Who Gains From Rural Agricultural Cooperative Membership? Empirical Evidence from Rural Zambia

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Jordan Blekking
M.Sc. Student
Department of Geography
Indiana University

Abstract: In the 1970s and 1980s policy makers across the globe looked to agricultural cooperatives as a means through which food insecurity would be more effectively mitigated. Policy makers viewed cooperatives as a means of bringing smallholders together in an attempt to leverage the benefits of collective action. Cooperatives often take on the role of serving as a bridge between smallholders and agricultural input producers, in order to increase the use of Green Revolution inputs by the rural poor. The Southern African nation of Zambia provides an ideal case study through which we may view the relationship between government-initiated smallholder cooperatives, improved agricultural inputs, and rural households due to the government's longstanding support of subsidized input distribution through cooperatives. Previous research finds Zambian cooperatives successfully pair smallholders with inputs, yet we find rural households with low agricultural production gain membership into cooperatives much less frequently and fail to secure the benefits policy makers associate with cooperatives.

Keywords: agriculture, cooperatives, Africa, Zambia

INTRODUCTION

Policy makers have used a variety of methods to address food insecurity in the developing work may be stabilized. Some methods may exist briefly, while others feature long-term solutions. Since the 1950s and 1960s policymakers across the globe have viewed agricultural cooperatives as a means of addressing food security through collective action (Mansuri and Rao 2013). Aggregating farmers into cooperatives for the purpose of acquiring resources and or marketing of crops can more efficiently provide benefits on a group scale as compared to individual farmers interacting with private markets.

Over the last decade and a half, the Southern African nation of Zambia has pursued an agricultural policy centered on the promotion of modern inputs and agricultural cooperatives for smallholder use across the country. It has been argued this policy has had limited success in overcoming nation-wide food insecurity (Mason et al. 2013), even so the policy remains throughout the country.

A number of empirical studies examine the effect of subsidized agricultural inputs throughout Sub-Saharan Africa (Ricker-Gilbert and Jayne 2012; Jayne and Rashid 2013; Mason et al. 2013), including within the Zambian context, although there is little research about how cooperative membership may impact smallholders and their farming systems. A smaller body of literature exists on which groups of farmers from within rural communities engage in cooperatives by purchasing membership shares.

If the narrative promoted by policy makers holds true, smallholders (of all socio-economic backgrounds) engaged in cooperative participation should have more dynamic farming systems and increased agricultural output, in comparison to households not affiliated with a local cooperative. The following paper empirically examines the representativeness of cooperatives and the impact of cooperative affiliation with farm level outcomes.

THE ROLE OF COOPERATIVES

The International Cooperative Alliance (as cited in Ortmann and King 2007) defines a cooperative as "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise". Through the creation or promotion of cooperatives, particularly agricultural cooperatives, often through governmental incentives, policy makers seek a method in which large groups of individuals may be reached at once, and through which the benefits of a larger group may affect individuals. Cooperatives exist to serve their members, and are not always motivated solely by profit, but rather by the needs of particular services that benefit members (NCBA 2005 as cited in Ortmann and King 2007).

Cooperation amongst smallholders facilitates the bridging of technical divides, as well as the enhancement of productivity (Bernstein 2010). Agricultural cooperatives allow for individual households to formulate into collective units, so that economies of scale may be more effectively met. In short, agricultural cooperatives in the developing world are pursued as a way to meet individual desires through group formulation and collective action. Ortmann and King (2007) identify three types of agricultural cooperatives:

1. Market – cooperative members pursue this form to gain entry to more lucrative

markets; reduce handling, processing, production, and distribution costs

2. Service – this form of cooperative provides a set of services for the member: credit, insurance, and specialized processing among others
3. Inputs – the facilitation, distribution, and sales of modern inputs (seed, fertilizer, chemical sprays, etc.) may be encouraged through this medium

Regardless of the classification of a cooperative, the end goal remains the same for all members: to bridge the gap between, what Bernstein (2010) calls the "upstream" and the "downstream." The upstream being all activities, inputs, and labor required for the growing of a commodity, while downstream indicates the marketing and sales of produced commodities (Bernstein 2010). The role of cooperatives seeks to expand the ability of groups to engage in "the collectivization of the modes of production and means of capital accumulation…" (Akwabi-Ameyaw 1997). By working together, the argument states, smallholder farmers may exceed their own individual efforts in the pursuit of production, which will ultimately benefit the state through more readily supplied markets and improved livelihoods for the rural base.

Globally, cooperatives have served as an essential piece of the development strategies pursued by a litany of institutions, such as the World Bank, United States Agency for International Development (USAID), and numerous governments and government agencies. USAID first pursued the prescription of cooperative establishment in the 1950s and 1960s (Mansuri and Rao 2013). There exists an implicit assumption that collective action through cooperative membership serves to benefit farmers but there has been little research exploring who participates in cooperatives and why.

COOPERATIVES IN AFRICA

The resounding belief that collective action gains surpass the gains smallholders achieve through their own individual actions has driven the growth of agricultural cooperatives across the African continent, in particular in Southern and Eastern Africa, and cemented their place as a cornerstone of socioeconomic and agricultural policy.

Numerous studies identify cooperatives as being central to the strategy necessary to improve smallholder agricultural production and livelihoods, in light of the disproportionate challenges faced by these farmers (Abebaw and Haile 2013; Shiferaw et al. 2009; Markelova et al. 2009; Verhofstadt and Maertens 2014). While organizational structure and membership rules substantively affect a cooperative's role and efficacy, the most compelling argument in favor of cooperatives in developing countries is the reduction of transaction costs and helping farmers to collectively achieve economies of scale (Akwabi-Ameyaw 1997; Fischer and Qaim 2011). High transaction costs constitute one of the greatest barriers to market entry for smallholder farmers (Holloway et al. 2000; Ortmann and King 2007).

A case study of cooperatives in Rwanda finds cooperative membership leads to greater use of modern inputs, market access, and ultimately increased revenue. The overall effect of cooperative membership within the study is strong and positively influences farm productivity, however maize farmers receive greater benefits as compared to horticulturalists (Verhofstadt et al. 2014). Abebaw and Haile (2013) and Fischer and Qaim (2011) find cooperative engagement by smallholders in Ethiopia and Kenya, respectively, has a significant, positive effect on the adoption of fertilizers.

There also exists a thread of research on the organizational of cooperatives.

Organization of cooperatives can be internal, where farmers form their own group with benefits delivered only to participating members or through the involvement of external initiatives from government, private, or non-government entities. Akwabi-Ameyaw (1997) cites the provision and improvement of services for the poorest rural inhabitants to be one of the most important functions of cooperatives in Zimbabwe. Francesconi and Heerink (2001) find cooperative membership increases the probability farmers will engage in commercial activities in Ethiopia. However, cooperatives may not easily attain effective organizational structures due to the institutional arrangement of the cooperative (Markelova et al. 2009). Findings from Rwanda support this claim, indicating the formal hierarchical structure of a cooperative is indicative of the cooperative's viability (Bingen 2002). Research also finds cooperatives may be undercut by misuse of funds and resources for self-motivated gains (Akwabi-Ameyaw 1997; Bingen 2002).

In summary, important elements of cooperatives in developing countries are organizational structure, a specific function or goal of the cooperative, well defined rules, and responsible leadership and oversight. Use of cooperatives and similar institutions at the local-level can positively impact the uptake of new, more well suited cultivars, increased use of fertilizers, and overall technical efficiency (Shiferaw 2009; Abebaw and Haile 2013; Abate, Francesconi, and Getnet 2014).

A REMNANT OF THE GREEN REVOLUTION

In the 1960's and 1970's, agricultural production in developing countries increased through the emergence of high yielding varieties of wheat and rice, which when paired with inorganic fertilizer and pesticides achieved significant yield gains. The "Green Revolution", as it became known, impacted both large and small producers alike through the introduction of "improved varieties and cultivation methods, greater fertilizer use, "soft" credit, and technical advice to farmers (promoted through extension services)" (Bernstein p. 74 2010). The revolution was particularly effective in Asia and led to substantial agricultural gains (Pretty et al. 1995, Denning et al. 2009). Through increased accessibility to inputs by poorer farmers, Asian nations were effectively able to double the average yields of staple crops like rice and wheat (Evenson and Golin 2003), and countries like India went from experiencing annual food deficits to becoming surplus producers (Fresco 2009). Higher yields drove grain prices down, which increased accessibility to foodstuffs for those typically excluded from market-provided grains.

Although grain production has increased across Africa, the continent did not experience a Green Revolution in the way Asian countries did. This is in part due to maize being the dominant staple crop across sub-Saharan Africa. While total hectares under maize production has increased in Africa since the decades in which Asia's Green Revolution took effect, total maize yields increased annually by only 1% through the early-1990s, but by the mid-1990s maize yields had improved by 2.9% annually (McCann 2005).

The 1990s were a period in which market reforms occurred across Africa, and through it divergent avenues of agricultural input development took hold. Prior to the initiation of market reforms in sub-Saharan Africa, investment in the maize sector and associated institutions established during the colonial period led to maize breeding success in countries like Kenya and Zimbabwe, particularly during the 1970s and 1980s (Smale et al. 2003; Denning et al. 2009). Innovations in technology, policies, institutions,

and especially breeding improved germplasm were at the core of this success. Coupled with improved germplasm were investments in extension, seed distribution, fertilizer subsidies, delivery, and access to credit. Market reforms led to reduced involvement of governmental research institutions and the greater incorporation of regional and international firms into the development, marketing, and distribution of the inputs featured in Asia's Green Revolution (Denning et al. 2009). The increase in seed capabilities that led to the 2.9% growth in regional yields is largely the result of the commercialization of the inputs industry throughout Africa.

African governments' policies took the gains developed through privatization of seed and fertilizer development and coupled these inputs with strategies that helped to avoid food deficits by implementing ambitious and somewhat successful, albeit costly, fertilizer and hybrid maize subsidy programs (Denning et al. 2009; Mason et al. 2013). In subsequent years governments through throughout sub-Saharan Africa have continued their support of subsidy, breeding, and farmer engagement programs with the goal of achieving yields similar to the Green Revolution in Asia.

COOPERATIVES IN ZAMBIA

The average Zambian smallholder typically produces only enough to sustain their household and a small surplus for sale. With roughly 1.5-million smallholders nation-wide (about 9% of the population), smallholders are responsible for the majority of maize production (CSO/MAL 2014 as cited in Resnick and Mason 2016). About 87% of all smallholders cultivate the crop, which constitutes 60% of the country's caloric intake (Dorosh et al. 2009).

Since independence in 1964, each political administration supported pro-cooperative policies (FAO). Cooperatives in Zambia have been formulated to provide a specific avenue through which socioeconomic and poverty eradication may occur (Ministry of Agriculture and Livestock 2016). To achieve this goal, the Ministry of Agriculture's Department of Cooperatives looks to use cooperatives as a way to enhance the agricultural sector's productivity and production. Within the Zambian context, enhancement of agricultural productivity and production begins with the use of Green Revolution inputs, namely hybrid seeds and inorganic fertilizer and the use of input cooperatives in the distribution of these inputs.

Zambian policy makers incentivize more intensive agricultural production through the Farmer Input Support Programme (FISP). FISP follows the Green Revolution model by distributing hybrid maize seed and fertilizers as a means of encouraging higher yields and greater production (Bernstein 2010). FISP began providing subsidized hybrid maize seed and fertilizer to cooperative members during the 2002/2003 growing season (Mason et al. 2013).[1]

The Zambian Ministry of Agriculture states, "Cooperatives are the main channel in the distribution of inputs" and FISP is entirely implemented through cooperatives

[1] In 2002 the package featured eight bags of fertilizer (50 kilograms a piece) and twenty kilograms of hybrid maize seed – enough to cultivate one hectare of maize cropland. Since that initial package, the program has undergone transformations, namely the reduction in 2008 of subsidized inputs provided – a halving of the 2002 inputs package to four bags of fertilizers each and ten kilograms of hybrid maize seed (Resnick and Mason 2016).

(Ministry of Agriculture 2015). In addition to serving as an avenue for input delivery, the FISP, since inception, has been tasked with facilitating the organization, dissemination of information, and creation of rural cooperatives and other institutions (MACO 2002 from Mason et al. 2016). For farmers wishing to gain access to FISP, the farmer must first register as a cooperative member and obtain a bank account. Membership is done through the purchase of one cooperative membership share, and the subsequent renewal of the membership through the payment of annual renewal fees. Once a registered cooperative member, the farmer may engage with the FISP if s/he can meet the following four aspects of criteria (Ministry of Agriculture and Livestock 2015):

- The farmer must be registered in their local farmer register;
- Must cultivate between 0.5 and 2.0 hectares;
- Or must be raising 2 to 10 cows, 5 to 30 pigs, 5 to 30 goats, 20 to 100 chickens, or 1 to 2 fish ponds;
- Constitute the ability to pay the required farmer contribution for the FISP.

However, cooperative membership does not guarantee a farmer the opportunity to receive subsidized inputs. Once a member of the cooperative, the farmer applies to the Camp Agricultural Committee (CAC), and the CAC reviews the list of applicant farmers, chooses which farmers to admit into the program, and from there a list of approved farmers is generated at the district level (Smale et al. 2015). Once approved for involvement with the FISP, the farmer must pay a fee to the program: 400 Zambian Kwacha (ZMK).[2] During the 2015/16 season one FISP package was worth 2,100 ZMK.

A chief objective of FISP and previous incarnations of the subsidization program has been to ensure farmer organization and improve the dissemination of knowledge from stakeholders to farmers (MACO 2002 from Mason et al. 2016). In addition to forming cooperatives, the FISP was intended to increase farmer access to lines of credit by ensuring all input purchases must be made through designated financial institutions (Mason et al. 2016).

While successful at connecting smallholder farmers with improved inputs and credit, the FISP program has received a lot of criticism. Since the program's start in 2002, the FISP has been plagued by a number of substantial issues. Burke et al. (2012) find the hybrid maize seed and fertilizer combination made available through the "traditional" form of FISP were poorly suited for Zambia's soils, while another report highlights late delivery of the agricultural inputs to cooperative members as a plague to the policy's efficacy (Sitko et al. 2012).[3] Further research indicates that as a result of the combination of late delivery and a poorly suited input package, the program has had only minimal effects in its ability to reduce the rural poverty rate throughout Zambia (Mason et al. 2013).

Regardless of the usefulness of the FISP in reducing poverty and increasing livelihoods at the rural level through its wide-range of objectives, the FISP continues to maintain a central position within Zambian agricultural policy. Jayne (2008) suggests Zambia's long history with agricultural subsidization is one of the central ties that bind the Zambian Government and the Zambian people. During Zambia's 51 years of independence there was only a brief period in the early 1990s where there were no

[2] At the time of the survey, the exchange rate for United States Dollars to Zambian Kwacha was $1 to 9.3 ZMK.
[3] The "traditional" form of FISP provides hybrid maize seed and inorganic fertilizer (both Urea and a mixture of Nitrogen, Phosphorous, and Potassium).

agricultural subsidies in Zambia (Mason et al. 2013). The role of cooperatives seems unlikely to change so long as their existence and functionality remains integral to the FISP. However, it is worthwhile to examine whether cooperative membership and thus participation in the FISP program is democratic.

CASE STUDY LOCATION

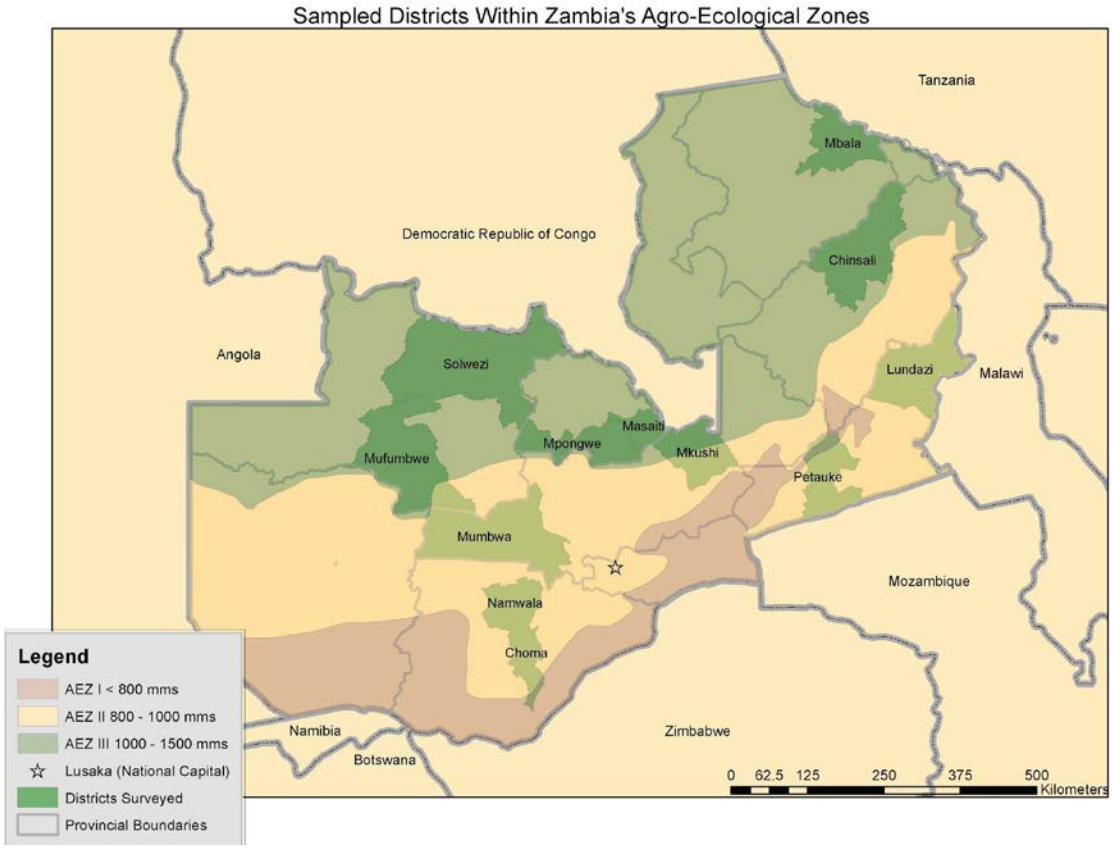


Figure 1: Agro-Ecological Zones of Zambia and Districts Sampled

Zambia is a landlocked country in sub-Saharan Africa with a population of more than 16 million people (World Bank 2016). The country is a characterized by a dryland ecosystem in which the majority of farmers rely solely on rainfall agricultural production. Almost all field crops are grown without irrigation and subject to high rainfall variability. Nationally, average annual rainfall varies from 800 to 1,200 mm/year. The heterogeneity of rainfall rates creates a natural gradient of declining rainfall from the north to the south of the country. The northern portion of the country lies within Agro-Ecological Zone III (AEZ III) and receives the greatest amount of rainfall 1,000 to 1,500 mm per year (see Figure 1 for AEZ distribution). Agro-ecological zone II (AEZ II) spans the middle of the nation and is characterized as a medium rainfall belt (800 – 1,000 mm), while the southernmost agro-ecological zone (AEZ I) typically receives less than 800 mm of rainfall annually.

SAMPLE SELECTION AND DATA

This case study relies on two different types of data. The first is a questionnaire disseminated to 127 agricultural cooperatives collected from June to early July 2016 within a single district: Choma District, Southern Province. Choma District sits within the transition zone between AEZ I (low rainfall) and AEZ II (medium rainfall) and largely consists of members from the Tonga and Ila tribes. Cooperatives sampled were selected from a master list held by the District Agricultural and Cooperatives Officer (DACO). The master list identifies 999 registered cooperatives within five distinct cooperative classifications throughout the district. The first three identify the most active and productive cooperatives, while the last two categories are low functioning and defunct cooperatives. None of the 127 cooperatives selected for sampling were from the lowest two groups; rather all cooperatives sampled were selected from the top three categories, and the highest functioning group had all (six) of its cooperatives selected, and the remaining 121 cooperatives were randomly selected from a combined list of the second and third tier cooperatives. Table 1 provides descriptive statistics of the sampled cooperatives.

Table 1: Descriptive Statistics of the Cooperatives Sampled

	Mean	Stand. Dev.	Min	Max
Years Active as Cooperative	5.02	5.14	<1	42
Cooperative Leader's Gender (1=yes)	0.83			
Total Cooperative Membership	28.45	28.01	10	250
Male Members	15.07	19.19	0	151
Female Members	13.51	12.2	2	99
Cost of One Membership Share	111.42	177.42	0	2000
Annual Membership Renewal Cost	63.46	24.8	50	200
Main Cooperative Activity	Count	Percentage	Cumulative	
FISP / Crop Production	55	43.31	43.31	
Livestock (Non-Dairy)	54	42.52	85.83	
Dairy	4	3.15	88.98	
Maize Trading (Non-Governmental)	10	7.87	96.85	
Money Lending	2	1.57	98.43	
Gardening	1	0.79	99.21	
Carpentry	1	0.79	100	

N = 127 Cooperatives

Within the cooperatives sample, males lead 83% of the cooperatives. Cooperatives, on average, have 15 male members and 13 female members. The cost of one membership share averages 111 ZMK, with the annual membership renewal fee having a cost of around 63 ZMK. On average, cooperatives have only been around for five years, although our sample features a range of 42 years for cooperative age.

The second data set used in the study was collected from June to early August 2016. A household survey was conducted among 1,174 rural households in six of Zambia's ten provinces. From the total sample, 948 records were used in this analysis.

Within each province two districts were surveyed: the district containing the provincial capital and a rural district (see Figure 1 for map of districts sampled). Our selection criteria created a useful geographic distribution of sampled districts across Zambia's geographic landscape and agro-ecological zones. Table 2 provides descriptive statistics of the sampled population.

Table 2: Descriptive Statistics of the Households Sampled

Variable Names	Mean	Stand. Dev.	Min.	Max.
Cooperative Membership (1=yes)	0.62	0.49	0	1
HH Head's Age	46.69	14.60	16	87
HH Head from Location (1=yes)	0.65	0.48	0	1
HH Head's Gender (1=male)	0.82	0.39	0	1
Household Members Over 12 Years Old	4.13	2.21	1	16
HH Head's Education	3.05	1.29	1	7
Time to Village Market	38.57	55.96	0	600
Time to Primary Maize Field	34.92	41.04	0	240
Number of Maize Plantings	1.77	0.99	1	5
HH Had Off-Farm IGA	0.37	0.48	0	1
Land Cultivated (all crops)	2.53	2.48	0.10	25
Maize Yield per HA	1590.85	1240.02	5.55	10000
Non-Agricultural Income	5969.06	7981.05	0	48750
Livestock Index	2.64	8.62	0	215.25
Asset Index	2.97	1.41	1	5

N = 948 Households

Household selection was determined first through the identification of regional markets. These markets were identified during meetings conducted with each district's DACO and crop marketing team. The DACO and district agricultural marketing team identified secondary and tertiary markets as potential sites to conduct the household surveys.[4] After identifying these markets twenty nearby households were selected using a crossing pattern (like a bullseye) in which the market served as the central node and roadways leading away from the market serve as vectors from which to select households. From here five households were selected in each direction, with roughly each household being one kilometer from the previously sampled household.

The questionnaire focused on a wide-range of categories, such as household demographics, finances, charcoal and fuelwood use, agricultural and labor activities, and integrated agricultural systems, of which maize production and involvement within a cooperative and the government's input subsidy program were two sub-sections. Table 2 provides complete descriptive statistics of the population used in this analysis.

Within the sampled population (1,174 households), 82% of the household heads are male with an average age of nearly 46 years (the average age for the total sample is

[4] Secondary markets are defined as markets typically found near the junction of a primary and secondary road (outside of an urban center), while tertiary markets are rural, roadside markets.

46.5 years). The average household head has completed primary education, but has not gone on to secondary education. Households in our sample have 6.9 household members on average, with 0.11 migrants coming from the family. The household farm, on average, is just over 2.5 hectares of land, and 63% of sampled households are members of a local agricultural cooperative and pay a membership fee of 96 Kwacha annually.

METHODS

We use a logistic regression model to understand the relationship between household characteristics and agronomic information and the odds of being a cooperative member during the 2015/16 growing season. We estimate a logistic regression where the dependent variable is cooperative membership during the 2015/16 growing season (coded as a 1, if yes). Independent variables include a vector of household characteristics, a vector of agronomic variables, and a vector of geographic variables (see Table 3 for hypothesized effect on cooperative membership and variable type).

Table 3: Hypothesized Effect of Independent Variables

Variable Name	Hypothesized Effect on Cooperative Membership	Variable Type
Household Head's Age	+	Continuous
Household Head's Gender	-	Binary
Household Head from Area	+	Binary
Household Head's Educational Attainment	+	Ordinal
Household Population Over 12 Years Old	+	Continuous
Area Cultivated in 2015/16	+	Continuous
Cooperative Member in 2015/16	+	Binary
Household	+	Binary
Distance to Village Market	-	Continuous
Distance to Primary Maize Field	-	Continuous
Livestock Index	+	Continuous
Asset Index	+	Continuous

We include two indices of household wealth. The first index measures wealth concentrated in livestock through the measurement of Tropical Livestock Units (TLU). TLU used differing weights in order to create a standardized unit of measurement. The second index mirrors a similar index formed by the World Bank and the Demographic and Health Survey (Rutstein and Johnson 2004). In rural settings, traditional indicators of wealth (such as income) may be difficult to reliably capture, so an asset index like the one used in our model provides useful insight into the economic status of rural households through the provision of an alternative measurement of wealth.

We based the asset index on assets commonly found within rural Zambia. Assets not owned by between 5% and 95% of our sampled population were dropped. We use principal components analysis (PCA) to aid in the calculation of the index. PCA assigns each household asset a factor score, and these factor scores produce a continuous measurement for individual households. The index is then divided into quartiles to better

understand the effect asset ownership has on predicting a household's involvement with an agricultural cooperative. All analysis was conducted using Stata 14.2.

COOPERATIVE SURVEY RESULTS

The cooperative survey shows an average age of only five years of activity for cooperatives in Choma District, with 28 members, on average. Males lead 105 (83%) of the surveyed cooperatives, while 22 (14%) groups feature female leaders. Figure 2 displays the primary activities undertaken by the surveyed cooperatives in Choma District.

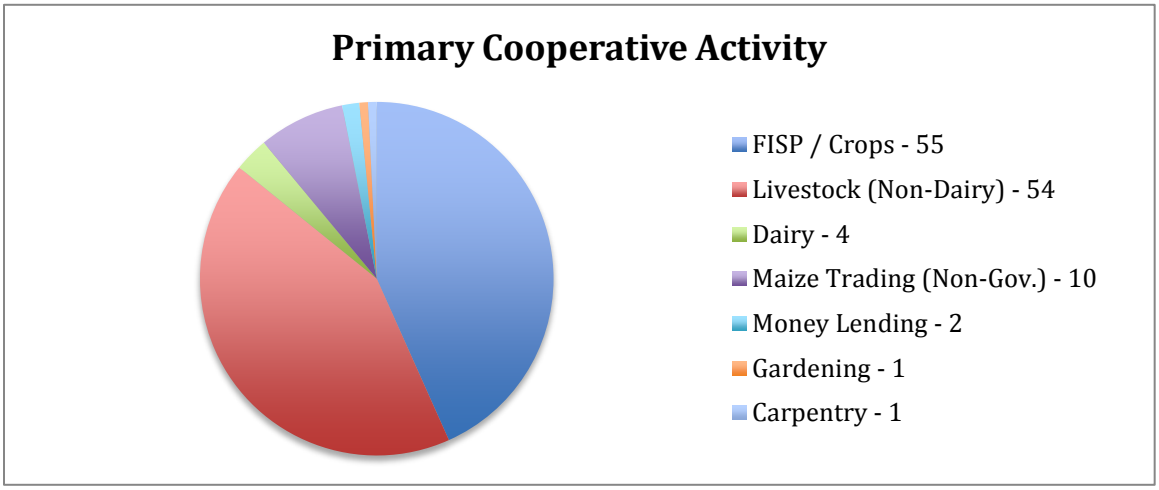
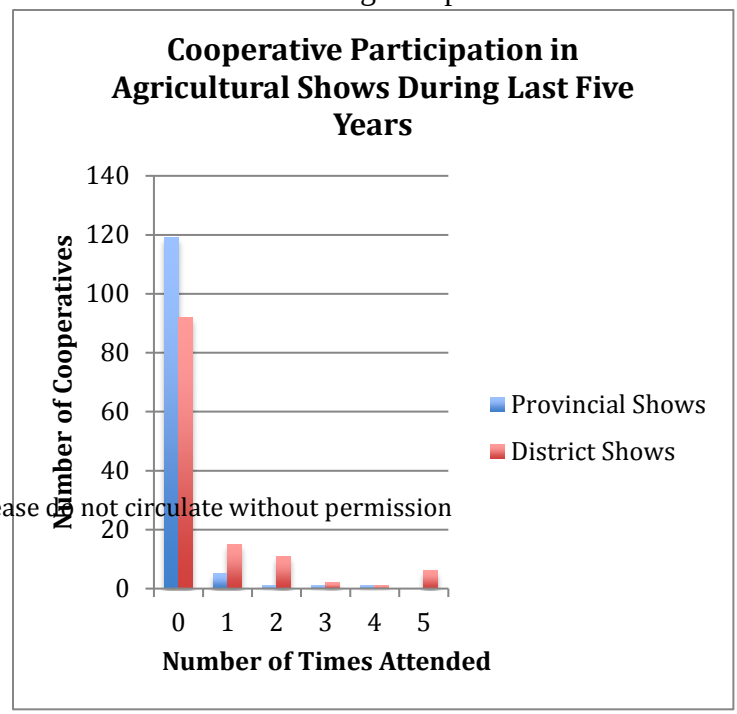


Figure 2: Main Activities of Cooperatives

Membership share prices and annual membership renewal fees express price volatility across the surveyed groups. There exists a range of approximately 2,000 Kwacha for one membership share, with the median share price being 100 ZMK. Annual membership renewal fees range from 50 ZMK to 200 ZMK, with a median rate of 100 ZMK. In addition to membership prices, farmers must also pay an additional 400 ZMK for the FISP input pack (Ministry of Agriculture 2015). However, within cooperatives, not every member receives the support through the FISP. On average, about 14 cooperative members, roughly half the members of the average cooperative receive the subsidized inputs package.

When asked a series of questions to understand the functionality of cooperatives as a collective action group, 92 out of 127 (72%) said the cooperative worked to facilitate the purchasing of seed and fertilizer. Most often, the facilitation of these inputs was done through the organization of transportation for bringing recently purchased inputs from



an agro-dealer (seller of agricultural inputs) back to the rural communities.

Some cooperatives engage in sharing, primarily through the sharing of oxen-drawn plows (32%, 41 of 127), and seed packs. The sharing of maize seed may mitigate risk uncertainty due to climate change, or as a method through which farmers may experiment with new varieties without having to fully invest all their efforts in a new cultivar for a growing season. Twenty-nine of 127 (22%) cooperatives indicated sharing or splitting packs of maize seed.

Figure 3: Participation in Agricultural Shows

When asked about situations where knowledge transfers may occur, cooperatives seem to seldom function as a collective unit. Figure 3 illustrates the frequency of cooperative engagement in district and provincial agricultural shows over the last five years. An overwhelming majority of cooperatives do not attend the shows: 119/127 for provincial shows; 92/127 for district shows. Admittedly, members may attend on their own, however the lack of cooperative participation may indicate low group cohesion. Of the nine cooperatives that attended district shows three or more times over the last five years, all but two are within 25 kilometers of the district capital – site of the annual show. Thirteen cooperatives report holding field days between June 2015 and May 2016, while 114 held no field days. One cooperative reports holding two field days, the most days held within our sample.

LOGISTIC REGRESSION MODEL RESULTS

The output from the logistic model is in Table 4. Model results indicate the gender of the household head does not play a statistically significant role in the household's participation in an agricultural cooperative. We do not find evidence that male-headed households are more likely to be cooperative members as hypothesized.

The model indicates farmers with lower asset ownership have lower odds of being in a cooperative. Households from the third, fourth, and fifth quintile (highest asset ownership) have at least a 120% greater increase in the odds of being cooperative members than households in the lowest, most asset-poor, quintile. Model results also illustrate households with low resource availability (measured through land cultivated, the number of maize plantings in a season, and maize yield) have lower odds of being cooperative members. Planting an additional maize variety in a season increases a household's odd of being a cooperative member by 69%, holding all else equal. Greater cultivated area for a household increases the odds of a household participating in a cooperative by 28%. While greater maize yields increase cooperative participation odds by 50% over low-production households, holding all else equal.

Table 4: Results of Logistic Regression

Variable Names	Odds Ratios	Robust Stand. Err.	z
HH Head's Age	1.079**	0.036	2.27
HH Head's Age Square	0.999*	0.000	-1.67
HH Head From Here	1.299	0.220	1.55
HH Head's Gender (1=male)	1.023	0.215	0.12
Number of People Over 12 Years	0.990	0.044	-0.23
HH Head's Education	1.185**	0.085	2.36

Distance to Village Market	1.003***	0.001	2.7
Distance to Primary Maize Field	0.992***	0.002	-4.33
Number of Maize Plantings	1.689***	0.192	4.6
Off Farm Income Opportunities	1.243	0.217	1.24
Log of Cultivated Area	1.377***	0.160	2.74
Log of Maize Yield	1.498***	0.134	4.51
Non-Maize Income	1.000	0.000	-1.62
Livestock Index	0.995	0.007	-0.78
Asset Index			
2	1.234	0.270	0.96
3	2.200***	0.501	3.46
4	3.239***	0.823	4.63
5	2.772***	0.873	3.24
Constant	0.001***	0.001	-6.51

Pseudo R2 = 0.193

N = 948

* = Statistical significance at the 10% level, ** = 5% level, and *** = 1% level

Of the 1,174 households surveyed from June to August, 728 households report being affiliated with a local agricultural cooperative, and from this amount only 107 (15%) households are female-headed. Alternatively, 96 female-headed households (22% of non-cooperative member households) reported no cooperative affiliation. According to the most recent findings released through the Government of Zambia's Demographic and Health Survey, 27% of rural households nationally are female-headed households (CSO 2015). Our survey indicates an underrepresentation of female-headed households involved with the nation's cooperative network.

DISCUSSION

The two most commonly reported 'functions' of cooperatives in Southern Province were for FISP participation and livestock marketing and sales. Livestock cooperatives are likely more common in Southern Province because Tonga and Ila tribes (the majority groups within the area) both rely heavily on cows for their livelihoods. The FISP program appears to incentivize smallholder farmers into cooperative participation through the subsidized inputs.

However, the cooperative survey results also indicate a failure or lack of engagement by cooperatives to embark in knowledge sharing and production. District and provincial agricultural shows are an important hub within Zambia through which rural farmers are able to access a large amount of information. Farmers may attend the shows as individuals, but it is unclear if knowledge is then transferred back to the cooperative. Cooperative representatives indicate farmer-to-farmer knowledge exchange to be the second most common source of information regarding hybrid maize varieties (33%), while agricultural extension agents remain the primary source of information at about 43% of all responses. Given the high prevalence of FISP oriented cooperatives and the low participation in agricultural shows at the district and provincial levels and the low

propensity to hold field days indicates suggests that knowledge transfer is not a prominent function of the cooperatives. For the average cooperative, it is more than likely that cooperatives operate with the sole function of gaining access to subsidized inputs and are formed in order to enroll in FISP.

Model results indicate the household head's gender is not statistically significant in predicting the odds a household will engage with a cooperative. This finding is consistent with Fischer and Qaim's (2011), who found no gender bias within Kenyan banana cooperatives. This result goes against the effect we hypothesized when selecting variables for use in the model, however the descriptive statistics do indicate an underrepresentation of female-headed households within our sample. Female-headed households are regarded as more vulnerable throughout the development literature. A cooperative network skewed away from female-headed households creates a problematic situation for Zambia, especially when considering the national proportion of female-headed households has risen by 3% from 2007 to the time of the national survey in 2013/14 (CSO 2015). A growth in such a substantial portion of the population must be taken into consideration in order to achieve sustainable rural agricultural development. While our model does not indicate significance, gender must stand as an important component of the national cooperative systems in order to engage farmers from across socio-economic spectrum.

Household survey results also indicate cooperative-affiliated households are more resource endowed than those not participating in cooperatives. Unsurprisingly, the educational attainment and age of the household head are both highly significant. We also find households with more assets participate in cooperatives. Households within the top three quintiles have increased odds of being cooperative members during the 2015/16 growing season, in comparison to the lowest quintile at a highly significant level. As a result of wealthier households gaining increased entry to cooperatives, it seems unlikely the nation's efforts to achieve collective action at the community level through the organization of cooperatives have been successful, or will become successful in the future.

Three variables from the model are statistically significant in increasing the odds of a household becoming a cooperative member, yet these three variables pose endogeneity concerns. In particular, we highlight the effect of the land cultivated, the yield per hectare of maize, and the number of maize plantings during the 2015/16 season. We are unable to deduce if cooperative membership causes statistically higher prevalence of these variables, or if their effect increases cooperative membership directly. For example, does belonging to a cooperative increase the yield per hectare of a farmer, or does increased yield per hectare allow a farmer more money that enables them to pay for expenses associated with cooperative membership.

Prior research by Mason and others (2013) finds the FISP has a positive, although limited, effect on increasing yields throughout Zambia (1.88 kg of maize per kg of FISP provided fertilizer), but the extent to which the program's benefit is due to cooperative membership, rather than entirely due to the subsidies is not clear. Given the minimal effect listed by Mason and others it seems unlikely that improved yield allows farmers to participate in cooperatives, but rather smallholders from greater socio-economic classes within the rural areas join cooperatives first, then gain the benefit to farm productivity via FISP. It is likely that without the benefits gained through cooperatives (namely FISP),

participating households would remain at a higher and more productive level than non-cooperative participating neighbors. These households already having greater resources to begin with: more land, education, and asset wealth. These households hold a substantial advantage over resource-poor households. The concern is that cooperatives, like the FISP, are not equitably distributed across households and not benefitting the poorest and most vulnerable households.

Past research by the Zambia-based Indaba Agricultural Policy Research Institute (IAPRI) identifies a similar issue with the FISP. IAPRI argues the FISP largely misses the program's purported target of aiding the poorest of the rural poor as a result of the high fees associated with the FISP. IAPRI recommends the removal of all program-associated fees in an effort to increase inclusion by the rural poor into the program (Sitko et al. 2012). This is also true of cooperative, which in some cases may go toward the facilitation of input transportation and other group activities but stand as a barrier to entry and opens a window for potential financial mismanagement. Farmers feel obliged to pay since they get access to the greater FISP benefits but they do not get much benefit from the cooperative itself.

Furthermore, the FISP perpetuates a dependency on input subsidies across Zambia, which potentially jeopardizes the effectiveness of creating a network of functioning cooperatives nationwide. Bernstein (2010) identifies the commodification of subsistence agriculture as "forced commercialization", and the continuous development of cooperatives for the sole function of diffusing modern inputs into rural areas stands to negatively affect cooperatives in the long-term. When writing about Zimbabwean cooperatives formed through heavy government intervention Akwabi-Ameya (1997) notes, "Any program that perpetuates dependency is inimical to efforts at sustainable development." Cooperative members and policy makers alike could benefit to a greater extent through organic cooperative formation in which input diffusion does not serve as the primary reason for the cooperative's existence.

Ortmann and King (2007) identify the ability to evolve and adapt as imperative to cooperative maintenance and success. The greatest way to adapt in a beneficial fashion will be through the sharing of knowledge from farmer to farmer, as well as the inclusion of outside knowledge from NGOs, government entities, and even agricultural companies. A cooperative system constructed to improve access to new ideas and methods would provide substantial gains in both the short-term and long-term. However, for now, the capture of FISP benefits is the main impetus for forming and maintaining cooperatives and until policy makers disentangle the FISP from cooperatives the full benefits of cooperatives will not be realized. The traditional benefits of a cooperative: reduction of transport costs, collective bargaining and marketing, and knowledge sharing could all play an important role in raising yields and increasing food security in Zambia.

The current cooperative program may succeed in disseminating Green Revolution inputs, but the network fails in transferring knowledge and educating members. This may be due to a lack of trust and reciprocity between members. Agrawal (2001) identifies shared norms, social capital, and the past successes of working together as a group as a key determinant of a group's success at collective action. The short period of existence for the average cooperative, only 5 years, may be too little time to create the social bonds needed in order to drive cooperatives toward more shared success. Further research into the social construction and spatial distribution of cooperatives would greatly

aid this narrative surrounding cooperatives within rural Zambia and across sub-Saharan Africa. Understanding the dynamics of cooperative members, especially in cooperatives that have functioned for longer, would create a more nuanced understanding of the shared norms and social capital necessary to ensure cooperative success and longevity.

CONCLUSION

Smallholder farmers in Zambia and throughout sub-Saharan Africa face a number of challenges to remain food secure. Previous research identifies high transaction costs as one of the greatest limitations faced by rural smallholders, largely due to poor infrastructure and roads throughout Africa. To reduce transaction costs, policy makers can exploit cooperatives by fostering collective action to reduce market transaction costs, increase bargaining power, and facilitate knowledge dissemination among smallholder farmers. By pairing cooperatives with a large-scale subsidy program that seeks to increase access to modern inputs, policymakers defeat the purpose of cooperatives. Increasing agricultural productivity could be more equitably distributed if the structure of cooperatives is improved. and or the costs of cooperatives are removed.

Results from the household survey conducted in six of Zambia's ten provinces indicate cooperative membership favors more resource endowed and less vulnerable households. Findings from the cooperative survey demonstrate that cooperatives seldom operate with the goal of diffusing knowledge and educating members. Poverty alleviation and rural development could be more effectively addressed if cooperatives can provide benefits of collective action to their members, rather than simply serve as avenue for seed and fertilizer dissemination. A crucial function of farmer groups in the future must be the development of cooperatives to serve as a hub of knowledge transfer.

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