selection bias, we find that
 - participation in cattle markets raises household income by over 50%
 - decomposition results suggest that poor households derive relatively smaller benefits from participation than their non-poor counterparts due to
 - 80.3% of the inter-group income differential

Conclusion

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- The results suggest that with appropriate interventions, participation in livestock markets can
 - enhance the welfare of smallholder households and
 - contribute to poverty reduction

Thank you for your attention