5

Urbanization and its Impact on Ghana's Rural Transformation

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5.1 Introduction

Ghana has rapidly urbanized in recent years and more than half the total population now lives in urban areas. However, urbanization in Ghana has not followed the typical historical pathway for the economic transformation of an agrarian country. As discussed in earlier chapters, urbanization in Ghana has not been driven by an agricultural revolution and the development of a labor-intensive manufacturing sector but by rapid growth in the services sector. Moreover, urbanization has involved growth in medium and small towns as well as large cities, perhaps bringing more local opportunities to rural-based households. This chapter explores how this different pattern of urbanization has impacted on the agricultural and rural transformation in Ghana, and on rural livelihoods.

The chapter addresses three broad questions. First, are patterns of rural employment in Ghana changing with urbanization and are those changes related in any systematic way with proximity to urban centers of different sizes? Second, does proximity to different-sized urban centers have any impact on patterns of agricultural intensification? Finally, what are the impacts on household livelihoods and welfare outcomes? To answer these questions the analysis goes beyond the usual agroecological breakdown (Chapter 4) and uses a spatial typology of rural areas based on work by Berdegue et al. (2015) and others in Latin America.

The rest of the chapter is structured as follows: Section 5.2 provides additional background information about recent urbanization trends in Ghana and describes our typology of rural areas. Section 5.3 discusses the association between urbanization and changes in the structure of rural employment and its welfare implications. Section 5.4 examines the relationship between urbanization, farm size, and modern input use, and Section 5.5 concludes.

5.2 Urbanization Trends in Ghana

Ghana has always been relatively urbanized compared to other African countries. This is partially due to the post-Independence expansion of the cocoa sector (Jedwab and Moradi 2011), and the promotion of state-owned industries in the late 1960s and early 1970s (Ackah, Adjasi, and Turkson 2014). However, urbanization has been especially rapid in the past two decades, as shown in Figure 5.1. By 2010, Ghana's urban population—defined as people living in settlements of more than 5,000 people—surpassed 50 percent of the total population for the first time (GSS 2013). Urbanization has involved the growth of large cities, but more so the development of small cities and towns throughout the country. There has been substantial migration of workers from rural to urban areas, alongside substantial employment growth in the rural nonfarm economy, leading to a decline in the share of workers remaining in agriculture (Figure 5.2).

5.2.1 A Spatial Typology of Rural Areas

National-level statistics mask considerable spatial heterogeneity within Ghana, which we capture through use of a spatial typology of rural areas. Specifically,

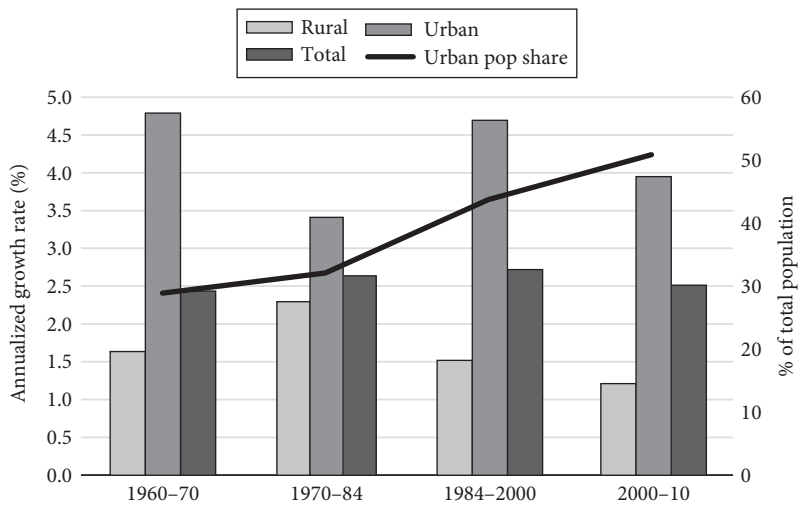

Figure 5.1. Annual growth rate in the population between census years, and urban population share in census years, 1960–2010

Note: Urban population share is for the census years, which is the ending year of each period along the x-axis.

Source: Authors' calculation using data from the five rounds of censuses (GSS 2013).

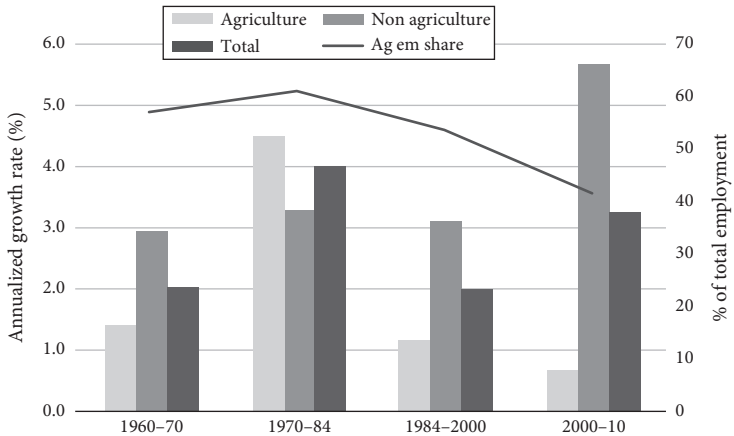

Figure 5.2. Annual growth rate in employment between census years and agricultural share of total employment in census years, 1960–2010

Note: Agricultural employment share is for the census years, which is the ending year of each period along the x-axis.

Source: Authors' calculation using data from the five rounds of censuses (GSS 2013).

we take districts as our primary spatial unit, and classify districts by the size of their largest city. Similar studies have found correlations between the size of a city and its impact on the surrounding rural areas (e.g., Berdegue et al. 2015; Deichmann, Shilpi, and Vakis 2008). An alternative approach would be to capture the effect of proximity to cities using a gravity model as done by Binswanger-Mkhize et al. (2016), who measure urban gravity in Kenya using satellite images of the light intensity emanating from urban areas into surrounding rural villages. However, this approach requires data that is not available for Ghana.

Ghana has a well-defined south–north divide, which, amongst other things, reflects spatial differences in agroecological conditions, population density, rural infrastructure, and levels of urbanization. As a first step in our typology, we therefore differentiate between two major regions based on both the north–south divide and agroecological conditions. We distinguish between the agriculturally dominant north, comprising the regions of Brong Ahafo, Northern, Upper East, and Upper West, which we call the *North*. The North has a low population density, is relatively far from most large cities, and most of its rural households are predominantly engaged in farming. The North also corresponds closely to the savanna and transition agroecological zones, and hence has its own well-defined farming systems (Chapter 4). The remaining regions: Ashanti, Central, Eastern, Greater Accra, Volta, and Western, are then grouped

into the *South*, which is less dependent on agriculture, is more urbanized and densely populated, and has a well-developed rural nonfarm economy. The South corresponds closely to the forest and coastal agroecological zones, which also have their own well-defined farming systems (Chapter 4).

Taking districts as our primary spatial unit using 2010 census data, each of the two regions is subdivided into four groups based on the proximity of each district to cities of different sizes. *Big city districts* are those that contain parts of Accra and Kumasi, and hence are only in the South, *2nd-tier city districts* are those with cities of between 100,000 and 500,000 people, which are located in both the North and South, *3rd-tier city districts* are those with cities containing between 40,000 and 100,000 people, and *non-city districts* are those with no settlement of over 40,000 people. This leads to a total of seven groups of districts in Ghana, three in the North and four in the South. These are mapped in Figure 5.3.

Although the South covers a much smaller land area than the North, the 2010 census shows that 73 percent of the total population and 63 percent of the rural population live in the South. Moreover, the majority of the total population lives in districts with cities of at least 40,000 people in both regions; 40 percent of the rural population also lives in such districts.

Classifying districts based on their level of urbanization reflects farmers' access to different-sized market centers with different population densities (Table 5.1). As such, more recent interpretations of the induced innovation theory (Pingali et al. 1987; Binswanger and McIntire 1987; McIntire et al. 1992), which emphasize the role of market access as well as population pressure (resulting in decreased access to land) in driving agricultural intensification, suggest that farmers in more urbanized areas will be more likely to adopt agricultural intensification practices and technologies.

5.3 Changing Patterns of Rural Employment and Welfare Outcomes

5.3.1 Changes in Employment

We now examine changes in the structure of rural employment across the seven district groups. Unlike other studies, we focus on employment at the household rather than individual level in order to distinguish between changing employment patterns that involve entire households shifting sectors, and farm household diversification that involves employment of members in multiple sectors including agriculture. We classify rural households into

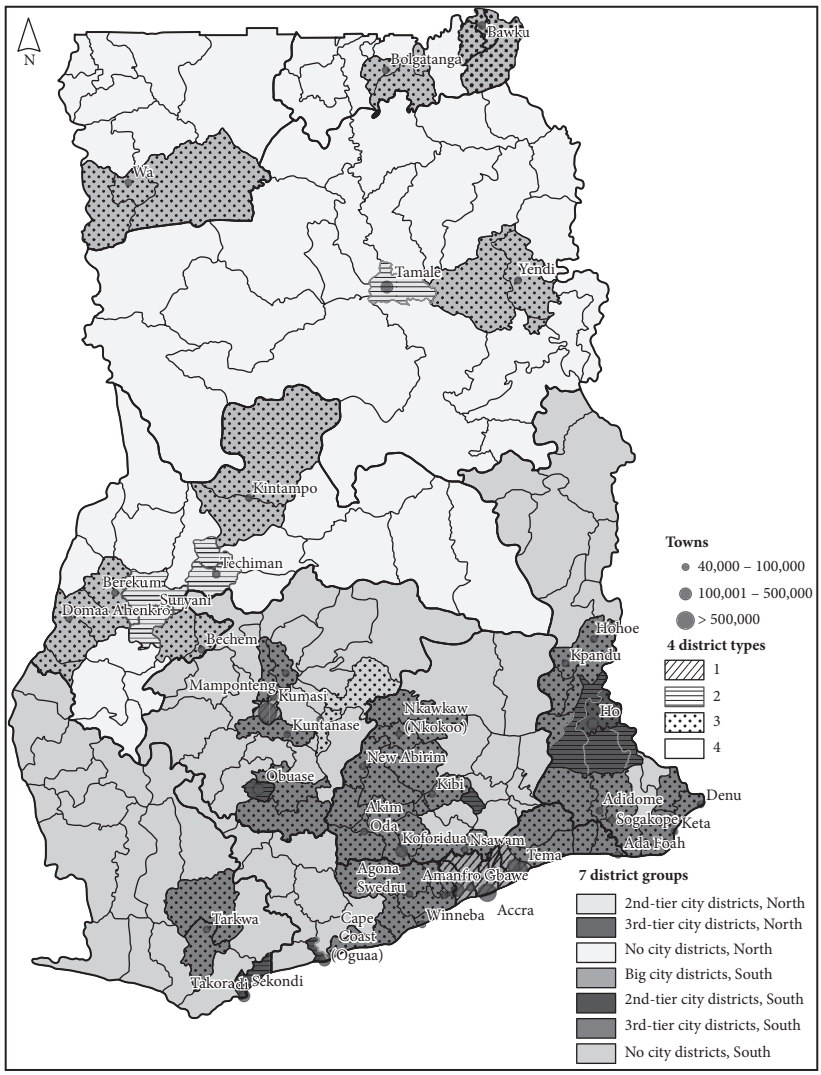

Figure 5.3. Ghana map showing the different types of districts

Source: The map was created by Mekamu Kedir Jemal (IFPRI) who combines 2010 Census data with other spatial data including cities and road networks. Spatial data of cities, towns and road network are from University of Ghana Remote Sensing & Geographic Info Systems website (http://www.ug.edu.gh/rsgislab/rs-gis-geonode-app.html).

three types based on members' reported primary occupations in the census or GLSS data: (1) agricultural households that have members whose primary employment is in agriculture and that have no family members primarily engaged in non-agriculture—called *agriculture-only* households; (2) nonagricultural households that have members whose primary employment is in

Table 5.1. Population densities by district group, 2000 and 2010 (people/km²)

District Group	2000			2010		
	Total	Rural	Urban	Total	Rural	Urban
North:						
2nd-tier city districts	210	72	138	257	73	184
3rd-tier city districts	57	40	17	69	45	24
No city districts	28	23	5	37	28	9
North total	38	27	10	48	33	16
South:						
Big city districts	2,410	127	2,283	3,577	129	3,448
2nd-tier city districts	753	133	620	1,023	119	904
3rd-tier city districts	136	89	48	177	100	77
No city districts	71	56	15	84	62	22
South total	135	68	68	178	75	102

Source: Authors' calculation using Population and Housing Census 2000 and 2010.

non-agriculture and having no members whose primary employment is in agriculture—called *non-agriculture-only* households; and (3) households that have members with primary employment in both agriculture and non-agriculture—called *mixed* households. We ignore a small percentage of rural households that do not report any primary employment. Table 5.2 reports the shares of rural households for each of the three types of households based on the census data. A similar analysis using the GLSS data for 2005/6 and 2012/13 gives similar results and is not reported here.

In both the South and North, rural households' exit from agriculture has been highly correlated with proximity to cities and their population sizes. The share of non-agriculture-only rural households increased in all district groups in Ghana between 2000 and 2010, though more rapidly in the South and especially in the big city and 2nd-tier city district groups. This was mirrored by an almost equivalent pattern of decline in the shares of agriculture-only rural households in the South and the district group with 2nd-tier cities in the North. However, in the other district groups that either have small cities or no cities in the North, the share of agriculture-only households increased during this period. Thus, there has been a sizeable movement of household from agriculture to the rural nonfarm economy in the South and in districts with secondary cities in the North. Despite this exit, the share of rural agriculture-only households remains high in district groups without big and secondary cities in both the North and South, averaging 46 percent even in the South in 2010. Only in the areas with relatively larger cities did non-agriculture-only households dominate in the rural areas in 2010.

Table 5.2. Distribution of rural households by agricultural, nonagricultural, and mixed occupations across district groups (each type of district's total rural households = 100)

District group	North			South		
	Agri. only	Non-agri. only	Mixed	Agri. only	Non-agri. only	Mixed
Census 2000						
Big city districts				27.7	50.3	12.3
2nd-tier city districts	53.8	18.2	20.3	38.3	32.4	14.9
3rd-tier city districts	58.2	11.2	19.1	50.1	21.1	18.8
Non-city districts	62.6	8.2	19.0	61.5	13.9	17.9
Regional total	60.9	9.7	19.1	55.3	18.4	18.0
Census 2010						
Big city districts				9.0	74.1	6.6
2nd-tier city districts	37.7	34.9	20.4	14.9	59.7	10.2
3rd-tier city districts	63.7	14.5	17.8	39.4	34.1	17.4
Non-city districts	67.5	10.5	18.6	53.4	23.0	17.0
Regional total	64.7	13.0	18.5	45.6	29.7	16.7
Difference in 2000–10						
Big city districts				–18.7	23.8	–5.8
2nd-tier city districts	–16.1	16.6	0.0	–23.4	27.4	–4.7
3rd-tier city districts	5.5	3.2	–1.3	–10.7	12.9	–1.4
Non-city districts	4.9	2.3	–0.4	–8.0	9.1	–0.9
Regional total	3.8	3.3	–0.6	–9.6	11.3	–1.3

Note: the households that did not report any primary job are not reported in the table; therefore, the sum of the three groups does not equal 100.

Source: Authors calculation using data from the 2000 and 2010 Census (GSS 2003, 2013).

There has been a modest but surprising decline in the shares of agriculture/non-agriculture mixed rural households in both North and South (Table 5.2). Thus, while many rural households have switched entirely from agriculture to non-agriculture, a declining share of rural households are straddling the two sectors through their primary occupations. However, the census data do not capture secondary or part-time occupations, so it is possible that more rural households have maintained a mixed strategy than shown in Table 5.2, but on a part-time basis.

Some insights about this can be gained from the GLSS data. Figure 5.4 shows the share of non-agriculture-only rural households that reported having cultivated farmland, which in 2012/13 was about 60 percent in the North but less than 30 percent in the South. The size of the land area held by such households is small, mostly less than 2 hectares. However, it does seem that many households whose members' primary occupations lie outside agriculture are still engaged in farming as a secondary or part-time occupation.

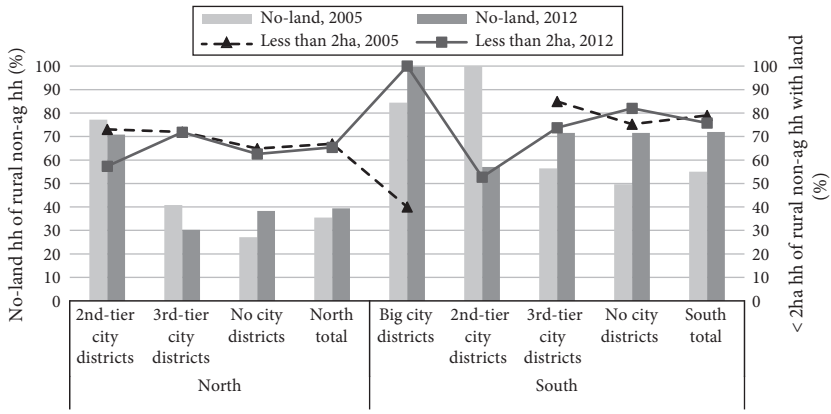

Figure 5.4. Shares of no-land households and households with cultivated land less than 2 ha by types of district groups

Source: Authors' calculations using data from GLSS5 for 2005 and GLSS6 for 2012 (GSS 2008, 2014).

Additionally, some rural households classified as agriculture-only also report having nonfarm household enterprises, though these are likely to be seasonal or part-time activities. This phenomenon was more prevalent in the relatively less urbanized districts, though its importance fell between 2005/6 and 2012/13 (GSS 2008; 2014—not pictured in Figure 5.4).

The census data also provides detailed insights into the types of primary employment, and we focus on non-agriculture-only households in Table 5.3 for such information. By far the largest share of nonagricultural employment in the rural areas is in informal activities, and this is true for all district groups in both census years. Informal trade is more prevalent than informal manufacturing, and more so in 2010 than in 2000. Between the North and South informal manufacturing is also more prevalent in less urbanized areas in the North, as much of it involves small-scale food processing for the local market. The growing importance of informal trade suggests increasing integration of rural areas with urban areas and the broader economy (Haggblade, Hazell, and Brown 1989).

5.3.2 Changes in Welfare Outcomes

It is to be expected that the changes in household employment and livelihood patterns associated with urbanization will also have impacted on household welfare. We know from earlier chapters that average per capita incomes have

Table 5.3. Types of primary employment amongst non-agriculture-only households, by district type, 2000 and 2010

	% of rural nonagricultural households with family members engaging in:					
	Formal only	**Inf. mfg only**	**Inf. trade only**	**Inf. mfg & trade**	**Inf. others**	**Formal & informal combined**
			2000			
North:						
2nd-tier city districts	30.1	10.5	21.6	4.3	9.7	23.7
3rd-tier city districts	16.1	27.5	14.0	5.0	18.0	19.3
No city districts	21.7	25.6	18.7	2.7	15.6	15.7
North total	21.0	24.4	17.6	3.6	15.6	17.8
South:						
Big city districts	27.7	6.3	15.5	2.9	13.0	34.5
2nd-tier city districts	24.8	10.1	22.7	3.3	12.0	27.1
3rd-tier city districts	19.4	16.2	23.6	4.9	13.7	22.1
No city districts	23.6	16.8	22.1	4.1	12.5	20.9
South total	22.1	15.3	22.2	4.3	13.1	22.9
National total	21.9	16.9	21.4	4.2	13.5	22.0
			2010			
North:						
2nd-tier city districts	29.2	5.4	20.8	4.9	9.7	30.0
3rd-tier city districts	24.0	14.7	21.2	4.1	14.5	21.5
No city districts	22.9	19.0	22.0	4.2	11.4	20.4
North total	24.3	15.6	21.6	4.3	12.0	22.3
South:						
Big city districts	24.0	6.0	19.5	3.0	10.9	36.6
2nd-tier city districts	25.4	8.8	20.0	3.8	10.1	31.9
3rd-tier city districts	20.5	14.5	24.1	4.2	12.0	24.5
No city districts	23.6	13.3	25.3	3.8	11.6	22.4
South total	22.3	13.2	24.1	3.9	11.7	24.8
National total	22.6	13.5	23.7	4.0	11.7	24.4

Source: Authors' calculation using data of Census 2000 and 2010 (GSS 2003; 2013).

grown significantly in Ghana with the economic transformation, that the national poverty rate has fallen, and that a variety of other social welfare indicators (e.g., literacy, mortality rates) have also improved (Chapters 2 and 4). But how have these welfare gains been spatially distributed, and how do they relate to urbanization? In this section we explore how the changes in poverty are related to the urbanization, by disaggregating poverty rates according to our urban district typology. Table 5.4 displays poverty rates for agriculture-only and non-agriculture-only rural households as well as for total

rural households in the North and South across different district groups in 2005/6 and 2012/13. We were not able to include the mixed households because the sample sizes in the GLSS surveys for this group were too small.

Table 5.4 confirms a widely held view that the rural poverty rate is much higher in the North than in the South; in fact the poverty rate was nearly twice as high in the North as in the South in in 2012/13 (54.4 percent compared to 28.9 percent). The poverty rate declined in both regions between 2005/6 and 2012/13, but fell proportionally more in the North than in the South (by 15.3 percent and 9.1 percent, respectively). So although the poverty rate is still much higher in the North, at least the regional gap is closing. Another general result is that households are poorer than nonagricultural households in both regions, a pattern that did not change between 2005/6 and 2012/13. Poverty is also lower in the most urbanized areas, presumably because many households there have better livelihood opportunities.

Table 5.4. Rural poverty rate in the north and south across district groups

District group	North			South		
	Agri. only	Non-agri. only	North total	Agri. only	Non-agri. only	South total
2005/2006						
Big city districts				–	–	11.4
2nd-tier city districts	44.7	–	39.3	–	–	41.3
3rd-tier city districts	64.1	32.3	61.6	31.3	19.5	27.7
Non-city districts	65.6	62.4	66.8	39.7	14.5	35.5
Regional total	64.4	50.4	64.2	36.6	16.0	31.8
2012/2013						
Big city districts				–	10.7	24.8
2nd-tier city districts	40.4	10.4	38.7	5.4	5.3	4.2
3rd-tier city districts	64.8	39.2	55.3	32.8	19.7	28.6
Non-city districts	58.4	49.6	55.2	32.7	14.2	29.9
Regional total	59.2	42.3	54.4	32.7	16.1	28.9
Difference, 2012/13–2005/06						
Big city districts				–	–	13.5
2nd-tier city districts	–4.2	–	–0.5	–	–	–37.1
3rd-tier city districts	0.7	6.9	–6.3	1.5	0.2	0.9
Non-city districts	–7.2	–12.8	–11.6	–6.9	–0.3	–5.5
Regional total	–5.2	–8.1	–9.8	–3.9	0.1	–2.9

Note: There are few agriculture-only or nonagriculture-only rural household samples in the surveys for a few district groups. " – " represents such a situation in a particular type of district, where the weighted rural population is less than 100,000 and we therefore did not report the poverty rate.

Source: Authors' calculation using data from GLSS5 for 2005/6 and GLSS6 for 2012/13 (GSS 2008 and 2014).

Looking at the changes between 2005/6 and 2012/13, the biggest decline in the North was in the rural districts without cities, where it fell proportionally more among nonagricultural than agricultural households. It would seem that the growth in nonfarm employment opportunities for rural households has been a step out of poverty for many. In the South the biggest poverty reduction was in districts with 2nd-tier cities, whilst poverty worsened in districts with big cities. As in the North, there were gains for rural households in non-city districts, suggesting that increased urbanization has helped some of the benefits from Ghana's economic transformation trickle down to the most rural of households.

5.4 Urbanization and Agricultural Intensification

5.4.1 Farm Size Distribution

Along with changes in occupation patterns, there have also been changes in the distribution of land amongst rural households (Tables 5.5a and 5.5b). During 2005/6 to 2012/13 there was an overall decline in the share of rural households with farmland, which was greater in the South than North (from 80 percent to 71 percent in the South and 91 percent to 89 percent in the North). The decline was most marked in Southern big city districts (from 42 percent to 12 percent). However, despite these changes, the majority of rural households still held cultivated land in 2012/13 in all types of districts except big city districts (Table 5.5b).

Nationally, the share of small farms with less than 2 ha declined from 53.3 percent in 2005/6 to 49.3 percent in 2012/13. This was offset by some increase in the shares of medium-sized farms (2–5 ha and 5–20 ha), while the share of farms larger than 20 ha remained at about 1 percent. Similar patterns of change occurred on average in both the North and South. However, there was a reverse trend in the most urbanized districts of the South, where the shares of small farms increased from 77 percent to 90 percent in big city districts and from 52.6 percent to 61.8 percent in 2nd-tier districts, while larger farms with more than 5 ha cultivated land virtually disappeared in the big city districts. Apparently, the trend is for farming in the most urbanized districts to be undertaken by small-scale units. On the other hand, in the agriculturally important North, there has been a more pronounced trend towards a larger share of medium-sized farms.

However, these changes in the distribution of rural households by farm size seem not to have affected the average farm sizes of small, medium, and large

Table 5.5a. Shares of rural households by farm size and district group, 2005/6

District Group	Percent landless house-holds	Percent landed households by farm size				Percent landed households
		< 2 ha	2–5 ha	5–20 ha	> 20 ha	
North						
2nd-tier city districts	27.0	55.5	39.0	5.6	–	73.0
3rd-tier city districts	7.9	49.6	28.9	17.8	3.8	92.1
No city districts	8.1	40.7	42.0	14.3	3.1	91.9
Total North	9.0	43.9	38.0	16.2	3.2	91.0
South						
Big city districts	57.9	77.2	16.2	3.1	3.5	42.1
2nd-tier city districts	29.4	52.6	34.6	12.7	–	70.6
3rd-tier city districts	22.6	65.9	25.8	7.6	0.7	77.4
No city districts	16.5	52.0	31.1	15.1	1.2	83.5
Total South	20.2	58.0	28.8	11.8	1.3	79.8
National total	16.8	53.3	31.8	12.9	1.9	83.2

Note: Land is defined as cultivated farmland.

Source: Authors' calculation using data of GLSS6 (GSS 2014).

Table 5.5b. Shares of rural households by farm size and district group, 2012/13

District group	Percent landless households	Percent landed households by farm size				Percent landed households
		< 2 ha	2–5 ha	5–20 ha	> 20 ha	
North						
2nd-tier city districts	22.8	40.5	37.7	20.6	1.2	77.2
3rd-tier city districts	7.7	49.3	35.3	13.1	2.3	92.3
No city districts	10.2	32.5	44.4	21.7	1.4	89.8
Total North	10.3	37.3	41.7	19.4	1.7	89.7
South						
Big city districts	87.8	90.3	9.7	–	–	12.2
2nd-tier city districts	42.7	61.8	24.5	12.9	0.8	57.3
3rd-tier city districts	35.0	61.6	29.2	8.4	0.8	65.0
No city districts	22.3	52.2	34.5	13.1	0.2	77.7
Total South	28.8	55.8	32.3	11.4	0.4	71.2
National total	23.2	49.3	35.6	14.2	0.9	76.8

Note: Land is defined as cultivated farmland.

Source: Authors' calculation using data of GLSS6 (GSS 2014).

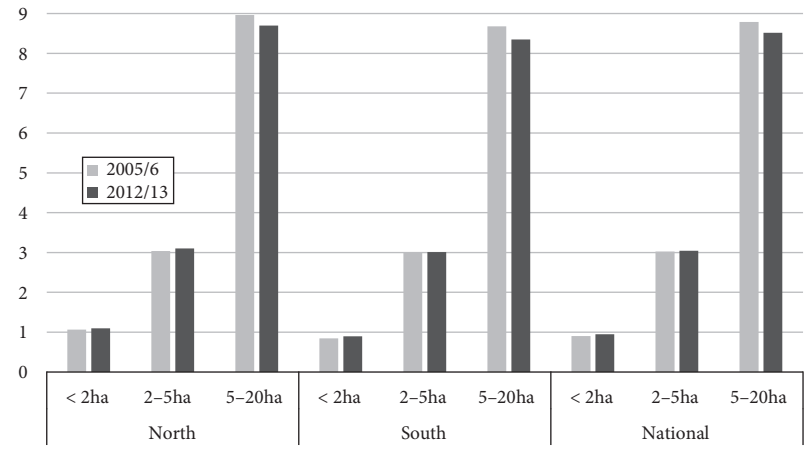

Figure 5.5. Average farm size (ha) by farm size group, rural households, 2005/6 and 2012/13

Note: Farm size is defined according to cultivated farmland and only rural households with cultivated farmland are counted.

Source: Authors' calculation using GLSS5 and GLSS6 (GSS 2008, 2014).

farms (Figure 5.5). The average farm size for the small farms with less than 2 ha is about 0.91 and 0.95 ha in 2005/6 (GLSS5) and 2012/13 (GLSS6), respectively, at the national level, and 3.02 ha and 3.05 ha for the farm size group of 2–5 ha in these two rounds of the surveys, while farms of 5–20 ha in size have become marginally smaller on average. These trends are similar in both the North and South.

5.4.2 Farming Practices

Urbanization has had important impacts on rural livelihoods, increasing the share of rural households engaged in the nonfarm economy. It has also contributed to an increase in the share of small, part-time farms in urbanized areas, and a shift towards more medium-sized farms in the agriculturally important areas of the North. The induced innovation hypothesis predicts that urbanization and associated increases in population density and market access should lead to more intensive farming practices, both in terms of land-use patterns and the choice of technologies. We examine these relationships in this section.

Table 5.6. Share of rural farm households using organic and inorganic fertilizer, 2012/13

Type district		< 2 ha	2–5 ha	5–20 ha	> 20 ha	Total
North	2nd-tier city districts	38.7	59.1	70.3	82.0	53.4
	3rd-tier city districts	55.5	67.2	63.9	84.5	61.4
	No city districts	48.3	69.0	73.1	93.5	63.5
	Total North	50.3	68.2	71.3	89.8	62.4
South	Big city districts	3.6				3.3
	2nd-tier city districts	15.7	36.4	50.4	0.0	25.1
	3rd-tier city districts	23.3	42.3	58.6	48.7	32.0
	No city districts	28.6	47.6	56.1	29.2	38.8
	Total South	26.2	45.7	56.6	40.4	36.1
National	Total	32.7	55.0	63.7	73.7	45.4

Source: Authors calculations using GLSS6.

Fertilizer use, particularly inorganic fertilizer, has increased significantly in Ghana from 3.7 kg NPK/ha arable land in 2002 to 35.8 kg/ha in 2013 (Chapter 4). Still, only 45 percent of farmers were using either organic or inorganic fertilizer in 2012/13 (GLSS6), and the share of farmers using fertilizer was nearly twice as high in the less-urbanized North than in the more-urbanized South (Table 5.6), which can be explained by problems with declining soil fertility in the North (Chapters 4 and 6) rather than urbanization. Table 5.6 also shows an inverse relationship between the degree of urbanization of a district and the share of farmers using fertilizer in both the North and South, i.e., the lower the level of urbanization for a district group, the higher percentage of farmers that use fertilizer. Thus, rather than any pattern of induced fertilizer adoption from urbanization, these data suggest that the main drivers of increased fertilizer use may have been a) the need to maintain soil fertility and crop yields in the North as fallow periods were shortened, and b) possibly the introduction the government's fertilizer subsidy policy in 2007/8.

Herbicide and insecticide use in Ghana has also increased sharply in recent years, from less than 2 percent of all farm households in 1998 to about 55 percent in 2013 (Grabowski and Jayne 2016). Nationally, about 70 percent of farm households used herbicides or/and insecticides in 2012/13 (GLSS6), and with the big city district group in the South as an exception (possibly due to few observations covered by the survey), the use of herbicides/insecticides is more evenly distributed between the North and South than is fertilizer use (Table 5.7). In both the North and South, small farms are less likely to use herbicides or insecticides than medium-sized or large farms (with

Table 5.7. Share of rural farm households using herbicides or insecticides, 2012/13

Type district		< 2 ha	2–5 ha	5–20 ha	> 20 ha	Total
North	2nd-tier city districts	85.6	93.8	78.5	100.0	87.4
	3rd-tier city districts	43.1	73.3	88.1	96.1	60.9
	No city districts	59.0	81.4	92.4	93.8	76.7
	Total North	55.0	80.2	90.9	94.8	73.1
South	Big city districts	7.3				6.6
	2nd-tier city districts	56.3	62.9	94.1		62.4
	3rd-tier city districts	59.1	79.1	84.1	69.5	67.1
	No city districts	63.4	78.9	80.8	50.9	71.0
	Total South	61.5	78.7	82.0	60.7	69.4
National		59.6	79.3	86.3	83.3	70.6

Source: Authors' calculations using GLSS6 data.

Table 5.8. Share of rural households using mechanization, 2012/13

		< 2 ha	2–5 ha	5–20 ha	> 20 ha	Total
North	2nd-tier city districts	42.3	54.2	62.3	100.0	51.6
	3rd-tier city districts	20.5	43.6	51.9	96.1	34.5
	No city districts	26.5	40.1	59.4	66.6	40.3
	Total North	25.3	41.6	58.2	78.6	39.3
South	Big city districts	28.8				26.0
	2nd-tier city districts	17.1	0.0	0.0	0.0	10.6
	3rd-tier city districts	23.1	36.9	50.4	69.5	29.8
	No city districts	19.2	35.1	50.5	51.4	28.9
	Total South	20.7	35.1	49.3	60.9	28.8
National		22.0	37.8	53.6	72.8	32.6

Source: Authors' calculations using GLSS6.

exceptions for larger-than-20-ha size group in the South, (again possibly due to few observations in the survey). However, there is no consistent pattern of increased use of herbicides with levels of urbanization within the North or South, suggesting that urbanization is not inducing greater use.

Mechanization. The share of farmers using mechanization (mostly tractors for land preparation) doubled from 17 percent in 2005/6 to 33 percent in 2012/13 (based on GLSS5 and GLSS6 data). About 40 percent of farm households used mechanization in 2012/13 in the North, compared to less than 30 percent in the South (Table 5.8). The lower use in the South is possibly due to the problems with tree stumps in the forest zone. The share of farm households using machinery also increased with farm size in both the North and

South, but more so in the agriculturally important North. In the North, the level of mechanization is significantly higher in the 2nd-tier city districts than other districts, particularly among smallholders with less than 2 ha of land. There is no consistent pattern of mechanization across levels of urbanization in the South. The factors driving mechanization are explored more fully in Chapter 9.

5.4.3 Regression Analysis of the Links between Urbanization and Modern Input Adoption

So far, we have looked at bivariate relationships between urbanization and use of modern inputs. Further insights can be obtained by using regression techniques to unravel more complex multivariate relationships. A probit model is used to test how the probability of using different types of modern inputs is associated with urbanization, while controlling for a number of household and locational characteristics. The latter included farm size group, type of household head (youth, gender, level of education), the degree of urbanization of the districts in which the households live (using our district typology), and a set of infrastructural variables such as access to markets, public transportation, or electricity at the rural community level. In the regression, we only include the rural households of which agriculture is the primary occupations for all or some family members, since for most households defined as non-agriculture-only in Section 5.3any agricultural activity appears to be part-time.

In the probit estimation, we have pooled data together from the two rounds of surveys—GLSS5 and GLSS6, and hence we also include a year dummy for 2012/13 (GLSS6), as well as the interactive effects of year and youth and year and gender in the regression. Still, there are too many missing variables in the regressions to test any causal relationships (e.g., we are unable to control for wages or missing household effects), but they do reveal some interesting patterns of association. We only report the marginal effects of the probit estimation in Table 5.9.

Urbanization, as captured through our typology, has some significant but complex links with agricultural intensification. Rural households in all the three district groups in the agriculturally important North have a higher predicted probability of using fertilizers than households in the South, which as we mentioned above, may be driven by increasing soil fertility problems in the North. However, contrary to the bivariate relationship of Table 5.5, in

Table 5.9. Probit model regressions for input use, pooled data of GLSS5 and GLSS6

Independent variable	(1) Fertilizer	(2) Herbicides/ Insecticides	(3) Hiring labor	(4) Mechanization
Farm size				
Less than 2 ha	−0.278***	−0.147***	−0.223***	−0.286***
	(0.0461)	(0.0449)	(0.0501)	(0.0389)
2–5 ha	−0.140***	−0.0236	−0.116**	−0.187***
	(0.0463)	(0.0447)	(0.0503)	(0.0388)
5–20 ha	−0.0842*	0.0709	−0.00961	−0.0869**
	(0.0475)	(0.0462)	(0.0519)	(0.0399)
Base is > 20 ha				
Types of district groups				
2nd-tier city districts, North	0.250***	0.174***	0.177***	0.0803**
	(0.0452)	(0.0522)	(0.0508)	(0.0383)
3rd-tier city districts, North	0.187***	−0.172***	−0.0150	−0.000881
	(0.0184)	(0.0181)	(0.0205)	(0.0172)
No city districts, North	0.139***	−0.0827***	0.0103	−0.00338
	(0.0138)	(0.0137)	(0.0154)	(0.0128)
Big city districts, South	0.0217	−0.0730	0.180*	0.175**
	(0.107)	(0.109)	(0.103)	(0.0857)
2nd-tier city districts, South	−0.00633	−0.159***	0.0604	−0.0807
	(0.0621)	(0.0587)	(0.0669)	(0.0630)
3rd-tier city districts, South	−0.0693***	−0.0404***	−0.0254	−0.00712
	(0.0156)	(0.0150)	(0.0166)	(0.0140)
Base is no city districts, South				

Notes: Farm size is based on cultivated area. Rural households defined as agricultural only or agricultural and nonagricultural mixed households in GLSS5 are included in the regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' own estimation using GLSS5 and GLSS6 data.

which we could not find a consistent pattern of increased use of fertilizer with levels of urbanization within each of the two regions, the probit estimation shows that in the North, the higher the urbanization level—measured by the size of cities in different district groups, the higher the predicted probability of using fertilizer. For example, compared with households in the South's districts without cities, the predicted probability of using fertilizer increases by 25 percent in the North's districts with secondary cities, while the marginal effects are smaller in Northern districts with 3rd-tier cities or without cities, at 18.7 percent and 13.9 percent, respectively.

The probit estimates show a similar relationship between farm size and use of fertilizer as we observe in Table 5.6, i.e., the smaller the farm size is for a rural household, the less likely for it to use fertilizer. For example, the predicted probability of using fertilizer is 27.8 percent lower for households

Table 5.9. Probit model regressions for input use, pooled data of GLSS5 and GLSS6 (cont.)

Independent variable	(1) Fertilizer	(2) Herbicides/ Insecticides	(3) Hiring labor	(4) Mechanization
Year dummy for 2013	0.156***	0.346***	–0.0743***	0.149***
	(0.0108)	(0.00876)	(0.0124)	(0.00993)
Youth-headed household	0.00104	0.0234*	–0.0433***	0.00602
	(0.0134)	(0.0134)	(0.0147)	(0.0123)
Female-headed household	–0.0695***	–0.0842***	0.0612***	–0.0385***
	(0.0159)	(0.0155)	(0.0168)	(0.0144)
Year dummy* Youth	0.0596**	–0.0663**	–0.0200	0.0295
	(0.0266)	(0.0269)	(0.02904)	(0.0245)
Year dummy* Female	–0.00362	–0.0440	–0.0184	–0.0773**
	0.02845	(0.0286)	(0.0303)	(0.0261)
Education level				
Primary completed	0.0265**	0.0647***	0.0609***	0.0601***
	(0.0134)	(0.0131)	(0.0144)	(0.0121)
Secondary completed	0.0828***	0.0961***	0.0833***	0.0863***
	(0.0267)	(0.0276)	(0.0303)	(0.0241)
University and above	0.0130	0.352**	0.184	0.136
	(0.0894)	(0.148)	(0.142)	(0.143)
Base is no education				
Access to markets	–0.0335**	–0.0276*	0.0314*	–0.0278**
	(0.0145)	(0.0143)	(0.0161)	(0.0126)
Access to public transportation	0.0418***	0.103***	0.0769***	0.0904***
	(0.0125)	(0.0124)	(0.0138)	(0.0116)
Access to electricity	–0.00848	–0.0381***	0.0284**	–0.00746
	(0.0124)	(0.0122)	(0.0134)	(0.0116)
Observations	13,388	13,340	13,340	13,340

Notes: Agricultural only or agricultural and nonagricultural mixed rural households in GLSS5 are included in the regressions. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Authors' own estimation using GLSS5 and GLSS6 data.

with less than 2 ha of land compared to households with 20 ha or more, but the probability is only 14.0 percent and 8.4 percent lower for those with land of 2–5 ha and 5–20 ha, respectively. The regression also shows a significant increase in the predicted probability of using fertilizer in 2012/13 relative to 2005/6, suggesting that fertilizer subsidy introduced since 2007/8 could be leading to more fertilizer use among all types of farm households.

The probit results for the use of herbicides/insecticides, hiring labor and use of mechanization also show that the smaller the farm size, the less likely they are to be used. As with fertilizer, their use also increases with the education level of the household head.

While predicted probabilities of fertilizer, herbicide/insecticide and mechanization use are higher in 2012/13, they are lower for hired labor use. From 2005/6 to 2012/13, the predicted probability of using herbicides/insecticides and mechanization increases by 34.6 percent and 14.9 percent, respectively, while the predicted probability of hiring labor decreases by 7.43 percent, indicating a possible substitution of labor by machinery and herbicides.

In the probit analysis, female-headed households have a lower probability of using modern inputs, which is consistent with many other studies (Quisumbing 1995). However, the marginal effect is positive for hiring labor among female-headed households, possibly due to the labor constraints such households face. The sign of the marginal effect for the youth dummy is not consistent and often insignificant in the regressions. This result is somewhat surprising, since younger farmers might be expected to be more open to new technologies and knowledge than older adults.

The marginal effect of urbanization on the use of other inputs is not always consistent with that for fertilizer use. Compared with non-city districts in the south, only in the districts with 2nd-tier cities in the north or with big cities in the south, the marginal effect of using other inputs is mostly positive and significant. The sign of marginal effect tends to be negative, if significant, for the other types of district groups in both North and South.

Among the three variables related to market access or public infrastructure, the marginal effect of input use is positive only for the access to public transportation variable. The probability for any modern input use or labor hiring increases by 4.18–10.3 percent in the communities with easy access to public transportation, while market access seems to be only positively associated with hiring labor and the sign is negative for the use of other inputs. Market access is measured by whether a rural community has a daily or periodic market. It is also possible that better access to public transportation allows farmers to get access to market through traders who can come to villages directly.

5.5 Conclusions

Ghana has rapidly urbanized in recent decades, through the development of many secondary and small cities as well as through growth of large cities, particularly in the South of the country. Urbanization has diversified rural livelihood opportunities, leading to significant growth in the share of rural households engaged primarily in the nonfarm economy. In addition to

migration to urban areas, there has been widespread diversification of rural households into the rural nonfarm economy on a full- or part-time basis. The result has been a substantial decline in the share of households who depend primarily on agriculture. Urbanization has also contributed to an increase in the share of small, part-time farms in the more urbanized areas, and a shift towards more medium-sized farms in the agriculturally important areas of the North. These patterns of change in household employment have also led to spatial patterns of change in the incidence of poverty. Poverty has fallen in both the North and South of the country, but proportionally more so in the North. And while the impacts are mixed in districts with larger cities, poverty rates have fallen for all household types in the non-city districts. It would seem that increased urbanization has helped some of the benefits from Ghana's economic transformation trickle down to the most rural of households.

The induced innovation hypothesis predicts that urbanization and associated increases in population density and market access should lead to more intensive farming practices, both in terms of the land-use patterns and the choice of technologies. Although there has been substantial uptake of fertilizers, herbicides, and mechanization in recent years, we find only limited support for the hypothesis that this has been driven by urbanization, and this support is mainly in the North and in some districts with big cities in the South. More generally, fertilizer appears to be used mainly for offsetting declining soil fertility rather than intensification. Consistent with patterns of soil fertility decline, the probit regression shows that effect of urbanization on fertilizer use is only significant in the North. This is also consistent with findings in Chapter 6.

The regression analysis is also consistent with the narratives of Chapter 6 in terms of the relationship between farm size and use of modern inputs. Chapter 6 describes how farmers in the savanna and transition zones are cropping larger areas and using mechanization to reduce labor requirements in the face of increasing wages. In the probit regressions here, the probability of fertilizer use and using other inputs and mechanization and hiring labor increases significantly with farm size.

Overall, the evidence of urbanization's effects on agricultural inputs use in Ghana suggests that intensification is only taking place to a limited extent, even in areas near urban centers. Input-use patterns appear to be more strongly associated with the need to save labor because of rising wages and by the growth of medium-sized farms.

References

Ackah, C., C. Adjasi, and F. Turkson. 2014. "Scoping Study on the Evolution of Industry in Ghana". Learning to Compete Working Paper No. 18. Washington: Africa Growth Initiative (AGI) at Brookings.

Berdegue, J., F. Carriazo, B. Jara et al. 2015. "Cities, Territories and Inclusive Growth: Unraveling Urban–Rural Linkages in Chile, Colombia, and Mexico." *World Development* 73: 56–71.

Binswanger, Hans P., and John McIntire. 1987. "Behavioral and Material Determinants of Production Relations in Land-abundant Tropical Agriculture." *Economic Development and Cultural Change* 36(1): 73–99.

Binswanger-Mkhize, H., T. Johnson, P. Samboko, and L. You. 2016. "The Impact of Urban Growth on Agricultural and Rural Nonfarm Growth in Kenya." Rome: International Fund for Agricultural Development.

Deichmann, U., F. Shilpi, and R. Vakis. 2008. "Urban Proximity, Agricultural Potential and Rural Non-farm Employment: Evidence from Bangladesh." *World Development* 37(3): 645–60.

Grabowski, P., and Jayne, T. 2016. "Analyzing Trends in Herbicide Use in Sub-Saharan Africa." East Lansing: Food Security and International Development Working Paper No. 142. Department of Agricultural, Food, and Resource Economics, Michigan State University.

GSS (Ghana Statistical Service). 2003. Population and Housing Census 2000. Census data. Accra.

GSS (Ghana Statistical Service). 2008. Ghana Living Standards Survey Round 5 (GLSS 5). Survey Data. Accra.

GSS (Ghana Statistical Service). 2013. Population and Housing Census 2010. Accra.

GSS (Ghana Statistical Service). 2014. Ghana Living Standards Survey Round 6 (GLSS 6). Survey data. Accra.

Haggblade, S., P. Hazell, and J. Brown. 1989. "Farm–Nonfarm Linkages in Rural Sub-Saharan Africa." *World Development* 17(8): 1173–201.

McIntire, John, Daniel Bourzat, and Prabhu Pingali. 1992. "Crop Livestock Interaction in Sub-Saharan Africa." Washington, DC: World Bank.

Pingali, Prabhu, Yves Bigot, and Hans P. Binswanger. 1987. *Agricultural Mechanization and the Evolution of Farming Systems in Sub-Saharan Africa*. Baltimore, MD: Johns Hopkins University Press.

Quisumbing, Agnes. 1995. "Gender Differences in Agricultural Productivity: A Survey of Empirical Evidence." FCND Discussion Paper No. 5. Washington, DC: IFPRI.