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Agricultural Lives of the Poor

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ABOUT THE PROGRAM ON FOOD SECURITY AND THE ENVIRONMENT

Stanford University's Program on Food Security and the Environment (FSE) addresses critical global issues of hunger, food security and environmental degradation from agricultural practices worldwide by generating vital knowledge and innovative, policy-relevant solutions. FSE is a joint program between the Freeman Spogli Institute for International Studies (FSI) and the Woods Institute for the Environment (Woods).

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Introduction

The Agricultural Lives of the Poor project seeks to summarize, systematize, and make publicly available basic data on the agricultural production and consumption behavior of the global poor. Detailed information on both consumption and production (net and across commodities) is essential to fully comprehend the lives and prospects of the global poor. Three quarters of the world's poor, the 2.5 billion people who live on less than $2 a day, live in rural areas (Ravallion et al., 2007). Agriculture is especially important for these individuals as a means of income generation and food security, and as a sector, is credited for driving economic growth in the rural economy (World Bank, 2008). As rural households are simultaneously consumers and producers of agricultural commodities, net consumption/production position is crucial for understanding the heterogeneous impacts of public policies, changes in global markets and prices, and environmental changes on these vulnerable populations. In conjunction with data on indicators of households' abilities to respond to various shocks, improved targeting of both research and interventions is possible.

Good data are fundamental to any good policy analysis or fruitful development intervention. Unfortunately, for broad swaths of the developing world systematic, comprehensive data describing basic household economic behavior is lacking: what the poor buy and sell, how easily they substitute among consumption goods and incomes sources, and how such behavior varies by income class. Even basic data that typify poor households as net producers, subsistence, sub-subsistence, or landless laborers are not centralized and easily accessible. As a result, these areas remain immune to simple first-order assessments of the impact of policy interventions or market developments, not to mention the more detailed modeling work necessary to identify winners and losers under different policy and price scenarios. Finally, the lack of comparable data across poor countries inhibits our understanding of how the lessons learned from studies in one country transfer across borders.

The ALP project combines production and consumption data on individual crops and food groups at the household level. By combining this data with food security indicators derived from food expenditure data, the results more fully describe the agricultural lives of the poor and hungry. Furthermore, we isolate producing households and describe indicators of their ability to respond to a changing environment. In addition to the poverty impact of food prices, the data are primed to answer many relevant research questions, such as if net producers are food insecure, and the degree of specialization of net producers. The results of this project will inform efforts to prioritize and target agricultural-

related interventions and policy reforms, and to understand and manage the distributional effects of various market developments on a regional-to-global scale. The ALP data is also available in order to provide the foundation for future project collaborations.

This paper presents data from five of the first countries incorporated into the Agricultural Lives of the Poor project: Ghana, Guatemala, India, Malawi, and Uganda. Datasets were selected based on availability and depth of detail on consumption expenditures, sources of income, and agricultural practices. Each of these survey components is necessary in order for ALP to focus on net consumption/production at the household level, and to understand expenditure and consumption behavior. Net consumption and production data of individual crops and food groups is further disaggregated by subgroups formed on characteristics that include economic status, household attributes, livelihood strategies, calories available, landholding, tenure types, and agricultural input use.

Literature Review

In response to the food price shock in 2007-2008, several studies have analyzed household survey data for net food consumption/production in order to determine the welfare impact of price increases. Zezza et al. (2008) perform the most disaggregated impact analysis by building on the FAO Rural Income Generating Activities database and distinguish poverty impacts over rural/urban, expenditure categories, land ownership status, livelihood strategy, and use of agricultural inputs. The main finding in the short term is that poor households and households with limited assets and access to agricultural inputs will suffer the most due to increased food prices. This agrees with the conclusion reached by Ivanic and Martin (2008) that average national poverty increases are more frequent and larger than poverty reductions in the recent food price shock. Aksoy and Isik-Dikmelik (2008) look at sub national impacts and conclude that on average when food prices rise, there is a net welfare transfer from high income net food consumers to poorer net producers, since the average income of net food buyers are higher than the average incomes of net food sellers. The measure of poverty impacts in these papers is the compensating variation, which was first used by Deaton (1989) to analyze the impact of food price increases on households.

More broadly, recent efforts to better characterize poverty and hunger have focused on household survey data. Banerjee and Duflo (2007) analyze thirteen household surveys to describe the economic lives of the poor in a systematic way. They make two observations particularly relevant to this project:

the share of food expenditures declines as incomes rise, and poor households tend to lack specialization in income generation, which corresponds to the small scale of household enterprise. The FAO's Rural Income Generating Activities project hosts a separate public database that describes income sources using data from an array of household surveys, but does not include net consumption/production information. In an independent IFPRI project, household expenditure data are used to create indicators of food security and consumption behaviors, such as calorie sufficiency and dietary quality (Smith and Subandoro, 2007). The methodology developed is detailed, including recommendations on designing the food expenditure portion of household surveys, and the results are being spatially mapped in conjunction with the joint IFPRI and University of Minnesota Harvest Choice project. Separately, the Harvest Choice project is also building a database that spatially characterizes smallholder production systems, identifies production constraints, and describes the biophysical context of agricultural systems. However, it does not appear that the consumption and production portions of the data will be linked at the household level.

These disparate sources provide very useful information, such as improved estimates of household well-being, and the prevalence of production systems. However, the combination of multiple analytical methods at the household level provides not only a better description of constraints faced and decision making at the household level. As most rural households in developing countries are both producers and consumers of agricultural commodities, a focus on either household production or consumption to the exclusion of the other will undoubtedly miss important interactions between the two. In brief, a comprehensive characterization of the agricultural lives of the poor will provide the basic building blocks for policymakers who want to analyze poverty impacts in a wide array of fields, including climate change, energy, land use, and nutrition.

Data and Methodology

In order to calculate accurate net consumption/production at the individual crop and food group level, household surveys must include detailed questions on both consumption and income. These requirements limit the number of household survey datasets eligible for use, as many survey leave out one aspect, or do not collect information in enough detail for credible estimates of totals. The initial set of household survey data analyzed was conducted in six countries listed in Table 1: Ghana, Guatemala, India, Malawi, and Uganda. Several other household datasets with the same types of information are available and will be added to the analysis, including datasets from India (national), and Panama.

Table 1. Dataset Details.

Country	Year	Survey	Source	# of HHs	% rural
Ghana	1998	Ghana Living Standards Survey Round Four	LSMS	5,998	63%
Guatemala	2000	Encuesta de Condiciones de Vida	LSMS	7,276	53%
India- UP and Bihar	1998	Living Standards and Measurement Survey	LSMS	2,251	100%
Malawi	2004	Integrated Household Survey- 2	LSMS	11,280	87%
Uganda	1999	National Household Survey	UBOS	10,644	78%

For these analyses poor and extremely poor households are determined using two metrics: an international poverty line and relative poverty within each survey. The 2005 International Comparison Program purchasing power parity (PPP) results and corresponding revised World Bank $PPP 1.25 and $2.50 per person international poverty lines are used to identify the extremely poor and poor, respectively (Chen and Ravallion, 2008). To convert national currency values to $PPP, the national consumer price index is used, and to account for internal country price differences, regional deflators are used when they are available. Using the PPP benchmarks and CPI numbers is necessary to compute an international poverty line but the methodology is subject to much criticism. Therefore, as an alternative, relative poverty within countries can be used as a proxy and expenditure deciles and quintiles are calculated for this purpose. The advantage of analysis at the decile and quintile level is that details may be illuminated that are obscured by averages across international poverty groupings. Following best practices, consumption expenditure aggregates are used in place of income as a measure of welfare, because of the better quality of expenditure data and the tendency of households to smooth consumption (Deaton, 2004). Household consumption expenditure aggregates are calculated using standardized methodology across datasets, with food for home consumption valued at either the households' purchase price or the median purchase price for the closest administrative unit.

Income estimates are also calculated and categorized into a standard set of sources. Similar to food expenditures, the entire quantity of the agricultural harvest is valued at either the households' sell price or the median sell price for the closest administrative unit. In order to calculate net consumption/production that is comparable across datasets, a set of comparable crops and food groups has been determined and all food bought and agricultural products sold are labeled accordingly. The net position is calculated by subtracting the value of food bought from the value of agricultural products

sold. In cases where a food product is unambiguously derived from a single agricultural crop, the value of these food products (corn tortillas, bread, buns…etc.) is included in the consumption value. Net producers are defined as households with a positive net position, and net consumers are households with a negative net position.

The methodology used in ALP is a combination of individual methodologies developed previously for household survey analysis. Here we combine the calculation of consumption expenditures, income, calorie availability, net consumption/production, as well as add data on agricultural, demographic, and socioeconomic characteristics. This combination of approaches allows richer answers to a varied set of research questions that goes beyond the poverty impact of rising food prices. The standard list of agricultural crops and food groups also allows for instant analysis across countries and can also link consumption and production behaviors of multiple crops in agricultural households. By providing fairly disaggregated summarized data, we hope to instigate more research questions and show that a thorough analysis of poverty requires linking these multiple methods.

Overview of Results

Poverty

As expected, the majority of households in the ALP datasets are poor, and the poor live mostly in rural areas. The mean daily per capita expenditure ranges from $PPP 1.03 in rural Uttar Pradesh and Bihar states in India to $7.89 in Guatemala. The proportion of households who are extremely poor using the poverty line of $PPP 1.25 ranges from 8% in Guatemala to 76% in India. A proportionally smaller share of households fall under the $PPP 2.50 poverty line, ranging from 39% in Guatemala to 96% in India. In all countries, poverty is largely rural, with rural households comprising on average 90% of households living on less than $1 a day and 88% of households living on less than $2 a day.

Table 2. Poverty.

Country	Year	Average daily per capita expenditures ($PPP)	Under $1.25 PPP		Under $2.5 PPP	
			% of HHs	% rural	% of HHs	% rural
Ghana	1998	3.21	27	85	63	78
Guatemala	2000	7.89	8	89	39	82

India- UP and Bihar	1998	1.03	75	--	97	--
Malawi	2004	1.92	52	94	86	91
Uganda	1999	2.29	46	93	83	88

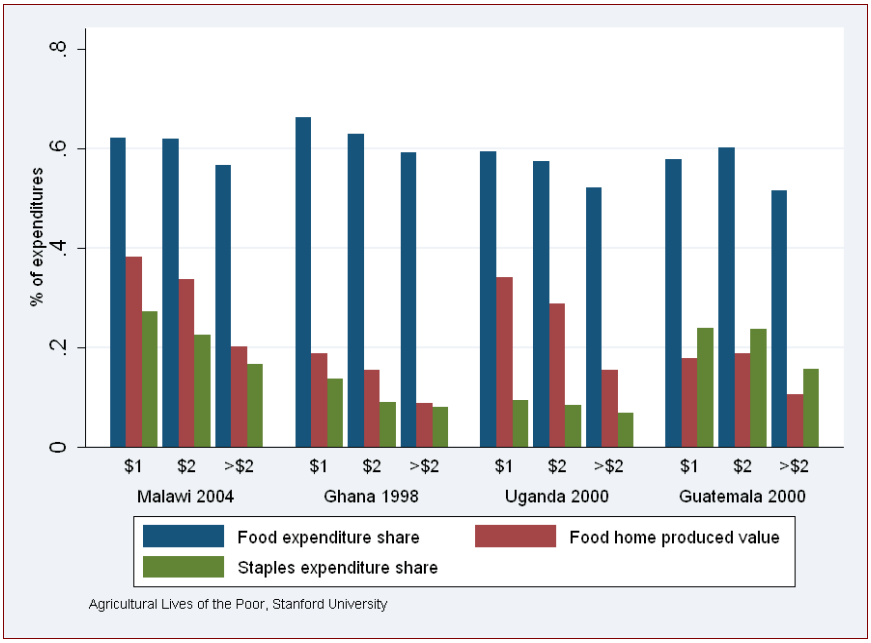
Table 3. Expenditures on food and income source.

Expenditure group	**% household expenditures on food**	**Income Source**					
		Agriculture	**Ag. wage**	**Non-ag wage**	**self employment**	**remittances/ transfers**	**Other**
Extremely poor	**62%**	**45%**	**23%**	**13%**	**10%**	**7%**	**6%**
(<$1.25/cap/day)							
Ghana	66%	32%	30%	16%	8%	8%	6%
Guatemala	58%	38%	36%	11%	8%	3%	4%
Malawi	62%	54%	16%	12%	10%	8%	0%
Uganda	60%	55%	11%	*	12%	7%	15%
Poor	**60%**	**39%**	**18%**	**23%**	**13%**	**7%**	**6%**
($1.25-$2.50/cap/day)							
Ghana	63%	29%	20%	27%	11%	8%	5%
Guatemala	60%	35%	30%	17%	8%	5%	5%
Malawi	59%	42%	7%	24%	18%	8%	1%
Uganda	57%	49%	15%	*	15%	8%	13%
Near poor	**57%**	**30%**	**16%**	**34%**	**16%**	**8%**	**5%**
($2.50-$4.00/cap/day)							
Ghana	61%	24%	15%	36%	13%	9%	3%
Guatemala	59%	33%	23%	25%	10%	6%	3%
Malawi	52%	25%	6%	40%	18%	7%	4%
Uganda	55%	36%	21%	*	23%	9%	11%

Food Security Indicators

In order to gauge food security at the household level, we use both expenditure and caloric indicators. The results presented in Figure 1 show that food expenditure, as a share of total household expenditure, is generally around 50-60%, and is consistently higher for poor households. Moreover, the value of food produced at home for own consumption as a share of total expenditures is higher for the poor, especially in Malawi and Uganda where the population is largely rural and heavily dependent on subsistence agriculture. The comparatively high values of these indicators suggest that the poor are quite vulnerable to shifts in food prices and that food security is highly tied to subsistence production. Thus changes in international and domestic policies, markets, and production constraints heavily affect the rural poor.

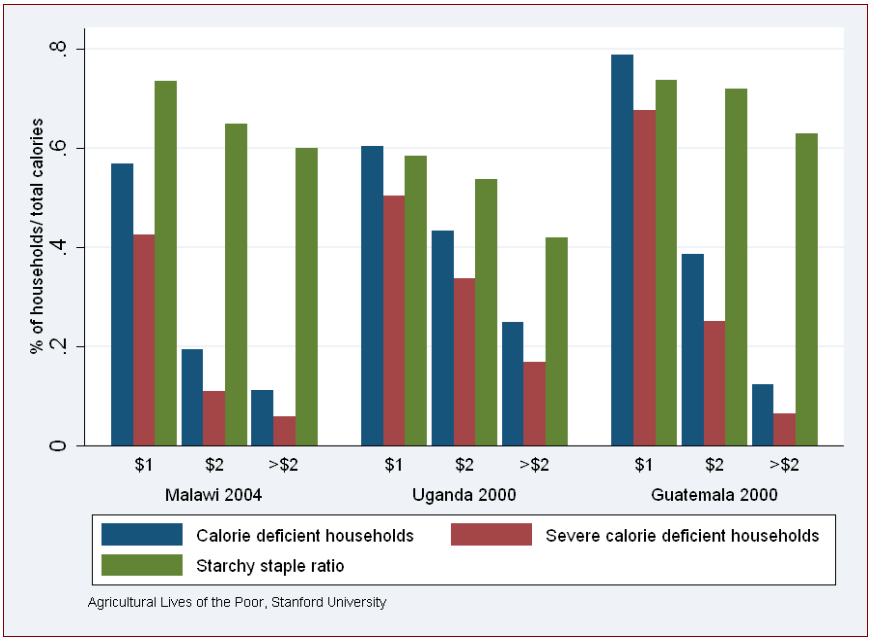
Figure 1. Food Security Indicators, expenditure.



In three of the surveys, we were able to convert expenditures to calories available at the household level using similar methodology to Smith and Subandoro (2007). Calorie deficient and severely calorie deficient households are calculated using gender and age recommended daily values at medium activity level and low activity level, respectively (WHO, 2002). Calorie deficiency is strongly inversely correlated with incomes, and surprisingly, there are households who are not classified as poor using the $2 a day poverty line but that are calorie deficient. The large drop off in calorie deficient households in Malawi between extremely poor and poor households is unexpected, but this may be due to the availability of food aid or agricultural input subsidies. The starchy staple ratio, the share of calories from starchy

staples, is also inversely correlated with incomes as shown in Figure 2. Generally, staples are the cheapest source of both calories and proteins, and thus poor households rely on staples for the bulk of their calories. A high starchy staple ratio also implies lower diet diversity, which can indicate hidden nutrient deficiencies. Interestingly, Guatemala has a surprisingly high starchy staple ratio despite relatively higher incomes. This can be largely attributed to the high reliance and cultural significance of maize and maize products in Guatemala.

Figure 2. Food security indicators, consumption.

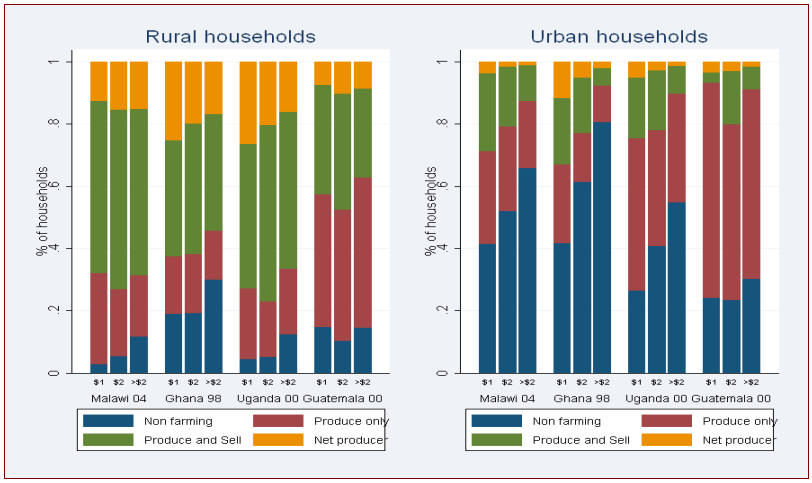


Net producers

Net producers, or households that sell more agricultural products than they purchase, are a crucial determinant of broader food security. Production changes in these households can drastically affect domestic food supply. Holding all other factors equal, net producing households would stand to gain from a rise in the price of the commodities they sell. In the following sections, we use the term net producers to mean net producers of staples. By looking at staples as a group, the welfare impacts of price changes takes into account possible substitution between staples, since the prices of staples generally track each other rather closely. Households that are not net producers of staples are predominantly net consumers of staples, although a small share of net neutral households exists. Where there are more subsistence households, such as in Malawi and Uganda, the percentage of net neutral households is somewhat larger.

The share of net producing households, net consuming households that farm and sell, net consuming farming households, and non farming households is shown in Figure 3. By classifying these different types of producers, we can identify those households that sell in local markets. There is a higher proportion of net producers among poor households, especially in Ghana and Uganda. As Guatemala is a richer country, we expect there to be fewer net producers than in poorer countries. In rural Malawi there are more net producers in relatively richer rural households, which is not a pattern observed in the rural economies of the other countries. This may be a result of a lack of non farming opportunities in Malawi, or the ability of richer rural households to access more agricultural assets or inputs. The share of non farming households is the highest in Ghana at all income levels. The existence of a large cash crop economy, specifically cocoa, explains this in the rural economy, as many households depend on agricultural wages. Households that both farm and sell crops, but do not sell enough to be net producers are the largest share of the population in all countries and across all income levels.

Figure 3. Share of households that are net producers.

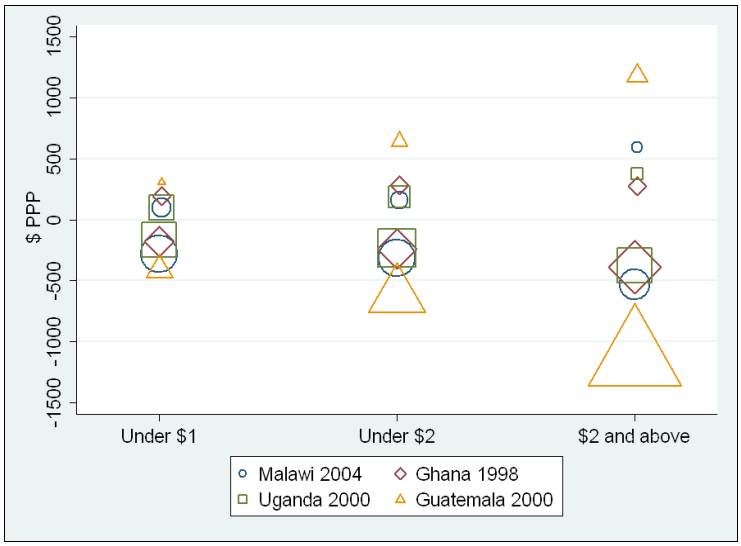


There are relatively fewer households that farm and do not sell any agricultural products. This finding emphasizes the importance of functioning markets and infrastructure to support market participation. Targeting investments in this direction would thus reach the vast majority of poor rural households. Another important observation is that there are producers in urban areas indicating that households have plots outside of urban areas or backyard garden plots. Among urban households, there is clearly a larger share of households that do not farm at all, but the data show that urban agriculture is quite important, especially in poor households. The definition of rural and urban is defined by each individual survey and thus may not be entirely consistent across countries, but this result is consistent with other

literature showing that peri-urban and urban agriculture can be important for food security among the urban poor (Nugent, 2000).

The average net position, or sales net purchases, is shown in Figure 4 for net producers and net consumers in each income group. By definition, net producers have a net position above zero, and net consumers below zero. The size of the markers represents the relative share of households within each country that are net producers/consumers at each income group. The absolute value of net position rises for both net producers and net consumers as incomes rise. At each income level in Guatemala, net producers/consumers have the largest absolute net position compared to the other countries. Perhaps the higher participation in markets and higher incomes in Guatemala creates larger net producers and consumers. This contrasts with the net position values for Malawi, Ghana, and Uganda at each income group, which generally have the same average value.

Figure 4. Net consumption/production ($PPP)



The specific crops that net producers grow in each country are listed in Table 4. The lists of crops are checked against individual country FAO food balance sheets in order to ensure that results are fairly consistent with national production data. Net producers in Malawi appear to be more diversified based on the number of crops listed. However, this may be a product of survey design as the survey tool includes a more detailed listing of crops in the agricultural harvest section. There are a couple of crops that do not appear in the net production table that are important food crops. In Malawi, even though production of both cassava and potatoes is considerable, there are not significant shares of net producing households for either crop. Neither yams nor cocoyams (taro) appear as net production

crops for Ghana, because production is almost entirely subsistence. Likewise, in Uganda, the production of millet is entirely as a subsistence crop. However it is surprising that there is not a significant share of banana net producing households in Uganda.

Table 4. Share of households that are net producers of crops.

Malawi 2004	Maize (13%), sweet potato (5%), groundnut (12%), soybean (5%), bean(4%), egg (5%), fruits (9%), vegetables (9%) , chicken (17%), goat (8%)
Ghana 1998	Maize (24%), rice (4%), cassava (5%), bean (4%), vegetables (4%), plantain (5%)
Uganda 2000	Maize (25%), cassava (11%), sweet potato (5%), groundnut (9%), bean (23%)
Guatemala 2000	Maize (11%), bean (7%)

How do net producers and net consumers differ?

In order to better understand net producing households, we compare the per capita expenditures of net producers to net consumers. The ratio of per capita expenditures of net producers to net consumers is shown in Table 5, with values less than one indicating that net producers are on average poorer than net consumers. Nationally, the data for each country show that net producers are on average poorer than net consumers. Among extremely poor rural households, there is a mixed pattern, with Malawi as the only country where net producers are on average better off than net consumers. If households are broken into expenditure deciles, net producers are also significantly richer than net consumers in the poorest expenditure decile of Uganda. Otherwise, the difference between incomes of net producers and consumers is negligible in extremely poor and poor rural households. However, the difference in incomes is greater among the non poor, as net consumers are relatively richer. This indicates that if the prices of staples rise, the first order welfare transfer would be from richer net consumers who are mostly in urban areas to poorer net producers. This is consistent with other findings and suggests that a rise in food prices would on average transfer income from richer to poorer households (Aksoy and Isik-Dikmelik 2008; Ivanic and Martin, 2008). This observation raises the question as to whether or not higher food prices harm the poor, because despite the fact that net consumers are a larger share of the population, they are on average richer. In most cases, the relatively small share of households that are net producers drives the conclusion that higher food prices raise overall national poverty levels.

Table 5. Net Producer/Consumer Expenditure Ratios.

	All households	Rural households		
		Under $1	Under $2	Above $2
Malawi 2004	.88***	1.06***	.99**	.94
Ghana 1998	.64***	.99	.99	.88***
Uganda 2000	.64***	1.0	.98***	.93*
Guatemala 2000	.53	.97	.99	.52

Difference in means test between net producers and consumers ***Significant at 1%; **Significant at 5%; * Significant at 10%

The relative importance of income sources for net producers and net consumers also differs. As expected, at all expenditure levels, a larger share of income for net producers is from agriculture. In general, the agriculture sector (agriculture + agricultural wage) is a smaller share of livelihoods as incomes rise both within and across countries. Even among net producers, in richer countries of Ghana and Guatemala, households are more diversified into wage labor. Both agricultural wage and non-agricultural wage income are more important income sources for net consumers in all countries. Transfers, which include remittances and other transfers, and self-employment are also both relatively more important sources of income for net consumers at all income levels.

The general results from the analysis of ALP data are consistent with the conclusions of other data analysis projects, and support general development economics intuition. The data show that the poor spend more money on food, have less to eat, and eat relatively more staples. Poverty is more rural, and thus poor households are highly dependent on agriculture. Additionally, we know that the greatest numbers of net producers are located among the rural poor and that they are generally poorer than net consumers, and have less diversified income sources. Among the extremely poor, the majority of households farm and sell some produce in markets, but do not sell enough to be net producers. Thus, they also depend on other income source, such as wage labor, which in rural areas is likely working in the fields of net sellers. The results of ALP data analysis can be further disaggregated to look at target groups in further detail. The following section illustrates several research questions that can be answered in depth with the dataset.

ALP Research Questions

I. Are poor net producers food insecure?

Sufficient caloric intake has enormous benefits, such as the ability for household members to participate in higher activity levels, increased returns to education, and decreased susceptibility to disease. Thus we might assume that poor net producers would fulfill their own household's calorie requirements before selling calories on the market. However, Banerjee and Duflo (2008) find that the poor choose to spend their money on items such as alcohol and tobacco and on festivals instead of purchasing additional calories. They affirm that the income elasticity for food is not as high as expected, even among those living on less than $1 a day. Furthermore, the foods consumed by the poor are not the cheapest calories available, which are generally staples. They argue that although poverty lines are historically constructed to denote calorie sufficiency, it is clear that the poor make decisions based on other priorities. With the ALP data, we can take this analysis a step further by looking at the intersection of calorie sufficiency, net producers, and poverty.

Food security indicators for rural net consumers and producers at different income levels are shown in Table 6. Perhaps surprising at a basic level is the existence of net producing households that are calorie deficient. As expected, the percent of households with calorie deficiency declines as incomes rise among both net producers and consumers, but does not drop to zero in the $2 a day and higher income group. Among households that live on less than a $1 a day, there is no significant difference in calorie sufficiency between net consumers and producers for both Malawi and Guatemala. However, there is a significant difference in the mean starchy staple ratio, or the percentage of total calories from starchy staples. Thus in Malawi and Guatemala, net producing households eat a more diverse diet, even though they have the same amount of calories available as in net consuming households. This pattern is reversed only for net producers among the non-poor in Guatemala, where although there are less calorie deficient households, net producing households have a higher starchy staple ratio. In Uganda, there is a larger difference in calorie deficiency at all income levels, with net producers much less likely to be calorie deficient than net consumers. However, the pattern for the starchy staple ratio is reversed, with net producing households having a higher starchy staple ratio across all income groups. It appears in Malawi and Guatemala, net producers make choices to diversify their diets and may sacrifice calorie sufficiency in order to obtain these other calories. This contrasts with the Uganda data, which shows that net producers significantly reduce calorie deficiency, but derive more calories from starchy staples than net consumers at the same income levels.

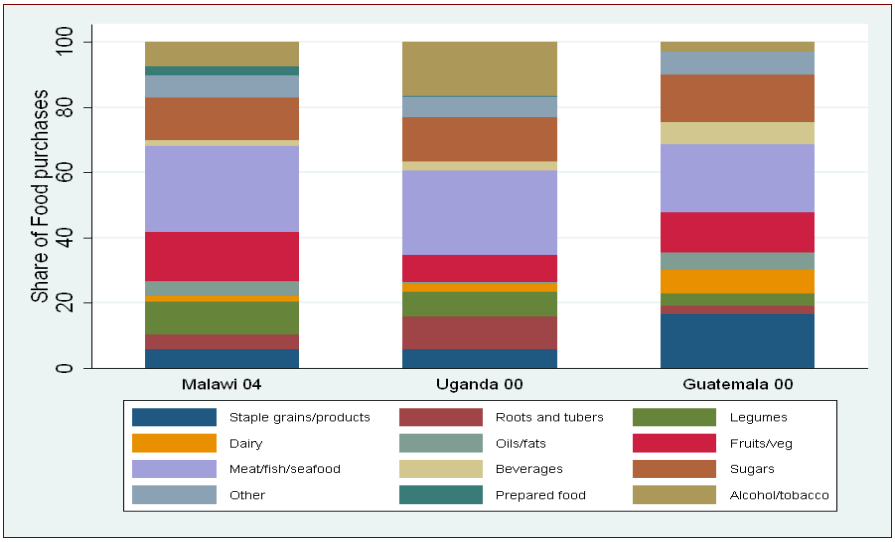
Table 6. Food security indicators for net consumers/producers.

		Under $1		Under $2		$2 and above	
		Calorie deficient	SSR	Calorie deficient	SSR	Calorie deficient	SSR
Malawi 2004	**NC**	57%	74%***	20%***	65%***	12%***	60%
	NP	56%	71%***	16%***	62%***	6%***	59%
Uganda 2000	**NC**	63%***	58%***	44%***	54%*	25%	41%***
	NP	53%***	61%***	39%***	55%*	23%	49%***
Guatemala 2000	**NC**	79%	74%*	39%	72%***	13%	63%***
	NP	77%	68%*	33%	68%***	9%	67%***

Difference in means test between net producers and consumers ***Significant at 1%; **Significant at 5% ;* Significant at 10%

Why are there calorie deficient net producers? To further explore the household expenditure decisions that lead to this situation we focus on the food purchases hungry net producing households make. The share of non-food purchases ranges from 16-22% of total expenditures, which indicates that households are spending incomes on non-food items, even though they are calorie deficient. However, if we assume that non-food expenditures do not change, what decisions are households making among the types of foods purchased? The share of food purchases from total expenditure ranges from 15% in Malawi, to 18% in Uganda, and 22% in Guatemala. The composition of food purchases by poor hungry net producers is shown in Figure 6. Across all countries, the two food groups that represent significant purchases are meats/seafoods and sugars. Households sell the starchy staple calories they produce for meat/seafoods and sugars. In Guatemala, processed staple products, such as tortillas, are also important. Thus even among hungry net producing households, the cheapest calories are not being purchased or eaten. Households make choices to buy and eat more attractive calories and to make non-food purchases before fully satisfying calorie requirements. By combining consumption data and net production data, this analysis shows that not only are the poor making decisions to purchase more attractive calories, but households are using the income from selling staple calories to buy other foods.

Figure 6. Food Purchases by Poor Hungry Net producers.



It is clear that decision-making at the household level determines whether calorie sufficiency, diversity of diet, or other non-food expenditures take priority. There is literature that suggests that when females have control of expenditures decision or higher status within a household, health and nutrition become priorities in expenditures and investments (Smith et al., 2002). Through household surveys, it is difficult to assess which household members make expenditure decisions. As a proxy, we look at the gender of the household head and calorie deficiency at the household level and find that the effect is strong in the Sub-Saharan Africa datasets. Female headed households are much less likely to be calorie deficient in the data for Malawi and Uganda. The data provide confirmation that increased female control in expenditure decision-making may generate immediate health and nutrition benefits as caloric requirements are satisfied.

Table 7. Calorie Deficiency in Net Producing Households.

	Under $1		**Under $2**		**$2 and above**	
	Female head	**Male head**	**Female head**	**Male head**	**Female head**	**Male head**
Malawi 2004	48%***	58%***	10%***	18%***	5%	6%
Uganda 2000	51%	54%	30%**	40%**	7%***	26%***

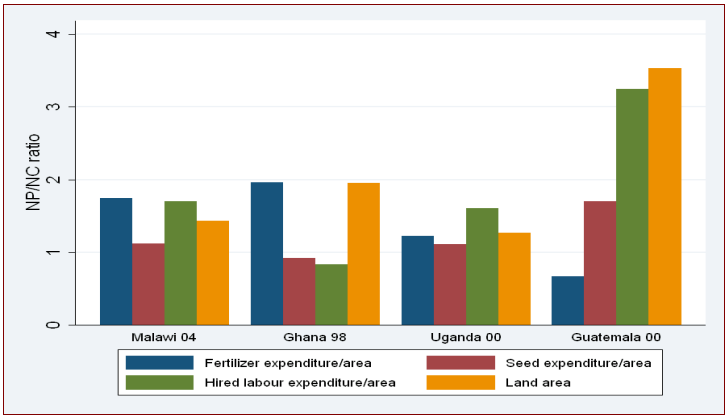
***Significant at 1%; **Significant at 5%;* Significant at 10%

II. What are the resources available to poor net producers and what does this indicate about their ability to adjust production?

Farmers respond to changes in markets and prices for agricultural inputs and outputs. However the ability to adjust production as a response is influenced by transaction costs, which in rural economies can be a vast range of problems such as missing information, poor infrastructure, lack of agricultural assets and input markets, and lack of credit. Without panel data or household models, it is impossible to estimate the behavior response of households. However, by comparing the resources available to net producers and net consumers, we can gauge the ability of farmers to adjust production. We compare the use of important factors that directly affect production among net producers and net consumers living on less than $1 a day: access to land, agricultural inputs, and labor. Figure 7 shows the normalized input expenditures to land holdings using net producer to net consumer ratios. The relative importance of these inputs between countries is pronounced.

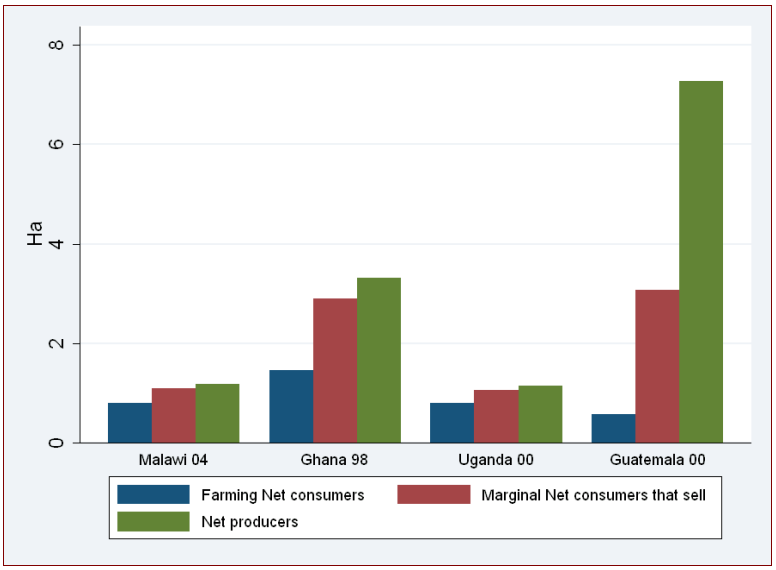
In Malawi and Ghana, net producers spend approximately twice the amount on fertilizers by area than net consumers. The difference is not as large in Uganda, and moreover in Guatemala, net producers spend less on fertilizers than net consumers. Seed expenditures only seem important for net producers in Guatemala, which is probably due to the low use of improved seeds in the Sub-Saharan African countries. Additionally, net producers in Guatemala spend relatively more on hired labor, which is likely due to the much larger farms of net producers in Guatemala. Surprisingly, the use of irrigation is not correlated with net producers in any of the countries. This may be due to the lack of specific detail on the type, quantity, and timing of irrigation, the highly unreliable survey data on irrigation, or overall low levels of irrigation in the sample countries.

Figure 7. Agricultural Inputs.



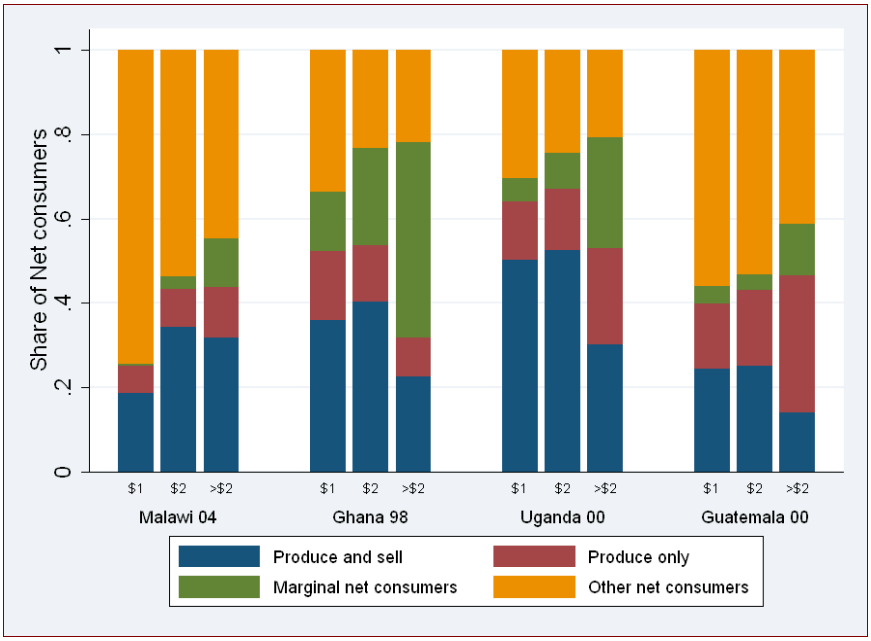
The relative importance of land cultivated among poor farming households is particularly striking. Figure 7 shows that there is little difference in land holdings between net producers and consumers in Malawi and Uganda. This is expected since all land holdings are generally small in these countries. On the other hand, in Ghana and Guatemala, net producers have two to three times more land than net consumers. Figure 8 shows the land holdings of poor net producers compared with net consumers. Net consuming farmers have been broken up into marginal net consumers that sell produce (defined as net consumers with food purchases representing less than 10% of total expenditures) and other net consumers.

Figure 8. Land Area (ha).



Poor marginal net consumers, who also sell agricultural products in markets, range from 20% of net consumers in Malawi to 50% of net consumers in Uganda (Figure 9). This group is isolated because they represent households that could become net producers, as they are already producing agricultural products and participating in output markets. The average land area farmed by each group hovers around one hectare in Malawi and Uganda. This would imply that the area farmed is not driving the factor between net producers and consumers. In Ghana and Guatemala, land holdings seem to be the most important difference between the agricultural resources available to net producers and net consumers. In Ghana, marginal net consumers and net producers have approximately one additional hectare of land. The difference in landholdings in Guatemala is quite large, where marginal net consumers have two additional hectares of land and net producers have another additional four hectares compared to net consumers.

Figure 9. Marginal Net consumers.

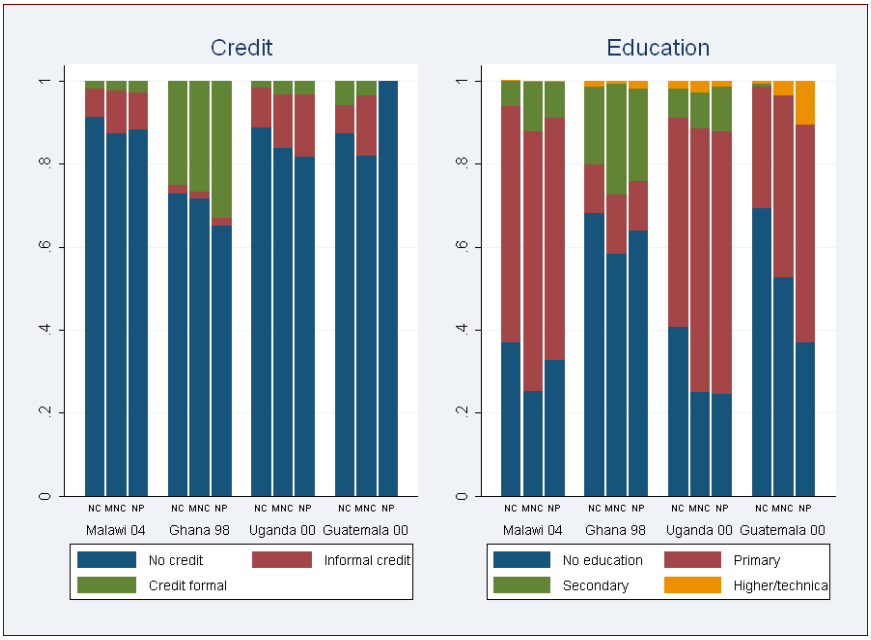


What does the relative significance of agricultural inputs to net producers in these countries tell us about farmers' abilities to adjust production? Based on these results, we conclude that in Malawi, net producers have approximately the same amount of land as net consumers, and perhaps increased production among net producers is a result of the relatively larger amounts of fertilizer applied. Therefore, access to credit and well functioning fertilizer markets may be what are most important for production increases in Malawi. In Ghana, it appears that both fertilizer and land are important to net producers. For net producers in Guatemala, it appears as if land and hired labor are the distinguishing factors.

We also look at access to credit and education levels to assess whether these non-agricultural resources are important in explaining what households are net producers among the poor. Figure 10 shows access to credit and the education level of the household head among poor net consumers, marginal net consumers, and net producers. Except in Ghana, there is little formal credit, and the only pattern observed is the slight increase in access to credit for net producing households. Unfortunately, gathering credit data is plagued by difficulties, so these inconclusive results may reflect the poor quality of data. The only clear pattern across countries in the data for the education level of household heads, is that net consumers have less education than marginal net consumers and net producers. In Guatemala, net producers have higher education levels as households produce more. The lack of clear

patterns across countries may indicate that credit and education may not be as important to net producers as they are to higher incomes.

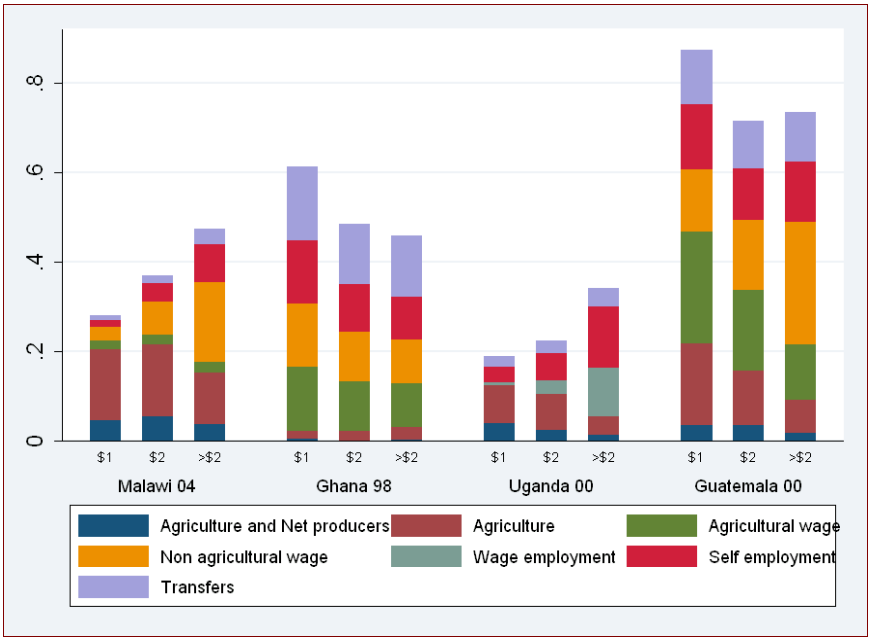
Figure 10. Credit and Education.



III. How specialized are net producers?

Another way to gauge whether poor farmers will be adjust production, we look at how specialized net producers are in terms of household income and the diversity of crops grown. Both types of diversity also determine how vulnerable households are to changes in markets and environmental conditions. Banerjee and Duflo (2008) find that there is not a high degree of income specialization among the poor. However, as net producers are relatively successful agricultural producers, perhaps these households specialize in agriculture. We look at the data to determine whether households tend to specialize in order to generate enough agricultural products to sell more than the value of food purchased. Figure 11 shows the share of households that have specialized incomes, with net producing households that specialized in agriculture shown as a subset of households that specialize in agriculture. The definition of income specialization used here is having more than 90% of total income from one source. The data shows that on the contrary, net producers who do not specialize in agriculture represent the bulk share of net producers. This indicates that net producers may not be as vulnerable to production failures as they also rely on other sources of income.

Figure 11. Income Specialization.



In general, poorer countries show less specialization than richer countries, which is consistent with the results of Banerjee and Duflo (2008) and Davis et al. (2008). Additionally, households are not as specialized in agriculture as the largely agriculture-based economies of these countries may suggest. In Malawi and Uganda, there are particularly vulnerable groups of producers that specialize in agriculture but that are not net sellers. These net consuming households derive the majority of their income from agriculture and are sub-subsistence and subsistence consumers, and thus would be extremely vulnerable to production disturbances such as drought or floods. Additionally, there is a large share of households in Ghana and Guatemala that specialize in agricultural wage income and are thus also at risk to production constraints.

Net producers have relatively diverse sources of income, but do they specialize in producing one crop? The crop diversity of net producers may be important if farmers shift crops in response to changes in markets, tastes, or environmental stressors. Figure 12 shows the average number of crops grown and sold by net producers at different income levels. Table 8 lists the specific crops that are most commonly grown and sold. On average, net producers are not specializing in only one crop, grow on average at least four different crops, and sell on average at least two crops. As incomes rise, there is a slight tendency to sell more crops, not less. Combined with the land data shown earlier, we infer that net producers are able to plant a larger number of crops because of their larger land holdings.

Figure 12. Number of Crops grown and sold by Net producers

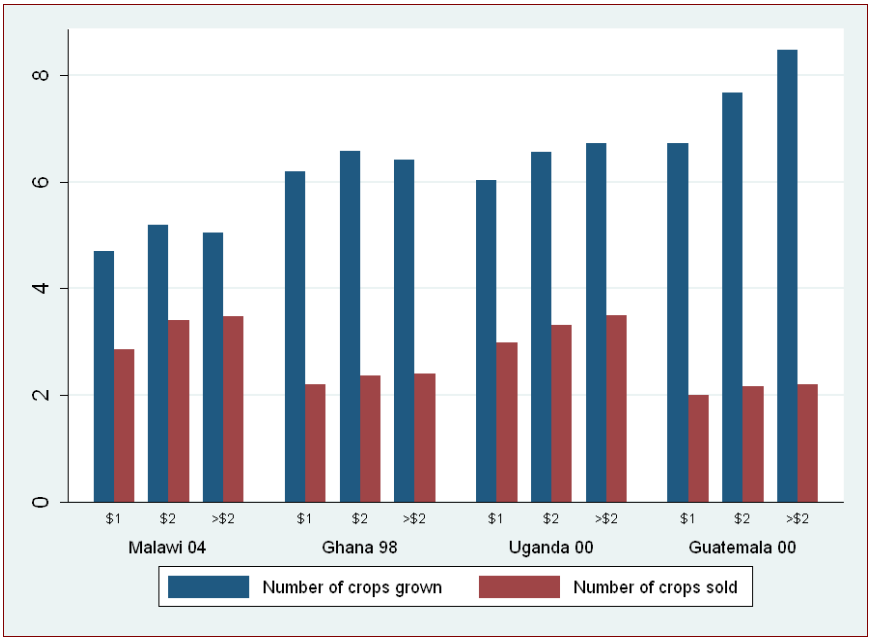


Table 8. Crops Commonly Grown by Net producers .

Malawi 2004	Maize, chicken, tobacco, fruits/veg, groundnuts
Ghana 1998	Rice, cassava, groundnut, beans, plantains, vegetables
Uganda 2000	Maize, cassava, beans, plantains, coffee
Guatemala 2000	Maize, beans, fruit/veg, eggs, potato

The majority of net producers of staples are also net producers of multiple crops (Figure 13). Table 9 lists the common crop combinations that are net produced. Although the diversity is noteworthy, none of these crop combinations contains more than one grain staple. Thus net producing households would still be vulnerable to changes in production constraints for the staple they produce. Additionally, their diets would also be vulnerable as staples represent the bulk of calories eaten. Net producing households are diverse in terms of the crops they grow, sell, and net produce. Net producers also have relatively diverse income sources, with small portion only specializing in agriculture.

Figure 13. Net producers of Multiple Crops.

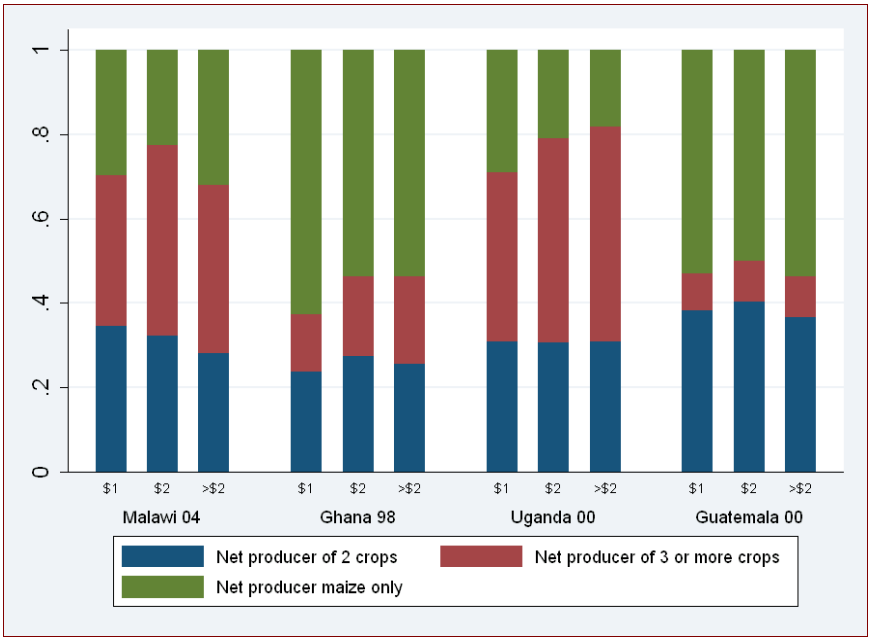


Table 9. Net producers of Multiple Crops.

Malawi 2004	Maize and groundnut; maize and chicken
Ghana 1998	Maize and plantains
Uganda 2000	Maize and beans; maize and plantains
Guatemala 2000	Maize and beans

Conclusion

We combine the calculation of household expenditures, income, calorie availability, net consumption/production, as well as add data on agricultural, demographic, and socioeconomic characteristics to allow richer answers to a varied set of research questions that goes beyond the poverty impact of rising food prices. The general results from the analysis of ALP data are consistent with the conclusions of general development economics and other household analysis projects. The data show that the poor spend more money on food, have less to eat, and eat relatively more staples. Poor households are highly dependent on agriculture and the majority of net producers are located among the rural poor, are poorer than net consumers, and have less diversified income sources. Among the extremely poor, the majority of households farm and sell some produce in markets, but do not sell enough to be net producers. Thus, they also depend on other income sources, such as wage labor, which in rural areas is likely working in the fields of net sellers.

The data also provide insights into the agricultural lives of the poor that go beyond what has been previously explored. By combining consumption data and net production data, we show that poor households are using the income from selling staple calories to buy other foods. The data also show that increased female control in expenditure decision-making is associated with less calorie deficiency. By linking this data to production resources, we are able to show the relative importance of resources that net producers have in order to adjust production. Access to credit and well functioning fertilizer markets are most important for production increases in Malawi. In Ghana, it appears that both fertilizer and land are important to net producers. For net producers in Guatemala, it appears as if land and hired labor are the distinguishing factors.

Diversity in income sources and crops grown are also important indicators for households' ability to adjust production and their vulnerability to production shocks. In general, poorer countries show less specialization than richer countries, which is consistent with other literature. Net producers who do not specialize in agriculture represent the bulk share of net producers, and thus these households may not be as vulnerable to production failures as they also rely on other sources of income. The majority of net producers of staples are also net producers of multiple crops. This indicates that households may have some ability adjust production among crops grown from year to year. However, households do not usually grow more than one staple and thus may still be vulnerable to production failures of the staple crop.

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