Chapter 9

Malawi

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During 2000–06, Malawi's agricultural sector was one of the worst performing in Sub-Saharan Africa, with its gross domestic product (GDP) declining by an average 0.6 percent per year (World Bank 2010). Given that agriculture constituted more than one-third of Malawi's economy, its stagnation slowed overall economic growth in the country, despite nonagriculture's stronger performance. Population growth also outpaced economic growth, causing per capita incomes to fall. By 2006 Malawi and its agricultural sector were clearly in crisis. Poverty remained high and widespread, and malnutrition and food insecurity were worsening (Malawi, NSO 2005; Harrigan 2008).

It is true that Malawi is one of the most densely populated countries in Africa, and that it is prone to the detrimental effects of climate variability and extreme weather events, particularly droughts (Pauw et al. 2010). However, Malawi does have more favorable agro-ecological conditions than many other African countries (Diao et al. 2007). Indeed, agriculture's poor performance during the early 2000s stood in stark contrast to that of the 1990s, when the sector grew by more than 7 percent per year and was the driving force behind rising per capita GDP (World Bank 2010). This rapid growth was at least partly a result of structural reforms, which, despite sequencing and implementation problems, removed many distor-

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tionary market interventions (see Kherallah and Govindan 1999; Orr and Mwale 2001; Harrigan 2003; Dorward and Kydd 2004). These reforms addressed some of the constraints on agricultural growth, but many still remained in effect at the end of the 1990s (and some may have emerged from the reforms themselves; see Chilowa 1998). These constraints include, among others, inadequate rural infrastructure and high transaction costs (Fafchamps, Gabre-Madhin, and Minten 2005; Dorward 2006), a lack of access to credit and modern inputs (Diagne and Zeller 2001), and improper land management practices (Carr 1997).

The structural explanation for slower agricultural growth in Malawi was that land expansion was the driving force behind agricultural growth in the 1990s, and this became increasingly unsustainable because of high rural population density (and seasonal labor shortages; see Alwang and Siegel 1999; Orr 2000). Indeed, the expansion of harvested land area accounted for three-fifths of production growth during 1997–2005, with the rest driven by yield improvements (FAO 2010). In 2006, recognizing the need for an intensification strategy to address the food crisis, the Government of Malawi implemented an extensive new program to subsidize and distribute modern inputs to smallholder farmers. This effort helped generate higher agricultural and national economic growth of 6.5 and 5.5 percent per year, respectively, during 2006–09 (Sanchez, Denning, and Nziguheb. 2009; World Bank 2010; Dorward and Chirwa 2011). The 2006 program was not the first attempt to publically provide farm inputs in Malawi, but previous initiatives had faced external opposition and other implementation problems (see Harrigan 2008).

Recent surveys suggest that poverty in Malawi fell between 2006 and 2009 (Malawi, NSO 2009). However, this reduction occurred mainly in urban areas and the northern region of the country. Therefore, despite higher national maize production resulting from the new input-subsidy program, there remains a pressing need for broad-based growth and poverty reduction. Domestic demand and marketing constraints, which cause maize prices to fall when production expands, impede progress by limiting income growth for farmers. Indeed, the need for smallholder farmers in Malawi to diversify into staple crops other than maize has long been recognized (see, for example, Orr and Mwale 2001).

Given the recent successes in improving food security in many parts of rural Malawi, there is now greater scope for a more diversified agricultural growth strategy (see Harrigan 2008). In this chapter we evaluate different agricultural growth paths for Malawi in terms of their ability to reduce poverty throughout the country. We also estimate the fiscal implications of the investments needed to accelerate agricultural growth. For this purpose we develop a recursive dynamic computable general equilibrium (DCGE) model of Malawi based on the one described in Chapter 2 of this volume. One of the distinctive features of this case study is its integration of a "farm typology" within the DCGE model, which allows a higher resolution assessment of growth and poverty effects.

The chapter is structured as follows. We first review the structure of Malawi's agricultural sector and introduce the farm typology. We then describe the structure of the Malawian DCGE model and its underlying data sources. The model results are then presented for the baseline growth scenario and the accelerated agricultural growth scenarios. This is followed by the results from the investment analysis. We conclude the chapter by summarizing our findings.

Agriculture in Malawi

Agriculture provides a vital source of income for most Malawians. At the national level, the sector contributes more than 40 percent to GDP and 60 percent to foreign earnings (exports), and it employs three-quarters of the population.[1] Malawi has one of the highest population densities in Sub-Saharan Africa, and the average landholding size is only 1.13 hectares for rural households (World Bank 2010). Given these land constraints, we focus our discussion of the structure of agriculture around the importance of farm size in determining the cropping patterns and opportunities of farmers. Malawi can be divided into eight subnational regions or agricultural development domains (Figure 9.1). We define the three rural farm household groups in each region according to the size of their landholdings. Our discussion of this typology of farmers focuses on the most important staple crop (maize) and export crop (tobacco).

Almost all farmers grow maize. However, farmers with small landholdings (less than 0.75 hectares per household) rarely grow tobacco and other export-oriented crops (Table 9.1). This group of farmers, which we call "small-scale farmers," is characterized by small landholding sizes and few opportunities for export crop production. About one-third of Malawian farmers fall into this small-scale category, of which two-thirds reside in the three larger southern regions, Lilongwe, Machinga, and Blantyre (see Table 9A.1 in the appendix to this chapter). The average landholding size for small-scale farmers is 0.69 hectares, of which 0.36 hectares is allocated to maize and 0.16 hectares to pulses. Not only are landholdings small, but average crop yields for small-scale farmers are also slightly below the national average. Small-scale farm households also tend to have lower per capita incomes and expenditures and a higher incidence of poverty. Although this farm group makes up only 30 percent of the total population, they account for 36 percent of the poor population.

Unlike small-scale farmers, farmers with more than 3 hectares of land are far more likely to engage in export-crop production, especially tobacco, tea, and sugar-

Figure 9.1— Agricultural districts in Malawi

Source: Authors.

cane. Although these farmers harvest 14 percent of cropland, they account for a much larger share of the land allocated to export crops and a smaller share of non-maize foodcrops, such as roots and pulses. We call these farmers "large-scale farmers" although it should be noted that this group includes farms ranging from 3 hectares to large estates. The average large-scale farm is 8 hectares in size, although this number is biased upward by a relatively small number of very large farms, such that the median farm size for this group lies well below the mean. Large-scale farms tend to have higher than average per capita expenditures: US$204 per person compared to US$122 for small-scale rural farmers. Accordingly, the incidence of poverty

Table 9.1—Land and population distribution across farm and nonfarm households

Indicator	All farm and nonfarm	Urban farm	Urban nonfarm	Rural farm: All sizes	Rural farm: Small (<0.75 ha)	Rural farm: Medium (0.75–3.0 ha)	Rural farm: Large (>3 ha)	Rural nonfarm
Population (thousands)	12,173	654	727	10,335	3,731	6,240	363	458
Number of households	2,694	133	189	2,237	942	1,241	54	134
Household size	4.5	4.9	3.8	4.6	4.0	5.0	6.7	3.4
Per capita expenditure (US$)	150.8	286.2	308.6	129.6	121.6	130.1	203.7	185.8
Poverty rate (percent)	52.4	30.0	21.2	56.7	61.0	55.6	30.6	37.5
Share of poor (percent)	100.0	3.1	2.4		35.7	54.4	1.7	2.7
Harvest area (thousand ha)	3,050	174		2,876	647	1,792	437	
Average farmland (ha)	1.13	1.31		1.29	0.69	1.44	8.02	
Maize	0.57	0.99		0.63	0.36	0.70	3.67	
Other cereals	0.05	0.01		0.06	0.04	0.08	0.09	
Roots	0.12			0.15	0.09	0.18	0.36	
Pulses and nuts	0.26	0.23		0.30	0.16	0.36	1.17	
Horticulture	0.03	0.03		0.04	0.02	0.05	0.13	
Tobacco	0.05	0.04		0.06		0.03	1.79	
Other export crops	0.04	0.02		0.05	0.01	0.05	0.81	
Crop yields (mt/ha)								
Maize	1.13	1.00		1.14	1.07	1.14	1.27	
Rice	1.17	1.24		1.11	1.12	1.17	1.61	
Sorghum and millet	0.58			0.49	0.59	0.58	0.59	
Cassava	5.50			5.28	5.25	5.54	6.07	
Groundnuts	0.75	0.75		0.66	0.68	0.76	0.78	

Source: Authors' calculations using Malawi, NSO (2005) and Malawi, MAFS (2007).

Notes: Per capita expenditure is mean expenditure unadjusted for adult equivalence. It is based on the national basic needs poverty line (approximately MWK16,165 or US$115 per person per year). ha = hectare. mt = metric ton. MWK = Malawian kwachas. Blank cells = not applicable.

among large-scale farm households is about half that of small-scale farm households (30.6 percent compared to 61.0 percent). Given lower poverty rates and because there are only about 54,000 rural farm households with more than 3 hectares of land, only 1.7 percent of Malawi's poor people live on large-scale farms. With the exception of tobacco, large-scale export-crop production is often concentrated in specific agroecological zones. For example, tea production takes place mainly in the Blantyre region, whereas sugarcane production is mainly in Salima.

Most Malawian farmers fall between the small- and large-scale groups identified above. These "medium-scale" farmers, whose plots average 1.44 hectares, tend to have more diverse cropping patterns, with similar shares of land allocated to maize and nonmaize foodcrops. This group comprises 1.2 million households. Medium-scale farmers do cultivate export-oriented crops, particularly tobacco and cotton. They have larger than average household sizes, yet their per capita expenditures are above the national average. About 56 percent of people living on medium-scale farms fall below the national poverty line; this number is well above the poverty rate of large-scale farms but only slightly below that of small-scale farms. Despite the slightly lower poverty rate, the large size of this population group means that more than half of poor Malawians live on medium-scale farms in rural areas.

Finally, urban agriculturalists are an important part of Malawi's agricultural sector. They account for almost 6 percent of harvested land (see Table 9.1). These urban farm households have cropping patterns similar to those of medium-scale rural farm households, except that they usually grow maize rather than root crops. This preference is not surprising, given the concentration of urban households in the central and southern regions of the country (roots are a more important food-crop for northern farmers) (see Table 9A.1 in the appendix to this chapter). Urban farm households also tend to be more heavily engaged in higher earning off-farm activities compared to rural households. Thus, even though farm sizes and agricultural incomes of urban farmers are similar to those of medium-scale rural farmers, the average per capita income is substantially higher for urban farmers. The poverty level among urban farm households is thus below that of even large-scale, nonfarm rural households, both of whose poverty rates are below the rural average.

This typology of farm and nonfarm households in each of the eight regions forms the underlying structure of the DCGE model. However, before describing the model we first review Malawi's agricultural policies and the constraints to faster growth in the sector.

The Malawian DCGE Model

A new SAM for Malawi was developed for this study to capture the country's economic structure in 2004, including the linkages between agricultural and nonagricultural sectors. The SAM is the main database for calibrating the Malawian DCGE model. It is built using a range of data sources, including national accounts, trade and customs data, government budgets, and household survey data. The information from these disparate sources was reconciled using cross-entropy estimation techniques (as described in Chapter 2).

The SAM contains detailed production information on 36 sectors, 17 of which are in agriculture (see Table 9A.2 in the appendix to this chapter). Crop production and land area data are drawn from Malawi, MAFS (2007), and crop technologies are from Malawi, MAFS (2003). When production information was unavailable for certain crops, information was taken from FAO (2010). Agricultural crops are grouped into five broad groups: (1) cereal crops (for example, maize, rice, sorghum, and millet); (2) root crops (for example, cassava and potatoes); (3) pulses and nuts (such as beans, oilseeds, and groundnuts); (4) horticulture (fruits and vegetables); and (5) high-value export-oriented crops (for example, tobacco, cotton, and sugarcane). The SAM also includes different forms of livestock, and forestry and fisheries. These agricultural commodities are not only traded domestically and abroad but are also used as inputs by downstream activities in manufacturing, such as food and wood processing. Conversely, agricultural producers use nonagricultural inputs, such as fertilizer and transport. Nonagricultural production technologies were drawn from the input–output table in Chulu and Wobst (2001). The SAM database on production technologies and linkages allows the DCGE model to evaluate economywide impacts of growth in different agricultural crops and subsectors.

The DCGE model also captures heterogeneity in spatial production patterns. Rural agricultural production is disaggregated into Malawi's eight main agro-ecological regions (see Figure 9.1) and into small-, medium-, and large-scale farmer groups (based on the farm typology described in the previous section). To capture the importance and unique circumstances of urban agriculture, urban agricultural production is treated as a separate region. Thus, nine subnational regions are identified in the model (eight rural and one urban) and have different initial cropping patterns.

Each group of farmers in each region responds to changes in production technology, commodity demand, and relative prices by reallocating their agricultural lands to different crops in order to maximize income. These representative farmers also reallocate labor and capital between farm and nonfarm activities, including livestock and fishing, wage employment on larger farms, and migration to nonagricultural work in more urbanized sectors. Labor in the Malawi model is separated into categories, including region-specific family farmworkers, national unskilled labor working both on and off the farm, and national skilled non-farmworkers.

By capturing farm-level information across subnational regions, the DCGE model can assess growth effects at the national level while also taking into account the microlevel decisionmaking typically associated with more detailed farm models. This linking of farm-level and economywide models is an extension of the DCGE model beyond what is used in earlier case studies in this volume. The Malawi model is an ideal tool for capturing regional and intersectoral production linkages. However, the output from each region is traded in national markets because of a lack of information on intranational trade flows in Malawi.

Finally, the DCGE model endogenously estimates the impact of alternative growth paths on the incomes of various household groups. These household groups include both farm and nonfarm households and are also disaggregated across the nine regions and rural and urban areas. The rural farm households are further separated by land size into small-, medium- and large-scale farm households. The income elasticities determining these household groups' marginal budget shares are estimated using the 2004–05 Integrated Household Survey (IHS2) (Malawi, NSO 2005) (see Table 9A.3 in the appendix to this chapter). Each household in the survey is also linked to its corresponding representative household in the DCGE model. This linkage takes place in the microsimulation module in which changes in representative households' consumption and prices in the DCGE model are passed down to their matching households in the survey, where total consumption expenditures are recalculated. The revised level of per capita expenditure for each survey household is compared to the official poverty line, and standard poverty measures are recalculated. Thus, poverty is measured in the same way as in official poverty estimates, and changes in poverty estimated by the DCGE model reflect differences in household consumption patterns and income distribution captured in IHS2.

Baseline Growth Scenario

We first evaluate poverty reduction under Malawi's current growth trends and patterns, which we call the "baseline" scenario. As mentioned above, Malawi experienced modest national growth and negative agricultural growth in 2000–06. If we expand the period to 1990–2005, national GDP growth is still low at 2.8 percent (Malawi, NSO 2007). However, agriculture's growth rate over this longer period was 4.6 percent per year. Considering that agricultural growth in Malawi is erratic due to climate variability and that average growth rate has been particularly low in recent years, we target a more modest agricultural growth rate in the baseline scenario for agricultural GDP: 2.8 percent per year for 2005–15 (Table 9.2). We therefore select the period prior to the new input subsidy program as the baseline, so that the accelerated growth scenarios, which are reported later in this chapter, will reflect in part the successes of this program. The changes in crop yields and land area needed to support the baseline level of agricultural GDP growth are reported in Table 9.3. The nonagricultural sectors are expected to maintain a similar growth

Table 9.2—GDP growth rates in model scenarios (percent)

Sector	Share of gross domestic product: Total, 2004	Share of gross domestic product: Agriculture, 2004	Annual growth rate: Baseline scenario, 2004–15	Annual growth rate: Agriculture scenario, 2004–15
Total gross domestic product	100.0		3.24	4.78
Agriculture	40.1	100.0	2.77	5.99
Cereals	11.9	29.7	2.53	6.35
Maize	10.1	25.1	2.57	6.67
Rice	1.2	2.9	2.42	4.67
Other cereals	0.7	1.7	2.18	4.11
Roots	2.8	6.9	2.41	4.51
Pulses and nuts	5.3	13.1	2.48	5.05
Pulses and oilseeds	3.4	8.6	2.38	4.70
Groundnuts	1.8	4.5	2.67	5.68
Horticulture	4.3	10.6	2.70	5.02
Vegetables	2.8	7.1	2.62	4.79
Fruits	1.4	3.5	2.85	5.46
Export crops	10.2	25.3	3.09	7.00
Tobacco	5.9	14.7	2.89	7.32
Cotton	0.9	2.3	3.33	7.40
Sugarcane	1.5	3.8	3.28	6.27
Tea	1.6	4.0	3.48	6.25
Other crops	0.2	0.6	3.37	6.93
Livestock	2.5	6.1	3.50	6.29
Poultry	1.1	2.8	3.64	6.29
Other livestock	1.4	3.4	3.38	6.30
Fisheries	2.3	5.6	3.12	4.99
Forestry	1.0	2.5	2.42	4.71
Manufacturing	10.8		3.20	3.73
Food processing	3.9		3.40	4.40
Beverages and tobacco	2.4		2.34	2.48
Textiles and clothing	1.4		3.05	3.10
Wood products	0.9		3.53	4.35
Other industry	5.7		3.23	3.09
Services	43.4		3.66	4.03

Source: The Malawian dynamic computable general equilibrium model results.
Note: GDP = gross domestic product. Blank cells = not applicable.

performance to what was observed during 1990–2005. In other words, manufacturing and service sectors grow slightly faster than agriculture (3.2 and 3.7 percent, respectively).

After accounting for changes in population, the DCGE model results show a modest per capita GDP growth rate of 1 percent during 2005–15. Consistent with this slow growth is a modest decline in poverty. The national poverty headcount

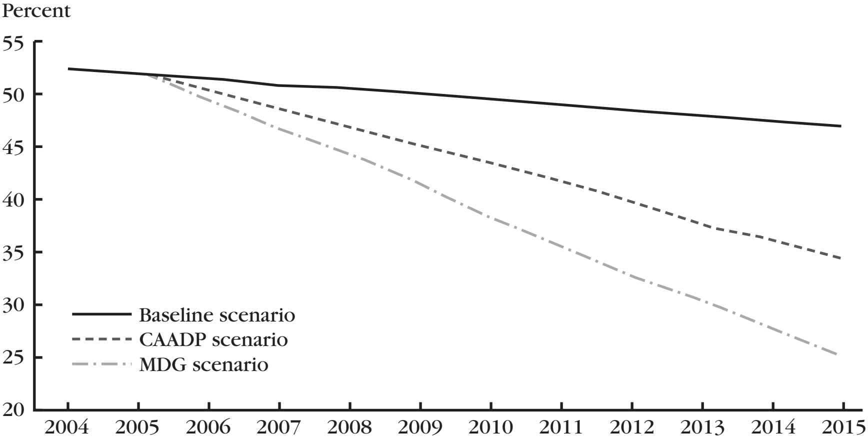
Table 9.3—National crop yields, harvested area, and production levels in model scenarios

Crop	Crop yields				Production quantity				Harvested area		
	Level (mt/ha)		Growth rate (percent)		Level (thousands of mt)		Growth rate (percent)		Share of total (percent)		
	Initial, 2004	Target, 2015	Baseline scenario, 2004–15	Agriculture scenario, 2004–15	Initial, 2004	Target, 2015	Baseline scenario, 2004–15	Agriculture scenario, 2004–15	Initial, 2004	Baseline scenario, 2015	Agriculture scenario, 2015
Cereals											
Maize	1.13	1.64	1.40	3.47	1,733	2,994	2.68	5.10	50.4	50.8	52.5
Rice	1.17	1.82	1.20	4.10	50	79	2.59	4.39	1.4	1.4	1.3
Other cereals	0.58	0.93	0.81	4.30	59	89	2.47	3.81	3.3	3.5	2.8
Roots	5.50	8.47	1.43	4.00	1,798	2,729	2.46	3.87	10.7	10.5	9.3
Pulses and nuts											
Pulses and oilseeds	0.50	0.71	1.48	3.34	245	381	2.49	4.11	16.2	15.8	15.4
Groundnuts	0.75	1.01	1.51	2.77	155	264	2.70	4.96	6.8	6.8	7.5
Horticulture											
Vegetables	11.80	15.99	1.57	2.80	252	405	2.77	4.39	0.7	0.7	0.7
Fruits	8.82	12.50	1.51	3.22	637	1,083	2.98	4.94	2.4	2.4	2.5
Export crops											
Tobacco	0.78	1.43	1.96	5.66	104	217	3.19	6.93	4.4	4.4	4.4
Cotton	0.85	1.57	2.45	5.79	53	113	3.68	7.06	2.1	2.1	2.1
Sugarcane	43.95	74.83	2.40	4.96	944	1,832	3.63	6.22	0.7	0.7	0.7
Tea	3.04	5.18	2.58	4.97	50	97	3.81	6.23	0.5	0.5	0.5
Other crops	0.45	0.81	2.39	5.51	7	14	3.63	6.79	0.5	0.5	0.5

Source: Authors' calculations using Malawi, MAFS (2007) and the Malawian dynamic computable general equilibrium model results.

Notes: Crop yields are imposed on the model, but production quantities and harvested land allocations are endogenous results from the model. mt = metric tons. mt/ha = metric tons per hectare.

Figure 9.2—National poverty headcount ratios in model scenarios



Source: The Malawian dynamic computable general equilibrium model results.
Notes: Poverty line is MWK16,165 or US$115 per person per year. The poverty headcount ratio is the proportion of the population with per capita consumption below the poverty line. CAADP: Comprehensive Africa Agriculture Development Programme. MDG = Millennium Development Goal. MWK = Malawian kwachas.

rate falls from 52.4 percent in 2004 to 47.0 percent by 2015 (Figure 9.2). Urban poverty falls from 25.4 percent to 23.7 percent by 2015; rural poverty declines from 55.9 percent to 50.2 percent during the same period. Given such modest declines in the poverty rate and the 2.2 percent annual growth in population, the absolute number of poor people increases from 6.38 million in 2004 to 7.04 million by 2015. The model results suggest that if Malawi had followed the same growth path that had previously led to the food system crisis of the mid-2000s, then poverty reduction would indeed have been limited. This result underscores Malawi's need to accelerate growth and poverty reduction if the country is to come close to achieving the first Millennium Development Goal (MDG) of halving poverty by 2015.

Accelerated Growth Scenarios

Impacts on National and Agricultural Growth

This section examines the potential contribution of different agricultural subsectors to helping Malawi achieve more rapid overall agricultural and national economic growth. More specifically, we consider what would be needed for Malawi to reach a 6 percent agricultural growth rate target—what we will call the "Agriculture" scenario or CAADP scenario. Given the country's land constraints and its recent successes in improving the use of modern farm inputs, accelerated growth in the Agriculture scenario is assumed to come from raising crop yields and livestock production efficiency. Potential crop yields are taken from field trials performed by Malawi's Agricultural Research and Extension Trust (Malawi, MAFS 2003) (Table 9.4). These numbers suggest that there is great potential to further increase agricultural production levels. However, even with the input subsidy program, it is unrealistic to expect that potential yields will be realized nationwide over the next 10 years. Therefore, we target more modest increases in crop yield increases by 2015 in the Agriculture scenario (see Table 9.3).

The baseline scenario assumes that average yields for maize, to take one example, will remain fairly constant, at 1.13–1.31 metric tons per hectare (mt/ha), for the next 10 years (see Table 9.3). The Agriculture scenario models a 3.5 percent per year improvement in maize yields. Thus, national average maize yields reach 1.64 mt/ha by 2015. This value is well below the maximum potential yields identified by field trials, indicating the potential for much higher growth in maize production than is modeled here. Even though the Agriculture scenario is less optimistic than field trials, recent trends in maize yields indicate that sustaining 1.6 mt/ha nationwide by 2015 poses considerable challenges. According to statistics from Malawi, MAFS (2007), national maize yields using local seeds have averaged only 1.27 mt/ha. Similarly, the data show that maize yields for local seed varieties were well below the target maize yield during 1997–2006. With the exception of 2002 and 2005, which were drought years, the yields from composite seeds have also fallen short of

Table 9.4—Comparison of potential yields and crop yields in model scenarios (mt/ha)

	Modeled crop yields				
Crop	Initial, 2004	Baseline scenario, 2015	Agriculture scenario, 2015	MDG, 2015	Potential yield
Maize	1.13	1.31	1.64	1.85	5.00
Beans	0.46	0.54	0.66	0.75	2.50
Soybeans	0.76	0.90	1.09	1.24	2.25
Groundnuts	0.74	0.88	1.01	1.15	2.50
Cassava	5.39	6.30	8.30	9.28	10.0
Cotton	0.84	1.10	1.57	1.93	2.50
Paprika	0.29	0.38	0.53	0.70	1.30
Burley tobacco	0.78	0.97	1.43	1.75	1.80

Sources: Malawi, MAFS (2003) and the Malawian dynamic computable general equilibrium model results.
Notes: Potential yields are based on field trial experiments by the Agricultural Research and Extension Trust. MDG = Millennium Development Goal. mt / ha = metric tons per hectare.

the target yield. Thus, the government would not only have to improve the distribution of hybrid and composite seeds but also improve current farming practices and the distribution of other inputs if it is to help farmers reach yield potentials by 2015. For these reasons, 1.64 mt/ha is considered a reasonable, albeit still challenging, maize yield target for the Agriculture scenario.

Agriculture's current poor performance means that achieving the 6 percent annual agricultural growth target poses a substantial challenge. Malawi would need first to double its 1990–2006 agricultural growth rate and then sustain this rate of growth over a 10-year period. However, modeling results indicate that, given its crop yield and agricultural productivity potentials, Malawi could achieve an average agricultural growth rate of 6 percent during 2005–15. Because agriculture forms such a large part of the Malawian economy, this acceleration in agricultural growth would significantly increase the national GDP growth rate from its current 3.2 percent to 4.8 percent per year. Faster agricultural growth will also stimulate additional growth in the nonagricultural sectors, both by increasing final demand for nonagricultural goods and by lowering input prices and fostering downstream processing. For instance, in the Agriculture scenario, the GDP growth rate in the food-processing sector increases from 3.4 to 4.4 percent per year. Expanding agriculture also generates additional demand for chemicals and transport services, which further stimulates manufacturing and service sector growth. Accelerating agricultural growth therefore has strong growth-linkage effects for the whole economy.

Impacts on Household Income and Poverty

The acceleration of the agricultural growth rate to 6 percent per year and the spill-over effects into nonagriculture cause poverty to decline by a further 12.5 percentage points. This result is shown in Figure 9.1, where the share of Malawi's population below the poverty line is 34.5 percent by 2015 in the Agriculture scenario compared to 47.0 percent in the baseline. Thus, taking population growth into account, achieving the target of a 6 percent agricultural growth rate lifts an additional 1.88 million people above the poverty line by 2015. This would be sufficient to substantially reduce the absolute number of poor people in Malawi by 2015. Food security would also improve, with annual average per capita cereal consumption rising from 153.5 to 176.7 kilograms by 2015.

Faster agricultural growth would benefit most households, although rural households benefit more than urban households in terms of increases in per capita real income. Table 9.5 shows that per capita income of rural households grows by 2.0 percent annually in the Agriculture scenario and by 1.2 percent for urban households. However, in rural areas, the large-scale farmer group benefits the most, as this group's per capita income grows at 2.5 percent per year. In contrast, the income growth rate for the small-scale farmer group is 2.0 percent. This difference is con-

Table 9.5—Household incomes and poverty in model scenarios

Region	Per capita income (thousands of MWK), 2004	Annual growth (percent)		Change (percentage points), 2004–15	Initial poverty rate (percent), 2004	Final poverty rate (percent)		Change (percentage points), 2004–15
		Baseline scenario, 2015	Agriculture scenario, 2015			Baseline scenario, 2015	Agriculture scenario, 2015	
National	17,395	0.73	1.84	1.11	52.4	47.0	34.5	–12.5
Urban	69,582	0.22	1.22	1.00	25.4	23.7	17.7	–6.0
Farm	54,717	0.52	1.57	1.05	30.0	26.1	20.6	–5.5
Nonfarm	82,891	–0.02	0.95	0.97	21.2	21.7	15.3	–6.4
Rural farm	10,678	0.81	2.01	1.20	55.9	50.2	36.8	–13.4
Karonga	11,566	0.93	2.12	1.20	62.8	55.4	41.9	–13.4
Mzuzu	11,881	0.98	2.44	1.47	55.0	49.1	33.8	–15.4
Kasungu	12,748	0.90	2.22	1.32	43.0	35.2	12.0	–15.2
Salima	7,045	1.01	2.33	1.32	56.3	47.4	32.5	–14.9
Lilongwe	8,610	0.87	2.12	1.24	47.0	41.4	28.3	–13.2
Machinga	6,575	0.84	2.10	1.26	67.7	63.2	50.2	–13.0
Blantyre	10,569	0.81	1.96	1.15	61.4	56.1	43.1	–12.9
Ngabu	6,156	0.89	2.17	1.28	70.6	64.9	48.8	–16.1
Small farms	5,450	0.80	2.04	1.24	61.0	56.1	42.4	–13.8
Medium farms	9,185	0.82	2.08	1.26	55.6	49.2	35.0	–14.1
Large farms	47,749	1.16	2.46	1.30	30.6	23.7	14.5	–9.2
Rural nonfarm	44,014	–0.01	0.87	0.88	37.5	38.1	33.5	–4.6

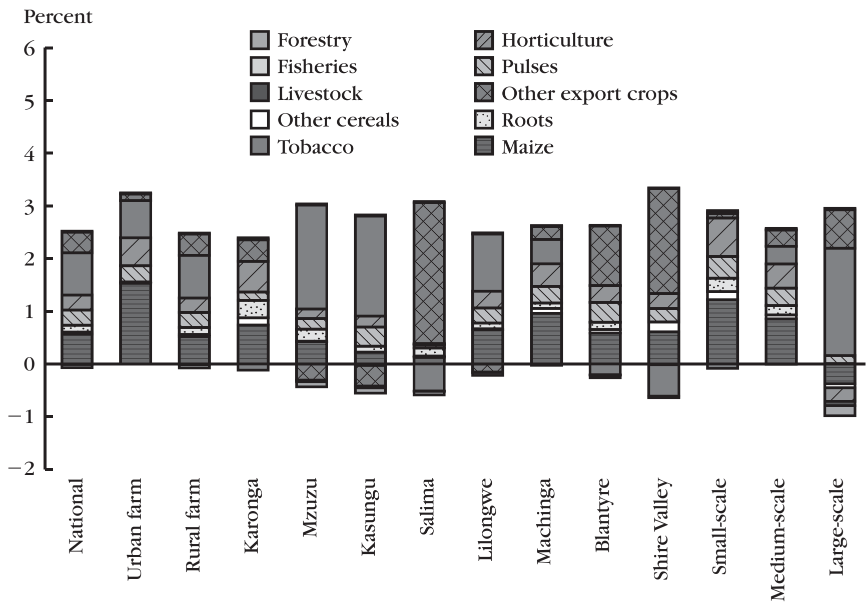
Source: The Malawian dynamic computable general equilibrium model results.
Note: MWK = Malawian kwachas.

sistent with estimated changes in poverty. Although the percentage point decline in the poverty rate is low for the large-scale farmer group (the group with the lowest initial poverty rate), the speed of poverty reduction is actually fastest for this group. Again, in contrast, the decline in poverty is slowest for smallholders relative to other farmers: 42 percent of small-scale farmers remain poor in 2015.

As discussed earlier in this chapter, higher value crops are typically grown by large-scale farmers in Malawi, which explains why large-scale farmers' incomes rise the most. This trend is evident in Figure 9.3, which shows the contributions of growth in different subsectors to changes in the value of production for different farm types. To measure these contributions we designed a series of scenarios in which additional growth in the Agriculture scenario only applied to a single agricultural subsector. For example, in the maize-led growth scenario, additional yield growth occurs only for maize while growth in the other sectors is the same as in the baseline.

Figure 9.3 highlights the importance of export-crop-led growth in determining production growth for certain regional farm types. For example, Salima benefits most from more rapid growth in sugarcane; Blantyre and Ngabu benefit most from

Figure 9.3—Sources of additional production growth by farm household group



Source: The Malawian dynamic computable general equilibrium model results.

Notes: Figure shows real production growth over and above baseline scenario growth. The sector indicated is the one driving growth in the scenario.

expanding tea and cotton production; and Lilongwe, Kasungu, and Mzuzu benefit most from faster tobacco growth. Taken together, these findings indicate that increases in export crops could generate the same additional agricultural production as maize-led growth, at least at the national level.

The figure also indicates that the sources of additional production vary across farm types. Not surprisingly, farmers who already depend heavily on maize tend to benefit more from maize-led growth. Such benefit comes from not only productivity gains in maize production but also from additional growth in other crops because of the reallocation of cropland. When maize production increases, prices for maize may fall as increased incomes for maize growers are spent on consumption of other products. In response to changes in relative prices, farmers may allocate less land to maize and grow more of other crops. The DCGE model captures both direct and indirect effects when assessing the effects of improved yields in different subsectors.

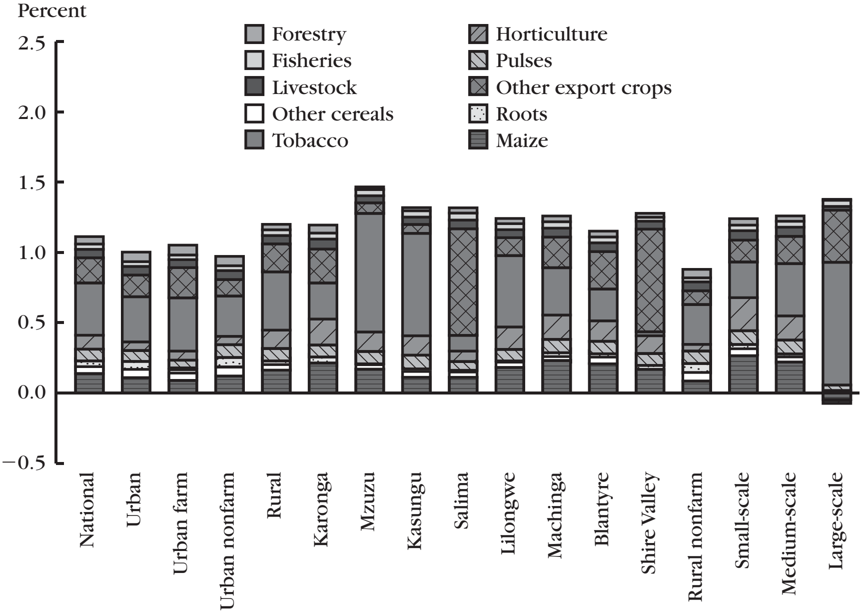
The model also takes into account potential competition for limited agricultural resources. For example, farmers in Salima and Ngabu (Shire Valley) appear to be hurt by tobacco-led growth (Figure 9.4). However, this decline in production for nontobacco-producing regions reflects the shift in nationally mobile resources (that is, unskilled labor and agricultural capital) to the production of export crops. The model captures how the increased growth potential for tobacco causes farm labor and capital to shift to the production of export crops on large-scale farms, causing declines in production by other farm types. However, these resource reallocations or indirect effects from export-crop-led growth are relatively small. Overall, the model indicates that rural and small-scale farms would benefit greatly from faster agricultural growth.

Figure 9.4 shows that rising incomes for rural farm households in Mzuzu and Kasungu are driven by growth in tobacco, with almost three-quarters of additional incomes being generated by this crop alone. In contrast, households in Salima benefit more from expanded sugarcane production. This is not surprising, given the current concentration of Malawi's sugarcane production among large-scale farmers in this region.

Decomposing Agriculture's Impacts on Poverty

The discussion above highlighted the potential contributions of agricultural subsectors to accelerating agricultural growth and poverty reduction. However, the different sizes of these subsectors make it difficult to compare the effectiveness of sectoral growth in reducing poverty. Understanding how poverty–growth linkages vary at the subsector and household levels is important for designing pro-poor growth strategies. In this section, we calculate poverty–growth elasticities that allow us to compare the pro-poorness of growth in alternative subsectors. More specifi-

Figure 9.4—Sources of additional per capita income growth by household group



Source: The Malawian dynamic computable general equilibrium model results.

Notes: Figure shows income growth over and above baseline scenario growth. The sector indicated is the one driving growth in the scenario.

cally, the elasticity measures the percentage change in the poverty rate caused by a 1 percent increase in agricultural GDP per capita.

Table 9.6 shows the calculated poverty–growth elasticities in the different subsector growth scenarios. The results indicate that agricultural growth driven by maize, pulses (particularly groundnuts), and horticulture is more effective at reducing poverty than growth in export crops.[2] For example, a 1 percent increase in maize GDP causes the national poverty headcount rate to decline by 0.74 percent, whereas a similar degree of growth in export crops, such as tea and sugarcane, causes the poverty rate to decline by only 0.57 percent. This result emphasizes the importance of maize for poor households in Malawi, both as a source of income and as an item in households' consumption baskets. Although root crops are less effective at reducing the incidence of poverty, they are somewhat more effective at reducing the severity of poverty among Malawi's poorest households, as reflected in the crop's relatively large poverty gap (depth) and squared-gap (severity) elasticities.

Table 9.6—National poverty–growth elasticities in model scenarios

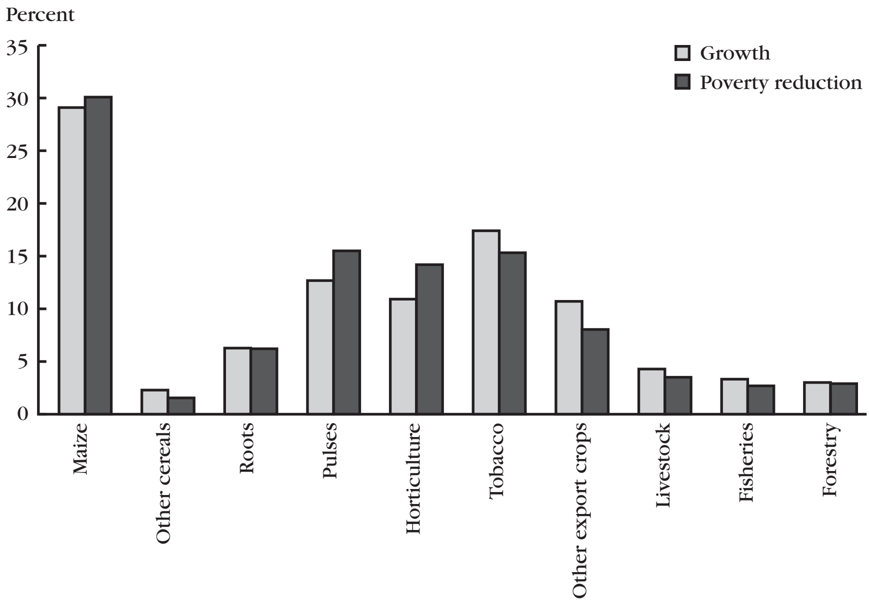
Sector driving growth	Elasticity: Poverty headcount ratio	Poverty gap	Squared poverty gap
Maize	–0.742	–1.173	–1.474
Other cereals	–0.430	–0.672	–0.833
Roots	–0.621	–1.048	–1.312
Pulses	–0.778	–1.237	–1.514
Horticulture	–0.854	–1.360	–1.694
Tobacco	–0.621	–0.855	–1.009
Other export crops	–0.572	–0.836	–1.051
Livestock	–0.335	–0.515	–0.637
Fisheries	–0.512	–0.846	–1.078
Forestry	–0.437	–0.715	–0.891

Source: The Malawian dynamic computable general equilibrium model results.
Notes: The poverty headcount ratio is the proportion of the population with per capita consumption below the poverty line. The poverty gap is the extent, measured as a proportion of the poverty line, to which a given group of poor people's consumption level falls below the poverty line. The squared poverty gap is the average of the squared values of the poverty gaps for different groups of poor people.

An alternative representation of poverty–growth linkages is shown in Figure 9.5, which compares each subsector scenario's contribution to agricultural growth and poverty reduction. The higher than average poverty–growth elasticities of growth led by maize, pulses, and horticulture can be seen in the enhanced contributions of these sectors to poverty reduction compared to growth in the Agriculture scenario. However, Malawian policymakers should not overly rely on poverty–growth elasticities when designing the country's growth strategy, because having a high elasticity can be meaningless if a sector has poor growth prospects. Thus, even though tobacco has a lower poverty–growth elasticity than does horticulture, the rapid growth potential of both sectors means that they account for a similar share of overall poverty reduction in the Agriculture scenario. Conversely, a growth strategy should not overly rely on sectors with the potential for high growth without accounting for their potential contributions to the national economy. For example, the small size of the pulse and nut sectors means that even though they have higher poverty–growth elasticities than maize, the small sizes of the sectors will limit their ability to substantially raise national agricultural GDP. A diversified agricultural strategy is clearly warranted in Malawi.

The importance of agriculture for overall growth is not only due to its large share of the economy but also because of its linkages to the nonagricultural sector. For example, increasing maize production stimulates growth in food processing while also reducing food prices and increasing real incomes, which are then spent

Figure 9.5—Share of additional growth and poverty reduction under the Agriculture scenario



Source: The Malawian dynamic computable general equilibrium model results.
Notes: Figure shows additional growth over and above baseline scenario growth. The sector indicated is the one driving growth in the scenario.

on nonagricultural commodities. We explicitly measure this linkage effect in Table 9.7. In the maize-led growth scenario, total GDP increases by 12.8 billion Malawian kwachas (MWK12.8 billion), and agricultural GDP increases by MWK11.5 billion. Thus, for every one MWK1.00 increase in agricultural GDP led by maize growth, there is an additional MWK0.11 increase in nonagricultural GDP (that is, a multiplier of 1.11). Comparison of these ratios across model scenarios suggests that even through fisheries-led growth contributes less to agricultural growth in the Agriculture scenario (see Figure 9.5), it is more effective at stimulating nonagricultural growth than is export-crop-led growth. This is because the latter has weaker economywide growth linkages, reflecting the fact that most export crops are exported directly as raw agricultural materials rather than contributing to downstream production.

Price Effects and Marketing Constraints

As a landlocked country, export opportunities are few for many of Malawi's agricultural products. Price effects and demand constraints must therefore be taken into account when developing growth strategies for the country. Domestic prices are

Table 9.7—Agriculture's economywide growth-linkage effect

Sector driving growth	Sector's initial GDP (2004 MWK million), 2004	Sectoral growth rate (percent)		Additional GDP relative to baseline (2004 MWK million)		Growth multiplier (1)/(2)
		Baseline scenario, 2005–15	Sector scenario, 2005–15	Total GDP 2015 (1)	Agricultural GDP 2015 (2)	
Maize	18,273	2.57	6.95	12,819	11,539	1.11
Other cereals	3,394	2.33	4.30	1,540	867	1.78
Roots	5,064	2.41	4.03	3,036	2,392	1.27
Pulses	9,564	2.48	4.78	6,165	4,888	1.26
Horticulture	7,717	2.70	6.96	4,915	4,196	1.17
Tobacco	10,686	2.89	8.65	7,133	6,765	1.05
Other exports	7,765	3.37	7.74	3,421	3,218	1.06
Livestock	4,466	3.50	6.13	1,649	1,629	1.01
Fisheries	4,096	3.12	4.21	904	778	1.16
Forestry	1,847	2.42	8.03	1,188	1,144	1.04

Source: The Malawian dynamic computable general equilibrium model results.

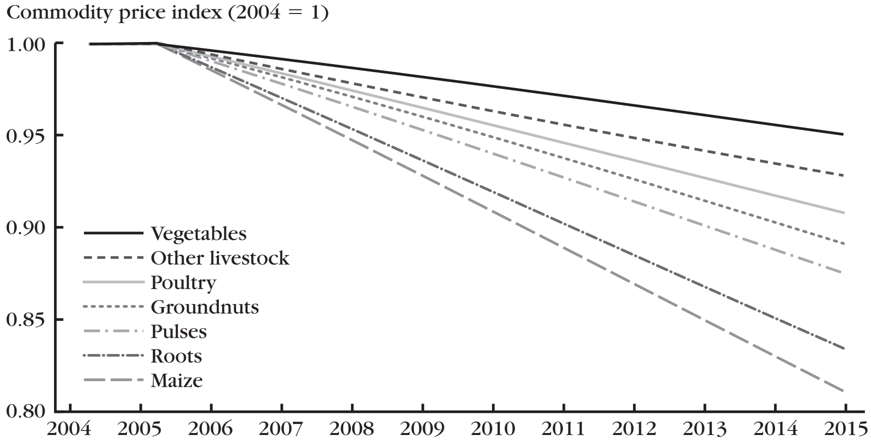
Notes: GDP = gross domestic product. MWK = Malawian kwachas.

endogenous variables in a model, which allows us to compare relative price changes in different scenarios. We report prices for selected agricultural products in Figure 9.6 to show the importance of accounting for demand constraints.

Even though maize is Malawi's most important staple food, its income elasticity is only 0.6 in rural areas. Root crops have the next lowest elasticity: 0.7 in rural areas (see Table 9A.3 in the appendix). Thus, given a 1 percent increase in household income, an average Malawian rural household increases maize consumption by 0.6 percent and root crops consumption by 0.7 percent. Moreover, given that maize is mainly consumed directly as food, it usually has weak linkages to downstream food-processing and animal-feed sectors. Accordingly, maize and root crops face stringent demand constraints when their production increases too rapidly, and without government price supports, their prices would start to decline. Although a modest decline in prices might help poor households in urban areas and net buyers in rural areas, if prices fall too much, then the income gains to the maize and root crop farmers can be significantly reduced. In contrast, groundnuts have a higher income elasticity (1.18) and stronger linkages to food processing. Thus, groundnut prices fall by less than those of maize or root crops. Finally, the much higher income elasticities of poultry and other livestock (1.32 and 1.48, respectively) mean that demand for these commodities grows more rapidly than incomes do, thereby preventing prices from falling very much in the Agriculture scenario.

Overall, the DCGE modeling analysis shows that many factors affect growth options and the prioritization of subsectors in an agricultural strategy. Our analysis

Figure 9.6—Relative producer price changes in the Agriculture scenario



Source: The Malawian dynamic computable general equilibrium model results.

Note: Figure shows real price changes relative to baseline prices.

emphasizes the following factors: poverty–growth elasticities, sectoral growth potentials, subsectors' sizes in the economy, and economywide linkage effects. Taking all factors into account, our analysis suggests that the highest priority should still be given to improving maize yields, but that pulses and horticultural crops are also possible sources of diversified growth.

Meeting the First MDG of Halving Poverty by 2015

Although achieving a 6 percent agricultural growth rate significantly reduces poverty, it is insufficient for Malawi to achieve the first MDG. As indicated in Table 9.4, crop yields in the Agriculture scenario remain below the potential yields identified by research field trials. This gap indicates further growth potential in agriculture beyond what we have modeled. Also, because of the market constraint discussed above, without growth in the nonagricultural economy, rapid agricultural growth will become unsustainable as incomes fail to keep pace with increased food supply. Thus, in the final MDG scenario, we accelerate growth in the nonagricultural sectors as well as targeting higher crop yields (see Table 9.4).

A more detailed investigation of nonagriculture's growth potential is required. However, the model results indicate that agriculture and nonagriculture would have to grow at 6.9 and 7.6 percent per year, respectively, if Malawi is to achieve the first MDG. This is equivalent to a total GDP growth rate of 7.4 percent per year, which causes the national poverty rate to fall to 25.2 percent by 2015. This rate is less than half the poverty rate for 1991 (54.0 percent). However, poverty would still remain high among certain household groups, especially in rural areas. For instance, two-fifths of the population living in the rural regions of Machinga, Blantyre, and Ngabu remain poor even in our MDG scenario. Thus, by 2015, more than half of Malawi's poor population will be living in these three southern regions. In contrast, poverty among urban households declines to 11.4 percent, and poverty in the Kasungu region is projected to fall by three-quarters (due primarily to faster tobacco growth). These data highlight the importance of increasing investments in the agricultural sector as well as targeting pro-poor interventions.

Agricultural Investment Analysis

Public Spending in Agriculture Required to Accelerate Growth

Malawi is one of a few African countries where the government currently allocates more than 5 percent of its budgetary resources to the agricultural sector (AU 2006). However, the current allocation is insufficient to maintain agricultural growth at a rate of 6 percent per year or higher. To promote general agricultural growth and poverty reduction in Malawi, the Government of Malawi and its development partners have implemented more than 150 agricultural development programs since 2000, and the government planned to spend MWK634.7 billion more between 2006/07 and 2010/11 for overall economic growth and development (Malawi, MDPC 2006). About 13.5 percent of these resources have been earmarked for priority areas covering agriculture and food security, irrigation, transport infrastructure, and integrated rural development. Although these interventions and investments may provide a better foundation for achieving higher agricultural growth, it remains unclear whether the planned investments will be sufficient to meet the country's growth and poverty-reduction targets. To assess the resource requirements, detailed information on especially the growth and poverty-reduction rates of return to such types of public investment is needed. These do not existent for Malawi, however. Thus, we use results from several studies and apply the methodology presented in both Chapter 2 and the Ghana case study (see Chapter 6) to assess the aggregate public agricultural expenditure (PAE) required to achieve an annual agricultural growth rate of 6 percent over the next 10 years and to achieve the first MDG.

Empirical evidence on the elasticity of agricultural productivity with respect to public agricultural spending in Africa shows a range of 0.08–0.38, with the elasticities being higher for development spending (for example, research and extension) compared to total spending (Thirtle, Lin, and Piesse 2003; Benin et al. 2008; Fan, Yu, and Saurkar 2008; Fan and Zhang 2008). These elasticities are comparable to those estimated for the Asia region or some specific countries, which range from 0.09 to 0.46 (Thirtle, Lin, and Piesse 2003; Fan and Zhang 2004; Fan, Yu, and

Saurkar 2008). Thus, we use a range of elasticities from the African context to represent the situation in Malawi. As the results of our investment analysis are quite sensitive to the elasticity values, we use 0.15 and 0.30 to represent a lower and upper bound (that is, a less or more optimistic public spending efficiency scenario, respectively). We do not separate the effect of public investment on the two different sources of growth (that is, total factor productivity and factor accumulation). The parameter values used in public investment simulations are summarized in Table 9A.4 in the appendix to this chapter.

Three cases are considered in estimating the required PAE underlying the DCGE model scenarios. The first is a baseline scenario, in which PAE and public nonagricultural expenditure (PNE) in 2004 constant prices continue to grow at rates of 13.8 and 8.3, respectively, during 2005–15 (growth that is consistent with trends during 1999–2005). Other factors (for example, interactions between types of spending, crowding-out effects of public spending on private investments, and nonspending factors affecting agricultural growth) also remain unchanged. Consistent with the DCGE model, 2004 is the benchmark for the investment analysis. Following the current spending patterns and growth trends, the share of PAE in total expenditure rises from 7.0 percent to 9.2 percent in 2010 and to 11.5 percent in 2015 (Table 9.8), because PAE grows more rapidly than total spending. This baseline is used to assess the additional resources required to reach the higher agricultural growth rates in the Agriculture and MDG scenarios (6 percent per year and 7 percent per year, respectively).

In the second case, accelerated agricultural growth will be supported by growth in PAE only, with other factors remaining unchanged from the baseline. In the final case, PNE also grows faster to match the higher growth rate required in nonagricultural GDP in the Agriculture scenario (3.9 percent) and MDG scenario (7.6 percent). This has an effect on agricultural growth, and we assume low-end and high-end elasticity values of 0.15 and 0.25, respectively.[3] Accelerated growth in both PAE and PNE is likely to have implications for other factors, such as the crowding-out effects of public spending on private investments, which would, in turn, affect the growth in public spending. We assume that these other factors remain unchanged from the baseline scenario and are already reflected in the estimated elasticities.

To reach the 6 percent agricultural growth rate target—when accelerated agricultural growth is supported only by increased agricultural spending—requires PAE to grow at 24.4 percent per year with the high elasticity and 35.1 percent with the low elasticity. Assuming that PNE continues to grow as in the baseline, then the total government budget is estimated to grow at 10.6 percent and 14.2 percent, respectively, for these limits on elasticities. Because agricultural spending expands more rapidly than total spending, the share of agricultural spending in total expenditure rises to 14.8–22.2 percent in 2010 and 25.8–46.4 percent in 2015 (see Table 9.8).

Table 9.8—Estimated government resource allocation in the investment analysis (percent)

Indicator	Baseline scenario	Agricultural growth from PAE growth only				Including effects of faster PNE growth			
		Agriculture scenario		MDG scenario		Agriculture scenario		MDG scenario	
		Low elasticity	High elasticity	Low elasticity	High elasticity	Low elasticity	High elasticity	Low elasticity	High elasticity
Real annual growth rate (percent)									
Total public expenditure	8.8	14.2	10.6	17.2	11.5	14.3	10.8	17.3	13.7
Agriculture	13.8	35.1	24.4	41.3	27.5	34.8	24.1	37.2	24.1
Nonagriculture	8.3	8.3	8.3	8.3	8.3	8.6	8.6	12.4	12.4
Government expenditure share (percent)									
PAE/total expenditure									
2004	7.0								
2010	9.2	22.2	14.8	27.2	16.8	21.6	14.4	20.0	12.1
2015	11.5	46.4	25.8	58.6	31.3	44.8	24.7	40.5	18.4
PAE/agricultural GDP									
2004	5.7								
2010	10.6	24.6	15.0	30.6	16.5	24.2	14.8	25.6	14.0
2015	17.6	82.9	33.4	123.3	39.7	80.5	32.6	89.3	29.6
PNE/nonagricultural GDP									
2004	51.0								
2010	66.6	65.2	65.2	52.7	52.7	66.5	66.5	65.9	65.9
2015	83.2	80.1	80.1	54.3	54.3	83.0	83.0	81.7	81.7
Total expenditure/total GDP									
2004	32.8								
2010	44.7	47.7	43.6	44.0	38.5	48.3	44.2	50.1	45.6
2015	58.1	81.4	58.9	80.8	48.7	81.9	60.1	84.6	61.7

Sources: Authors' investment analysis results based on their literature review of elasticities; data from Malawi, NSO (2007) and IFPRI (2010); and the Malawian dynamic computable general equilibrium model results.

Notes: GDP = gross domestic product. MDG = Millennium Development Goal. PAE = public agricultural expenditure. PNE = public nonagricultural expenditure. Blank cells = not applicable.

When we take the effect of accelerated growth in PNE into account, the share of agricultural spending in total expenditure reaches 24.7–44.8 percent by 2015.

These results confirm the importance of Malawi's allocating at least 10 percent of the government's total budget to agriculture in accordance with the Maputo Declaration on agriculture and food security (AU 2006). In fact, the results suggest that even in a more efficient spending scenario (that is, high elasticities), the government will need to allocate at least 25 percent of its total budget to agriculture by 2015 to achieve a 6 percent agricultural growth rate. Considering the 2006–11 period, the total resource envelope proposed in the Malawi Growth and Development Strategy (MGDS) (Malawi, MDPC 2006) seems to be in line with this requirement. However, nearly 51 percent of the total budget is earmarked for the development of the Shire–Zambezi Waterway. It is not clear how much of this money will be spent on the agriculture sector, which includes crops, livestock, forestry, and fishery. In contrast, direct public spending on agriculture and food security, irrigation and water, and integrated rural development represents only 4.3 percent of the total resource envelope in the MGDS.

The DCGE model results estimate that reaching the 6 percent agricultural growth rate target will significantly improve poverty outcomes. However, even in this accelerated growth scenario, Malawi will not be able to achieve the first MDG. Without complementary accelerated growth in the nonagricultural sectors, the binding demand or market constraints for agricultural outputs will prevent agricultural growth from translating into higher household incomes. Halving poverty by 2015 will require a doubling of the growth rate in the nonagricultural sectors (from 3.5 to 7.6 percent) and a higher annual growth rate in agricultural GDP (6.9 percent, which is more than double the baseline case of 2.8 percent). Assuming that agricultural growth is driven by growth in PAE only, government spending would have to grow by at least 24.1–37.2 percent annually (assuming a high and low elasticity, respectively) to support such high growth rates. Achieving the first MDG is not only a resource mobilization constraint for the government of Malawi but is also a challenge requiring improved efficiency of allocating and investing large amounts of resources.

Identifying Investment Priorities

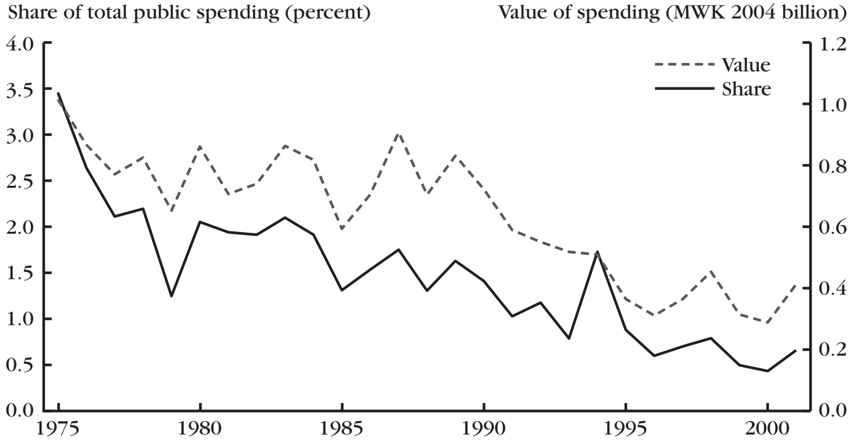
Estimating the total public resources needed to reach particular agricultural growth targets is important, but prioritizing investments is equally important. Because of a lack of historical data on specific investment programs and related outputs and outcomes, this study is unable to analyze specific investment priorities based on their potential agricultural growth and poverty-reduction rates of returns. However, we use results from other studies in an attempt to offer a guide to key investments that could help promote agricultural growth and rural poverty reduction. The evidence on the effect of different types of public spending on agricultural production and productivity in Africa and elsewhere, for example, shows that development expenditure (for example, spending on research and extension) has more favorable returns compared with other types of expenditure, whose effect may even be negative. Therefore, spending that is growth enhancing and pro-poor will be important. Similarly, spending that generates greater net positive interactions with other types of spending and greater net crowding-in effects on private investments will also be important.

The Government of Malawi's input subsidy program, for example, has been successful in raising agricultural production with strong poverty-alleviation implications, as Malawi experienced record-high maize harvests in successive years following introduction of the program. In 2007, the government spent 6.5 percent of its budget on subsidizing fertilizer packs to allow low-income farmers to purchase 50-kilogram sacks of fertilizer at MWK950 rather than the market price of MWK4,500. This input, along with good rains, helped raise the average maize yield from 0.8 to 2.0 mt/ha (Malawi, MAFS 2007). To sustain these outcomes, which are dependent on favorable weather conditions, it is crucial to broaden the portfolio to include long-term growth-enhancing public agricultural and rural investments.

A key investment area in agriculture is the support of technology generation and dissemination by means of agricultural research and development (R&D) and extension. Research on Uganda confirms that investment in agricultural R&D offers the greatest potential for enhancing productivity and reducing poverty (Fan and Zhang 2008). Similarly, Thirtle, Lin, and Piesse (2003) showed that for every 1 percent increase in yield brought about by investments in agricultural R&D, two million Africans can be lifted out of poverty. However, agricultural R&D spending in Malawi has been erratic and declining (Figure 9.7); this trend must be reversed. The current allocation is at the level of the African average of 0.5–0.6 percent, which is below the 1 percent recommended by the World Bank.

Irrigation is another key investment area that should be considered by Malawi's government. The impacts of irrigation are well known, and it is widely maintained that the success of the Asian Green Revolution in the 1960s and 1970s was built on the rapid expansion of irrigated areas (Spencer 1994). Malawi has an irrigation potential of about 162,000 hectares, but only a little more than 2 percent of total arable land is presently under irrigation (FAO 2010). Nevertheless, the Government of Malawi has recognized that irrigation and water development are key to the country's future because of their direct linkages with agriculture and energy. It is hoped that irrigation will help reduce overdependence on rainfed agriculture, and proper conservation of water will also contribute toward the generation of electricity. The government's key plans under the MGDS for 2006–11 (Malawi, MDPC 2006) included construction and promotion of small- and medium-scale irrigation schemes

Figure 9.7—Government agricultural research and development expenditure in Malawi, 1975–2001



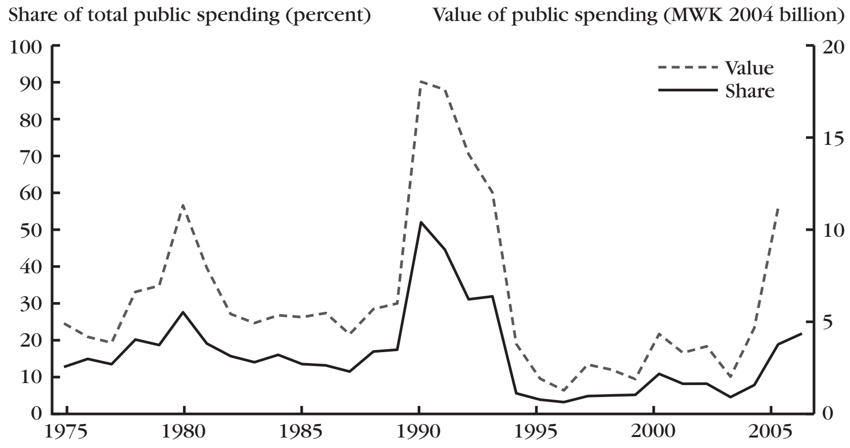
Source: Authors' calculations using IFPRI (2007, 2010) and Malawi, MAFS (2007).
Note: MWK = Malawian kwachas.

to enhance food and cash crop production. To this end, the government earmarked about 1.2 percent of its total budgetary resources for irrigation and water development and planned to rehabilitate existing schemes and develop new ones for a projected irrigated area of 16,000 hectares by 2011. Whether this allocation is sufficient to reach the set target is uncertain.

Empirical evidence also shows that government spending on broad infrastructure development contributes significantly to agricultural growth. In fact, investment in infrastructure, especially road development, is often ranked among the top two public spending sources of overall growth and poverty reduction (see Fan 2008; Fan, Mogues, and Benin 2009). Studies on several African countries as diverse as Ethiopia, Ghana, Uganda, and Zambia emphasize the importance of rural roads for increasing smallholder access to agricultural inputs and product markets. Roads enable farmers to participate in higher value-added market chains, which in turn significantly contributes to poverty reduction (Thurlow and Wobst 2004; Diao and Nin-Pratt 2005).

It is recognized that the inadequacy of the country's current transportation infrastructure results in high costs of production: transportation represents about 55 percent of costs, compared with 17 percent in other developing countries (Malawi, MDPC 2006). With its current road density of 161 kilometers per 1,000 square kilometers, Malawi is ranked 16th in Sub-Saharan Africa (IRF 2007). Government spending on transport and communications in Malawi has only

Figure 9.8—Government transport and communications expenditure in Malawi, 1975–2007



Source: Authors' calculations using IFPRI (2010) and Malawi, NSO (2007).

Note: MWK = Malawian kwachas.

recently started to improve, following a decline in the late 1990s (Figure 9.8). Investments in rural feeder roads, in particular, can have large poverty-reduction effects per unit of investment, as Fan and Zhang (2008) show in the case of Uganda. In Uganda, the marginal return to public spending on feeder roads, measured by the increase in poverty reduction and agricultural output, is three to four times larger than the return to public spending on *murram* and tarmac roads. Under the MGDS, the Malawian government planned to spend MWK7.6 billion during 2006–11 to improve the road network through including routine and periodic maintenance and rehabilitation, among other measures. Although this amount is unlikely to substantially improve road density, road conditions will probably improve, with a target of 71 percent of the road network being in good condition, 18 percent in fair condition, and only 11 percent in poor condition.

Conclusions

Malawi has the potential to improve crop yields and shift to an intensification-based growth strategy in its agricultural sector. Reaching and sustaining an annual agricultural growth rate of 6 percent requires yield improvements that are well below the potentials identified through field trials. Faster agricultural growth would stimulate growth outside agriculture, and it would reduce Malawi's poverty headcount rate to 34.5 percent by 2015. Most households are expected to benefit, although some households in regions growing high-value export-oriented crops, such as tobacco and cotton, would stand to gain more than would households in other parts of the country. Moreover, poverty among households in the southern regions would remain high, even with faster agricultural growth. Finally, rural households will benefit more than urban households, mainly because of their greater dependence on farm incomes. However, urban households should still benefit, because urban agriculturalists farm 6 percent of agricultural land in Malawi, and agricultural commodities are an important part of urban consumption baskets.

We used the detailed structure of the Malawian DCGE model to compare the effectiveness of growth driven by different subsectors in reducing poverty and encouraging broader-based growth. Our results indicate that additional growth driven by maize, pulses, and horticultural crops will have larger impacts on poverty reduction than similar growth led by growth in export-oriented crops. This is because yield improvements in the first three crops will not only directly benefit households by increasing incomes from agricultural production, but also indirectly benefit them by allowing farmers to diversify their land allocations to include higher value crops. Foodcrops and fisheries also have strong growth linkages to nonagricultural sectors, thereby stimulating broader economywide growth and poverty reduction. However, the higher growth potential of export crops relative to that of the nonmaize foodcrops means that export-led growth can still account for a significant share of overall poverty reduction. However, the small initial size and geographic concentration of certain crops, such as tea and sugarcane, means that their potential contributions to national growth and poverty reduction will remain limited, at least over the near term. Taken together, the characteristics of the various subsectors highlight the importance of broader-based agricultural growth but suggest that priority should be given to maize, pulses, horticulture, and smallholder export crops, such as tobacco and cotton.

Increasing agricultural growth to accelerate agricultural development in Malawi will require both additional investment in the sector and improvements in the efficiency of public spending. The investment analysis indicates that government spending on agriculture would have to grow by at least 20 percent per year to achieve and sustain an annual agricultural growth rate of 6 percent. Thus, the government will need to allocate almost one-quarter of its budget to agriculture by 2015. However, this spending scenario assumes that the government is able to invest with an efficiency exceeding that of many Sub-Saharan African countries. If this condition does not hold, then public spending on agriculture would have to grow at a much higher rate to reach the growth target.

Malawi may have turned the corner on its food and agricultural crises of the early 2000s. Maize production and food security have been greatly improved following the introduction of the new input subsidy program. This improvement provides an opportunity to diversify future agricultural growth to ensure that the benefits of agricultural growth are more widely spread than current welfare surveys suggest they are. Our analysis suggests that there are substantial welfare benefits to be had from combining a maize intensification strategy with policies that encourage a more diversified crop mix among smallholder farmers. A broader-based agricultural strategy is thus warranted. However, even with an annual agricultural growth rate of 6 percent, it is unlikely that Malawi will manage to halve poverty by 2015 and achieve the first MDG. Thus, although agriculture should be afforded high priority in Malawi's future development strategies, there remains the longer term need for economywide diversification into the nonfarm or nonagricultural sectors.

Appendix

Table 9A.1—Land and population distribution for rural farm households across regions

	Region								
Indicator	All	Karonga	Mzuzu	Kasungu	Salima	Lilongwe	Machinga	Blantyre	Ngabu
Population (thousands)	10,335	358	814	1,282	661	2,523	2,033	1,972	693
Number of households	2,237	71	163	246	143	537	465	474	137
Small-scale (<0.75 ha)	942	30	44	69	72	203	237	217	70
Household size	4.6	5.0	5.0	5.2	4.6	4.7	4.4	4.2	5.0
Per capita expenditure (US$)	129.6	116.7	132.0	152.8	130.9	145.4	110.3	125.3	101.0
Poverty rate (percent)	56.7	62.8	55.0	43.0	56.3	47.0	67.7	61.4	70.6
Share of poor (percent)		3.5	7.0	8.7	5.8	18.6	21.6	19.0	7.7
Harvest area (thousand ha)	2,876	81	295	525	128	591	482	599	175
Average farmland (ha)	1.29	1.13	1.80	2.13	0.89	1.10	1.04	1.26	1.28
Maize	0.63	0.54	0.80	1.08	0.41	0.59	0.58	0.50	0.66
Other cereals	0.06	0.10	0.06	0.01	0.04	0.03	0.06	0.09	0.22
Roots	0.15	0.28	0.36	0.20	0.18	0.09	0.10	0.17	—
Pulses and nuts	0.30	0.12	0.34	0.56	0.05	0.29	0.20	0.40	0.17
Horticulture	0.04	0.05	0.07	0.06	0.02	0.04	0.03	0.03	0.03
Tobacco	0.06		0.17	0.22		0.05	0.03	0.01	
Other export crops	0.05	0.04	0.01	0.01	0.20	0.01	0.04	0.05	0.20
Crop yields (mt/ha)									
Maize	1.14	1.17	1.30	1.37	1.33	1.24	0.96	0.93	0.79
Rice	1.11	1.64	1.83	1.09	1.51	1.86	0.76	0.74	1.09
Sorghum and millet	0.49	0.77	0.57			0.57	0.68	0.64	0.44
Cassava	5.28	5.64	6.80	5.46	5.41	6.83	3.55	4.89	
Groundnuts	0.66		0.75	0.81	1.03	0.88	0.57	0.49	

Source: Authors' calculations using Malawi, NSO (2005, 2007).

Notes: Per capita expenditure is mean expenditure unadjusted for adult equivalence. The poverty rate is the proportion of the population with per capita consumption below the poverty line. It is based on the national basic-needs poverty line (approximately MWK16,165 or US$115 per person per year). ha = hectare. mt/ha = metric tons per hectare. Blank cells = not applicable.

Table 9A.2— Structure of the Malawian social accounting matrix

Agricultural sectors	Maize; rice; other cereals (including sorghum and millet); root crops (including cassava, sweet potatoes, and Irish potatoes); pulses and oilseeds (including mixed beans and soybeans); groundnuts; vegetables; fruits; tobacco; cotton; sugarcane; tea; other crops (including sunflower seeds and paprika); poultry; other livestock (including cattle, goats, sheep, and pigs); fisheries; forestry
Industrial sectors	Mining; food processing; beverages and tobacco; textiles and clothing; wood and paper products (including furniture); chemicals and rubber products; machinery, equipment, and other manufacturing (including vehicles); construction; electricity and water
Service sectors	Agricultural trade and transport services; nonagricultural trade and transport services; hotels and catering; communication services; financial and business services; real estate services; community and other private services; government administration; health services; education services
Factors	Skilled labor (nonfarm); unskilled labor (nonfarm); agricultural capital; nonagricultural capital; Within each rural region: elementary labor (farm and nonfarm); small-scale farmland; medium-scale farmland; large-scale farmland; Within urban areas: urban farmland
Households	Within each rural region: Small-scale farms (<0.75 ha); medium-scale farms (0.75–3.0 ha); large-scale and estate farms (>3 ha); rural nonfarm; Within urban areas: Lilongwe nonfarm; other nonfarm; urban agriculturalists (all sizes)
Regions	Rural Karonga; rural Mzuzu; rural Kasungu; rural Salima; rural Lilongwe; rural Machinga; rural Blantyre; rural Ngabu; urban areas

Source: Authors' representation of Malawi's economy.
Note: ha = hectare.

Table 9A.3—Household income elasticities in the Malawian dynamic computable general equilibrium model

Sector	Rural	Urban	Sector	Rural	Urban
Maize	0.62	0.38	Processed foods	1.26	0.87
Rice	1.37	0.85	Beverages and tobacco	1.28	1.01
Other cereals	0.81	1.12	Textiles and clothing	1.11	0.98
Root crops	0.69	0.57	Wood and paper products	1.03	1.16
Pulses and oilseeds	0.72	0.54	Chemical products	1.06	1.12
Groundnuts	1.18	0.71	Machinery and equipment	1.06	1.12
Vegetables	1.07	0.79	Electricity and water	1.05	1.12
Fruits	1.07	0.79	Trade and transport	1.45	1.61
Other crops	1.06	0.79	Purchased ready-made food	0.93	1.02
Poultry	1.32	1.07	Communication services	1.61	1.78
Other livestock	1.48	1.12	Financial services	0.79	0.99
Fisheries	0.81	0.62			

Source: Authors' estimates using Malawi, NSO (2005).

Table 9A.4—Values of parameters used in public investment simulations

Quantity, growth rate, and elasticity	Baseline value
Annual average agricultural GDP growth rate target, $\hat{\theta}_{ag}$ (Agriculture scenario)	6.0
Annual average agricultural GDP growth rate target, $\hat{\theta}_{ag}$ (MDG scenario)	6.9
GDP in base period (2004 MWK billion)	
Agriculture, Q_{ag}	72.9
Nonagriculture, Q_{nag}	108.6
Annual average growth rate in GDP in base scenario (percent)	
Agriculture, $\dot{Q}_{ag}$	2.8
Nonagriculture, $\dot{Q}_{nag}$	3.5
Expenditure in base period in constant prices (2004 MWK billion)	
Agriculture or PAE, E_{ag}	4.2
Nonagriculture or PNE, E_{nag}	55.4
Annual average growth rate in expenditures in base scenario (percent)	
Agriculture, $\dot{E}_{ag}$ (growth due to PAE only)	13.8
Nonagriculture, $\dot{E}_{nag}$ (including faster PNE growth)	8.3

Elasticity	Low value	High value
Elasticity of agricultural GDP with respect to PAE, $\varepsilon^{Q}_{E_{ag}}$	0.15	0.30
Elasticity of agricultural GDP with respect to PNE, $\varepsilon^{Q}_{E_{nag}}$	0.15	0.25
Elasticity of agricultural GDP with respect to interaction of PAE and PNE, $\Phi^{Q}_{ag,nag}$	0.00	0.00

Sources: Authors' model specification and assumptions based on their literature review of elasticities; data from IFPRI (2010) and Malawi, NSO (2007); and the Malawian dynamic computable general equilibrium model results.
Notes: GDP = gross domestic product. MWK = Malawian kwachas. PAE = public agricultural expenditure. PNE = public nonagricultural expenditure.

Notes

1. These numbers are based on the 2005 Malawian social accounting matrix (SAM), described later in the chapter.

2. The poverty–growth elasticity for livestock may be underestimated, because the model does not capture the use of livestock to facilitate production in other agricultural subsectors (for example, animal traction for land preparation). Instead, the model treats livestock solely as producers of final products, such as meat and dairy products.

3. This range of values is moderate, based on the evidence reviewed in Chapter 4 on the elasticity of agricultural productivity with respect to PNE in developing countries, which ranges from 0.02 to 0.57.

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