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Farm Transition and Indigenous Growth

The Rise to Medium- and Large-Scale Farming in Ghana

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ABSTRACT

This paper characterizes the transition from small-scale farming and the drivers of farm size growth among medium- and large-scale farmers in Ghana. The research was designed to better understand the dynamics of change in Ghana's farm structure and contribute to the debate on whether Africa should pursue a smallholder-based or large-scale oriented agricultural development strategy. The results suggest a rising number of medium-scale farmers and a declining number of smallholder farmers in the country, a pattern that is consistent with a changing farm structure in the country's agricultural sector. More important, findings show that the rise to medium- and large-scale farming is significantly associated with successful transition of small-scale farmers rather than entry of medium or large farms into agriculture, reflecting small-scale farmers successfully breaking through the barriers of subsistence agriculture into more commercialized production systems. The findings in this paper also suggest that some of the factors thought to be important for change in farm structure are no obstacle to farm size growth, even though they may foster transition. Notably, the results here diverge from the patterns observed in Zambia and Kenya, which indicate that the emergent farmers came mostly from the urban elite. Unfortunately, past and current policy discussions have not featured these emergent farmers sufficiently in the quest to transform agriculture in Ghana. Government should capitalize on these emergent farmers who have a demonstrated ability to graduate productively as it strives to address challenges in the smallholder sector.

Keywords: indigenous farm growth, emergent farmers, farm structure, transformation, Ghana

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1. INTRODUCTION

Agriculture in Africa south of the Sahara (SSA) has for decades been characterized as smallholding with most farmers cultivating less than 2 hectares of lands in the subregion and living in endemic poverty. The global food price crisis of 2007–2008 added to the recent race to acquire large tracts of fertile lands in Africa, compounding the challenges facing agriculture development in the subregion. The policies set up to confront these challenges have traditionally focused on smallholder-led development strategies, but the failure of decades of interventions to transform agriculture has led many scholars to call into question the smallholder-led development strategies for solving challenges in African agriculture. Such failures also raised once again the persistent question of how to effectively transform Africa's agricultural production systems from largely smallholding and semi-subsistence farms to commercially oriented and more productive ones under a smallholder-based development approach.

A general argument often put forward in favor of smallholder farms is based on the relationship between small farms and high productivity, which was first reported by Sen (1962) and subsequently by others (Lipton 2009; Eastwood, Lipton, and Newell 2010; Binswanger-Mkhize and McCalla 2010). In addition to a strong belief in the efficiency and dynamism of smallholder agriculture, proponents of smallholder-led agricultural development are often inspired by a conviction that because poverty is concentrated in rural areas among smallholders, it is vital that any policy that aims to reduce poverty starts with smallholders (see, for example, Hazell et al. 2007; Wiggins 2009; Hazell 2011; Diao, Hazell, and Thurlow 2010). This argument is also consistent with the overall growth agenda indicating that growth starting among smallholders has far higher growth "linkages" than growth in any other sector (see, for example, Mellor 1995). Therefore, any policy that eliminates smallholders during the process of agricultural modernization will sideline a large segment of the rural population and will likely lead to social tension and leave many trapped in poverty (Breisinger et al. 2011). The success of a smallholder-led approach has been documented by Rosegrant and Hazell (2000), who drew from the Asian Green Revolution to show how agricultural growth reaching large numbers of small farms can transform rural economies and lift huge numbers of people out of poverty. In short, the dominance of a smallholder-led approach to agricultural development in SSA may be explained by Wiggins (2009) who indicates that there has been no generalized record of success with large farms in the subregion.

However, the smallholder-led agricultural development model has extensively been criticized, with scholars questioning its continuing relevance for Africa (Vink 2014; Collier 2008). For example, Vink (2014) indicates the debate on the inverse relationship is somewhat stale and does not really provide any useful information to policy makers because researchers have failed to shine more light on the issue, while perpetuating a dichotomy between small-scale farmers and corporate, industrial factory farms, as if the "missing middle" were inevitable and immutable. Likewise, Collier (2008) believes that a focus on smallholder farms is unlikely to be optimal for growth and even for poverty reduction. Thus, Collier contends that continuous focus on smallholder-led development means Africa has less chance of achieving accelerated growth and poverty reduction. Furthermore, Collier and Dercon (2014) argue that development strategies need to shift focus and resources away from smallholder farm models and open up new forms of commercialization without involving large state-led farms or geopolitically motivated mega farms, but rather encourage serious, large-scale investment in commercial agriculture and hybrid models involving the interaction between smallholder farmers and larger farmers. According to Dercon and Gollin (2014), the higher productivity advantage often ascribed to small farms is as a result of market failures, rather than a technological feature of farm size, and, therefore, an improvement in rural labor markets or land markets would reduce or eliminate the advantage of small farms.

Advocates of large farms also argue that these farms have the advantages of being technically more advanced and able to capture economies of scale and scope, mobilize funds and investment, and react to evolving market demand. For example, Foster and Rosenzweig (2011) indicate that while small farms have lower unit labor costs, large farms use less labor per unit of land, are more mechanized, and are more efficient when the shadow price of labor is taken into account. An alternative economic growth

argument suggests that as small farms get smaller, they are unlikely to have the types of cash income and expenditure patterns that promote growth in the rural nonfarm economy. However, past experiences show that countries have successfully taken different trajectories to agricultural growth. Although evidence from the Cerrado region of Brazil indicates that transformation based on soybean crop relied on large-scale mechanized production systems (Ferreira Filho and Vian 2014), the Asian Green Revolution was predominantly driven by smallholder farmers (Pingali 2012). But, attempts to bring the Asian Green Revolution to SSA have failed (Hazell 2010), and the extent to which a large-scale based development strategy is a reproducible—or even desirable—model of agrarian development in SSA is open to debate.

Parallel to the debate on the right strategy for agricultural transformation in SSA is a silent but important change taking place in Ghana's farm structure. While the number of medium-scale farmers has increased in the country (Diao et al. 2014; Jayne et al. 2014), research by Chapoto, Mabiso, and Bonsu (2013) suggests that this group of farmers has transitioned from small-scale to medium- and large-scale farming, and has been part of the agricultural commercialization and transformation process in the country for the last two decades but has been unnoticed. A survey conducted by the International Food Policy Research Institute and Savannah Agricultural Research Institute (IFPRI/SARI 2013) suggests that a pattern of indigenous transition is occurring from small-scale to mostly medium-scale farming in Ghana. This class of farmers has been able to grow under the numerous challenges plaguing the agricultural sector in the country, providing greater optimism about the prospects for a successful smallholder-led farm expansion under favorable conditions. Furthermore, these farmers generate spillover effects as they provide significant tractor services to small farms in their communities and beyond (see, for example, Houssou, Diao, and Kolavalli 2014). They are also increasingly being used by development programs to spread program benefits and reach smaller farmers. Yet, little is known about growth and dynamism among these farmers. Elsewhere, in Zambia and Kenya, there has been a rapid increase in the number of medium-scale farmers as well, but this growth was mainly driven by the urban elite with little evidence of growth via capital accumulation and expansion from smallholder farming (Sitko and Jayne 2014; Muyanga et al. 2013).

This paper brings a category of indigenous but dynamic farmers to the current debate on agricultural transformation in Ghana. We augment previous work by providing a quantitative assessment of the patterns identified through in-depth interviews by Chapoto, Mabiso, and Bonsu (2013). Specifically, the paper characterizes the class of emerging farmers in Ghana and singles out their distinctive features, the extent to which they have transitioned, and the drivers of such transition.

2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Conceptual Framework

We premise our analysis on the theories of transformation and evolution of farming systems. These theories are fully described elsewhere and will be summarized here. (See, for example, Chapoto, Mabiso, and Bonsu 2013; Diao et al. 2014; and Headey and Jayne 2014.) Several development economists have attempted to clarify the concept of transformation by defining stylized facts that characterize the outcome of a transformation process. Basically, this process entails the modernization of a country's economy, society, and institutions. Four important and interrelated processes define transformation.

First, transformation involves a change in the sectoral composition of an economy as agriculture's share in the gross domestic product (GDP) declines and nonagricultural shares increase (Chenery 1960; Kuznets 1966; Chenery and Taylor 1968). Second, shifts in sectoral shares are reflected in employment shares. That is, the share of the labor force employed in the agricultural sector falls, while employment shares in nonagricultural sectors rise. Third, rural-to-urban migration triggers urbanization during this transformation process (Kuznets 1966). And fourth, the capital-labor ratio in the nonagricultural sectors of the economy rises. According to Schultz (1964) however, the agricultural sector can make a much more significant contribution to economywide transformation through a productivity increase to support industrialization than can a mere provision of surplus labor and savings in the process of transformation. Scholars such as Johnston and Mellor (1961) and Johnston (1970) also indicate that the transition of smallholder farming from subsistence-oriented production to commercialized systems is an important feature of agricultural transformation in the process of economic development.

With regard to farming systems, Boserup (1965) theorizes two drivers of the evolution of farming systems: population pressures and market access. The author essentially postulates that as population densities increase and market access improves, farming systems evolve from forest fallow, bush fallow to permanent cultivation and multiple cropping systems that are characterized by an intensified use of farmland through increased use of inputs, such as mechanical power, fertilizers, seeds, among others. Farmers in this process are seen as individuals who make rational choices to maximize their utility or well-being over time, but are faced with a variety of constraints. As farmers make decisions over time with regard to changing opportunities and constraints, agricultural transformation takes place. However, the nature or trajectory of the transformation depends essentially on the farming system and its evolution, which in turn is affected by biophysical, historical, institutional, and socioeconomic factors (Chapoto, Mabiso, and Bonsu 2013).

A key dimension that has not been emphasized in the literature on farming systems and agricultural transformation is entrepreneurship. Productivity growth characterizes the process of transformation and the shift from a traditional (rural) to a modern (urban) economy. Entrepreneurship and human capital can play a significant role in this process. According to Schumpeter (1947), entrepreneurs are a driving force of development through a process of "creative destruction." In other words, an entrepreneur is an agent of change and is instrumental in finding new opportunities. Entrepreneurial spirit is an element of the human dimension and can be defined as a person who is creative and constantly looking for opportunities to improve or expand businesses for increased profits. Entrepreneurs are goal-oriented, determined, hardworking, energetic, and eager to take initiative, and they have a strong sense of commitment. An individual's level of entrepreneurship is therefore critical in accumulating productive and financial assets for maximizing output and profits (Robert 2012). The key questions are whether entrepreneurship has played any role in the process of farm transition (that is, growing from small farms to medium and large farms) and whether farmers who have transitioned have particular skills that others (that is, those who have remained small) do not have.

Agricultural Transformation: The Ghanaian Context

Features of transformation, such as the declining contribution of agriculture in the share of Ghana's GDP, are well documented (SRID 2014). Indeed, Ghana's economy has transformed, but the patterns of economic transformation in the country are characterized by high growth in the service sector, a stagnation in the manufacturing industry, and a marginal transformation in the agricultural sector, especially in terms of land productivity (Kolavalli et al. 2012). Trends in SSA agriculture also show that even though farming systems have reached the stage of permanent cropping, most countries in the subregion show limited land productivity growth in response to rising population density (Headey and Jayne 2014). Consistent with this pattern, Nin-Pratt and McBride (2014) found no correlation between population density and intensity of input use in Ghana. On the other hand, Codjoe and Bilsborrow (2011) reported some evidence of Boserupian effects of population on intensity of labor use in the dry and derived savannah zones of the country.

Rising population density has also been associated with small farms. For example, in Kenya, Muyanga and Jayne (2014) found that both household landholding size and cultivated land decrease with population pressure. Between 1960 and 2010, population density in Ghana has increased substantially, from 28 people per square kilometer to 103 per square kilometer in 2010 (see Table 2.1). However, the country's rural population density has increased only marginally during the same period. Ghana's rural population density is much lower than that of labor-abundant African countries, such as Rwanda, Malawi, Uganda, and Nigeria (Nin-Pratt and McBride 2014). Indeed, there are indications that the land-labor ratio has risen in rural Ghana (Diao et al., 2014), a pattern that is consistent with expansion of farmland and the emergence of medium and large-scale farmers in the country.

Table 2.1 Population density by region, 1960–2010

Region	Population density (person per square km)				
	1960	1970	1984	2000	2010
National	28	36	52	79	103
Rural	-	-	35	45	51

Source: Compiled from Diao et al. (2014) and Ghana Statistical Service (2013).

Access to both domestic and foreign markets can also drive land expansion and agricultural intensification, even in the absence of high population density, or accelerate the process of change where there is a preexisting population pressure. Although market access can influence the form of intensification, accessibility to markets is influenced by factors such as transportation and transaction costs. Both farmland expansion and intensification can occur where there are efficient and better transportation systems because farmers in these areas have access to markets and more opportunities to sell their products at lower transaction costs. On the other hand, with limited access to market infrastructure (that is, high transaction costs and lower profit margins), many smallholders would pursue or remained subsistence-oriented (Fan et al. 2013). In Ghana, farming systems have gone through significant changes in the past three decades. As farming systems change from forest fallow and subsistence orientation with fertile soils and limited market to permanent cultivation and commercial orientation with declining soil fertility, input needs increase and markets for both inputs and outputs become important. Access to markets can therefore play a significant role in the process of farm transition and commercialization.

Availability of land is also a key driving force of farm expansion. In Ghana, agricultural lands are under customary tenure systems, but there is a legal pluralism in the land tenure system, which sometimes creates confusion about the laws that govern particular land transactions. Agricultural lands under customary tenure systems are either under the control of landowning families whose decisions are mostly made by the family heads and their elders or are stool/skin land (Tsikata and Yaro 2011).[1] Most

[1] Stool/skin land includes any land or interest in, or right over any land controlled by a stool or skin, the head of a particular

important, access to farmlands is not a limiting factor in many parts of the country, as land is still widely available and can be acquired cheaply or used free. According to Chapoto, Mabiso, and Bonsu (2013), it is possible for a farmer in Ghana to expand his farmland to become a large-scale commercial farmer without title over the land, provided that he has the favor of the village chief and the community sanction over the land-use rights. In the southern part of the country, land acquisition involving the system of short-term hiring, renting, and leasing based on verbal, unwritten agreement with family members acting as witnesses is now common. For example, in the Western region, migrants/outsiders acquire lands via a purchase and shared tenancy agreement known as *abunu* and *abusa*,[2] and where tenants plant cocoa trees, they have access to the land for more than 70 years (Kasanga and Kotey 2001; Aryeetey et al. 2007). Conversely, in the northern part of the country, heads of family freely pick and select from the pool of land available and inform the chief (who is the custodian) of their claims. Migrants, on the other hand, offer the village chief kola nuts and are also allowed to pick and select from the pool of land (Tsikata and Yaro 2011). However, the issue of stumping remains a challenge to farm expansion, especially in the south of the country.

Rise to Medium- and Large-Scale Farming: The Role of Policies?

The growth to medium- and large-scale farms occurs within a policy environment, and hence may be a reflection of particular types of policies and investments in the agricultural sector. The goal of this section is not to evaluate the impacts of these policy interventions per se, but rather to discuss the policy environment within which some farmers have graduated and increased their farm size, while others have remained small. Several policies and programs have been enacted in Ghana since the colonial period.3 After independence, the government's major focus was the modernization of agriculture. Back then, subsistence agriculture was seen as unable to meet the needs of an expanding economy, and therefore, public policy has been dominated by large-scale investments in state or commercial farms and planned around agro-based industries (Boamah 2006).

The forms of commercialization adopted during this post-colonial period were based on the development of state farms, followed by state-sponsored projects that encouraged the use of synthetic inputs and large, private-sector commercial estate farms (Asuming-Brempong and Kuwornu 2013; Amanor and Pabi 2007; Dapaah 1995). For example, in the transition zone of Brong-Ahafo region, the development of state farms led to the rapid concentration of a modern infrastructure, comprising mechanized plowing services, synthetic input distribution depots, canning factories, irrigation infrastructures, and road networks facilitating the opening of markets in areas where the farms were located (Amanor and Pabi 2007). Among the policies and programs that were put in place to lead the modernization of agriculture and large-scale production in the Second Five-Year Development Plan (1959–1964) was the establishment of the Agricultural Development Corporation (Dapaah 1995; Asuming-Brempong and Kuwornu 2013). But, between 1969 and 1972, rural development became essential for agricultural development, and thus the government policy shifted from large farms to smallholder agriculture (Breisinger et al. 2011). This change in orientation resulted in investments in rural infrastructure, mainly feeder roads, electricity, and rural water, to encourage rural people to stay on their farms and discourage rural-to-urban migration (Asuming-Brempong and Kuwornu 2013; Breisinger et al. 2011). From 1972 to 1974, the Operation Feed Yourself (OFY) program was implemented as a bold attempt to promote the production of local food and provide raw materials to industries (Asuming-Brempong 2003; Dapaah 1995). However, the implementation of this program reversed much of the smallholder focus and returned to the development of large-scale farms through unrestricted access to subsidized formal credit and inputs (Dapaah 1995).

community, or the captain of a company for the benefit of the subjects of that stool or the member of that community or company (Administrator of Stool Lands Act 1994 [Act 481]).

[2] In *abunu* arrangement, the landowner and tenant share the harvest 50:50, whereas in *abusa* the share is 1:2.

[3] These policies are thoroughly described by Dapaah (1995) and Asuming-Brempong and Kuwornu (2013).

Under the Economic Recovery Program (ERP) and Structural Adjustment Program (SAP), agriculture was a natural target of intervention (Asuming-Brempong 2003). Public investment in agriculture had declined and tended to focus on single measures. For example, the Sasakawa Global 2000 project, which sought to replicate Asia's success in increasing agricultural production, started to promote integrated maize packages for smallholder farmers in 1986 (Breisinger et al. 2011). These and other singles measures, such as cassava disease control and mechanization of rice production, may have localized impacts but did not lead to the transformation of agriculture and bring about the type of growth seen in the Asian Green Revolution (Breisinger et al. 2011). According to Breisinger et al. (2011), the reasons attributed to the failure of these projects include unfinished privatization of input suppliers, poor infrastructure (such as storage and roads), and limited opportunities for marketing outputs. Additionally, the removal of subsidies on inputs like insecticides and fertilizers under the ERP/SAP in the 1980s added to the rapid increase in input prices, discouraging the use of these inputs (Asuming-Brempong and Kuwornu 2013; Asuming-Brempong 2003). The removal of subsidies in particular generally raised production costs and reduced fertilizer use among farmers.

Between 1991 and 2000, the need for a comprehensive framework for the recovery and accelerated growth of the agricultural sector informed the initiation of the Medium-Term Agricultural Development Program (MTADP). The objective was to define a program of policy and institutional reforms and a complementary set of investments needed to achieve a higher growth rate in agriculture. The policy reforms focused on the incentive framework for agricultural production, trade, and processing. From the MTADP emerged various programs and projects (with funding mainly from the World Bank) for improving the agricultural sector, including the National Agricultural Research Project (NARP) (1991–1999), the Agricultural Services Sub-sector Investment Project (AgSSIP), the National Agricultural Extension Project (NAEP), and the Agricultural Sector Adjustment Credit (ASAC), among others. The programs and projects implemented under the MTADP resulted in a substantial and sustained resurgence of food crop production by Ghana's two million smallholder farmers (Asuming-Brempong and Kuwornu 2013).

More recently, and in line with the government's effort to accelerate the modernization of agriculture and increase the productivity of the Ghanaian farmer, as indicated in the Food and Agricultural Sector Development Policy (FASDEP II), a number of programs, projects, and initiatives aimed at supporting farm growth have been introduced (MoFA 2007). For example, with the reemergence of public interest in mechanizing Ghanaian agriculture, the government initiated in 2007 the importation and subsidization of agricultural machinery to curb the high capital requirement that deters farmers from acquiring agricultural machines. Among the policies that were put in place was the establishment of Agricultural Mechanization Services Enterprise Centers (AMSECs) to improve smallholder farmers' access to mechanization services. An evaluation of the AMSEC program suggests that it has led to farm expansion among tractor users (Benin et al. 2012), but the program is not viable in the medium and long terms unless AMSECs increase their scale of operations (Houssou et al. 2013). The Fertilizer Subsidy Program (FSP) is another public spending program that was initiated in 2009, but the program has not been steady to date. The Block Farms Program (BFP) was also launched in 2009 and aimed to exploit economies of scale and lower unit cost of input and service delivery by bringing several farmers together onto large tracks of arable lands (in blocks) and providing them with extension services and credit in the forms of mechanization services, certified seed, and subsidized fertilizer and pesticides (Benin et al. 2012). This program had a large and commercial focus.

Furthermore, the out-grower-nucleus farmer linkage program, which aimed to promote smallholder access to credit and improved planting material, and provide extension advice on improved agronomic practices, was introduced to aid farm expansion (MoFA 2007). The implementation of the program has seen the commencement of a US$150 million Ghana Commercial Agriculture Project (GCAP), funded by a loan of $100 million from the World Bank and $50 million in co-financing from USAID. Among the objectives of the project are the development of large-scale commercial farms for cereal production and the establishment of innovative institutional arrangements (that is, out-grower schemes and contract farming) between large-scale investors and smallholders (MoFA 2011).

It is expected that the agricultural policies and programs put in place to date will create an environment conducive to agricultural transformation and the transition from small-scale to medium- and large-scale farming in the country. As shown above however, existing evaluations suggest that public interventions in the agricultural sector have had mixed results. For example, Braimoh (2009) reports that the economic reforms of 1983 have led to cropland expansion and increased commercialization of domestically produced food in the country. But earlier efforts to mechanize agriculture in the 1980s have failed, and it is unclear whether recent programs have contributed to the farm transition and growth that started 20 years ago among the surveyed farmers.

3. DATA AND METHODOLOGY

Data

This paper uses data from the 2013 IFPRI/SARI survey, which targeted mostly medium- and large-scale farmers and tractor owners. The survey covers 1,843 farmers in eight districts of Ghana (see Table 3.1) and was aimed at characterizing the transition of smallholder farmers who have become medium- and large-scale commercial farmers, assessing agricultural machinery ownership, and examining patterns of demand for agricultural mechanization among farmers in the country. Consistent with this objective, this paper focuses on the subset of medium- and large-scale farmers who have started small, totaling 915 farming households. See Chapoto et al. (2014) for further details on the survey.

Table 3.1 Sampling by farm size and district

Size	Total	Ejura	Techiman	Kintampo	Yendi	Gushiegu	Kassena Nankana	Bawku	Sissala East
Total in sample	1,843	253	217	221	269	300	160	195	228
small	768	82	112	100	108	71	103	121	71
medium	850	136	96	105	116	157	47	70	123
large	225	35	9	16	45	72	10	4	34
Sample frame total	7,631	1,858	720	774	822	1,143	533	530	1,251
small	1,946	200	313	213	257	151	315	294	203
medium	5,455	1,619	398	545	520	919	208	232	1,014
large	230	39	9	16	45	73	10	4	34

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: The farm size category is derived from the total land area cultivated by the main landholder: small, 5 ha or less; medium, 5 ha to 20 ha; and large, greater than 20 ha.

Methodology

We use a combination of descriptive methods and econometric models to analyze the distinctive characteristics of key farmer groups and the determinants of farm expansion and farm size dynamics. Specifically, we assess the correlation between farming household characteristics and source of growth using cross-tables and graphical displays. We ran a probit regression to identify the drivers of farm size growth among emergent farmers. The dependent variable in the probit model is a binary variable, which takes the value of 1 if the emergent farmer is indigenous and expanded from small-scale farming, and 0 if the emergent farmer entered farming from the nonfarm sector (held a job before starting farming or is currently working in addition to farming). The empirical model of farm expansion is estimated as follows:

$$FE_i = \alpha + \beta X_i + \varphi D_i + \varepsilon_i, \quad (1)$$

where FE is the binary dependent variable representing farm expansion, which equals 1 if farmer grew from small-scale farming and 0 if farmer grew from nonfarm sector; X is a vector of independent variables, including age of farmer when started farming, number of years farmer has attended school, parent education, aspirations gap, mobility index, migrant status, enterprise when started farming, and crops grown, among others. D represents the control variables, district or agroecological zones, ε is the error term. The list of variables used in the models is presented in Appendix Table A.1.

With regard to the drivers of farm size dynamics, we estimated a multinomial logit model. The dependent variable here is the time taken to transition, which takes three values as follows: 1 if the emergent farmer transitioned to medium- or large-scale within 5 years, 2 if the farmer transitioned within 6 to 10 years, and 3 if the farmer transitioned 10 years after becoming a farmer. This multinomial logit

model expresses the probability of farmers transitioning from small-scale to medium- and large-scale in a specific category. The advantage of the multinomial logit model is that it permits the analysis of decisions across more than two categories, allowing the determination of choice probabilities for different categories (Madalla 1983; Wooldridge 2002), and it is also computationally simple (Tse 1987). The probability that the ith farmer transitions in period j can be stated as (Greene 2003):

$$\text{Prob}(Y_i = j) = \frac{\exp\{x_{ij}^{'}\beta\}}{\sum_j^M \exp\{x_{ij}^{'}\beta\}} \quad \textit{for each j=1, M alternative.} \tag{2}$$

The probability of *ith* farmer transitioning in period *j* between a set of *M* periods is a function of the explanatory variables $x_{ij}^{'}$ and the β coefficients (Greene 2000),

$$\text{with } Y = \begin{cases} 1 = \text{transtioned within 5 years} \\ 2 = \text{transitioned within 6 to 10 years} \\ 3 = \text{transsitioned after 10 years} \end{cases}$$

Any change in the set of exogenous factors (ceteris paribus) will affect the response probabilities P(*y*=*j*|*x*), j=1, 2, . . . , *M*. For a given *x*, the probability of observing *j-th* outcome is:

$$\text{Prob}(Y_i = j|x_i) = \frac{\exp\{x_{ij}^{'}\beta\}}{1+\sum_j^M \exp\{x_{ij}^{'}\beta\}}. \tag{3}$$

The estimated parameters of the multinomial logit model only give the direction of the effect of the explanatory variables on the dependent variable, but estimates do not provide a direct interpretation of the actual magnitude of change or its probabilities. Differentiating equation (3) with respect to each explanatory variable provides the marginal effects of the explanatory variables given as:

$$\frac{\partial P_j}{\partial x_k} = P_j\left(\beta_{jk} - \sum_{j=1}^{M-1} P_j \beta_{jk}\right). \tag{4}$$

The marginal effects or marginal probabilities measure the likely change in the probability of a farmer transitioning (in terms of farm size) in a particular period with respect to a unit change in an independent variable from the mean (Greene 2000). The empirical specification for examining the influence of the explanatory variables on farmers transitioning from small-scale to medium- and large-scale in a specific period (*Y*) is given as follows:

$$Y_{i=1,\ldots M} = \beta_0 + \beta_1 X_i + \beta_2 A_i + v_i, \tag{5}$$

where *X* is a vector of the independent, *A* represents the control variables defined above, *v* is the error term.

4. KEY FINDINGS

Recent Trends in Ghana's Farm Structure

Ghanaian agriculture has traditionally been dominated by small farms with less than 2 ha of farmland, but the predominance of small farms in the country's agriculture is abating. Table 4.1 shows that about 50 percent of farmers in the country were small-scale farmers in 2012, while in 1999, small-scale farmers represented 56 percent of the farming population. Between 1999 and 2012, the share of small-scale farmers decreased by 3 percent in the country. At the same time, the share of farmers cultivating between 2 ha and 5 ha grew by 24 percent; those cultivating between 5 ha and 10 ha grew by 28 percent. Similar patterns of growth can be observed among farmers who cultivated more than 10 ha during the same period. More important, small-scale farmers cultivated only 14 percent of the total farmland in 2012 even though they constitute 50 percent of the country's farming population, while medium-scale farmers with farm size between 2 ha and 20 ha cultivated 72 percent of the total farmland in the country.

Table 4.1 Changes in farm structure in Ghana, 1999–2012

Farm size categories	Number of farming households			% in total farm households		% change 1999–2012*	% of total cultivated area	
	1999	2005	2012	1999	2012		1999	2012
0–2 ha	1,557,856	1,725,024	1,508,509	55.6	49.3	-3.2	16.8	14.0
2–5 ha	863,656	957,722	1,070,565	30.8	35.0	24.0	31.9	33.3
5–10 ha	257,032	256,620	328,354	9.2	10.7	27.7	21.8	23.2
10–20 ha	93,272	110,076	114,504	3.3	3.7	22.8	15.3	15.3
20–100 ha	27,768	46,143	33,667	1.0	1.1	21.2	10.2	10.7
>100 ha	1,424	6,958	1,740	0.1	0.1	22.2	4.1	3.5
Total	2,801,008	3,102,543	3,057,338	100	100	9.2	100	100

Source: Ghana Living Standards surveys 1999–2000, 2005–2006, and 2012–2013 (Ghana Statistical Service various years).
Note: *Percentage change from 1999 to 2012.

In short, although small farmers constitute a considerable share of the Ghanaian farming population, their number has declined between 1999 and 2012. On the other hand, the number of medium-scale farmers rose considerably during the same period. The land cultivated has also grown substantially among these medium-scale farmers. These findings are consistent with recent studies (see, for example, Diao et al. 2014; Jayne et al. 2014; Sitko and Jayne 2014), which suggest a changing farm structure in Ghana. There has been no record of generalized success with large farms in SSA in the past (Wiggins 2009); the emerging medium-scale farms may be a viable alternative to small farms. Meanwhile, standard household surveys often fail to capture a large number of these farmers; hence, little is known about them. We document the behavior of this emerging class of medium-scale farmers and the factors that may explain their growth and dynamism in order to bring new perspectives to the debate on African agriculture development, which has long been dominated by smallholder farming.

Key Features of Medium- and Large-Scale Farmers in Ghana

Table 4.2 shows the number of medium- and large-scale farmers broken down by initial farm sizes (small, 0–5 ha; medium, 5–20 ha; and large, >20ha) and their socioeconomic characteristics. The results show that the majority (85 percent) of the medium- and large-scale farmers in the survey districts started small, with less than 5 ha of farmland, while only 12 percent started as medium-scale farmers, and 2 percent started as large-scale farmers. With regard to farming experience, on average, the current medium- and large-scale farmers have been farming for 21 years. The results also show that the higher the scale of

transition, the higher the farming experience. For example, farmers who transitioned into medium-scale have 21 years of farming experience, whereas those who transitioned into large-scale have been farming for 24 years. Farmers who did not transition, whether they are medium- or large-scale farmers, have less farming experience.

Table 4.2 Patterns and sources of transition, farming scale, and education

Variable	Medium- and large-scale farmers	Started small and transitioned into:			Started as medium and transitioned into:			Started as large-scale
		Total	Medium-scale	Large-scale	Total	Large-scale	Remained medium	
Number of cases	1,075	915	738	177	134	26	108	26
% of cases	100	85.1	68.7	16.5	12.5	2.4	10.1	2.4
Farming indicators								
Farming experience (years)	20.8	21.2	20.5	23.7	19.0	24.0	17.8	18.5
Current landholding size (ha)	25.9	24.6	16.5	58.4	22.9	53.2	15.6	87.4
Current land cultivated (ha)	15.6	14.6	9.4	35.9	16.2	41.9	10.0	47.0
Initial farm size (ha)								
Mean	4.1	1.6	1.6	1.7	9.05	8.6	9.5	65.7
Median	1.6	1.2	1.2	1.2	8.1	8.1	8.1	39.7
Age and education								
Age	46.0	45.5	45.0	47.5	48.6	51.1	48.0	51.3
Can read or write in any language	31.3	30.5	30.8	29.4	32.8	34.6	32.4	53.8
Years of education	3.5	3.4	3.4	3.4	3.3	3.8	3.2	5.7
Sources of growth (%)								
Growth from farming	79.3	80.9	80.1	84.2	73.1	80.8	71.3	53.8
Held a job before farming	10.5	9.5	10.3	6.2	14.9	11.5	15.7	23.1
Working alongside farming	10.2	9.6	9.6	9.6	11.9	7.7	13.0	23.1

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

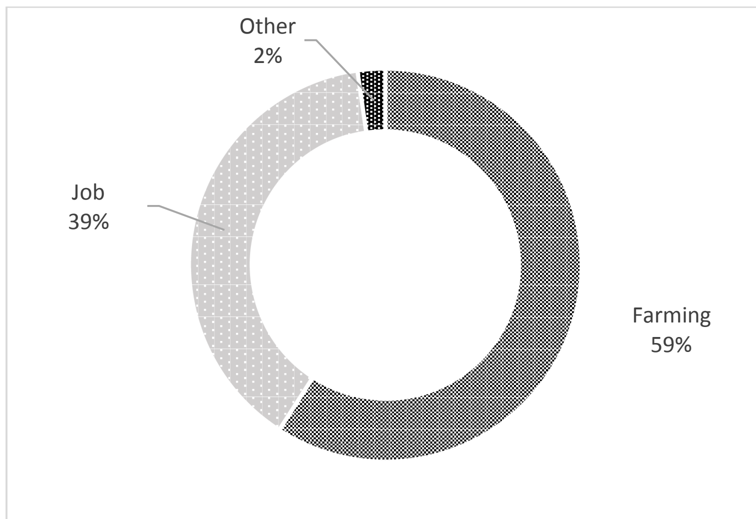
Estimates of the initial farm size show no substantial difference between those who started small and transitioned into medium-scale and those who started small and transitioned into large-scale (1.6 ha versus 1.7 ha). Additionally, 50 percent of the farmers who started small cultivated 1.2 ha of land initially. With regard to age, the farmers who started small are 46 years old, whereas those who started at a medium-scale are 49 years old. Large-scale farmers are older (above 50 years), except those who transitioned from small-scale farming (48 years).

Literacy rates are low, with about 30 percent of farmers able to read or write among those who started on a small-scale. But, these rates are slightly higher among farmers who started at a medium-scale (33 percent). Furthermore, 54 percent of the farmers who started on a large-scale can read or write. These large-scale farmers are also well educated, with 6 years of education, compared with the others, who seem not to be the elite as they had attended school for 3 to 4 years only.

An essential factor in understanding the rise to medium- and large-scale farming is the source of growth, which indicates where the emerging farmers originated. Table 4.2 shows that 79 percent of the current medium- and large-scale farmers came from the farm sector, 11 percent grew from the off-farm or nonfarm sector, and 10 percent work alongside farming. More important, 81 percent of the farmers who started small and transitioned into medium- and large-scale grew up from the farm sector; that is, they are indigenous farmers. This result contrasts with Sitko and Jayne (2012), who reported that in Zambia, most of the emergent farmers (57 percent) entered farming laterally, and used income from nonfarm jobs as startup capital to initiate farming. The results also diverge from Muyanga et al. (2013), who indicated that in Kenya, 59 percent of the medium- and large-scale farmers grew up from the off-farm sector.

Figure 4.1 shows the patterns of employment among the emergent farmers who work alongside farming (9.6 percent, or 88 of 915): 59 percent of this subgroup of farmers have farming as their primary job, whereas 39 percent are primarily engaged in formal nonfarm jobs, a result that contrasts with Sitko, Jayne, and Hichaambwa (2013), who reported that 71 percent of emergent farmers in Zambia were engaged in off-farm jobs as their primary occupation.

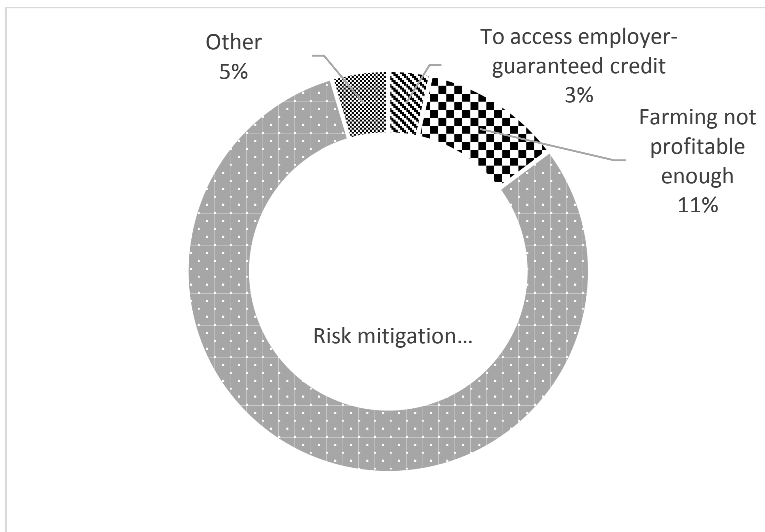
Figure 4.1 Primary occupation among farmers working alongside farming



Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Farmers combine farming with nonfarm jobs for several reasons (see Figure 4.2). When asked why they combine farming activities with nonfarm jobs, 81 percent of these farmers reported that they engage in off-farm business to mitigate risk; 11 percent indicated that they believe farming is not profitable enough and, hence, the need to diversify into nonfarm jobs in order to supplement their income. A few farmers (3 percent) in the group indicated that they combine farming with nonfarm jobs in order to access employer-guaranteed credit. We characterize the class of emergent farmers who started small (915 in total) and have successfully grown, with a particular focus on those who started out with farming: the indigenous emergent farmers.

Figure 4.2 Reasons behind working alongside farming



Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Rise to Medium- and Large- Scale Farming: Characterizing the Emergent Farmers

Socioeconomic Characteristics

Table 4.3 shows the socioeconomic characteristics of emergent farmers. For example, emergent farmers are predominantly men (97 percent) and are 46 years old on average. The low rate of women in the group can be explained by several constraints; in a qualitative survey by Chapoto, Mabiso, and Bonsu (2013), women farmers indicated that constraints such as access to land, labor, and productive assets limit their ability to expand and emerge like their male counterparts. Average landholding and cultivated land size amount to 25 ha and 15 ha among emergent farmers, respectively, but indigenous emergent farmers cultivate 15 ha on average, while farmers who entered farming laterally cultivate less land (14 ha).

With respect to their farming experience, 50 percent of the emergent farmers started farming prior to 1993; that is, 20 years ago. Almost all of these farmers (98 percent) are married, and half of them have two or more wives (polygamous). Indigenous emergent farmers are more likely to be polygamous but younger than their counterparts from the nonfarm sector. They also started farming earlier than their counterparts from the nonfarm sector. Within indigenous farmers, those who started faming with less than 2 ha started out earlier and are less likely to be polygamous compared with those who started with more than 2 ha.

With regard to education, the results show that only one-third of the emergent farmers can read and write, and literate farmers in the group have attended school for 3 years only. Most notably, the emergent indigenous farmers (that is, those who grew from the farm sector) are far less educated than their counterparts who entered farming from the nonfarm sector. Only 23 percent of emergent indigenous farmers can read and write, and these farmers have attended school for only 2 years, while two-thirds (63 percent) of the farmers who entered farming from the nonfarm sector are literate and have attended school for 8 years. A disaggregation of education by level clearly indicates that farmers who entered farming from the nonfarm sector are well-educated farmers. This pattern is consistent with Sitko, Jayne, and Hichaambwa (2013), who show that in Zambia, farmers who entered farming laterally are significantly more educated than those who started out in agriculture. The former can be considered elite farmers, but they are a minority in the survey districts in Ghana.

Table 4.3 Characteristics of emergent farmers

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
% of cases	100	80.9	19.1	65.4	34.6
% male main landholders	96.7	97.0	95.4	97.1	96.9
Age of farmer (years)	46	45	47	45	45
Current landholding size (ha)	24.6	24.6	24.8	23.4	26.8
Current land cultivated size (ha)	14.6	14.7	13.8	14.0	16.2
Year when started farming (median)	1993	1993	1994	1993	1996
Farming experience (years)	21	21	20	22	20
Marital status (%)					
Married	98.1	98.5	96.6	98.6	98.4
Polygamous	49.5	52.8	35.4	50.2	57.8
Education					
Can read and write in any language (%)	30.5	22.7	63.4	22.5	23.0
Years of education	3.4	2.3	8.1	2.4	2.3
Education groups					
No education	62.0	70.4	26.3	69.6	71.9
Primary	13.1	13.2	12.6	13.8	12.1
Secondary	19.9	15.4	38.9	15.5	15.2
Post-secondary	5.0	0.9	22.3	1.0	0.8
Settlement history					
% migrant	18.0	16.4	25.1	16.7	15.6
Years in settlement	22.6	22.6	22.7	23.1	21.4
% in nonfarm business	27.9	23.5	46.3	24.6	21.5
Parent education					
Father years of education	0.5	0.3	1.5	0.4	0.2
Mother years of education	0.2	0.1	0.6	0.1	0.1
Parents' position in community					
Chief/queen mother	14.4	14.9	12.6	14.7	15.2
Other important positions*	21.0	20.3	24.0	18.8	23.0

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: *Other important positions include chairperson of a village committee/association, religious leader, chief farmer, community health worker, or linguist.

With regard to their settlement history, only 18 percent of emergent farmers are migrants who had spent 23 years in their settlement, but the migration rate is higher (25 percent) among farmers who entered farming from the nonfarm sector. Expectedly, 46 percent of these farmers are engaged in a nonfarm business activity versus 23 percent among indigenous emergent farmers. With regard to parental education, emerging farmers' parents have generally a low education level, but parents of farmers who entered farming from the nonfarm sector are slightly more educated than parents of indigenous emergent farmers. Only 14 percent of these parents are chiefs, and 21 percent of them have occupied various positions as chairpersons, religious leaders, chief farmers, and health workers in their communities.

Furthermore, emergent farmers were motivated into farming by various reasons. When asked what attracted them to farming, they indicated that they went into farming because their parents were farmers, they wanted to feed their families, they wanted to farm as a business, and they wanted to make extra money, among others (Table 4.4). Specifically, more than half of these farmers (56 percent) indicated that they went into farming because their parents were farmers, 25 percent said they wanted to feed their families, and about 16 percent said they wanted to farm as a business or to make extra money. Yet all of these farmers have graduated from small-scale to medium- or large-scale farming, indicating that their motivation may have changed from subsistence to market and commercial production.

Table 4.4 Motivation for farming

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
% of cases	100	80.9	19.1	65.4	34.6
Most important motivation for farming (% reporting)					
Parents were farmers	55.7	58.0	46.3	61.0	52.3
Farming to feed family	24.7	25.5	21.1	23.1	30.1
Farming as a business	9.7	7.4	19.4	7.0	8.2
Making extra money	6.0	5.1	9.7	5.2	5.1
Inherited the farm	2.4	2.7	1.1	2.5	3.1
Supporting extended family	1.4	1.2	2.3	1.2	1.2

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

It is interesting also to note that 30 percent of the farmers who entered farming from the nonfarm sector indicated that they engaged in this activity to farm as a business or make extra money, while only 12 percent of the indigenous farmers said they did so for the same reason. However, the fact that most of the emergent farmers came into farming because their parents were farmers, points to the presence of a path dependence in terms of life career among rural communities.

Growing crops and rearing livestock were the major activities among emergent farmers when they started farming (Table 4.5). About 48 percent of these farmers started out in agriculture with crops only, while 52 percent started with both crops and livestock. This pattern does not differ between indigenous farmers and farmers who entered farming from the nonfarm sector. Likewise, cereals (48 percent), oilseeds (21 percent), and roots and tubers (24 percent) were the major crops they started with. But farmers who grew from the nonfarm sector started mostly with cereals (56 percent) and less with oilseeds (16 percent) and root and tubers (18 percent) compared to indigenous emergent farmers. Furthermore, the number of crops grown by these two groups of farmers has doubled from two to four since they started farming. Crop diversification has become common among farmers. According to Chapoto, Mabiso, and Bonsu (2013), as farmers expand, they grow more crops, but they concentrate most of their land on one or two crops.

Table 4.5 Enterprises when started farming

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
% of cases	100	80.9	19.1	65.4	34.6
Enterprise when started farming (%)					
Crops only	47.5	47.4	48.0	47.9	46.5
Livestock only	0.1	0.1	0	0.0	0.4
Both crops and livestock	52.3	52.4	52.0	52.1	53.1
Type of crops (%)					
Cereals	48.2	46.4	56.0	45.2	48.4
Oilseeds	21.0	22.2	16.0	25.6	15.6
Roots and tubers	24.4	25.9	17.7	24.0	29.7
Horticultural crops	3.3	3.0	4.6	3.1	2.7
Tree and industrial cash crops	2.7	2.2	5.1	1.7	3.1
# of crops when started farming	1.8	1.8	1.9	1.5	2.3
# of crops grown now	3.8	3.9	3.6	3.9	3.9

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Patterns of Farmland Use among Emergent Farmers

We examine the patterns of farmland use among emergent farmers in Table 4.6. The results show that these farmers cultivate three-quarters (75 percent) of their lands, indicating that they put a greater share of their lands under cultivation. Fallow lands account for 15 percent of farmland use among these farmers, while virgin lands represent only 7 percent of the land owned. These patterns are fairly similar for indigenous farmers and farmers who entered farming from the nonfarm sector.

Table 4.6 Land use distribution among emergent farmers

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of farmers	915	740	175	484	256
Land cultivated (%)	75.6	75.9	74.3	75.7	76.2
Fallow area (%)	15.3	15.0	16.6	15.7	13.7
Virgin area (%)	7.2	7.4	6.4	7.1	7.8
Area rented out (%)	1.9	1.7	2.6	1.4	2.2

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

With regard to the land area allocated to various crops (Table 4.7), cereal crops (mostly maize and rice) account for the largest share of the area cultivated (63 percent), followed by legumes (20 percent), and roots and tubers (13 percent). Tree crops rank fourth in terms of importance, but farmers who entered farming from the nonfarm sector allocate a higher share of the area they cultivate to these tree crops compared with indigenous farmers.

Table 4.7 Importance of various crop types in percent of area cultivated

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	> 2ha
Number of farmers	915	740	175	484	256
Cereals	62.51	62.78	61.37	61.01	66.11
Legumes	19.84	20.45	17.23	20.91	19.59
Roots and tubers	13.11	12.95	13.82	14.34	10.32
Tree crops	3.77	3.14	6.47	3.23	2.97
Horticultural crops	0.35	0.24	0.84	0.15	0.41
All other crops	0.42	0.45	0.28	0.37	0.60

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Technology Adoption and Crop Yields

Adoption of agricultural technologies is essential for farm transformation. Table 4.8 shows the trends of technology adoption among emergent farmers. While about one-third of the emergent farmers use *obatampa* maize seed and other improved seeds, the rate of adoption of hybrid maize among these farmers is very low (7 percent). Likewise, the adoption of improved rice seed is estimated at 40 percent, but jasmine rice variety has been adopted by just 12 percent of these farmers.

Across the two groups, farmers who entered farming from the nonfarm sector were more likely to adopt improved maize and jasmine rice seeds compared to the indigenous farmers. These results seem to suggest that the low adoption of improved varieties is no obstacle to farm growth, but more potential could be realized if all of the farmers had adopted improved varieties of crops. Hence, it is essential to understand the factors that deter farmers from adopting these improved varieties. On the other hand, the use of weedicides is generally very high (87 percent) and the rate of use compares well between the two groups of emergent farmers. Amid increasing labor costs, weeding with chemicals is a strong alternative

to weeding with manual labor in Ghana. Only one-fifth of the farmers use pesticides, and farmers who entered farming from the nonfarm sector were more likely to use the chemicals than were indigenous farmers.

Table 4.8 Technology adoption: seed, pesticides, and weedicides (in percent)

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of farmers	915	740	175	484	256
Maize *obatampa* seed	29.0	29.6	26.1	31.8	25.5
Maize hybrid seed	6.5	7.0	4.3	6.8	7.4
Maize other improved seed	33.3	31.9	39.1	30.1	35.4
Rice jasmine (improved seed)	12.2	8.2	30.8	9.0	6.7
Rice other improved seed	39.8	40.8	35.4	40.7	41.0
Weedicide use	87.3	87.4	86.9	88.4	85.5
Pesticide use	19.2	16.9	29.1	16.1	18.4

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Fertilizer use rates have also been very high among emergent farmers. Table 4.9 reveals that 84 percent of these farmers use fertilizer. Use rates are comparable between groups, but the quantity of fertilizer use per hectare is higher among farmers who entered farming from the nonfarm sector (240 kg/ha) compared with their indigenous counterpart (224 kg/ha). A breakdown of fertilizer use rates by the quantities applied show that 20 percent of the emergent farmers use 0 to 50 kg of fertilizer per hectare, 17 percent use 50 to 100 kg of fertilizer per hectare, and 12 percent use 50 to 100 kg of fertilizer per hectare. Thus, the higher the quantity of fertilizer, the lower the use rate among these farmers, suggesting that fewer emergent farmers use higher doses of fertilizer per hectare. But, the comparison of the two groups shows a different pattern. While fewer farmers use higher doses of fertilizer per hectare among indigenous farmers, a higher share of farmers who entered farming from the nonfarm sector use higher doses of fertilizer per hectare. Thus, this group of farmers appears to be more progressive with regard to the adoption of technologies, but again the low fertilizer use per hectare among indigenous farmers does not seem to have constrained their growth. In sum, the results in Tables 4.8 and 4.9 reveal that there are differential patterns of adoption among emergent farmers depending on the technology considered.

Table 4.9 Fertilizer use and fertilizer use intensity among emergent farmers

	Overall	Growth from		Growth from farm sector with:	
Variable		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of farmers	915	740	175	484	256
Fertilizer use (% reporting)	83.9	83.9	84.0	82.6	86.3
Fertilizer use per area fertilized (kg/ha) among users	227.21	224.08	240.41	218.96	233.35
Fertilizer use by quantity (% reporting)					
None	15.6	15.7	15.4	17.1	12.9
0–50 kg	19.5	21.1	12.6	21.1	21.1
50–100 kg	16.9	17.4	14.9	20.0	12.5
100–150 kg	12.1	11.4	15.4	9.7	14.5
150–200 kg	12.8	12.4	14.3	13.4	10.5
200–300 kg	12.9	12.2	16.0	11.8	12.9
>300 kg	9.7	9.5	10.9	6.6	14.8

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

With regard to crop performances, cereal yields are generally low, with less than 2 tons per hectare (Table 4.10). The highest cereal yields were estimated at 1,403 kg/ha for rice and 1,381 kg/ha for maize. These estimates are consistent with yield estimates by Ragasa et al., 2013a, 2013b). But, cereal yields are higher among farmers who entered farming from the nonfarm sector compared with indigenous emergent farmers, indicating the presence of a fertilizer effect resulting from differences in fertilizer use intensity between the groups (see Table 4.9). Finally, the commercialization index measured by the value of crop sales in percent of value of total production is estimated at 73 percent, indicating a higher degree of commercialization among emergent farmers.

Table 4.10 Crop yields

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of farmers	915	740	175	484	256
Yield (kg/ha)					
Maize	1,381.4	1,364.3	1,455.9	1,351.1	1,389.4
Rice	1,403.0	1,336.2	1,709.1	1,387.6	1,237.3
Millet	671.7	648.3	827.7	673.3	607.0
Sorghum	669.8	641.0	956.3	674.7	582.2
Soybean	825.7	822.5	845.3	816.5	834.4
Cassava	3,072.8	3,284.0	2,521.5	3,541.1	2,522.2
Yam	7,674.4	7,677.3	7,656.3	8,216.2	6,549.2
Commercialization index	72.8	73.4	70.3	78.2	64.2

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Does the Scale of Transition Depend on the Source of Growth and Initial Farm Size?

We examine in Table 4.11 the correlation between the source of growth and farm size among the emergent farmers. The farm size distribution shows that two-thirds (65 percent) of emergent farmers are medium-scale farmers and one-third are large-scale farmers. This pattern is the same whether the farmers grew up in the nonfarm sector or whether they are indigenous farmers who started out in agriculture. Thus, the source of growth seems not to be correlated with farm size. Nonetheless, a breakdown of the group of indigenous farmers by initial farm size shows that famers who started out with higher farm sizes tend to have higher landholding and cultivated lands.

Table 4.11 Relationship between level of growth and initial farm size

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
% of cases	100	80.9	19.1	65.4	34.6
Medium-scale farmers (%)	64.7	64.7	64.6	63.8	66.4
Large-scale farmers (%)	35.3	35.3	35.4	36.2	33.6
Landholding size (ha)	24.6	24.6	24.8	23.4	26.8
Land cultivated size (ha)	14.6	14.7	13.8	14.0	16.2

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Dynamics of Transition: Patterns and Trajectories

As indicated earlier, the emergent farmers in the survey sample started out small and increased their farm size over time. In order to understand better this transition process, we examine in Table 4.12 the pattern of farm size growth among these farmers. The results show that the emergent farmers started farming with 1.6 ha of lands, and increased their farm size to 4 ha and 8 ha 5 and 10 years after becoming farmers, respectively. After 15 years of farming activities, they increased their farm size to 11 ha on average. These results suggest that the emergent farmers have doubled their farm size 5 and 10 years after they started farming, but their growth rate has declined from 50 percent to about 30 percent 15 years after they started farming. Likewise, the current farm size (15 ha) suggests that, on average, the growth rate has been lower than previously (24 percent). Table 4.12 also shows that these patterns do not depend on the source of growth. Furthermore, the breakdown of initial farm size shows that growth rates have been higher among indigenous emergent farmers who started with lower farm sizes. Overall, it appears that the farm size growth rate increased rapidly among emergent farmers in the first 10 years and declined after 15 years of their farming career.

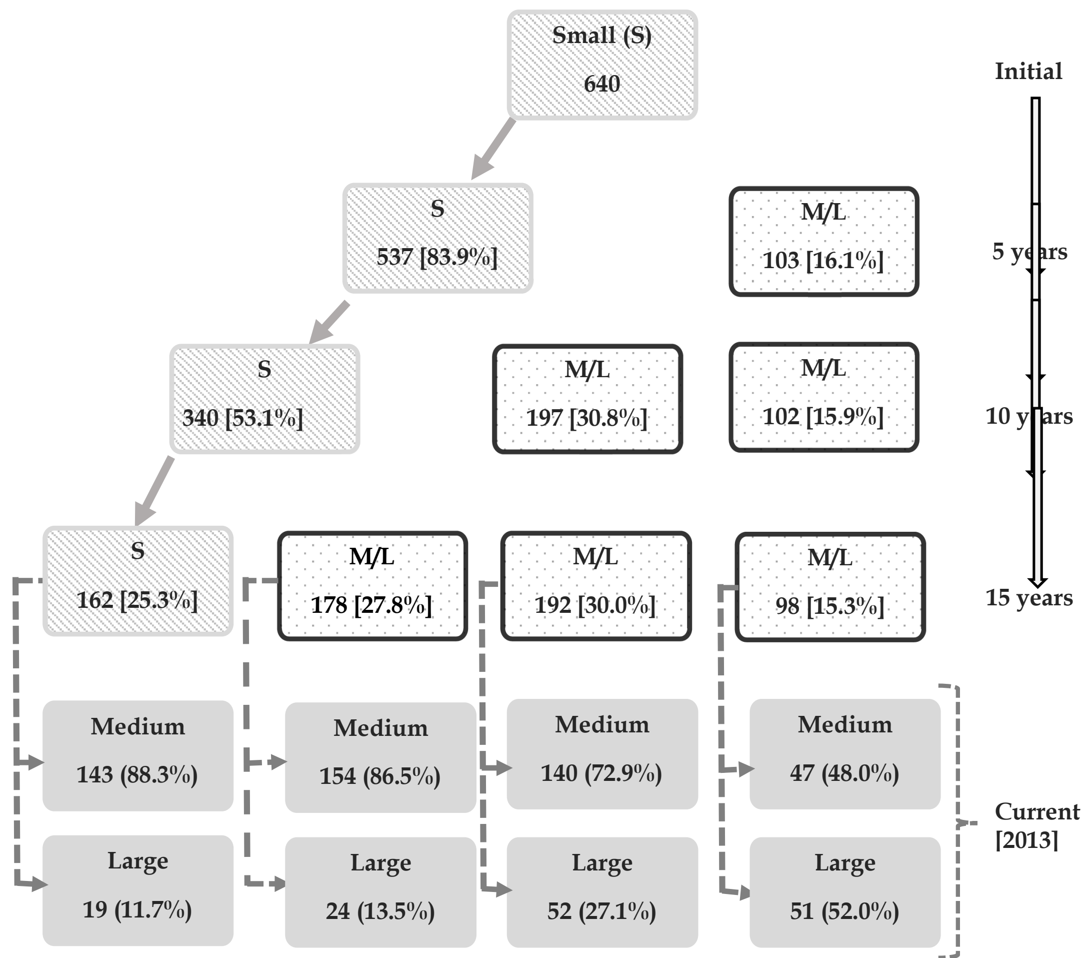
Table 4.12 Dynamics of land expansion among emergent farmers (ha)

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
% of cases	100	80.9	19.1	65.4	34.6
Initial land size	1.6	1.6	1.7	0.9	2.8
Land size after 5 years	4.2	4.2	4.3	3.4	5.7
Land size after 10 years	8.0	8.1	7.7	7.0	10.5
Land size after 15 years	11.1	11.2	10.7	10.2	13.5

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Figure 4.3 examines further the process of farm growth among emergent farmers who have been farming for at least 15 years (640 in total). Only 16 percent of these farmers expanded their farm size to attain medium- and large-scale status in the first 5 years, while the rest (84 percent) remained small during that period of time. An additional 31 percent of these small farmers (197 of 640) expanded their farm size and transitioned to medium- and large-scale only 10 years after they started farming, while 53 percent (340 of 640) continued to remain small. After 15 years of farming, 28 percent (178 of 640) of those who remained small also expanded their farm size. In sum, 75 percent of the emergent farmers transitioned within 15 years after they started farming. This timeframe corresponds roughly to the period 1999–2012, during which an emerging pattern of change in farm structure was recorded in Ghana (see Table 4.1). But, some farmers transitioned faster, while others grew to medium- and large-scale farming at a slower pace, indicating that the speed of transition is uneven among these farmers.

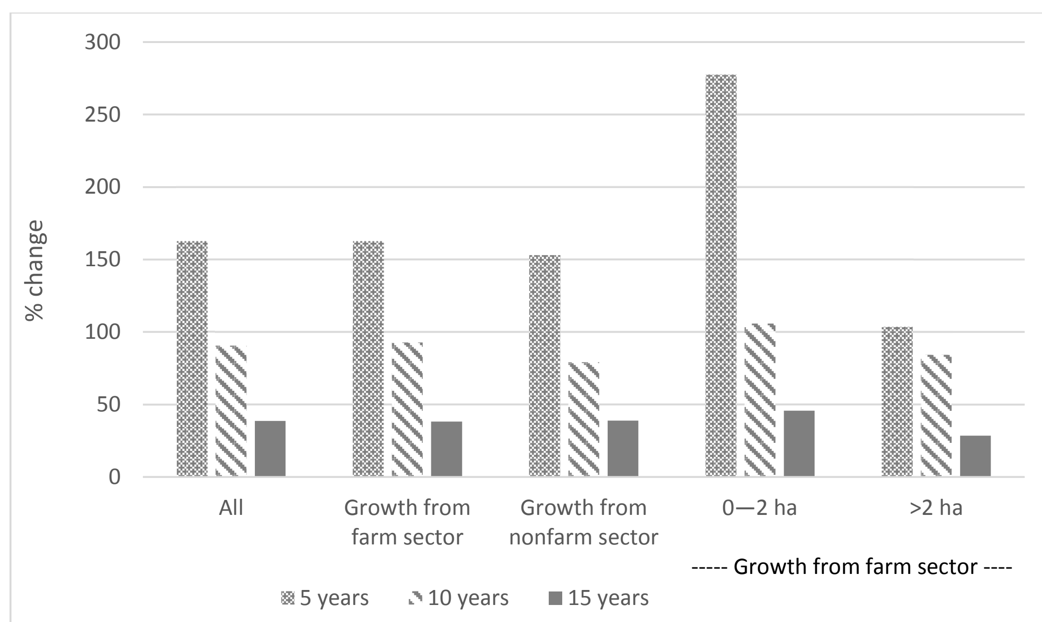
Figure 4.3 Farm size dynamics among medium- and large-scale farmers



Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: Numbers in [ ] are percentages of total farmers who started small (640) and have been farming for more than 15 years. Numbers in ( ) are percentages of farmer type in the group total after year 15 and add up to 100.

Trends in landholding size also show a rapid growth in the first 5 years of these households' farming life followed by a fall in growth rates 10 and 15 years after these farmers started farming (Figure 4.4). Specifically, landholding size grew by 163 percent in the first 5 years of farming career. This was followed by growth rates of 90 percent and 39 percent 10 and 15 years after they started farming, respectively. Likewise, Figure 4.4 suggests that the landholding size grew more vigorously among indigenous farmers in the first 5 and 10 years of their career compared to farmers who entered farming from the nonfarm sector.

Figure 4.4 Changes in landholding size among emergent farmers



Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

The breakdown of changes in landholding size by initial farm size among indigenous emergent farmers indicates that the lower the initial farm size, the higher the growth in landholding size and vice versa. For example, farmers who started farming with 2 ha of land or less grew by 278 percent in the first 5 years of farming, while those who started farming with more than 2 ha of land grew by 104 percent during the same period. In short, growth rates in landholding size are higher among farmers who started with smaller farm sizes. This finding suggests that where there is room for farm size growth, it is the smallest farms that grow the most. The result is consistent with the suggestion that growth intensity is less strong when farm size gets larger (see for example, Akimowicz et al. 2013). This trend may be explained by the “catch-up” effect observed among small farms (Butault and Delame 2005).

Sources of Land Acquisition and Tenure Security among Emergent Farmers

An examination of land acquisition and tenure security can provide insight into the land-related factors that may have influenced growth among emergent farmers in Ghana. Table 4.13 presents the trends in land acquisition among these farmers.

Table 4.13 shows that even though 72 percent of the farmers started farming before year 2000, 66 percent of them acquired their largest land after that time. More specifically, only 33 percent of these farmers acquired their land before 2000, while 42 percent of them acquired their land between 2000 and 2009 and 24 percent did so after 2000. This pattern of land acquisition may be explained by the country’s economic reforms, which began in 1983. According to Braimoh (2009), these reforms led to cropland expansion, with the creation of new plots, as well as increased commercialization following a rise in the demand for domestically produced food. Likewise, from 2007, public efforts to accelerate the modernization of agriculture and increase the productivity of the Ghanaian farmer have intensified and several initiatives aimed at supporting the development of medium- and large-scale farms were enacted (see Section 2). With the environment created by these efforts, it is probable that many emergent farmers have been encouraged to increase farming scale and acquire large tracts of farmland. Interestingly, about 70 percent of the farmers indicated that they obtained part of their land free of charge from relatives, 21 percent declared that they obtained part of their land free from chiefs, and 23 percent reported that they inherited their land.

Table 4.13 Patterns and sources of land acquisition

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
Decade first started farming (%)					
1969 or earlier	4.7	5.1	2.9	5.4	4.7
1970–1979	8.3	7.7	10.9	7.9	7.4
1980–1989	21.9	21.9	21.7	24.4	17.2
1990–1999	37.0	37.7	34.3	40.3	32.8
2000–2009	27.0	26.6	28.6	21.3	36.7
2010 or later	1.1	0.9	1.7	0.8	1.2
Decade largest land was acquired (%)					
1969 or earlier	1.5	1.8	0.6	1.4	2.3
1970–1979	3.0	2.6	4.6	2.5	2.7
1980–1989	8.9	8.9	8.6	10.1	6.6
1990–1999	21.0	21.9	17.1	24.4	17.2
2000–2009	42.1	42.8	38.9	39.7	48.8
2010 or later	23.6	22.0	30.3	21.9	22.3
Source of land (%)					
Given free by chief	20.7	20.9	19.4	20.9	21.1
Given free by relative	69.3	69.5	68.6	70.9	66.8
Given free by government	1.1	0.7	2.9	0.6	0.8
Purchased with title	1.9	1.6	2.9	0.8	3.1
Purchased without title	3.5	3.4	4.0	3.7	2.7
Inherited the land	22.6	23.5	18.9	23.8	23.0
Just walked in	5.4	5.3	5.7	6.0	3.9
Sharecropping agreement with landowner	2.6	2.8	1.7	2.5	3.5

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

With regard to tenure security, 94 percent of the farmers indicated that they operate their land under the customary tenure system (Table 4.14), unlike in Zambia, where most of the emergent farmers acquired titled land (see, for example, Sitko and Jayne 2014). Despite the predominance of the customary tenure system, 63 percent of these farmers indicated that they can leave their land unfarmed indefinitely without fearing of losing ownership rights. This result confirms findings by Chapoto, Mabiso, and Bonsu (2013), who reported that although farmers had no title to their lands, they did not worry that someone might take it or that it might be allocated to someone else by the chief. Access to land in West Africa is increasingly facilitated through "vernacular land markets" (see, for example, Mathieu et al. 2003; Kasanga and Kotey 2001; Amanor and Diderutuah 2001). The result is also consistent with Bruce and Migot-Adholla (1994), who indicated that customary tenure can provide adequate tenure security to enable farmers to take long-term interest and invest in their lands.

Nonetheless, these farmers use several strategies to ensure secured and continued access to their land, including stumping, permanent cropping (that is, without leaving the land fallow), and sharing part of harvest with the chief or village authorities (Table 4.14). Stumping is the most common practice used to secure access to land. This operation can take several years to complete manually, especially in the transition zone, where tree densities are higher compared to the Savannah zone.

With regard to the perceptions on land, about three-quarter (76 percent) of the emergent farmers indicated that arable land is still available in their communities (Table 4.15). This pattern is similar across the agroecologies and both groups of emergent farmers. Furthermore, most of these farmers (74 percent) believe that available land can be allocated to their households for agricultural purposes, while only 43 percent think that customary land can be titled. The breakdown of land perceptions by agroecology suggests that where there is a higher population density and higher land pressure—for example, in the Central Transition zone—a higher share of the farmers; that is 60 percent, agree that land titling is

possible, versus 31 to 34 percent in the Guinea and Sudan Savannah zones, where land is still abundant. Farmer assessment of land titling also depends on the source of growth. About 58 percent of the farmers who entered farming from the nonfarm sector indicated that customary land can be converted into titled properties, compared to 39 percent of indigenous farmers who indicated the same.

Table 4.14 Land tenure security

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
*Current tenure status of land (% reporting)**					
Customary (no title)	93.8	93.6	94.3	92.8	95.3
Titled land	8.4	8.2	9.1	9.3	6.3
Length of time land can be left unused (% reporting)					
Less than 6 months	5.7	5.9	4.6	5.6	6.6
6 to 12 months	8.7	8.4	10.3	9.1	7.0
12 months to 2 years	12.3	11.9	14.3	12.0	11.7
More than 2 years	21.3	22.0	18.3	22.5	21.1
Indefinitely	63.3	62.3	67.4	62.0	62.9
Strategies used to secure land (% reporting)					
Stump the land	37.9	37.4	40.0	38.2	35.9
Do not leave land fallow	24.6	23.4	29.7	24.6	21.1
Share harvest with chief/village authorities	9.0	8.4	11.4	7.2	10.5

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: *The percentages do not add up to 100 because some farmers have multiple plots with different tenure statuses.

Table 4.15 Farmer assessment of land availability (percent)

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
Land still available[a]					
All	75.8	75.3	78.3	72.9	79.7
Central Transition	87.7	86.8	90.0	84.9	90.9
Main Transition	74.1	73.1	76.5	71.6	76.9
Guinea Savanna	70.4	70.0	73.7	66.5	78.8
Sudan Savanna	77.6	78.5	73.9	79.2	77.8
Land can be given to household[b]					
All	74.3	74.3	74.3	71.7	79.3
Central Transition	82.2	83.0	80.0	80.8	87.9
Main Transition	72.4	72.4	72.5	70.5	76.9
Guinea Savannah	69.8	69.3	73.7	65.6	78.8
Sudan Savannah	77.2	78.5	71.7	79.2	77.8
Land titling possible[c]					
All	42.6	39.1	57.7	38.6	39.8
Central Transition	61.6	55.7	77.5	56.2	54.5
Main Transition	60.0	56.7	68.6	54.7	61.5
Guinea Savannah	31.4	28.0	57.9	28.4	27.1
Sudan Savannah	33.7	35.0	28.3	32.7	37.4

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: [a] Percentage answering yes to the question "Do village authorities still have unallocated arable land that could be given to households to farm in this area?" [b] Percentage answering yes to the question "Can unused lands be allocated to this household for cropping purposes?" [c] Percentage answering yes to the question "Is it possible in this village to convert customary land into titled property?"

Asset Accumulation and Farm Size Dynamics

As farmers expand their farm size, they can produce more marketable farm output and earn more income. Part of this income can be invested into productive and nonproductive assets. These assets, especially the productive assets can in turn aid further farm expansion. Table 4.16 examines the trends in the accumulation of assets among the emergent farmers.

Table 4.16 Asset ownership and values in Ghana Cedis (Gh¢)

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
Value of assets (excluding homestead)	19,249	15,441	35,330	15,611	15,121
Value of small farm assets	1,832	1,542	3,056	1,573	1,477
Value of large farm assets	10,479	9,690	13,809	9,769	9,541
Value of nonfarm assets	6,939	4,210	18,465	4,257	4,104
Value of homestead	23,268	20,753	33,891	18,300	25,379
Asset ownership (% owning)					
Cellphone	87.1	85.1	95.4	87.0	81.6
Radio	82.5	80.5	90.9	81.0	79.7
Television	44.0	39.3	64.0	41.1	35.9
Tractor	35.2	34.3	38.9	37.0	29.3
Car	6.9	4.7	16.0	5.6	3.1
Lorry or other vehicles	0.3	0.4	0	0.2	0.8

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: Gh¢ denotes Ghanaian Cedi. Gh¢ 1.9 = US$1.00 in June 2012.

The total value of assets owned is estimated at Gh¢ 19,249 among these farmers. Estimates across the two groups show that farmers who entered farming from the nonfarm sector own more than twice assets as the indigenous emergent farmers. Having worked in the nonfarm sector, the former may have accumulated more assets before they started to farm. Emergent farmers invested in both small and large farm assets, but indigenous farmers invested more in farm assets which represent 64 percent of the total value of assets (and less in nonfarm assets) compared with their counterparts whose farm assets are valued at 47 percent of total assets. In addition, large farm assets contribute the most (63 percent) to asset building among indigenous farmers, whereas nonfarm assets represent the highest share of assets (52 percent) among farmers who entered farming from the nonfarm sector.

With regard to the composition of assets, 87 percent of the emergent farmers own a mobile phone, 83 percent own a radio, 44 percent own a television, and 7 percent own a car. Furthermore, more than one-third (35 percent) of these farmers own a tractor. Expectedly, asset ownership rates are distinctly higher among farmers who entered farming from the nonfarm sector compared to indigenous farmers. Tractor ownership among the group is particularly important because it generates spillover effects as owners combine the use of the machines on their own farms with service provision to farmers in their communities and beyond (see, for example, Houssou, Diao, and Kolavalli 2014). The high ownership rate of information and communication technology tools may also contribute to improving the information network and farmers' access to agricultural markets. Experience in African countries such as Ghana and Kenya indicates that mobile phones can be used by farmers to access production and daily market information, such as commodity prices and extension messages (Asenso-Okyere and Mekonnen 2012).

The Road to Medium- and Large-Scale Farming

Does Assistance Matter?

Table 4.17 examines the role of inheritance in the transition from small-scale to medium- and large-scale farming. The aim here is to test whether inheritance is correlated with farm size growth. The results show that about one-third of emergent farmers (29 percent) inherited from relatives. Indigenous farmers were more likely to receive inheritance than farmers who entered farming from the nonfarm sector. With regard to the type of inheritance, land is the most commonly inherited asset, with 26 percent of farmers in the sample inheriting land.

Table 4.17 Role of inheritance in farm size growth

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
% receiving inheritance	28.6	29.3	25.7	30.2	27.7
Type of inheritance (%)					
Inherited land	25.8	26.4	23.4	27.3	24.6
Inherited cattle	6.3	6.6	5.1	6.4	7.0
Inherited money/precious jewelry	2.5	2.0	4.6	1.7	2.7
Inherited farm machinery (count)	5	3	2	3	0

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

We also examine the role of startup assistance in the transition of emergent farmers (Table 4.18). The results indicate that 71 percent of these farmers received startup assistance from parents and relatives. But farmland is the most commonly received assistance, as 66 percent of these farmers reported receiving farmland, which can essentially be accessed free of charge in the districts (see above). One-fifth (21 percent) of these farmers indicated that they received startup money, whereas 13 percent mentioned that they received livestock. On the other hand, only a small share of these farmers (7 percent) declared that they received government or nongovernment organization (NGO) assistance. Farmers who entered agriculture from the nonfarm sector were less likely to receive assistance from parents or relatives and more likely to receive government or NGO assistance compared to indigenous emergent farmers. In sum, while emergent farmers grew with barely any direct government or NGO support, assistance from parents and relatives (especially startup money) may have been critical in the transition for some of these farmers.

Table 4.18 Assistance received when farming started

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
% receiving assistance from parents/relatives	71.0	73.1	62.3	74.8	69.9
Type of assistance (% reporting)					
Farmland (excluding inheritance)	65.8	67.7	57.7	69.8	63.7
Startup money/inputs	21.4	23.0	14.9	25.0	19.1
Livestock	12.6	13.4	9.1	14.5	11.3
Farm machinery (count)	8	6	2	3	3
% receiving assistance from:					
Government	7.3	6.2	12.0	6.0	6.6
NGOs	6.6	5.8	9.7	5.6	6.3
Number of farmers receiving subsidized tractors from:					
Government	21	10	11	8	2
NGOs	16	12	4	7	5

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Access to credit can be a major determinant of farm expansion. Farmers may perform well and even compete with others if they have good access to credit. We examine the extent of emergent farmers' participation in the credit market as well as assistance received from fellow farmers in the past 5 years (Table 4.19).

Table 4.19 Access to formal credit/loan and assistance from peer farmers in the past 5 years

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
*Credit application rate (%)**	8.6	7.7	12.6	8.5	6.3
*Credit approval rate (%)***	86.1	86.0	86.4	87.8	81.3
% receiving assistance from fellow farmers in the form of					
Cash credit/loan	9.0	8.8	9.7	9.1	8.2
Credit for marketing farm output	10.6	10.9	9.1	10.5	11.7
In-kind credit (fertilizer, seeds, etc.)	21.3	23.8	10.9	24.2	23.0
In-kind credit (tractor services)	9.2	9.2	9.1	10.3	7.0

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: *Number of credit applicants=79, **Number of credits approved=68.

Table 4.19 shows that credit application rates are low among the emergent farmers. Only 9 percent of these farmers (79 of 915) indicated that they have applied for credits in the past 5 years (between 2008 and 2012), including 8 percent of indigenous farmers and 13 percent of farmers from urban backgrounds. Interestingly, most (86 percent) of the credit applications were approved (68 of 79). These results are consistent with findings from the 2012 Ghana Living Standard Survey, which show that only 12 percent of rural households applied for credit in the year preceding the survey, while 90 percent of the applicant households were granted credit (Ghana Statistical Service 2014a). Farmers may not apply for credit for several reasons. According to the GLSS survey report (Ghana Statistical Service 2014b), about 50 percent of rural households indicated that they did not apply for credit because of high interest rates, lack of collateral, high household indebtedness level, and insufficient credit supply relative to need, among others. The remaining households (50 percent) reported that they didn't need any credit.

Some of the emergent farmers also received assistance from their peers in the past 5 years. Overall, 9 percent of these farmers received cash credit from their peers, 11 percent received credit to market their farm outputs, 21 percent received in-kind credit in the form of inputs, and 9 percent received in-kind credit in the form of tractor services. The results across the two groups show that indigenous farmers were twice as likely (24 percent) to receive input credit from their peers in the past 5 years compared to their counterparts from the nonfarm sector (11 percent). In sum, access to credit is low and fairly similar between indigenous emergent farmers and those coming from the nonfarm sector, suggesting that there is no differential access to capital between the groups. The difference observed between the groups in terms of input credit may be explained by the social networks that have been established over time between indigenous farmers in their communities.

Do Aspirations and Aversion to Risk Matter for Farm Size Growth?

Aspirations are perceived as the ambition or desire to reach a multidimensional life outcome, and are strong motivators (Bernard and Taffesse 2014). They can determine consumption and investment behavior among individuals. Hence, they can affect farm size growth among the peasantry. Emergent farmers' aspirations windows were estimated using media exposure and mobility indices (Table 4.20). These aspirations window represents a set of people with experiences that can influence an individual's own aspirations (Kosec, Hameed, and Hausladen 2012). The media exposure index, which ranges from 2

to 10, is measured by the frequency with which farmers listen to the radio and watch television, with a lower score indicating more exposure to media and information and a higher score showing the opposite. Likewise, the mobility index ranges from 3 to 15 and is measured by the frequency with which farmers travel outside of their communities, districts, and regions. The lower the mobility index, the higher the farmer mobility and vice versa. It is expected that farmers who frequently travel outside their communities are more likely to meet people/farmers with high levels of aspirations and form an aspirations window.

As shown in Table 4.20, the average media exposure score among the emergent farmers was estimated at 3.8, indicating that these farmers are well exposed to the media and information. This result is consistent with the high rates of radio and television ownership among these farmers. A high exposure to the media can provide knowledge that is helpful in improving productivity and rural livelihood (Jensen 2007). On the other hand, the mobility index amounts to 8.6 on average, indicating a generally low level of mobility among emergent farmers. Expectedly, the results presented in Table 4.20 suggest that farmers who entered farming from the nonfarm sector are slightly more exposed to the media and are more mobile than indigenous farmers are.

Table 4.20 Aspirations and investment decisions among emergent farmers

Variable	Overall	Growth from		Growth from farm sector with:	
		Farm sector	Nonfarm sector	0–2 ha	>2 ha
Number of cases	915	740	175	484	256
Aspirations window					
Media exposure	3.79	3.97	3.05	3.88	4.12
Mobility index	8.63	8.81	7.88	8.79	8.84
Importance of aspiration dimensions (%)					
Education	37.0	36.0	40.0	36.0	36.0
Income	25.0	25.0	24.0	25.0	25.0
Assets	21.0	21.0	20.0	21.0	22.0
Social status	18.0	18.0	16.0	19.0	18.0
Median value desired					
Education (years)	13.5	13.4	14.2	13.6	13.0
Income (Gh¢)	19,166	18,588	21,644	18,578	18,607
Assets (Gh¢)	112,231	104,308	146,781	97,678	117,070
Level of social status (out of 10)	9.0	9.0	8.8	9.0	8.9
Risk aversion to investment (%)					
Very risk averse	78.0	76.9	82.9	74.6	81.3
Moderately risk averse	8.6	9.5	5.1	11.2	6.3
Slightly risk averse	1.1	1.2	0.6	1.7	0.4

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: Gh¢ denotes Ghanaian Cedi. Gh¢ 1.9 = US$1.00 in June 2012.

With regard to the dimensions of aspirations, we estimated the contribution of four aspiration indicators: income, education, asset, and social status (Table 4.20). The results show that farmers' desire to educate their children to high levels is their most important ambition, followed by welfare indicators, such as income and assets. Social status is the least important dimension of emergent farmers' aspirations. Farmers who entered farming from the nonfarm sector desire higher levels of education for their children (14 years) compared to indigenous farmers (13 years). Likewise, the former desire higher income and asset levels than the latter.

Household investment and production decisions are made within environments dominated by a multitude of risks, especially in developing countries. Risks can reduce a farmer's willingness to undertake activities and investments that have higher expected outcomes. The results regarding investment risks show that most of the emergent farmers (78 percent) are very risk averse. This pattern is consistent with numerous studies indicating that farmers are risk averse (see, for example, Dadzie and Acquah 2012; Akay et al. 2012; Yesuf and Bluffstone 2009; Binswanger 1980). The result may explain the gradual transition of these farmers (rather than abrupt growth) from small-scale to medium- and large-scale farming status. The findings also show that farmers who entered farming from the nonfarm sector display a higher risk aversion than do indigenous farmers.

Drivers of Farm Size Expansion among Emergent Farmers

This section presents the determinants of farm growth among emergent indigenous farmers. Model A includes district dummies as control variables and Model B controls for fixed agroecological zone effects (Table 4.21). With regard to the independent variables, the models include demographic variables (such as age), education, settlement history, crops grown, aspirations, risk, parents' history, and inheritance. Since we are interested in identifying the determinants of farm size growth, the selection criteria for the independent variables is exogeneity.

Models A and B show the same variables as statistically significant with identical signs. These variables include the farmer's age, formal education, migrant status, aspirations gap, media exposure index, mobility index, risk aversion, mother's number of schooling years, and occupation of parents. More specifically, Model A shows that the probability of emerging among indigenous farmers decreases by 17 percentage points when they are aged 30 years and above, implying indigenous farmers who start farming when they are older are less likely to emerge as medium- or large-scale farmers. On the other hand, the ability to read and write does not influence farm size growth. However, the probability of growing from small-scale among farmers who have attended school for 1 to 7 years or 8 years and above decreases by 10 percentage points and 38 percentage points, respectively, compared to those who have never attended school, indicating that farm size growth among indigenous farmers is associated with low education levels. The result is consistent with the descriptive analysis, which shows that indigenous farmers who expanded from small-scale farming had lower levels of formal education compared with their counterparts from the nonfarm sector. This finding suggests that a higher level of education is not essential for indigenous farm growth, but education may facilitate growth among individuals who entered farming from the nonfarm sector.

Furthermore, being a migrant farmer reduces the probability of emerging from small-scale farming by 10 percentage points. A migrant farmer is less likely to emerge from small-scale indigenous farming compared with emerging from the elite. A farmer's aspirations gap, measured by the combination of differences between actual and desired levels of income, children's education, assets, and social status, has a positive and statistically significant relationship with farm size growth. A unit increase in aspirations gap increases the probability of growing from small-scale by 15 percentage points. Thus, famers whose aspirations gap is high or those who live far below their desired aspirations level are more likely to be more resolute and motivated to grow and achieve a medium- or large-scale farming status.

Media exposure and mobility indices are positive and significantly correlated with the probability of growing from small-scale farming, indicating that indigenous farmers who have emerged are less likely to be exposed to the media and are less likely to travel less outside their communities4. The results are consistent with the descriptive analysis. In short, less exposure and less mobility do not seem to be obstacles to farm size growth among indigenous farmers.

[4] As per definition, the higher the media or mobility index, the less exposed or less mobile the farmer.

Table 4.21 Determinants of farm size growth

Variables	Probit Model			
	1=Growth from small-scale farming 0=Growth from the nonfarm sector			
	Model A		Model B	
	Coef-ficients	*Std. errors*	*Coef-ficients*	*Std. errors*
Age when started farming (ref. <20)				
20–30 years	*-0.03*	*-0.98*	*-0.02*	*-0.81*
30 years or greater	*-0.17***	*-3.14*	*-0.15***	*-2.91*
Can read and write in any language =1	0.04	1.06	0.03	0.85
Farmer education (ref. no education)				
1–7 years	*-0.11**	*-1.94*	*-0.10**	*-1.89*
8 years and above	*-0.38****	*-5.29*	*-0.37****	*-5.18*
Migrant farmer =1, 0 otherwise	-0.10**	-2.43	-0.10**	-2.47
Farmer started with crops only =1, 0 otherwise	-0.01	-0.21	0.00	0.03
Crop type (ref. roots and tubers)				
Cereals	-0.01	-0.44	-0.02	-0.64
Oilseeds	-0.00	-0.09	-0.02	-0.43
Aspirations gap	0.15**	2.32	0.16**	2.53
Aspirations window				
Media exposure index	*0.02***	*2.18*	*0.01**	*1.68*
Mobility index	*0.02***	*2.96*	*0.02***	*2.99*
Risk aversion (ref. moderately risk averse)				
Very risk averse	-0.08**	-3.21	-0.08**	-3.03
Slightly risk averse	-0.05	-0.25	-0.01	-0.07
Received assistance during farming career				
Startup assistance from parents/relatives =1	0.01	0.21	0.00	0.02
Benefited from NGO programs =1	-0.04	-0.82	-0.04	-0.80
Benefited from government programs =1	0.01	0.15	-0.02	-0.34
Inherited land, animals, or cash =1, 0 otherwise	-0.00	-0.18	-0.01	-0.27
Farmer's parents background				
Father years of education	-0.00	-0.07	-0.00	-0.06
Mother years of education	-0.02**	-1.99	-0.02*	-1.91
Parents were farmers =1, 0 otherwise	0.07**	2.40	0.07**	2.25
Chief/subchief/queen mother =1	0.02	0.50	0.02	0.48
Other important positions in community =1	-0.02	-0.61	-0.02	-0.62
District dummies (ref. Ejura)				
Techiman	-0.01	-0.14		
Kintampo North	-0.04	-0.68		
Yendi	0.05	1.35		
Gushiegu	-0.01	-0.20		
Kassena-Nankana East	-0.19**	-2.07		
Bawku Municipal	-0.03	-0.42		
Sissala East	0.03	0.68		
Agroecological zone (ref. Central Transition)				
Main Transition (Techiman, Kintampo North)			-0.02	-0.47
Guinea Savannah (Yendi, Gushiegu)			0.03	0.76
Sudan Savannah (Sissala East/Bawku/Kassena Nankana)			-0.02	-0.47
Observations	915		915	
Log lik.	-328.18		-333.59	
Chi-squared	236.75		225.93	

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: Std. stands for standard errors. Significance levels of coefficients: *** p<0.01, ** p<0.05, * p<0.1.

With regard to risk aversion to investment, the results suggest that farmers who are very risk averse are less likely to grow from small-scale indigenous farming, implying that emergent indigenous farmers are more likely to be risk takers, a result that is consistent with expectations and theory.

Furthermore, there is a negative and statistically significant relationship between the mother's education as measured by the number of schooling years and indigenous farm growth. More educated mothers may discourage small-scale farming among their children. On the other hand, being fathered by a farming family increases the probability of growing from small-scale farming among indigenous farmers. In short, parent education or occupation matters for indigenous farm size growth.

The remaining variables, including assistance from parents, relatives, NGOs, or government; inheritance; and initial enterprise (crops and/or livestock) were not significant in explaining farm size growth among indigenous farmers. As stated earlier, Models A and B display similar results with slight differences in the magnitude of the effects. With regard to the district fixed effects (Model A), emergent farmers in Kassena Nankana East district were less likely to grow from small-scale indigenous farming (but from the nonfarm sector) compared with those in Ejura district. The agroecological zones in Model B exhibit no statistically significant signs, indicating that the transition from small-scale to medium- or large-scale farming is not specific to the agroecological zones.

Factors Influencing Farm Size Dynamics

In addition to investigating the drivers of indigenous farm growth, we examine the factors that drive dynamism among emergent indigenous farmers using a multinomial logit and probit models (Table 4.22). Hence, our sample is limited to indigenous farmers who have been farming for at least 10 years, or 651 farming households in total. Dynamism is measured by the time taken to transition from small-scale to medium- or large-scale farming in the sample. In the multinomial logit, we use the transition after 10 years as the base category for the dependent variable dynamism, while the transition within 5 years and the transition within 6 to 10 years represent the first and second levels of the variable. In the probit model, the dependent variable dynamism takes the value 1 if the farmer transitioned within 5 years, and 0 otherwise. With regard to the independent variables, we use the set of covariates listed in Table 4.2.1 plus the initial farm size variables. Column 1 of Table 4.22 estimates the determinants of transition within 5 years based on the multinomial logit model. The estimated marginal effects and their signs reflect the expected change in the likelihood of transitioning within 5 years relative to transitioning after 10 years (the base category, or reference). Likewise, column 2 of Table 4.22 shows the determinants of transition within 6 to 10 years relative to transitioning after 10 years based on the multinomial logit model.

With regard to column 1 of the multinomial logit, transition within 5 years, the initial land sizes and the types of crops grown have statistically significant effects on farm size dynamics. Starting with land sizes between 0 and 0.5 ha, 0.5 and 1 ha, or 1 and 2 ha reduces the likelihood of transitioning to medium- or large-scale farming within 5 years compared with starting out with 2 ha of land or more. Thus, the lower the initial farm size, the longer it takes to transition to medium- or large-scale farming. In short, farmers who started with land sizes ranging from 0 to 2 ha are less likely to become medium- and large-scale within 5 years relative to those who started with more than 2 ha of farmland. The results are consistent with the fact that 63 percent (25 of 40) of the farmers who transitioned within 5 years started farming with more than 2 ha. Ghanaian small-scale farmers who started with less than 2 ha of farmland may transition and become medium- or large-scale farmers in more than 5 years. On the other hand, growing cereal crops increases the likelihood of transitioning faster (within 5 years) compared with growing roots and tubers. With regard to the fixed effects, emergent farmers living in Techiman district only are less likely to advance to medium- or large-scale within 5 years compared with those located in Ejura district. Residing in the other districts does not any differential effect on farm size dynamism compared with residing in Ejura district.

With regard to column 2 of the multinomial logit model, the results show that initial farm size (0.5 to 1 ha), initial type of enterprise (crops and/or livestock), aspirations gap, mobility index, risk aversion to investment, and farmer's father's level of education significantly affect transition within 6 to 10 years. Farmers who started with 0.5 to 1 ha of farmlands are less likely to transition within 6 to 10 years relative to transitioning in more than 10 years, indicating that the smaller the initial farm size, the longer it takes to transition to medium- or large-scale farming. This finding is consistent with the results

reported in column 1 of the model. Furthermore, indigenous farmers who started farming with the production of crops only are more likely to transition within 6 to 10 years compared with those who started with both crops and livestock. The fewer activities farmers embrace in the beginning of their farming career, the less time it takes them to transition and vice versa.

Table 4.22 Determinants of farm size dynamics

	Multinomial logit				Probit	
	(1)		(2)		(3)	
Independent variables	**Transition within 5 years**	**Std. errors**	**Transition within 6 to 10 years**	**Std. errors**	**Transition within 5 years**	**Std. errors**
Age when started farming (ref. <20)						
20–30 years	0.04	1.13	0.05	1.18	0.04	1.25
30 years or greater	0.02	0.43	0.10*	1.68	0.02	0.37
Can read and write in any language (=1)	0.05	0.95	-0.02	-0.22	0.05	0.82
Farmer education (ref. no education)						
1–7 years	0.01	0.15	-0.01	-0.17	0.01	0.24
8 years and above	0.04	0.54	-0.01	-0.14	0.05	0.69
Land size when started farming (ref. >2 ha)						
0–0.5 ha	-0.39***	-4.35	-0.06	-0.84	-0.18***	-9.41
0.5–1 ha	-0.20***	-5.14	-0.10**	-2.10	-0.14***	-6.21
1–2 ha	-0.14***	-4.28	-0.01	-0.31	-0.11***	-4.54
Migrant farmer (=1, 0 otherwise)	0.01	0.21	-0.02	-0.33	0.00	0.09
Started with crops only (=1, 0 otherwise)	-0.03	-0.87	0.08**	2.19	-0.03	-1.02
Crop types (ref. roots and tubers)						
Cereals	0.07*	1.76	-0.01	-0.13	0.06	1.63
Oilseeds	0.05	1.13	-0.05	-0.89	0.04	0.90
Aspirations gap	-0.12	-1.57	0.24**	2.41	-0.11	-1.58
Aspirations window						
Media exposure index	-0.01	-0.63	0.01	0.80	-0.00	-0.58
Mobility index	-0.01	-0.68	-0.02*	-1.72	-0.01	-0.64
Risk aversion (ref. moderately risk averse)						
Very risk averse	0.01	0.40	-0.12**	-2.70	0.01	0.45
Slightly risk averse	-0.02	-0.16	0.06	0.39	-0.03	-0.31
Received assistance during farming career						
From parents/relatives (=1)	0.01	0.36	-0.02	-0.43	0.02	0.53
From NGO(s) programs (=1)	-0.05	-0.69	-0.01	-0.16	-0.03	-0.65
From government programs (=1)	-0.00	-0.04	-0.00	-0.03	-0.01	-0.11
Inherited land, animals, or cash (=1, 0 otherwise)	0.01	0.28	-0.03	-0.67	0.01	0.21
Farmer's parents' background						
Father years of education	-0.02	-1.48	0.03**	2.52	-0.02	-1.64
Mother years of education	0.01	0.68	-0.03	-1.45	0.01	0.64
Parents were farmers (=1, 0 otherwise)	0.05	1.49	-0.03	-0.65	0.04	1.60
Chief/subchief/queen mother (=1)	0.03	0.78	-0.01	-0.25	0.03	0.72
Other positions in community (=1)	-0.01	-0.42	-0.01	-0.20	-0.02	-0.62
District dummies (ref. Ejura)						
Techiman	-0.14*	-1.66	-0.02	-0.24	-0.09**	-2.52
Kintampo North	-0.05	-0.78	-0.12	-1.51	-0.03	-0.71
Yendi	0.07	1.38	-0.13*	-1.84	0.08	1.24
Gushiegu	0.07	1.44	-0.10	-1.43	0.08	1.42
Kassena Nankana East	-0.00	-0.03	-0.07	-0.70	0.01	0.14
Bawku Municipal	-0.03	-0.40	-0.31**	-2.86	-0.03	-0.58
Sissala East	0.08	1.59	-0.11*	-1.66	0.09	1.49
Observations	651		651		651	
Log lik.					-246.79	
Chi-squared					97.86	

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).
Note: Std. errors stand for standard errors. Significance levels of coefficients: *** p<0.01, ** p<0.05, * p<0.1.

As concerns a farmer's ambitions, the coefficient on the aspirations gap is positive and significant, indicating that emergent farmers with higher aspirations gaps are more likely to graduate from small-scale farming within 6 to 10 years. Thus, aspirations may exert a positive influence on the pace of indigenous farm growth. Likewise, the higher the mobility index, the lower the likelihood of transitioning within 6 to 10 years. In other words, indigenous farmers who travel less outside their communities, districts, or regions are less likely to transition within 6 to 10 years. The result is consistent with the expectation that farmers who travel frequently might be more exposed to ideas and knowledge that is useful in accelerating their transition and, therefore, they are likely to be more dynamic than those who travel less. Even though mobility is no obstacle to indigenous growth (see Table 4.21), it does affect the pace of indigenous growth.

With regard to risk, column 2 shows that very risk-averse farmers among indigenous farmers are less likely to graduate to medium- or large-scale farming within 6 to 10 years, implying these farmers grow over a longer period of time compared to those who are moderately risk-averse. Interestingly, the farmer's father's education has a positive effect on the pace of transition. The higher the father's level of education, the higher the likelihood of transitioning faster, within 6 to 10 years. With regard to the fixed effects, farmers in Yendi, Bawku municipality, and Sissala East districts are less likely to take 6 to 10 years to transition compared with those located in Ejura district, indicating differences in dynamism among some of the districts.

With regard to the probit model (column 3), findings show that only the initial land size variables are (significant) determinants of farm size transition within 5 years. More specifically, farmers who started farming with 2 ha or less are less likely to transition within 5 years compared with those who started with more than 2 ha. This result is consistent findings from the multinomial logit model. With regard to the fixed effects, there is a lower likelihood of transitioning within 5 years among farmers living in Techiman municipality compared with those located in Ejura district. In other words, farmers in the Ejura district transitioned faster than those in Techiman district, indicating more dynamism in Ejura district compared with Techiman district. As with the multinomial logit model, residing in the other districts does not have any differential effect on farm size dynamism compared with residing in Ejura district.

We also estimate the multinomial logit and probit models using agroecological zones as control variables (see Appendix Table A.2). While the agroecological zones exhibit some effects on farm size dynamics, the marginal effects on the independent variables are similar to those presented in Table 4.22.

5. CONCLUDING REMARKS

This research was designed to better understand the dynamics of changes in farm structure in Ghana. The paper characterizes the transition of emergent medium- and large-scale farmers in in the country using the 2013 IFPRI/SARI survey data. In addition, we identify the factors that drive farm size growth and the conversion of farmland to agricultural uses among these farmers. Finally, we examine the determinants of the pace of growth among the indigenous emergent farmers. Estimates from nationally representative household data suggest that the number of farmers cultivating more than 2 ha of land has increased considerably in Ghana between 1999 and 2012, while the number of smallholder farmers has declined during the same period, indicating a change in the country's farm structure.

Furthermore, the survey results suggest that the rise to medium- and large-scale farming is significantly associated with a successful transition of small-scale farmers rather than entry of medium- or large-scale farms into agriculture. Findings from this research also indicate that the majority of the farmers who have grown their farmland are indigenous individuals who are younger than 50 years old. They are predominantly uneducated men who have grown rapidly in the first 10 years of their farming career. Most of these farmers have obtained their land free of charge from relatives under the customary land tenure system, and the majority have acquired their largest lands after the 2000s. They overwhelmingly believe that access to land is not a limitation to farm growth. They cultivate more land than the few farmers who entered farming as medium- or large-scale farmers, but they have started farming earlier, and most of them have grown without any direct assistance from either their parents or the government or NGOs. They cultivate three-quarters of their land mostly to cereal crops (maize and rice), and a few of them are engaged in a nonfarm business. Most of these farmers use fertilizer, but the usage rate is lower than recommended levels, and only a few of these farmers have adopted improved seeds. Interestingly, the few farmers who entered farming from the nonfarm sector tend to use higher quantities of modern inputs and obtain higher yields than do the homegrown or indigenous farmers.

Many of the indigenous emergent farmers have high aspirations, including educating their children and earning higher incomes. They are risk takers and most of their parents are farmers. Only a few of these farmers have had access to credit in recent years, but they have accumulated some assets, including productive assets that generate spillover effects in their farming communities and beyond. With regard to farm size dynamics, some of the emergent indigenous farmers have grown faster than others. Among those are farmers who started out farming with more than 2 ha of land; those who started growing crops only, especially cereals; those who have higher aspirations; and those who are exposed through outside travel. Furthermore, those who were born to more educated parents and those who are less risk averse tend to growth faster.

The transition to medium- and large-scale farming reflects small-scale farmers successfully breaking through the barriers of subsistence agriculture into more commercialized production systems, and suggests that successful smallholder-led expansion can be achieved under favorable conditions. Notably, the results here diverge from the patterns observed in Zambia and Kenya, which indicate that the emergent farmers essentially came from the urban elite. The findings also suggest that some of the factors thought to be important for change in farm structure are no obstacle to farm size growth, even though they may foster transition. It seems that emergent farmers were just seizing opportunities presented to them, and, hence, it is reasonable to think that the prevailing policy environment and market forces may have stimulated farm growth. Unfortunately, past and current policy discussions have not featured these emergent farmers sufficiently in the quest to transform agriculture in Ghana. As it seeks to address challenges in the smallholder sector, the government should capitalize on these emergent farmers who have a demonstrated ability to graduate productively. Specific policies should also focus on enabling factors in order to scale up farm transition and foster structural change in Ghanaian agriculture.

APPENDIX: SUPPLEMENTARY TABLES

Table A.1 Definitions of variables used in the models and descriptive analyses

Model variables	Definitions
Age of farmer (years)	The age of farmer when started farming
Can read and write (=1, 0 otherwise)	The farmer can read and write in any language
Years of education of farmer	Number of years the farmer has attended school
Migrant farmer (=1, 0 otherwise)	Farmer did not grow up in the village where farming
Crops only (=1, 0 crops and livestock)	Whether the farmer cultivated only crops when started farming
Cereals reported as main crops (=1, 0 otherwise)	Whether the farmer cultivates cereals as main crops
Oilseeds reported as main crops (=1, 0 otherwise)	Whether the farmer cultivates oilseeds as main crops
Horticultural crops reported as main crops (=1, 0 otherwise)	Whether the farmer grows horticultural crops as main crop
Aspirations gap	The difference between farmer's actual level of aspirations and the level he/she wishes to achieve in terms of income, children's education, assets, and social status
Media exposure index	Index on how often the farmer listens to radio and watch television
Mobility index	Index on how often the farmer travels outside his/her community, district, and region
Moderately risk averse (=1, 0 otherwise)	Whether the farmer is moderately risk averse
Very risk averse (=1, 0 otherwise)	Whether the farmer is very risk averse
Slightly risk averse (=1, 0 otherwise)	Whether the farmer is slightly risk averse
Startup assistance (=1, 0 otherwise)	Whether the farmer received startup assistance from parents/relatives
Benefited from NGO(s) programs (=1, 0 otherwise)	Whether the farmer benefited from NGO(s) programs
Benefited from government programs (=1, 0 otherwise)	Whether the farmer benefited from government programs
Inherited land, animals, or cash (=1, 0 otherwise)	Whether the farmer inherited land, animals, or cash
Years of education of father	Number of years the farmer's father attended school
Years of education of mother	Number of years the farmer's mother attended school
Parents were farmers (=1, 0 otherwise)	Whether the farmer's parents were farmers
Parents were chief/subchief/queen mother (=1, 0 otherwise)	Whether the farmer's parents were chief/subchief/queen mother

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Table A.2 Determinants of farm size dynamics, including agroecological dummies

Independent variables	Multinomial logit				Probit	
	(1)		(2)		(3)	
	Transition within 5 years	Std. errors	Transition within 6 to 10 years	Std. errors	Transition within 5 years	Std. errors
Age when started farming (ref. <20)						
20–30 years	0.04	1.28	0.05	1.17	0.04	1.42
30 years or greater	0.02	0.53	0.10*	1.70	0.02	0.48
Can read and write in any language (=1)	0.06	1.05	-0.01	-0.11	0.05	0.89
Farmer education (ref. no education)						
1–7 years	0.00	0.03	-0.02	-0.29	0.01	0.13
8 years and above	0.02	0.30	-0.02	-0.26	0.03	0.48
Land size when started farming (ref. > 2ha)						
0–0.5 ha	-0.39***	-4.35	-0.06	-0.82	-0.18***	-9.63
0.5–1 ha	-0.19***	-5.00	-0.11**	-2.10	-0.14***	-6.09
1–2 ha	-0.13***	-4.18	-0.01	-0.11	-0.11***	-4.44
Migrant farmer (=1, 0 otherwise)	0.01	0.23	-0.02	-0.29	0.00	0.11
Started with crops only (=1, 0 otherwise)	-0.02	-0.66	0.10**	2.52	-0.02	-0.84
Crop type (ref. roots and tubers)						
Cereals	0.06	1.64	-0.01	-0.18	0.05	1.53
Oilseeds	0.04	0.92	-0.04	-0.77	0.03	0.75
Aspirations gap	-0.10	-1.39	0.22**	2.28	-0.10	-1.46
Aspirations window						
Media exposure index	-0.01	-0.90	0.01	0.67	-0.01	-0.83
Mobility index	-0.01	-0.73	-0.02*	-1.82	-0.01	-0.64
Risk aversion (ref. moderately risk averse)						
Very risk averse	0.01	0.31	-0.11**	-2.60	0.01	0.32
Slightly risk averse	-0.01	-0.06	0.07	0.47	-0.02	-0.21
Received assistance during farming career						
From parents/relatives (=1)	0.01	0.16	-0.02	-0.38	0.01	0.36
From NGO(s) programs (=1)	-0.05	-0.72	-0.02	-0.23	-0.04	-0.78
From government programs (=1)	-0.01	-0.21	-0.01	-0.06	-0.01	-0.26
Inherited land, animals, or cash (=1, 0 otherwise)	-0.00	-0.00	-0.03	-0.64	-0.00	-0.07
Farmer's parents' background						
Father years of education	-0.02	-1.40	0.03**	2.52	-0.02	-1.56
Mother years of education	0.01	0.53	-0.03	-1.41	0.01	0.51
Parents were farmers (=1, 0 otherwise)	0.05	1.41	-0.02	-0.56	0.04	1.57
Chief/subchief/queen mother (=1)	0.02	0.65	-0.02	-0.30	0.03	0.65
Other positions in community (=1)	-0.02	-0.61	-0.02	-0.49	-0.03	-0.84
Agroeco dummies (ref. Central Transition)						
Main transition zone	-0.09	-1.53	-0.07	-1.09	-0.06	-1.61
Guinea Savannah	0.08	1.64	-0.11*	-1.75	0.08*	1.65
Sudan Savannah	0.04	0.92	-0.14**	-2.26	0.05	1.04
Observations	651		651		651	
Log lik.					-249.34	
Chi-squared					92.75	

Source: IFPRI/SARI survey on medium- and large-scale farmers and mechanization (2013).

Note: Ref = reference; Std. = standard errors. Significance levels of coefficients: *** p<0.01, ** p<0.05, * p<0.1.

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