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Gender and Policy Roles in Farm Household Diversification in Zambia

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Summary. — Many African governments, faced with low rural incomes and food security challenges, have developed input subsidy programs in order to enhance agricultural productivity. This paper adds to recent literature analyzing the effects of input subsidy programs and gender on crop diversification in Sub-Saharan Africa. We investigate the effect of Zambia's input subsidy program on crop allocation patterns by gender. In relatively land abundant Zambia, we test both single-equation crop diversification index models and multivariate regression models of cropland allocation. Our study finds that input subsidies reduce crop diversification more in male-headed households than in female-headed households. Further, multivariate regression results confirm that this occurs because female-headed households expand maize acreage less in response to the input subsidy. These findings suggest that greater cropland diversification will be maintained if input subsidy programs are accompanied by loan programs and other assistance which support leadership roles for women in farm households.

Key words — Zambia, crop diversification, gender, land allocation, input subsidy program, Sub-Saharan Africa

1. INTRODUCTION

Many African governments, faced with low rural incomes and food security challenges, have developed input subsidy programs in order to enhance agricultural productivity (Chibwana, Fisher, & Shively, 2012; Druilhe & Barreiro-Hurlé, 2012). Subsidies for maize production have been a focus in Sub-Saharan Africa. While the subsidy program in Malawi has been the subject of significant study (Bezner-Kerr, 2012; Chibwana *et al.*, 2012; Holden & Lunduka, 2012, 2013; Jayne, Mather, Mason, & Ricker-Gilbert, 2013; Mason & Ricker-Gilbert, 2013; Ricker-Gilbert, Jayne, & Chirwa, 2011; Ricker-Gilbert, Mason, Darko, & Tembo, 2013), subsidy programs have been implemented in other countries in the region, including neighboring Zambia (Jayne *et al.*, 2013; Mason, Jayne, & Myers, 2015; Ricker-Gilbert, Mason, *et al.*, 2013; Xu, Burke, Jayne, & Govereh, 2009).

In countries like Zambia where maize cultivation is already prevalent, such a subsidy program has the potential to reduce crop diversification. Indeed, the government of Zambia, in their 2011–16 Manifesto, expressed concern that their input subsidies made households more vulnerable to food supply shocks by encouraging greater farm specialization and household dependency on drought-sensitive and input-sensitive crops (Patriotic Front, 2011). More generally, crop specialization has implications for the environment, food security, and nutrition. Producers who expand monoculture cropping systems supported through fertilizer reduce biodiversity, soil quality, and resilience amid climate change (Kremen & Miles, 2012), and raise production and price risk with consequences for income and food security (Chibwana *et al.*, 2012; Fleuret & Fleuret, 1980). There also are additional labor requirements for women associated with fertilizer use which reduce time available for feeding and caring for children (Bezner-Kerr, 2012). By contrast, crop diversification has been positively associated with dietary diversity, with a significantly stronger association in the case of female-headed households (Jones, Shrinivas, & Bezner-Kerr, 2014).

This paper adds to the recent literature analyzing the effects of governmental food production programs in relation to gender and crop diversification (Benin, Smale, & Pender, 2006; Chibwana *et al.*, 2012; Gauchan *et al.*, 2005; Kankwamba, Mapila, & Pauw, 2012; Mason, Jayne, & Mofya-Mukuka, 2013; Mason & Ricker-Gilbert, 2013; O'donoghue, Roberts, & Key, 2009; Sichoongwe, Mapemba, Ng'ong'ola, & Tembo, 2014; Smale, Meng, Brennan, & Hu, 2003; Van Dusen & Taylor, 2005), by examining how Zambian farmers respond to an input subsidy program targeted to maize. Of particular interest is the relative response of crop diversification by female-headed households, after controlling for household socio-economic, market, and farm characteristics. While gender inequality in agriculture reflects a complex set of issues including control over resources, control over decision-making, labor requirements, and support from kin (Bezner-Kerr, 2005, 2012), female-headed households have been shown to exert influence over land use decisions (Shipekesa & Jayne, 2012). The relative response of female-headed households is uncertain. The land allocation decisions of female-headed households could be especially responsive to crop subsidies because women face production limiting constraints such as less access to productive resources, including inputs and land (Blackden & Bhanu, 1999). However, female-headed households instead could be less responsive to the subsidy program given the potential consequences of specialized production for food security and household nutrition, and since male and female farmers traditionally grow different crops.

Zambian input subsidy programs, which were introduced in the early 2000s, provided subsidies to fertilizer and seed inputs. The programs are described in more detail in Table 1. Zambia also has a panel data survey of farm households available for the years 2001, 2004, and 2008 to support evaluation of the subsidy program.

Compared to their well-studied neighbors in Malawi, Zambian producers also may have more options for modifying crop choice in response to agricultural subsidies. In particular, Jayne, Chamberlin, and Headey (2014) describe Malawi as part of "land constrained" Africa, a set of countries where

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Table 1. *Zambian input subsidy programs*

	Food Security Pack	Fertilizer Support Program
Introduction of subsidy	– 2000–01 agricultural season	– 2002–03 agricultural season
Objective	– Promote crop diversification and resource conservation practices among small-scale farmers	– Improve food security and input market participation by the private sector and cooperatives
Characteristics of targeted beneficiary	– Households farming less than 1 ha – Meet criteria of vulnerability	– Households farming up to 5 ha – No beneficiaries of the Food Security Pack – Active involvement in the farmer cooperative
Subsidized input pack	– 0.75-ha inputs: 0.25-ha cereal seed, 0.25 pulses seed, 0.25-ha cassava/sweet potato tubers and fertilizer for each cereal	– Subsidy to plant 1 ha of maize: 20 kg of hybrid maize seeds, four bags of 50 kg of Compound D basal dressing fertilizer and four bags of 50 kg of Urea top dressing fertilizer
Supported crop	– Mixed-Crop: Includes cereals and cassava	– Mono-Crop: maize
Size of subsidy/length of subsidy	– Completely subsidized – 3 years, but benefits continued until 2010	– Partially subsidized: year 1: 50%; year 2: 25%; year 3: 0% subsidized – 3 years, but benefits were extended
Distribution of subsidy	– Distributed by the by NGOs located at the district level	– Private seed and fertilizer companies provided the inputs – Distributed by District Agricultural Cooperatives (DACs)
Other relevant changes to the subsidy program		Successor: Fertilizer Input Support Program (2009–10 agricultural season-Current Agricultural Season); Subsidized input package was cut in half to support 0.5 ha of maize production (i.e., 10 kg of seed, two bags of 50 kg of Compound D basal dressing fertilizer, and two bags of 50 kg of Urea top dressing fertilizer)

little (non-forested) unutilized arable land is available, and average farm sizes are relatively small and falling, while neighboring Zambia is part of "land abundant" Africa, a set of countries with more unutilized arable land and relatively large average farm sizes. Jayne *et al*. (2014) report that Zambia has the fourth largest supply of non-forested unutilized land among African countries and an average farm size of 3.7 acres in 2008 compared to an average farm size of 1.4 acres in Malawi in 2009, although Sitko and Jayne (2014) also provide evidence of land scarcity in some regions of Zambia. To the extent that land holdings are associated with wealth, farm households in a country with larger farms may have greater potential to take on climate and other risks associated with cultivating cash crops. Farmers in a land abundant country also may have greater potential to react to a subsidy by expanding land under cultivation as well as through reallocating current holdings to new crops, although small-scale farmers in Zambia continue to face competition for land with mid-size and larger producers (Sitko & Jayne, 2014).

This paper also adds to the recent literature by linking models of crop shares (Chibwana *et al*., 2012), with single equation models of crop diversification indices (Benin *et al*., 2006; Kankwamba *et al*., 2012; Pope & Prescott, 1980; Sichoongwe, Mapemba, Ng'ong'ola, & Tembo, 2014). Specifically, in this paper the responsiveness of crop choice to the subsidy is measured using two crop diversification indices and a model of crop shares through a multivariate regression model. A multivariate model of crop acreage is also estimated, given the greater potential to expand land in cultivation in relatively land abundant Zambia. Use of these models implies that agricultural diversification is measured via crop choice at a point in time across farm acreage. We do not consider alternative measures of crop diversification which reflect the prevalence of intercropping and crop rotation (Kremen & Miles, 2012; Ponisio *et al*., 2015; Snapp, Blackie, Gilbert, Bezner-Kerr, & Kanyama-Phiri, 2010). Crop choice at a point in time is also a key household decision variable in our theoretical model of household utility maximization (Benin *et al*., 2006).

Single equation models of crop diversification generate insight on how the number of crops grown by each household, and crop proportional abundance on the farm, are affected by the input subsidy in relation to the farmer's gender. However, single equation estimations of crop diversification indices do not allow researchers to directly tie factors, such as input subsidies and the gender of the household head, to farmland allocation. By contrast, results from crop share and crop acreage models have potential to support, or fail to support, the findings of the single equation crop diversification model. In particular, if a subsidy is found to reduce crop diversification it should be found to encourage land allocation to crops which are most commonly grown even in the absence of the subsidy; that is, maize in the case of Zambia.

2. LITERATURE REVIEW

Farm diversification can be approached in different ways. One approach to farm diversification is to evaluate the household's resource and asset portfolio diversification. In this approach, household resource and asset portfolio diversification correlate to household income diversification. Household income diversification suggests a movement from subsistence food production into commercial farming or from in-farm to off-farm activities (Joshi, Gulati, Birthal, & Tewari, 2004). In this view, monoculture cropping [1] systems reduce production and price risks, increase farm productivity in drought regions, and reduce the exposure to food supply shocks. Research conducted by Ricker-Gilbert, Jayne, and Shively (2013) suggests maize specialization could provide market opportunities and increase flexibility for planting and harvesting. The other approach to farm diversification is to evaluate changes in the household's crop production diversification patterns. In