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It's a Small World After All

Defining Smallholder Agriculture in Ghana

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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ABSTRACT

Strategies for boosting the agricultural economies of developing countries usually focus on small farms, attempting, for example, to link smallholders with markets through production chain development. However, such strategies often fail to differentiate between different types of small farmers or to investigate the distribution of assets within the group—efforts that are important because unequal distributions of assets can restrict pro-poor growth. Further, strategies to develop production chains favor some small farmers over others (i.e., those already participating in targeted chains and those with relatively more productive assets).

Using landholding size as an organizational filter, we performed a basic descriptive analysis of smallholder traits in Ghana, using data from the 2005–2006 Ghana Living Standards Survey (GLSS5). We found strong inequalities in landholding distributions within Ghana’s small-farm sector in all regions of the country. Using a classification of smallholders we derived based on landholding size, we examined a variety of small-farm traits and found that many of the broadly perceived defining characteristics of smallholder agriculture—such as low input use and low market engagement—are negatively correlated with landholding size. The crowding of farms at the smaller end of the small-farm spectrum in Ghana suggests that rural development strategies based on expanding existing market chains will face challenges in connecting with the bulk of small producers, who are less well endowed than average statistics indicate.

Keywords: small farms, agricultural development, Ghana

1. INTRODUCTION

The transformation of agriculture is a predominant and explicitly stated objective of most developing agricultural economies. Often expressed as “modernization,” such a transformation is generally understood to entail a sustained transition from subsistence to specialized, market-oriented production. Although strategy discussions often emphasize the role of commercial enterprises in the transformative process, most strategic plans specify the goal of including smallholder farmers, usually the predominate actors in developing agricultural economies.

Policy-oriented discussions of smallholders often address this group in ways that emphasize broadly shared characteristics such as limited land and capital, high exposure to risk, low input technologies, and low market orientation (e.g., Dixon et al. 2003; World Bank 2003, Lipton 2005; Braun 2005. Many of these characteristics, of course, double as constraints to the envisioned transformation of the sector. Concrete efforts to improve the livelihoods of smallholders must recognize that the characteristics of the group are not only important in concept but also widely varying in reality.

Most smallholders in most developing areas are probably somewhat land constrained, poorly linked to markets, and more vulnerable to risk than are larger farmers in the same areas. However, not all smallholders are *equally* land constrained, market oriented, or vulnerable to risk. Therefore, the logical starting point for identifying priority policy interventions that target smallholders in a certain area would be recognizing important differences within and across that area’s small-farm sector. Nevertheless, strategy documents in many countries tend to refer to smallholders without explicitly defining the sector or distinguishing internal differences that extend beyond basic agro-ecologies (e.g., Government of Ethiopia 2006; Republic of Mozambique 2006; Government of Ghana 2007). The same is true for many policy-oriented scholarly treatments of the sector.¹

One reason for what appears to be a defiance of logic may have to do with the difficulty of assigning definitions to this group (Huvio et al. 2005). As one researcher noted, “The sole consensus on small farms may be the lack of a sole definition” (Nagayets 2005:p.1.). In general, a series of core attributes are offered (e.g., low input use, low output production, subsistence orientation) related to farm enterprises at the smaller end of the landholding spectrum. For convenience, a shorthand way of delimiting the sector is usually made (2, 5, and 10 ha are frequently used). Smallholder-oriented strategic discussions constructed on this basis, however, fail to conceptualize differences across small producers that likely condition their ability to respond to incentives for change. As a result, policies may not be sufficiently targeted to the realities of various actors within the small-farm sector (Asuming-Brempong et al. 2004; ISSER 2007).

In Ghana, for example, smallholdings are considered to constitute 90–95 percent of farms (Asuming-Brempong et al. 2004; SRID 2006a) and “about 80 percent of total agricultural production” (Government of Ghana 2003: 69). Strategy discussions rarely break down the group beyond basic agro-ecological divisions (e.g., north and south or coast, forest, and savannah). This shortcoming has been identified by Asuming-Brempong et al., who note that failure to differentiate between various livelihood contexts and production objectives has led to current policies that miss a large portion of the smallholder segment. In particular, they argue for the differentiation between poor and non-poor small farmers who are not currently engaged in markets: the poor will not be able to benefit from many of the targeted interventions (such as high-input, high-output technologies). Similar arguments have been made for gender-specific strategy formulation (Coulombe and McKay 2003; Aryeetey and McKay 2004; ISSER 2007).

This does not, however, suggest that land-based views of smallholdings are without value. Studies elsewhere have noted the strong relationship between farm size and household income and the centrality of land as an enabling asset for farm enterprise growth (Jayne et al. 2003; Negash and Niehof

¹ Even the 2008 World Development Report, for example, whose thematic focus of “Agriculture for Development” devotes much discussion to small-farm agriculture, does not define smallholding beyond noting, in an endnote, that “for much of the developing world, smallholders are defined as operating a farm of 2 ha or less” (World Bank 2007, 269).

2004). At the same time, Jayne et al. note the surprising lack of inquiry into land distributions within the small-farm sectors of developing countries. In this paper, we propose disaggregating small farms by landholding size as a key filter for examining differences within the sector and for disaggregating what is at present an overly inclusive definition. In doing so, the paper makes several related points:

Within the small-farm sector, assets and traits might not be uniformly distributed, and arbitrary thresholds might mask important distributional patterns.

Although smallness has many dimensions, an important way of making important distinctions within the group is through variation in landholding size, a key productive asset.

Landholding size correlates with several other small-farm characteristics, including agricultural income per capita and levels of input- and output-market engagement.

The distribution of small-farm land and other characteristics has implications for policies targeting a transformation of smallholder agriculture through increased commercialization, technology adoption, and productivity.

In pursuing these points, this paper contributes (1) an empirical inquiry into the importance of landholding as a defining characteristic of smallholder farmers and (2) a mode of structured exploration of sector composition with respect to standard policy objectives. More specifically for Ghana, we expect to contribute to the discussion of heterogeneous smallholding characteristics and their relevance to sectoral development objectives. The methods we employ are largely descriptive, exploratory, and structured in such a way as to uncover important geographical differences, recognizing that the smallholder landscape likely varies in important ways across geographical space.

The structure of this paper is as follows. Section 2 is a two-part review: the first part defines and describes key attributes of small farmers as expressed in the development literature for sub-Saharan Africa in general and Ghana in particular, and the second part discusses the strategic goals targeting Ghanaian small farmers. Section 3 explores the variability of these attributes for small farms in Ghana as revealed in data gathered from a household survey and other recent statistical work. We propose a set of basic small-farm groupings based on landholding size conditioned by agro-ecology, and we examine a number of farm characteristics within the range of holdings most representative of small producers in Ghana. Section 4 offers a discussion of the distribution of these small-farm characteristics. Finally, in Section 5, we discuss the implications for rural development strategies aimed at increased market linkages within this smallholder landscape and offer suggestions for further study.

2. NOTIONS OF SMALLHOLDER IDENTITY

Multiple Dimensions of Smallness

Built into the epithet *smallholder* is the connotation of limited land availability. However, many other aspects of smallness are critical to characterizing resource-poor small farmers in the developing world, such as limited capital (including animals), fragmented holdings, and limited access to inputs. Noting that resource-poor livestock keepers are a very diverse group, Chipeta et al. (2003) argue that defining the group by the number of animals held by a household may be misleading. Ghana's Poverty and Social Impact Analysis (PSIA) implicitly makes a similar argument for Ghanaian farmers, stating that household assets and risk conditions better define smallholders than do simple measures of landholdings (Asuming-Brempong et al. 2004). Likewise, other researchers (e.g., Von Braun 2005) have noted that a comparison of two farmers, one producing a high-value crop for market and the other producing a staple for home consumption, cannot be meaningful even if the two farmers have similarly sized farms. More nuanced conceptualizations of smallholders, however, tend to be more difficult to measure. Although quantitatively precise definitions are elusive, in looking across a variety of working definitions—for Ghana and elsewhere—several key themes emerge, among them landholding size, wealth, market orientation, and level of vulnerability to risk.

As already suggested, landholding size is perhaps the most direct and easily introduced indicator of who is a smallholder. It may also be the most abused. Ekboir et al. (2002, 2) state that “a small-scale farmer in any region of Ghana has less than 5 [ha]” but do not offer any support for that definition nor information on how many Ghanaian smallholders fall within it. The Ministry of Agriculture (SRID2006a: 6) maintains that “Agriculture is predominantly on a smallholder basis in Ghana. About 90% of farm holdings are less than 2 hectares in size,” although sources for these numbers are also un-cited.

While not necessarily attempting to define *smallholder* as a category, Jayne et al. (2003) provide evidence from eastern and southern Africa that the landholding size of the small farmer is strongly linked with household income, especially when the farm is less than 1 ha. Highlighting that intravillage variation in land access is often greater than intervillage variation, the researchers emphasize that it is misleading to target poverty reduction strategies on the basis of smallholder zones. Thus, although the link between holdings and poverty appears to be strong at the household level, the value of average landholding size as a meaningful indicator of geographical patterns of poverty is uncertain. Other studies have shown that farm size correlates with holdings of livestock and other assets (Negash and Niehof 2004) and is an indicator of wealth, associated in turn with high-value crop production and market participation (e.g. Green et al. 2006).

Using wealth rankings (although with somewhat ambiguous methods), the PSIA defines five categories of Ghanaian smallholders: large-scale commercial farmers; small commercial farmers; semicommercial farmers; non-poor, complex, diverse, risk-prone farmers; and poor, complex, diverse, risk-prone farmers. The latter three categories are together said to constitute smallholder farmers. The report generates some indicators of prevalence of smallholders on the basis of “the assumption that [noncommercial smallholders] constitute about 95% of the agricultural population,” although this assumption is undefended (Asuming-Brempong et al. 2004, 11).

Different levels of vulnerability to risk, like wealth, require more nuanced conceptualizations than do landholding size and market orientation, and partly for that reason, providing quantitatively explicit indicators of vulnerability might be more difficult. Nonetheless, an important assumption of smallholder-focused development is that relatively high degrees of vulnerability characterize smallholder farmers. Risk—the degree of probability of loss of welfare—may be of various types.² However, across such variation, vulnerability is linked to exposure and coping ability (Chambers 1989), which in turn are

² The PSIA identifies eight major types of risk faced by smallholders: production risks, credit risks, income risks, labor and health risks, nutritional risks, price risks, vulnerability to unethical trading practices, and employment risks (Asuming-Brempong et al. 2004).

associated with levels of assets (Moser 1998). Thus, that smallholder assets are generally limited is an important filter for understanding risk and vulnerability.

De Janvry and Sadoulet (2006) found that production of food for household consumption is a strategy to mitigate risks of price volatility, effectively increasing small farmers' preference to produce food crops over cash crops with potentially better markets. Even controlling for price risk and household preferences, Fafchamps (1992) found that small farmers tend to devote a smaller share of their land to cash crops than do large farmers.

As intimated in the definition derived so far, the "smallholder" label is often an implied cognate for subsistence farmers. In other words, a largely low market orientation is part of the working definition of *smallholder* used in policy discussions. This embeddedness is reflected in the general emphasis of poverty reduction strategy papers on transforming smallholder agriculture from subsistence to market orientation.³ In many cases, that idea is very explicit. Ghana's PSIA, for example, consistently refers to "smallholders/subsistence farmers" (Asuming-Brempong et al. 2004).

Market orientation is linked with the ability to generate marketable surplus, enabled by technologies (inputs and labor) to which many small farmers have limited access. For example, small producers who are also poor, remote, and linked to few credit markets are probably more susceptible to the liquidity constraints known to impact investment and production behavior (e.g. Fafchamps 1992). Other important defining characteristics of the smallholder are a lack of resources (including such considerations as land quality and access to technologies like irrigation) and farm enterprises primarily dependent on family labor.⁴

Understanding the role of these various traits in providing a meaningful working definition of *smallholder* prompts the question, How much of each of these aspects is captured by the others? This, of course, is an empirical question and may well vary from place to place. For Ghana, Asuming-Brempong et al. (2004) suggest that these characteristics are at least somewhat structurally related, noting that poor farmers with lower levels of market orientation and higher levels of risk tend to have smaller amounts of land available to them. In their multicountry study in eastern and southern Africa, Jayne et al. (2003) explicitly correlate land access with household farm and nonfarm incomes, especially at the smaller end of the smallholding range, suggesting that this relationship is robust in rural economies throughout sub-Saharan Africa. Connecting smallholding to income and poverty might lead to links with poverty-related constraints to investment and reduced opportunities to access credit, technology, and market information. On the other hand, other researchers have indicated the importance of land scarcity in driving labor-enabled intensification, the inverse relationship between land size and productivity observed in many developing countries (many empirical studies are reviewed by Heltberg [1998]). The validity of this relationship is not without controversy; omitted land quality and other issues may be important checks on its robustness (Eastwood et al. 2004).

Throughout the literatures concerned with small farmers in the developing world, the idea that "smallness" has multiple important dimensions is recurrent, although the approaches taken to defining such dimensions is often linked with very specific motivating questions. Treatments of the small farm sector as a whole, however, tend to treat the group using arbitrary thresholds of some single defining variable, often land holding size. Give the importance of land as a productive asset, it may not be unreasonable to assume that holding size as a definitional gradient (as opposed to a binary characteristic, i.e. small or not small) reflects other characteristics as well.

³ Poverty reduction strategy papers may carry different names in different countries but generally are national strategies for achieving pro-poor economic growth and often emphasize rural and agricultural development efforts that focus on the poor smallholder majorities of agricultural populations.

⁴ The literature suggests that dependence on family labor is a less useful criterion for defining smallholders in Ghana than elsewhere. According to Duncan and Howell (1992), "The hiring of labour is widespread, even among low-income households and especially on a seasonal basis. In Ghana, where the major constraint on agricultural production was found to be scarcity of labour, the most recent data [from 1970] suggest that about 60% of rural households use some outside labour, although most cultivation uses family labour. Even among the smallest producers (below 0.8 ha), over one-half used hired labour, and of those described as subsistence producers, one-quarter used hired labour." The GPRS, on the other hand, maintains that "hired labour is hardly used by [smallholders]" (Government of Ghana 2003, 86).

Transformative Aspirations for Smallholder Agriculture

The government of Ghana seeks to transform its agricultural sector to include small farmers (Government of Ghana 2003). Although sectoral strategies have been criticized for being nonspecific (Asuming-Brempong et al. 2004), transformative goals for small farmers include increased participation in markets and higher productivity, enabled in part by better access to and use of input and credit markets. These behaviors and outcomes are interlinked. For example, increased output commercialization is usually coupled with increased input commercialization (Braun et al. 1993), and marketable surpluses are linked with the use of technologies, conditioned in turn by extension and delivery systems and credit markets (Lipton 2005).

Engagement in this process varies with household and environment. Increased access to inputs and technologies, linked with extension and credit services, is most likely to be taken advantage of by farmers who have better endowments and face less risk (Pender et al. 2006). Compared with larger farmers, smallholders have longer uptake lags for new, high-yielding technologies (Hazell and Ramasamy 1991). Even when formal and semiformal links are set up externally to pull smallholders into new or stronger production chains, the connections are not evenly distributed: the likelihood of selection for participation in outgrower and other linkage schemes is reduced for producers who are poorer, have fewer existing links to markets and services, have fewer marketable surpluses, and have more pressing concerns about food insecurity compared with other farmers (Al-Hassan et al. 2006). A procommercialization strategy that does not distinguish among various smallholder attributes will probably increase income inequalities where divisions already exist by enacting policies that favor the larger, better-endowed, and less-risk-prone households.

This brief paper is aimed describing patterns of some of the producer characteristics and production conditions under which strategies will need to be differentiated. To keep things manageable, we want in particular to emphasize that farmer responsiveness to profitable opportunities (e.g., those made available by investments in technology or market developments) can be limited by characteristics such as wealth, risk, current level of market engagement, and current level of engagement with prioritized practices and/or related delivery systems. Therefore, understanding the distribution of such characteristics and conditions across the small-farm sector is important. Given the importance of farm size in defining membership in the sector, we pay particular attention to how these attributes vary with size of holdings.

3. DESCRIBING SMALL FARMERS IN GHANA

The Ghana Living Standards Survey of 2005–2006 (GLSS5) provides recent information on small farm households.⁵ Using a nationally representative sample of 8,687 households, the GLSS5 provides data useful for generating inferences for administrative regions and major ecological zones (Figure 1). The GLSS5 was designed to provide information on household consumption and expenditure but also contains a great deal of information on the specific production and marketing activities of the rural agricultural households surveyed.

In this paper, *landholding* refers to land used by farmers for production and is the sum of all reported plot sizes per household.⁶ Of the 8,687 households, 3,399 had no reported farmland areas and were excluded from our analysis. We also removed large farms from the sample, defined as those comprising more than 10 ha. This value roughly corresponds with the 94th percentile of the weighted sample and is consistent with estimates that small farms account for 95 percent of rural producers in Ghana. Further, it corresponds with exclusion thresholds used elsewhere (e.g., Jayne et al. 2003). This left 4,940 households in the sample.

Because of data structure and quality issues, we were not able to use the GLSS5 to look at farm-level productivity. To consider yields of staple crops, we used district-level production data on major crops primarily produced by small farms. These data were compiled by the Statistics, Research, and Information Directorate (SRID) of the Ministry of Food and Agriculture at the district level for the period 1992–2006.

Figure 1. Regions and ecological zones used by the GLSS5



Note: Regional boundaries and names are superimposed over ecological zones defined at the district level.

⁵ Data from the GLSS5 as well as the Ghana Living Standards Survey of 1998–1999 (GLSS4) are presented in the appendix.

⁶ Our definition of *landholding* does not distinguish among types of tenure arrangements, although the importance of distinguishing modalities of access to land has been well argued (e.g., Deininger 2004) and could be looked at in subsequent work with the data from the GLSS5, which includes some information on tenure.

To consider differences in physical access to markets, we used data on urban centers and road networks within a geographic information system to estimate travel times to markets of various sizes. Then we then associated those values with household data from the GLSS5 at the level of the district.

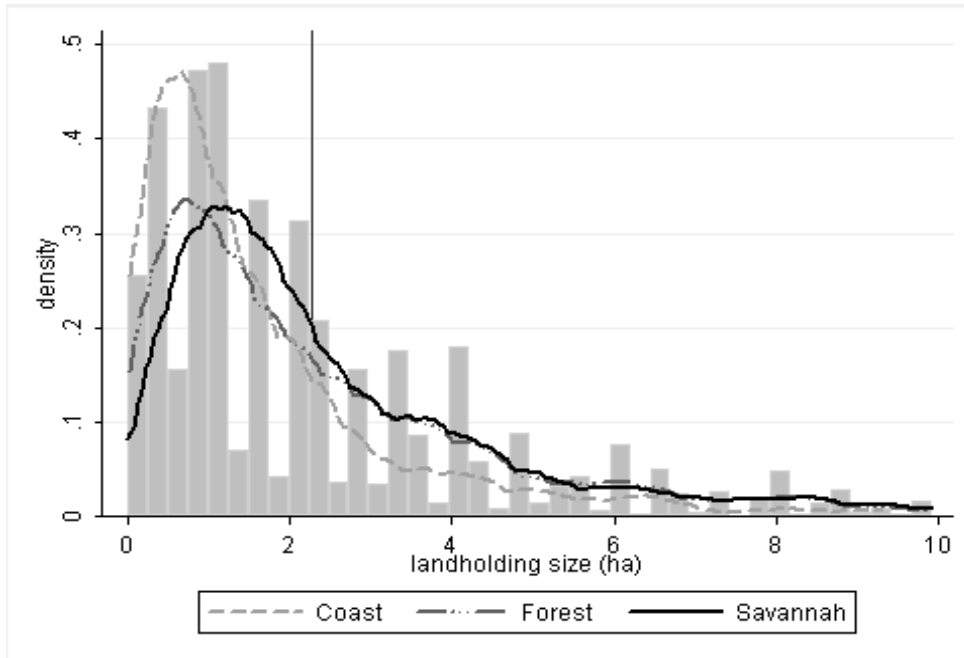
Basic Dimensions of Ghana’s Smallholder Landscape

Here we describe some basic distinctions among Ghana’s smallholders that we found by looking at the distributions of land and income. Together, those two factors suggest some fundamental differences within the small-farm sector.

Distribution of Landholding Sizes

A highly skewed distribution of holdings is evident within Ghana’s small-farm sector (Figure 2). Even excluding large holdings (more than 10 ha), the majority of the distribution still falls below the mean: more than 60 percent of farmers operate less than the average landholding size. These patterns are consistent regionally, although skew increases from the northern savannah toward the southern coast.

Figure 2. National distribution of landholding sizes: Histogram and density functions by ecological zone⁷



Note: National mean landholding (2.27 ha) is shown as vertical line. Kernel density functions for each ecological zone use the Epanechnikov kernel and optimal bandwidth as determined by Stata.

Table 1 shows the distribution of landholding size by major ecological zone and gender of household head. The savannah zone (with a median landholding of 2.0 ha) has larger holdings compared with the coast and forest zones (1.2 and 2.6 ha, respectively). Most agricultural households in the forest and coast zones operate 2 or fewer hectares.

⁷ This and subsequent figures and tables are based upon the 2005/2006 GLSS5, unless noted otherwise.

Table 1. Distribution of landholdings, by ecological zone and gender of household head

Zone	Median landholding (ha)	% less than 5 ha	% less than 2 ha	Mean per capita landholding (ha), by quartile				% virtually landless*	Gini
				Bottom	2nd	3rd	Top		
Coast	1.21	94%	70%	0.09	0.23	0.47	1.70	15%	0.58
Male	1.21	93%	66%	0.09	0.23	0.47	1.74	13%	
Female	0.81	98%	82%	0.09	0.23	0.47	1.61	19%	
Forest	1.62	89%	55%	0.12	0.33	0.63	2.08	9%	0.56
Male	2.02	86%	48%	0.12	0.33	0.63	2.03	7%	
Female	1.01	96%	71%	0.12	0.33	0.65	2.26	13%	
Savannah	2.02	87%	48%	0.13	0.32	0.60	1.51	7%	0.48
Male	2.02	86%	44%	0.13	0.32	0.60	1.53	7%	
Female	1.21	96%	71%	0.13	0.35	0.60	1.38	9%	

Note: * Less than 0.1 ha per capita.

Jayne et al.'s (2003) notion of “virtually landless” households reflects an important fact: beyond some threshold of land availability, it is unlikely for a small farm to viably support itself through farm production alone. Following their characterization of such households as those operating 0.1 ha per capita or less, we found a substantial minority of the virtually landless in all zones of the country, but especially in the coastal south.

Those patterns reflect strong inequalities in landholding distributions throughout the country. Gini coefficients computed for each ecological zone range from 0.48 to 0.58, reflecting distributional inequities comparable with those found for eastern and southern Africa (Jayne et al. 2003),⁸ where land distribution issues have had a higher profile.⁹

The lower number of very small farms in the north may be attributed to lower land productivity combined with fewer off-farm employment options that might allow small farms to be viable. It is interesting to note that the average size of smallholdings in the savannah zone has grown more over the last decade than elsewhere (see the appendix for comparison of summary statistics from 1998–1999 and 2005–2006). This might indicate that holdings too small to be viable have simply dropped out of production in the north. In general, the smallest farms everywhere tend to be located in districts closer to large markets and with higher population densities, reinforcing the idea that off-farm opportunities are particularly (and perhaps critically) important for households with limited landholdings.

As noted elsewhere, female-headed households are an important component of the smallholder sector (ISSER 2007). Such households are also more prevalent at the lower end of the landholding-size spectrum (Table 2). This is especially true in the coast and forest zones, where they account for 38–40 percent of the bottom quartile of landholdings per capita. Although overall shares of female-headed farm households are greatest in the south, the land operated by female-headed households is consistently smaller than for male-headed households everywhere in the country. The smallest farms (less than 0.1 ha per capita) have the largest shares of female household heads.

⁸ These coefficients are also comparable with those found in many parts of Asia in the 1960s and 1970s (Haggblade and Hazell 1988).

⁹ For example, Lipton (2006) highlights inequalities in land distribution in eastern and southern Africa, which are often attributed to the well-documented “colonial land grab” and/or the political economy of postcolonial redistribution in those areas.

Table 2. Share of small farms headed by women classified as poor, by landholding size

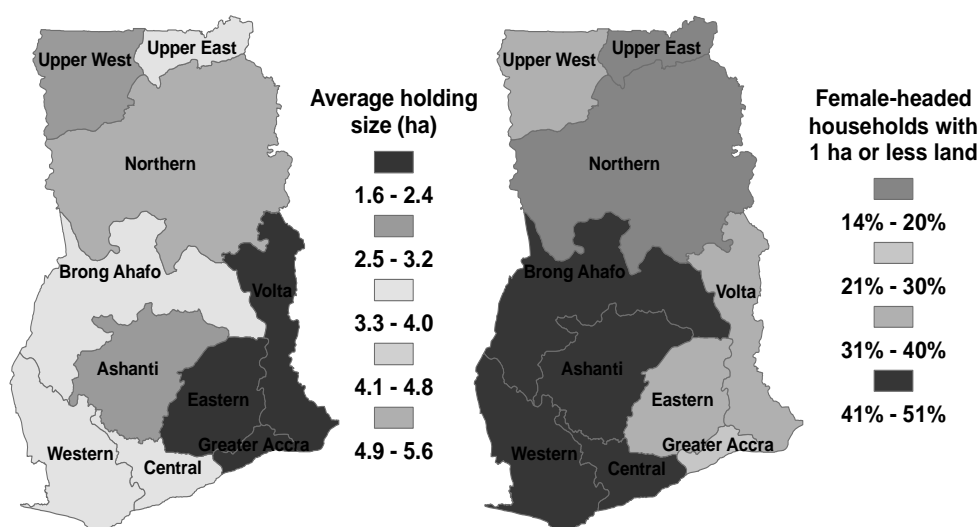
Per capita landholding quartile	Coast		Forest		Savannah	
	% poor	% fhh*	% poor	% fhh*	% poor	% fhh*
Bottom	20	38	26	40	51	18
2nd	20	28	18	33	60	15
3rd	13	26	18	25	51	8
Top	9	25	9	20	35	13
Virtually landless**	24	38	30	43	38	18
<i>Ghana</i>	<i>15</i>	<i>30</i>	<i>18</i>	<i>30</i>	<i>49</i>	<i>14</i>

Note: Poor households are those with calculated annual incomes falling below a poverty line of 900,000 cedis (about US\$363); from Coloumbe and Wodon (2007).

* fhh = female-headed household.

** Less than 0.1 ha per capita.

Figure 3. Regional distributions of landholdings



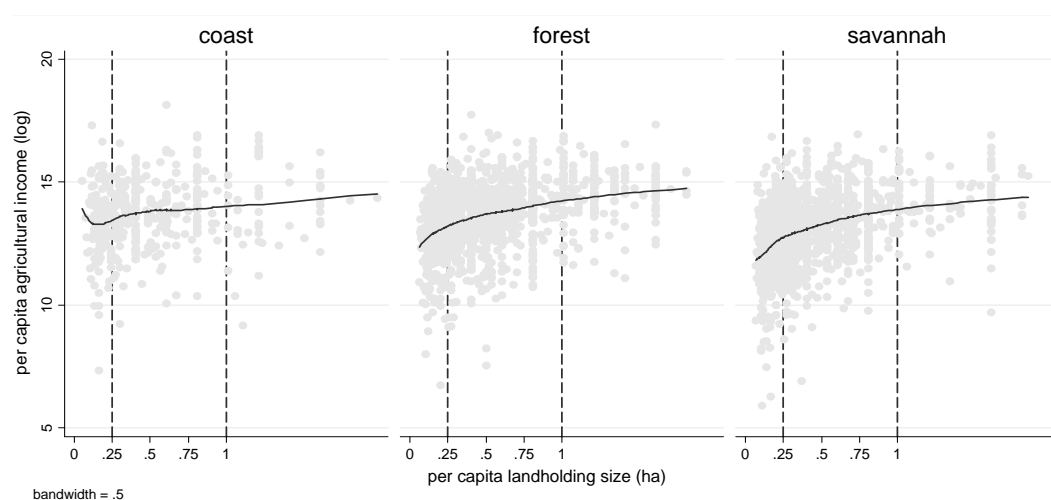
Distribution of Income and Income Source

Income per capita is significantly related to landholding size, especially for areas with fewer off-farm opportunities. The relationship holds for both agricultural and total per capita household income but is somewhat stronger for agricultural income (which may be taken as a coarse proxy for farm productivity). Figure 4 depicts that relationship, showing locally weighted regression lines and scatter plots of agricultural income and land holdings per capita. The steep and reversing curve in the smallest farms of the savannah zone indicates that more of the smallest farmers (i.e., the virtually landless) in the savannah zone are engaged in the intensive, market-oriented opportunities which are relatively more abundant there than further north.

Differences in source of income, reflecting alternative livelihood strategies, are also apparent across the landholding distribution (Table 3). As expected, nonagricultural income is more prevalent in the bottom quartile, where farm production is less likely to satisfy household income and food requirements. However, median agricultural income shares are still very high across this group, especially

in the savannah zone, where half of farming households receive more than 55 percent of their income from farm activities. This indicates a significant reliance on very limited land resources.

Figure 4. Relationship between landholding size and agricultural income per capita



Notes: Farm size = 0–10 ha; $n = 4,090$; $r = 0.32$.

Coast: $n = 732$; $r = 0.16$.

Forest: $n = 2,237$; $r = 0.38$.

Savannah: $n = 1,971$; $r = 0.40$.

All Pearson's correlation coefficients are significant at $p = 0.01$ level.

Table 3. Income sources (share of total), by per capita landholding quartile

Zone		Quartile							
		Bottom		2nd		3rd		Top	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Coast	Agriculture	32%	37%	54%	42%	55%	40%	58%	57%
	Nonfarm self-employment	32%	37%	18%	28%	16%	27%	12%	27%
	Off-farm employment	19%	34%	12%	27%	10%	26%	13%	45%
	Remittances	11%	24%	10%	28%	13%	31%	10%	21%
	Rental income	5%	13%	6%	18%	5%	13%	8%	30%
Forest	Agriculture	42%	71%	55%	82%	63%	47%	69%	73%
	Nonfarm self-employment	24%	65%	18%	65%	16%	29%	11%	37%
	Off-farm employment	17%	32%	13%	30%	9%	24%	7%	25%
	Remittances	14%	29%	12%	30%	9%	26%	10%	45%
	Rental income	4%	14%	2%	9%	2%	21%	3%	30%
Savannah	Agriculture	41%	73%	66%	46%	78%	71%	71%	149%
	Nonfarm self-employment	28%	38%	17%	29%	12%	35%	8%	22%
	Off-farm employment	12%	29%	5%	18%	3%	14%	6%	21%
	Remittances	8%	17%	6%	20%	5%	13%	9%	112%
	Rental income	11%	61%	7%	28%	3%	51%	6%	63%

Note: SD = standard deviation.

These patterns of land and income distributions suggest some fundamental differences within the farm sector, which may be at least partially captured by distinctions in landholding size per capita. We suggest that the smallest smallholders—those with less than 0.1 ha of land per capita—are considerably different from most small farmers in Ghana because of their greater reliance on off-farm revenue and lesser likelihood of farm-based livelihood strategies not subsidized by alternative income sources. At the other end of the spectrum, the attenuated distribution of larger small farms argues for distinguishing between the majority of smallholdings and the minority with relatively more land and higher incomes (and generally higher variability in income source). Because the ecological zone-specific per capita landholding quartiles reflect important geographical differences in land productivity and average family size, we use the top quartile of these distributions to separate the “typical” smallholders from their larger counterparts (which we term “moderate smallholders”). This core, middle range of typical landholding sizes represents about two-thirds of the country’s small farms (Table 4).

Table 4. Distribution of smallholder classes, by ecological zone

Zone	Smallholder class			All
	Virtually landless	Typical smallholder	Moderate smallholder	
Coast				
n	65,110	262,439	107,768	435,317
%	15%	60%	25%	100%
Forest				
n	110,607	814,257	304,128	1,228,992
%	9%	66%	25%	100%
Savannah				
n	52,282	486,598	178,218	717,098
%	7%	68%	25%	100%
Ghana				
n	227,999	1,563,294	590,114	2,381,407
%	10%	66%	25%	100%

Using these basic distinctions as an organizational framework, we present a range of household attributes corresponding to central aspects of the generalized notion of small producers described earlier (Table 5). Typical smallholders earn significantly less than the largest quartile and about the same or less than do the virtually landless, which tend to have larger nonfarm incomes, as well as greater incomes from horticulture and other high-value annual crops (indicating that many of the smallest farms are in high-access, high-density areas with better high-value market opportunities). Food crops, particularly maize and cassava, are important sources of income to the majority of typical smallholders, especially in the coast and forest zones. High-value perennials (mainly tree crops) tend to be relatively more important sources of income on larger farms across ecosystems. However, use of credit and inputs is relatively low across all farm sizes and ecological zones.

Table 5. Household attributes, by smallholder class

Household attribute	National mean	Smallholder class		
		Virtually landless	Typical smallholder	Moderate smallholder
Coast				
Landholding size (ha)	1.62	0.27	1.25	3.32
Household income/capita (2005 cedis)	3,470,000	2,240,000	3,040,000	5,250,000
Agricultural income share (%)	50%	29%	51%	58%
Off-farm employment income share (%)	14%	23%	12%	13%
Gross value of crop sales (2005 cedis)	3,240,000	818,460	3,270,000	4,630,000
Food crop seller (%)	72%	56%	73%	77%
Food crop sales (2005 cedis)	1,700,000	462,423	1,790,000	2,230,000
Maize/cassava seller (%)	68%	53%	70%	75%
Maize/cassava sales (2005 cedis)	1,210,000	373,431	1,350,000	1,390,000
Maize/cassava share of total sales (%)	35%	23%	39%	34%
Annual crop seller (%)	37%	43%	35%	37%
Annual crop sales (2005 cedis)	1,070,000	348,698	1,220,000	1,140,000
Perennial crop seller (%)	36%	32%	31%	50%
Perennial crop sales (2005 cedis)	468,659	7,339	260,537	1,250,000
Agricultural credit use (%)	2%	0%	2%	2%
Any formal credit use (%)	7%	9%	8%	5%
Fertilizer purchaser (%)	23%	12%	27%	23%
Forest				
Landholding size (ha)	2.30	0.28	1.74	4.53
Household income/capita (2005 cedis)	3,250,000	2,700,000	2,640,000	5,070,000
Agricultural income share (%)	57%	35%	55%	69%
Off-farm income share (%)	12%	20%	13%	7%
Gross value of crop sales (2005 cedis)	3,470,000	2,490,000	2,680,000	5,920,000
Food crop seller (%)	72%	61%	73%	72%
Food crop sales (2005 cedis)	1,520,000	2,240,000	1,120,000	2,320,000
Maize/cassava seller (%)	66%	59%	67%	64%
Maize/cassava sales (2005 cedis)	844,036	1,310,000	630,160	1,250,000
Maize/cassava share of total sales (%)	26%	21%	29%	21%
Annual crop seller (%)	33%	36%	35%	28%
Annual crop sales (2005 cedis)	449,122	67,370	495,224	464,530
Perennial crop seller (%)	56%	40%	52%	75%
Perennial crop sales (2005 cedis)	1,500,000	187,059	1,070,000	3,140,000
Agricultural credit use (%)	3%	2%	3%	4%
Any formal credit use (%)	9%	7%	9%	8%
Fertilizer purchaser (%)	22%	10%	20%	33%
Savannah				
Landholding size (ha)	2.60	0.38	2.17	4.44
Household income/capita (2005 cedis)	2,110,000	2,060,000	1,550,000	3,660,000
Agricultural income share (%)	64%	39%	64%	71%
Off-farm income share (%)	6%	17%	5%	6%
Gross value of crop sales (2005 cedis)	3,090,000	689,470	2,580,000	5,190,000
Food crop seller (%)	78%	71%	76%	88%
Food crop sales (2005 cedis)	2,460,000	634,999	2,110,000	3,960,000
Maize/cassava seller (%)	52%	52%	47%	66%

Table 5. Continued

Household attribute	National mean	Smallholder class		
		Virtually landless	Typical smallholder	Moderate smallholder
Savannah (continued)				
Maize/cassava sales (2005 cedis)	558,650	380,302	489,221	800,538
Maize/cassava share of total sales (%)	16%	17%	14%	20%
Annual crop seller (%)	33%	33%	30%	42%
Annual crop sales (2005 cedis)	495,975	47,730	394,025	905,833
Perennial crop seller (%)	27%	32%	25%	30%
Perennial crop sales (2005 cedis)	131,516	6,741	74,123	324,823
Agricultural credit use (%)	2%	0%	3%	2%
Any formal credit use (%)	6%	9%	6%	5%
Fertilizer purchaser (%)	38%	25%	38%	40%

Small-Farm Characteristics

Within the range of landholding sizes that characterizes the majority of small farms (0.1–0.8 ha per capita¹⁰), landholding size is significantly associated with many of the characteristics of the typical small farm. Smaller farms have smaller crop portfolios, lower rates of participation in commodity markets, and lower levels of input and credit use.

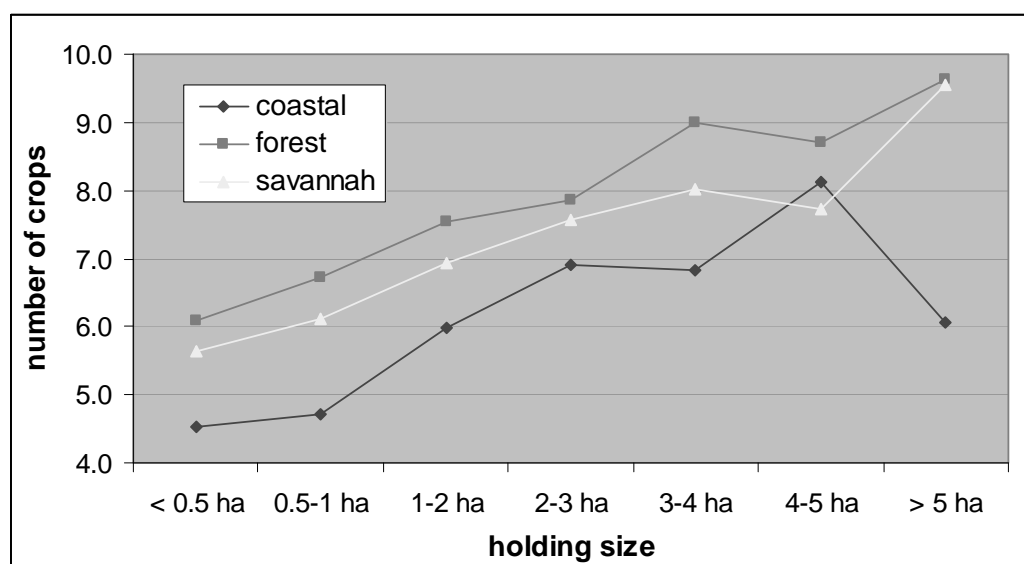
Crop Portfolios

In general, producers with smaller landholdings have portfolios with fewer number of crops compared with producers with larger holdings (Figure 5). The relationship between landholding size and portfolio diversity is significant in all regions and ecological zones and increases in intensity toward the north¹¹. Although the relationship between diversity and landholding size holds true across geography (i.e. national, regional, and ecological zone levels), the overall diversity of crops is notably less on the coast. This might indicate that production specialization is relatively higher in the south, where market linkages are better and risks are lower.

¹⁰ Corresponding roughly to 0.5 to 5.0 ha per farm.

¹¹ Pearson's correlation coefficients for the coast, forest and savannah are 0.19, 0.28, and 0.32, respectively all significant at the $p = 0.01$ level.

Figure 5. Mean number of crops per household, by landholding size and ecological zone



Although crop choice varies considerably with agro-ecology, maize and cassava are the most frequent crops in the portfolios of all small farms.¹² The presence of those two crops in farm portfolios is relatively constant across landholding sizes and major geographical zones (Table 6, but the importance of the crops is negatively related to landholding size. Data-quality issues precluded the calculation of crop-specific harvest area shares. However, of the nearly 12 percent of households that grew *only* maize and/or cassava, the mean household landholding size was 1.7 ha (and the median was 0.8 hectares),¹³ thus highlighting the importance of those commodities for incomes and food security to very small farms.

Table 6. Share of producer households with maize and cassava in their portfolios, by landholding size and ecological zone, 2005–2006

Holding size	Maize			Cassava		
	Coast	Forest	Savannah	Coast	Forest	Savannah
< 0.5 ha	66%	63%	41%	85%	83%	37%
0.5-1 ha	70%	68%	44%	89%	80%	22%
1-2 ha	74%	68%	47%	92%	82%	22%
2-3 ha	76%	66%	64%	90%	82%	24%
3-4 ha	68%	66%	72%	87%	86%	35%
4-5 ha	65%	65%	78%	91%	81%	25%
> 5 ha	63%	67%	86%	85%	81%	35%
<i>Average</i>	<i>70%</i>	<i>66%</i>	<i>61%</i>	<i>88%</i>	<i>82%</i>	<i>27%</i>

Other crop choice patterns are more reflective of variation in landholding size and geography. Table 7 summarizes shares of farms growing common agricultural commodities. High-value cash crops

¹² A total of 34 crop designations in the GLSS5 were evaluated: cocoa, coffee, rubber, coconut, oil palm, plantain, banana, oranges, wood, cola nut, kenef, cotton, groundnut/peanut, tobacco, pineapple, sugar cane, cassava, yam, potatoes, maize, rice, guinea corn/sorghum/millet ropes, tomatoes, okro, garden egg/eggplant, beans/peas, pepper, leafy vegetables, onion, avocado pear, mango, and pawpaw, as well as catchall designations for other vegetables and other crops.

¹³ This is a less severe, but otherwise consistent, story with that from 1998–1999: 22 percent of households in the GLSS4 sample had only maize and/or cassava in their portfolios, and the average landholding size for those households was 1.2 ha.

(e.g. tomatoes, oil palm, cocoa) are more prevalent, on average, among larger landholders, although this is not uniformly so. The highest rates of high-value crop choice are found the coast, as expected.

Table 7. Proportion of households growing major crops, by ecological zone

	Holding Size							Zone average
	< 0.5 ha	0.5-1 ha	1-2 ha	2-3 ha	3-4 ha	4-5 ha	> 5 ha	
Coast								
Maize	66%	70%	76%	76%	68%	65%	63%	70%
Sorghum/millet	0%	0%	0%	0%	3%	0%	0%	0%
Rice	0%	0%	1%	1%	0%	0%	0%	1%
Cassava	85%	89%	90%	90%	87%	91%	85%	88%
Yam/cocoyam	2%	6%	12%	12%	13%	0%	8%	7%
Plantain	22%	30%	35%	35%	45%	44%	49%	34%
Groundnuts	1%	1%	3%	3%	6%	3%	4%	2%
Beans	3%	2%	3%	3%	3%	0%	6%	3%
Tomatoes	12%	15%	23%	23%	32%	15%	21%	18%
Okro	3%	4%	11%	11%	10%	12%	10%	6%
Peppers	25%	24%	35%	35%	39%	35%	28%	29%
Oil palm	18%	17%	37%	37%	32%	53%	30%	26%
Cocoa	2%	9%	22%	22%	32%	29%	31%	15%
Forest								
Maize	63%	68%	66%	66%	66%	65%	67%	66%
Sorghum/millet	0%	0%	0%	0%	0%	0%	0%	0%
Rice	0%	1%	3%	3%	2%	1%	4%	2%
Cassava	83%	80%	82%	82%	86%	81%	81%	82%
Yam/cocoyam	11%	16%	23%	23%	26%	19%	27%	20%
Plantain	53%	59%	66%	66%	71%	76%	79%	66%
Groundnuts	4%	3%	2%	2%	5%	3%	4%	3%
Beans	1%	3%	4%	4%	6%	2%	5%	3%
Tomatoes	7%	7%	14%	14%	13%	15%	14%	11%
Okro	4%	6%	6%	6%	7%	3%	10%	7%
Peppers	8%	15%	18%	18%	21%	18%	23%	17%
Oil palm	15%	18%	29%	29%	40%	42%	47%	29%
Cocoa	13%	22%	52%	52%	61%	68%	76%	44%
Savannah								
Maize	41%	44%	64%	64%	72%	78%	86%	61%
Sorghum/millet	19%	36%	40%	40%	41%	45%	52%	40%
Rice	12%	18%	20%	20%	22%	21%	31%	21%
Cassava	37%	22%	24%	24%	35%	25%	35%	27%
Yam/cocoyam	17%	26%	38%	38%	48%	44%	54%	35%
Plantain	6%	2%	4%	4%	3%	6%	5%	4%
Groundnuts	25%	32%	43%	43%	49%	48%	58%	43%
Beans	14%	16%	25%	25%	28%	26%	49%	27%
Tomatoes	9%	4%	7%	7%	7%	10%	23%	9%
Okro	10%	5%	12%	12%	14%	17%	38%	14%
Peppers	14%	6%	14%	14%	14%	16%	35%	15%
Oil palm	1%	0%	0%	0%	2%	2%	2%	1%
Cocoa	0%	0%	3%	3%	2%	4%	4%	2%

Note: Numbers in bold correspond to crops grown by 40 percent or more of households in that ecological zone.

Productivity

Although agriculture in Ghana has grown in recent years, productivity in the food crops that smallholders dominate has been variable and stagnant in many areas. Growth rates for maize and cassava from 1999 through 2004 were modestly positive, although most of this growth has come from area expansion (Table 8). Further, national rates mask a great deal of subnational variation: yield increases have tended to be weakest (or negative) in the forest and savannah zones.¹⁴ Given the majority share of the small farms in those zones, the trends are disconcerting. The lower productivity rates in the north stand in contrast with the relatively higher input use rates there, as other researchers have noted (e.g., Asuming-Brempong et al. 2004). At current levels of technology use within the sector, major yield gains are not likely. Nonetheless, because yields are low relative to what is possible for varieties currently in the field, the likelihood of technology-driven yield gains is high (MOFA 2006).

Table 8. Growth rates and yields for maize and cassava, by ecological zone

Zone	Average annual growth, 1999-2004						Average yield (2003-2005)	
	Maize Prod.	Area	Yield	Cassava Prod.	Area	Yield	Maize	Cassava
Coast	2.9%	0.4%	2.5%	4.2%	2.6%	1.6%	1.7	12.8
Forest	1.9%	2.1%	-0.2%	3.5%	1.9%	1.6%	1.6	13.7
Savannah	3.9%	2.0%	1.9%	4.3%	4.1%	0.2%	1.6	13.2
<i>National</i>	<i>2.7%</i>	<i>1.8%</i>	<i>1.0%</i>	<i>3.9%</i>	<i>2.6%</i>	<i>1.2%</i>	<i>1.6</i>	<i>13.4</i>

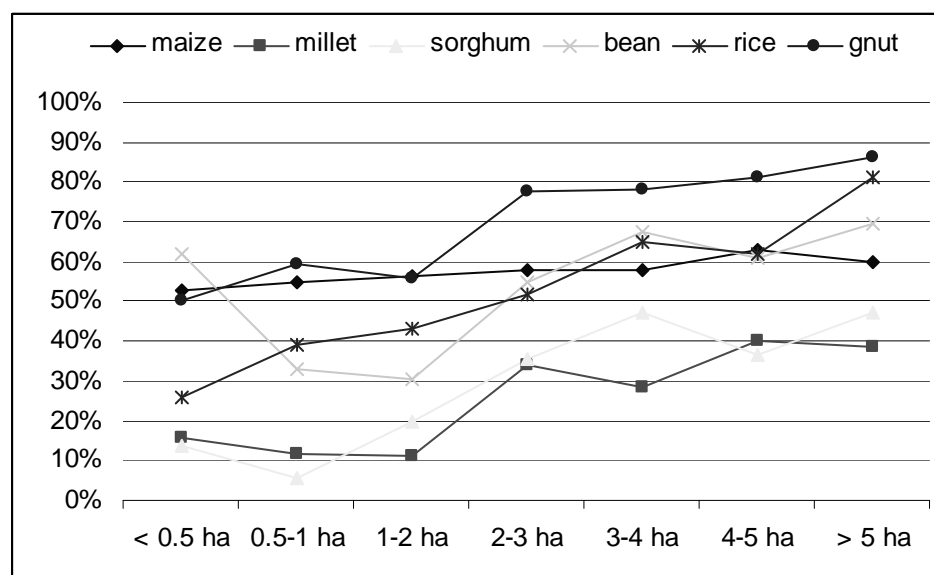
Source: Calculated from district-level data from SRID. Growth calculations based on three-year averages for each period (1998-2000, 2003-2005).

Market Participation

This analysis examined the current rate of commercialization of five crops: maize, rice, groundnut, beans, and sorghum/millet. Commercialization rates vary according to type of crop and ecological zone. At the national level, groundnut has the highest rate of 69 percent, and sorghum/millet has the lowest rate of 25 percent. Market participation for households with smaller landholdings, although generally less than that for households with larger holding, is significant even at the smallest landholding sizes and for all staple food crops (Figure 6).

¹⁴ Because 2003 and 2005 were relatively highly productive years, an alternative set of reference years would likely show even lower rates of growth, particularly in yield.

Figure 6. Market participation (% of producers who sell), major food crops, 2005–2006



Note: gnut = groundnut.

In terms of high-value crop marketing, the GLSS5 records the value of high-value sales for the two-week period preceding the time of interview. Based on that window, participation in high-value markets is clearly differentiated by both landholding size and ecological zone (Table 9). Larger shares of farms participated in high-value markets, and larger sales volumes were reported for larger landholdings and for holdings in the south. Unfortunately, structural and quality issues with the GLSS5 data precluded more detailed analysis of aggregate commercialization indicators, such high- versus low-value crop marketing behavior, indicators of market-oriented specialization, etc.

Table 9. Share of farms producing high-value cash crops* (average value of two weeks' sales)**

Per capita landholding quartile	Coast	Forest	Savannah
Bottom	11% (¢85,018)	10% (¢76,365)	5% (¢56,549)
2nd	25% (¢151,902)	21% (¢87,770)	9% (¢91,623)
3rd	20% (¢99,408)	27% (¢85,701)	14% (¢98,718)
Top	35% (¢131,869)	31% (¢102,160)	19% (¢106,211)

Notes: * High-value crops include avocado, cashew nut, cocoa, coconut, coffee, cola nut, cotton, garden egg, ginger, kenef, leafy vegetables, lime/lemon, mango, okro, onion, oranges/tangerine, pawpaw, pepper, pineapple, rice, rubber, shea nut, sugarcane, tiger nut, tobacco, tomatoes, watermelon, wood lot, other fruits, and other vegetables.

** Average value of total sales made in the two weeks before the survey interview.

Use of Credit

The limited use of credit by Ghanaian small farmers is well noted (e.g., Asuming-Brempong et al 2004). In the 2005–2006 GLSS data, the share of households that report using credit from formal and informal sources averages less than 20 percent in every zone and size of landholding (Table 10). Credit is more frequently used in the coast and forest zones than in the north. No significant relationship exists between landholding size and credit use by itself, however. Further, we found no strong relationship between credit use and the gender of the household head, a finding made elsewhere (ISSER 2007).

Table 10. Share of farmers using credit, by landholding size and ecological zone

Per capita landholding quartile	Agricultural credit*						Any credit					
	Coast		Forest		Savannah		Coast		Forest		Savannah	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Bottom	3%	1%	3%	1%	1%	4%	21%	16%	19%	15%	10%	8%
2nd	1%	4%	5%	2%	3%	3%	13%	11%	18%	12%	6%	9%
3rd	5%	0%	5%	0%	6%	4%	17%	5%	18%	8%	10%	12%
Top	3%	0%	6%	5%	2%	10%	10%	9%	19%	10%	7%	16%
<i>Average</i>	<i>3%</i>	<i>1%</i>	<i>5%</i>	<i>2%</i>	<i>3%</i>	<i>5%</i>	<i>15%</i>	<i>11%</i>	<i>18%</i>	<i>12%</i>	<i>8%</i>	<i>11%</i>

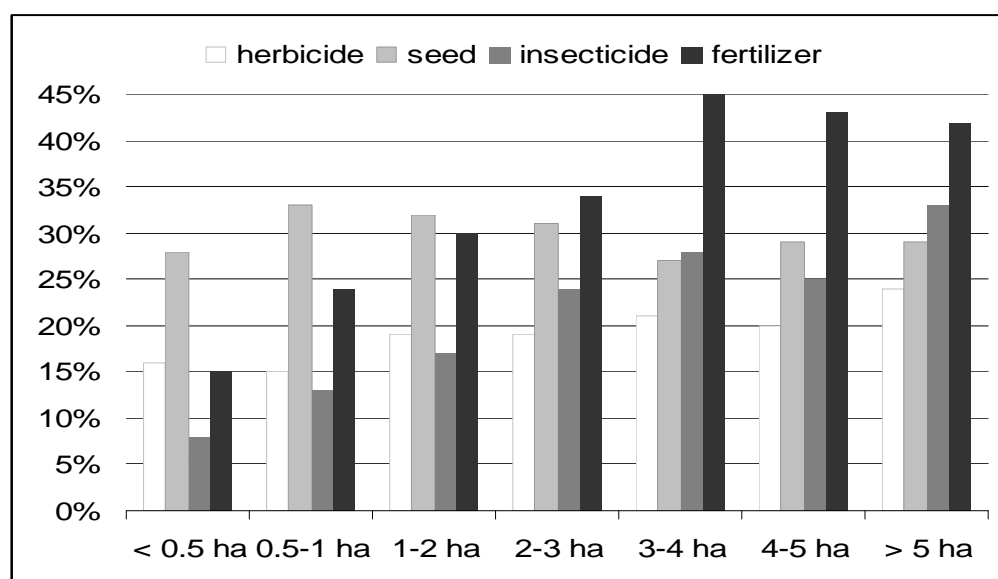
Notes: * Includes any loans used for any of the following categories: agricultural land, agricultural equipment, agricultural inputs, and business.

** Includes loans made for agriculture or business, as well as for housing, education, health, ceremonies, funerals, vehicles, other goods, or other purposes. Both types of credit include any loans obtained from the following: state bank, private bank, cooperative, government agency, nongovernmental organization, business firm, employer, moneylender, or trader.

Use of Agricultural Inputs

Overall use rates for various inputs (i.e., the share of producers reporting expenditure on a given input) vary by landholding class, being generally lower at lower landholding levels (Figure 7). In terms of frequency of use, purchased seed is clearly the most important input for households at the smaller end of the landholding spectrum. At higher levels, insecticide and fertilizer are more frequently purchased.

Figure 7. Share of farmers using purchased inputs, by landholding size



As the foregoing discussion has suggested, many of farm characteristics are highly associated with landholding size. Table 11 shows the correlation between landholding size and farm characteristics for typical smallholders (i.e., excluding the virtually landless and each ecological zone's top landholding quartile). Better land endowments correspond to larger incomes per capita and greater income shares from agriculture. Larger smallholdings are also more likely to participate in food markets (other than maize and cassava) and high-value perennial crop markets. Credit use is more frequent, as is use of purchased inputs, especially fertilizer. With few exceptions, these relationships are stable across agro-ecological space.¹⁵

¹⁵ The major exception is use of inputs other than fertilizer (i.e., use of herbicides, insecticides, and improved seed), which is highly dependent on crop choice and biophysical production conditions and therefore varies considerably by ecological zone.

Table 11. Correlation between landholding size and farm characteristics

Characteristic	Correlation Coefficient																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Landholding size (ha)	1.00																
2 Household income/capita (2005 cedis)	0.04	1.00															
3 Agricultural income share (%)	0.16	0.14	1.00														
4 Off-farm employment income share (%)	-0.08	-0.10	-0.28	1.00													
5 Gross value of crop sales (2005 cedis)	0.25	0.48	0.14	-0.09	1.00												
6 Food crop seller (%)	0.02	0.09	0.07	-0.05	0.12	1.00											
7 Food crop sales (2005 cedis)	0.19	0.39	0.10	-0.07	0.76	0.17	1.00										
8 Maize/cassava seller (%)	-0.09	0.07	0.01		0.05	0.75	0.09	1.00									
9 Maize/cassava sales (2005 cedis)	0.07	0.41	0.09	-0.05	0.37	0.19	0.46	0.25	1.00								
10 Maize/cassava share of total sales (%)	-0.08	0.02	0.03	-0.03		0.38	0.10	0.51	0.38	1.00							
11 Annual crop seller (%)	-0.06	0.06	-0.04	0.05	0.07	0.32	-0.04	0.37	-0.05	-0.31	1.00						
12 Annual crop sales (2005 cedis)	0.05	0.28	0.06	-0.04	0.61	0.02	0.05	0.01	0.05	-0.06	0.19	1.00					
13 Perennial crop seller (%)	0.04	0.00	-0.02	0.04		0.13	-0.10	0.22	-0.11	-0.39	0.45	-0.05	1.00				
14 Perennial crop sales (2005 cedis)	0.28	0.13	0.09	-0.05	0.34	-0.06	0.05	-0.06	0.05	-0.12	-0.05		0.33	1.00			
15 Agricultural credit use (%)	0.09	0.03	0.04	0.01	0.06		0.00	-0.01	0.01	-0.02	0.02	0.02	0.08	0.14	1.00		
16 Any formal credit use (%)	0.08	-0.01	-0.05	0.18	0.02	0.01	-0.02	0.00	0.01	-0.02	0.03	0.01	0.06	0.09	0.55	1.00	
17 Fertilizer purchaser (%)	0.20	0.09	0.10	-0.04	0.15	0.04	0.06	0.01	0.07	0.01	0.03	0.12	-0.07	0.11	0.11	0.07	1.00

Note: Observations restricted to “typical smallholders,” excluding the virtually landless and the top quartile of landholding sizes. Table includes only correlation coefficients significant at the 1% level or better.

Constraining Environments

It is worth noting that the smallest and poorest farms are particularly vulnerable to the constraints imposed by remoteness, missing or under-developed credit and input markets, and the risks associated with high variability in climate and/or commodity prices. Although such constraints vary considerably across Ghana, a large portion of Ghanaian smallholders live and work in environments that can reasonably be characterized as challenging and which magnify the limitations less-endowed farmers have in accessing markets. To fully explore these constraints is beyond the scope of this analysis. However, we can note the distribution of small farms with respect to one key aspect of challenging geography: remoteness.

Access to markets is a key constraint to smallholder development from a number of perspectives. Access to output markets for marketable surplus is a key component of sectoral transformation strategies, and access to input markets is linked to that for several reasons. First, input use is often economic only under conditions of marketable surplus. Second, in well-functioning markets, input costs will decrease as access increases (assuming input and output markets are found in the same locations). Therefore, reducing access constraints is an important strategic goal in Ghana's current rural development dialogue.

Table 12. Distribution of smallholders relative to market towns of 50,000 or more inhabitants

	Hours of Travel Time			
	< 3	3–6	> 6	
Coast	79%	18%	3%	100%
Forest	60%	28%	11%	100%
Savannah	7%	47%	46%	100%
<i>National</i>	47%	33%	21%	100%

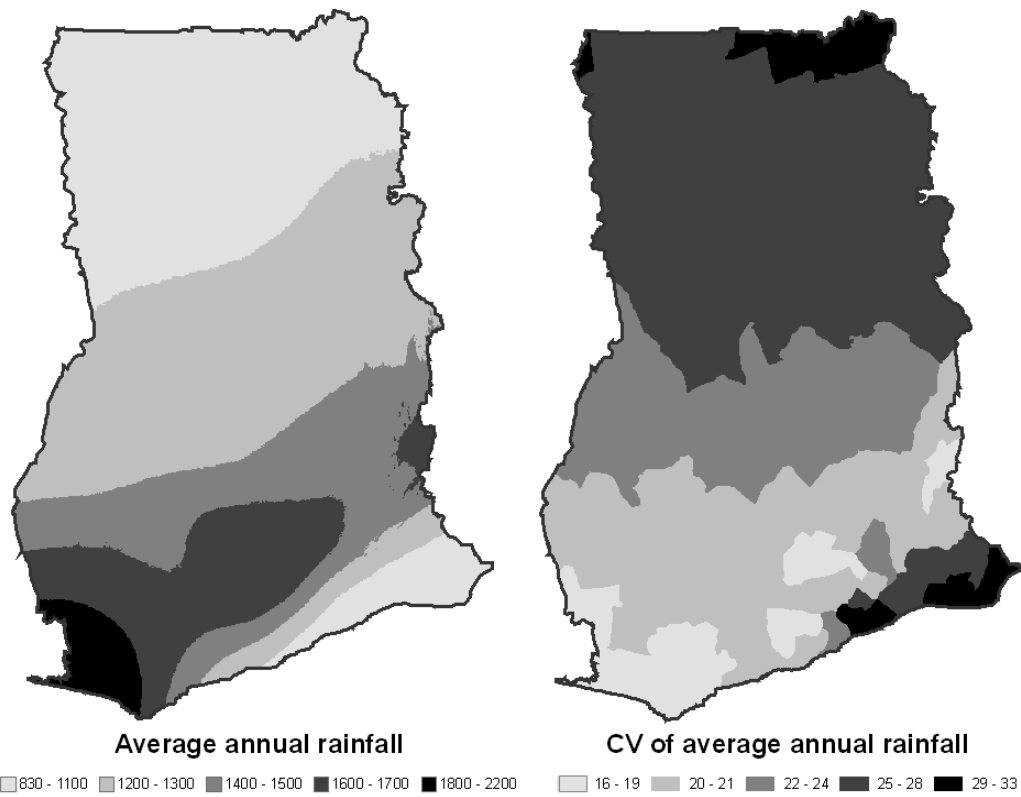
Using a coarse spatial filter to determine the access conditions under which smallholders live and work provides some insights into the contexts within which efforts to improve market linkages must take place. Table 12 summarizes the approximate number of typical smallholders living within different bands of travel time to market towns of 50,000 or more people.¹⁶ By the conservative estimates shown in this table, more than a fifth of Ghanaian small farmers live in districts which involve, on average, more than six hours travel time to such markets.

Compounding the issue of remoteness is that of spatially varying production risks, which is importantly, although not exclusively, tied to rainfall patterns (Figure 8). This is clearly a bigger issue in the north, where remote areas are often also characterized by low average rainfall and higher inter-seasonal variability (Kasei 1990; Friesen 2002).

Patterns of geographic disadvantage range from those which are relatively simple to approximate, such as those shown here, to much more complex phenomena, such as spatially-varying price variability, institutional presence, etc. However represented, such conditions are likely to be particularly difficult for the smallest and poorest producers to overcome. This further underscores the need to include strategies for those elements of the small farm sector which face relatively greater challenges in responding to risky and remote market incentives.

¹⁶ These distributions were estimated using a geographic information system, using methods similar to those described in Chamberlin et al. (2006).

Figure 8. Rainfall amounts and variability in Ghana



Source: Average annual rainfall from WorldClim (2005); Rainfall variability is represented by the coefficient of variation (CV) of 50 years of synthetic observations (Thornton, unpublished).

4. DISCUSSION

Smallholders in Ghana clearly conform to the standard model of the small farmer in a developing agrarian economy, but important variation within this group is apparent. In general, smaller land holding size seems to reinforce “classic” characteristics of the group such as lower use of inputs and the degree and type of farm commercialization. Although smaller farms are more likely to engage in high-value annual markets, most of the other variables considered in this study do not indicate clear patterns of intensification with reduced farm size. Instead, on average, larger farms have higher incomes per capita, higher levels of market engagement (including for high-value perennials), higher use of inputs (especially fertilizers), and greater use of credit.

In all ecological zones, most smallholders occupy the smaller end of the landholding spectrum and tend to share many characteristics: lower agricultural income per capita (which may be taken as a partial indicator of productivity), predominance of food crop marketing, and weak engagement with input and credit markets. Small-farm characteristics are further exacerbated by geographically varying risk and remoteness: the smallest and poorest farmers are especially susceptible to the production and marketing risks in the northern savannah and in the more remote areas of the south. Those areas offer fewer cash crop opportunities, more incentives not to specialize, and overall low crop productivity— conditions that tend to reinforce each other and are likely to be particularly constraining for the smallest farmers who constitute the bulk of producers.

The distribution of small-farm characteristics and tendencies suggests that the ability to respond to strategic efforts to increase the market orientation of smallholders (e.g. contracted production, linked input-output market support) will be skewed toward larger farms, which are already better engaged with existing input and output markets. The high incidence of virtual landlessness in all areas indicates that many household may be unwilling or unable to use land for market-oriented production which entails risk (e.g. as part of an outgrower scheme involving input credits). These observations, in turn, collectively suggest several priorities for the pro-poor rural development dialogue in Ghana. First, access to land should be an important part of the rural development discussion, especially in the context of pro-poor growth. Distribution of land appears highly unequally distributed at present. Although this study was not able to explicitly consider land quality, this should be part of a more detailed examination of land access issues.

Second, policy objectives geared toward expanding production chains should focus on bringing in new market participants, i.e. in addition to enhancing the participation of current participants. Development strategies that emphasize increased provision of (improved) technologies will likely benefit larger and better-endowed smallholders who are already better linked to input delivery systems. Strategies focusing on improving farmer–market linkages through outgrower schemes or contract farming often favor the selection of better-endowed farmers with market-production experience (Al-Hassan et al. 2006). Because most landholding-size variation happens within communities,¹⁷ such strategies may increase inequalities within rural communities which are already stratified by land, labor, and capital assets.

Third, an emphasis on high-value, export-oriented chains (horticulture and tree crops) is unlikely to reach the majority of small producers in the near term. Staple food crop markets (particularly maize) are more important to broader segments of the small-farm sector. Thus, the current emphasis in the FASDEP (Government of Ghana 2007) on tree crops and vegetables may need to be accompanied by further thinking on how to pull new small producers into those chains, especially those with limited experience with existing input, output and credit markets.

Fourth, this distribution of small-farm characteristics would suggest that broad-based investments (infrastructure, information systems, education), which have more inclusive benefits, are important for rural Ghana, particularly for smallholders primarily engaged in food crop markets.

¹⁷ Following Jayne et al. (2003), we tested for this by regressing landholding size per capita against a range of locational dummies, including ecological zone, region, district, and economic area or village. Adjusted *r*-squared values are 0.01, 0.03, 0.01, and 0.30, respectively, indicating that the majority of landholding variation occurs *within* villages.

Fifth, as part of a pro-poor commodity development focus, it would make sense to include maize and cassava, given the strong presence of those crops in the smallest farm portfolios across the country, and on the stronger markets for maize in remote areas. Currently, the FASDEP acknowledges the need to pay special attention to crops produced by the poor but identifies only sorghum, millet, groundnut, and shea nut as focal points for pro-poor crop investments (Government of Ghana 2007).

Finally, continued exploration of off-farm employment potential is warranted, especially for those areas where very small holdings in risky environments may make commercially oriented on-farm enterprises less appealing as livelihood strategies.

5. CONCLUSIONS AND SUGGESTIONS FOR FURTHER STUDY

Across rural Ghana, important variations are apparent in the small-farm attributes that are likely conditioners of the impact of interventions targeting increased farmer–market linkages and other avenues of “agricultural modernization.” Based on this study, we advocate making at least basic distinctions among the virtually landless, the “typical” smallholding, and the relatively better-endowed small farm, based in part on geographically differentiated land distributions per capita. For typical smallholdings, smaller farms show more pronounced expressions of the stylized notion of smallholder agriculture—that is, lower use of inputs, farm diversity, and market engagement. This relationship appears especially acute in female-headed small farm households. This is generally true across the country, although some attributes (crop choice, portfolio size, and type of market engagement) are clearly also conditioned by agro-ecology. Thus, although smallness certainly has many other dimensions, the size of landholdings is clearly an important indicator of the distribution of small-farm characteristics and tendencies.

Distinguishing among the various commercial orientations and wealth characteristics of small-farm households is important in designing inclusive interventions. Strategies for achieving an agricultural transformation in Ghana currently emphasize the expansion of export-oriented market chains, farm–market linkage strategies such as outgrower schemes, new technologies, and expanded delivery systems. Because technologies, marketing linkages, and delivery systems favor better-endowed farmers (i.e., those with more wealth, better access to inputs, and more land), such interventions are less likely to directly reach the poorer farmers who tend to be found at the smaller end of the landholding spectrum. This point has been made elsewhere (ISSER 2007; Asuming-Brempong et al 2004) and is recognized by the latest version of FASDEP (Government of Ghana, 2007). However, inclusive and pro-poor growth objectives have not yet been accompanied by detailed strategies for reaching the smallest farmers.

Further, farmers will most easily adopt new practices within the contexts of existing livelihood strategies. Given that many small farmers not only have minimal access to credit, inputs, advice, and market information but also produce under high risks, efforts to increase productivity of smallholders should focus on technologies with low adoption barriers (low cost, low risk) and expansion of markets in which they are already engaged (food crop markets). Poor physical access tends to be accompanied by fewer services, more volatility in market opportunities, and greater risk for adopting strategies that involve new technologies or new market opportunities. In turn, the risks that producers with limited endowments face are exacerbated and are thus most difficult to overcome by the smallest of smallholders. Efforts to strengthen the market participation of producers in such circumstances may benefit from implementation strategies which include risk management components (e.g. insurance).

The work presented in this paper has been essentially exploratory and descriptive in nature. A more detailed approach to characterizing smallholders by a constraints-oriented typology would be useful. In order to more thoroughly examine the relationships among the farm characteristics presented here, factor analysis or other clustering techniques might be used to quantitatively identify the multivariate nature of “smallness” in the Ghanaian small-farm sector. There may be important interaction effects and thresholds that could be uncovered with such analysis.

REFERENCES

- Al-Hassan, R.M., D.B. Sarpong, and A. Mensah-Bonsu. 2006. *Linking smallholders to markets*. Ghana Strategy Support Program Background Paper No. GSSP 0001, Department of Agricultural Economics and Agribusiness, University of Ghana, Legon.
- Aryeetey, E. and McKay, A. (2004). *Operationalizing Pro-Poor Growth: Ghana Case Study*. Department for International Development, UK
- Asuming-Brempong, Samuel, Ramatu Al-Hassan, Daniel Bruce Sarpong, George T-M. Kwadzo, Sesi K. K. Akoena, Owuraku Sakyi-Dawson, Akwasi Mensah-Bonsu, Ditchfield P. K. Amegashie, Irene Egyir and Steve Ashley. 2004. *Poverty and Social Impact Analysis (PSIA) Studies for Ghana: Economic Transformation of the Agricultural Sector*. Final Report submitted to the National Development Planning Commission (NDPC)/ Ministry of Food and Agriculture (MoFA), and DFID, Ghana, for the “Economic Transformation of the Agriculture” Sector Study. Report submitted in June 2004 by the Department of Agricultural Economics & Agribusiness, University of Ghana and Department of Economics, University of Ghana with technical support from The IDL Group, U.K.
- Chamberlin, J., J. Pender, and B. Yu. 2006. *Development Domains for Ethiopia: Capturing the Geographical Context of Smallholder Development Options*. International Food Policy Research Institute, Development Strategy and Governance Division/Ethiopian Strategy Support Program. Washington, D.C. International Food Policy Research Institute (IFPRI).
- Chambers, R. 1989. “Vulnerability, Coping and Policy”, *IDS Bulletin* 20 (2): 1-7.
- Chipeta S., Hoydahl E. and Krog J., 2003. *Livestock Services and the Poor. A Global Initiative – Collecting, Coordinating and Disseminating Experiences*. Draft Report, Danida, IFAD and The World Bank.
- Coulombe, H. and A. McKay. 2003. *Selective Poverty Reduction in a Slow Growth Environment: Ghana in the 1990s*. Paper prepared for the World Bank, Human Development Network.
- Coulombe, H., and Q. Wodon. 2007. *Poverty, livelihoods, and access to basic services in Ghana: an overview*. Background paper for Ghana CEM, April 2007. World Bank. Washington DC
- de Janvry, A., and E. Sadoulet. 2006. *Progress in the modeling of rural households’ behavior under market failures*. Chap. 8 in *Poverty, inequality and development: Essays in honor of Erik Thorbecke*, ed. A. de Janvry and R. Kanbur. New York: Springer.
- de Janvry, A., and E. Sadoulet. 2005. "Access to Land and Development" *New Palgrave Dictionary of Economics*, 2nd edition, edited by Steven Durlauf and Lawrence Blume, Palgrave Macmillan.
- Deininger, Klaus. 2004. ‘Land Policies for Growth and Poverty Reduction: Key Issues and Challenges Ahead,’ Paper prepared for the Inter-regional Special Forum on the Building of Land Information Policies in the Americas, 2004.
- Dixon, J., K. Taniguchi, and H. Wattenbach, eds. 2003. *Approaches to assessing the impact of globalization on African smallholders: Household and village economy modeling*. Proceedings of a working session on Globalization and the African Smallholder Study. FAO (Agricultural Support Systems Division [AGS] and Agricultural and Development Economics Division [ESA]) and the World Bank. Rome: Food and Agriculture Organization of the United Nations.
- Duncan A. and Howell J. 1992. *Structural Adjustment and the African Farmer*. Overseas Development Institute, London.
- Eastwood, R., M. Lipton, and A. Newell. 2007. *Farm size*. Chapter prepared for R. Evenson and P. Pingali (eds.) *Handbook of agricultural economics*. Vol. 3, Agricultural development : farmers, farm production and farm markets. Available at http://www.sussex.ac.uk/Units/PRU/farm_size.pdf
- Ekboir, J., K. Boa, and A.A. Dankyi. 2002. *Impacts of No-Till Technologies in Ghana*. Mexico D.F.:CIMMYT
- Fafchamps, M. 1992. *American Journal of Agricultural Economics*, 74 (1): 90-99.

- Friesen, Jan. 2002. Spatio-temporal Rainfall Patterns in Northern Ghana. Diploma Thesis. Geographische Institute der Rheinischen Friedrich-Wilhelms, Bonn University, Germany.
- Government of Ethiopia. 2006 Ethiopia: Building on progress: A plan for accelerated and sustained development to end poverty (PASDEP) (2005/06–2009/10). Ministry of Finance and Economic Development, Addis Ababa, Federal Democratic Republic of Ethiopia.
- Government of Ghana. 2003. *Analysis and policy statement*. Vol. I of *Ghana poverty reduction strategy 2003–2005: An agenda for growth and prosperity*.
<http://siteresources.worldbank.org/ghanaextn/Resources/GhanaPRSP.pdf>.
- . 2007. *Food and agriculture sector development policy (FASDEP)*. Draft revision. Accra, Ghana: Ministry of Food and Agriculture.
- Green, Maryann, Gastão Lukanu, Steve Worth. 2006. Use of wealth ranking to analyse factors influencing smallholder farmers' market participation in northern Mozambique. *Development Southern Africa* 23(5):669-683.
- Haggblade, S., Hazell, P., 1988. Prospects for Equitable Growth in Rural Sub-Saharan Africa, AGRAP Economic Discussion Paper 3, World Bank, Washington D.C.
- Hazell, Peter B. R., and Ramasamy, C. 1991. *The Green Revolution Reconsidered: The Impact of High-Yielding Rice Varieties in South India*. Baltimore: Johns Hopkins University Press for the International Food Policy Research Institute.
- Heltberg R.(1998), “Rural Market Imperfections and the Farm Size-Productivity Relationship: Evidence from Pakistan”, *World Development* Vol.26, No.10: 1807-1826.
- Huvio, T., J. Kola, and T. Lundström, eds. 2005. *Small-scale farmers in liberalised trade environment*. Proceedings of the seminar, October 18–19, 2004, Haikko, Finland. Department of Economics and Management Publications No. 38. Agricultural Policy. Helsinki: University of Helsinki.
- Institute of Statistical Social and Economic Research (ISSER). 2007. *Shared and inclusive growth in Ghana*. Draft report prepared for the Department for International Development, United Kingdom. ISSER, University of Ghana, Legon.
- Jayne, T.S., T. Yamano, M. Weber, D. Tschirley, R. Benfica, A. Chapoto, and B. Zulu. 2003. Smallholder income and land distribution in Africa: Implications for poverty reduction strategies. *Food Policy* 28: 253–275.
- Kasei, C.N. 1990. A Synopsis on the Climate of the North of Ghana. Presented at the 2nd workshop on improving farming systems in the savanna zone of Ghana. April 24-26 1990. Nyankpala Agricultural College. Nyankpala-Tamale, Ghana.
- Lipton, M. 2006. Can Small Farmers Survive, Prosper, or be the Key Channel to Cut Mass Poverty? *Electronic Journal of Agricultural and Development Economics* Vol. 3, No. 1, 2006, pp. 58–85. Agricultural and Development Economics Division (ESA), FAO: Rome. Available online at www.fao.org/es/esa/eJADE
- Lipton, M. 2005. *The family farm in a globalizing world: The role of crop science in alleviating poverty*. 2020 Vision for Food, Agriculture, and the Environment Initiative Discussion Paper No. 40. Washington, DC.: International Food Policy Research Institute.
- Moser, O. N. C., 1993. *Gender Planning and Development; Theory, Practice and Training*. Printed by Mackeys of Chatham plc, Chatham, Kent. Great Britain.
- Nagayets, O. 2005. *Small farms: Current status and key trends*. Information brief prepared for the Future of Small Farms Research Workshop, Wye campus of Imperial College, UK, June 26–29, 2005.
- Negash, A., and A. Niehof. 2004. The significance of *Enset* culture and biodiversity for rural household food and livelihood security in southwestern Ethiopia. *Agriculture and Human Values* 21: 61–71.
- Pender, J., S. Ehui, and F. Place. 2006. Conceptual framework and hypotheses. In *Strategies for sustainable land management in the East African highlands*, ed. J. Pender, F. Place, and S. Ehui. Washington, DC: International Food Policy Research Institute.

- Rapsomanikis, G. and A. Sarris. 2006. The Impact of Domestic and International Commodity Price Volatility on Agricultural Income Instability Ghana, Vietnam and Peru. WIDER Discussion Paper No. 2006/04. United Nations University, World Institute for Development Economics Research (UNU-WIDER): Helsinki, Finland
- Republic of Mozambique. 2006. *Action plan for the reduction of absolute poverty 2006–2009 (PARPA II)*. Maputo. Statistics, Research and Information Directorate (SRID). 2006a. Agriculture in Ghana, 2006: Facts and Figures. Report. Ministry of Food and Agriculture. Accra. Ghana.
- Statistics, Research and Information Directorate (SRID). 2006b. District-level agricultural production statistics for major crops, 1993-2006. Unpublished dataset. Ministry of Food and Agriculture. Accra. Ghana.
- Thornton, Phillip. Unpublished dataset. Coefficient of variation of long-term rainfall for sub-Saharan Africa. International Livestock Research Institute, Nairobi.
- von Braun, J. 2005. Small-scale farmers in a liberalized trade environment. In *Small-scale farmers in liberalised trade environment*, ed. T. Huvio, J. Kola, and T. Lundström. Proceedings of the seminar, October 18–19, 2004, Haikko, Finland. Department of Economics and Management Publications No. 38. Agricultural Policy. Helsinki: University of Helsinki.
- Von Braun, J., S. Malik, and M. Zeller, 1993. “Credit Markets, Input Support Policies, and the Poor: Insights from Africa and Asia, paper presented at the 1993 AAEA Pre-conference Workshop, “Post Green Revolution Agricultural Development Strategies in the Third World: What Next?” Orlando, Florida, July 30-31, 1993.
- World Bank. 2003. *Reaching the rural poor: A renewed strategy for rural development*. Washington, DC.

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