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# Patterns of Change in Malawi's Economy under Sector-Focused Investment Strategies

Results of scenarios run through 2030 using an  
economy-wide model for Malawi

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## ABSTRACT

Malawi's economic future is dependent upon a transformation of the economy that will involve increased economic productivity overall and considerable movement of labor and capital out of agriculture and into manufacturing and services. A dynamic Computable General Equilibrium model of the economy of Malawi was used to better understand the development gains that would be realized by 2030 through significantly increasing separately the productivity of each of the three sectors of the Malawian economy – agriculture, industry, and services. The scenarios run in the model involved increasing by 20 percent from current levels the annual growth rate in total factor productivity for each of the three sectors.

The results show important trade-offs in the choice of which sector should receive emphasis in any economic development strategy. A services-led strategy would result in higher economic growth overall and broadly rising incomes, contributing the most to a structural transformation of the Malawi economy. However, the principal beneficiaries of increased investment to improve productivity in the services sector will be better-off households. In contrast, an agriculture-focused strategy would better meet the needs of the poor and their access to food, but would result in continued lagging growth for Malawi's economy and many poorer households continuing to be unable to obtain sufficient income to exit their poverty and realize much better lives for themselves and their children. The industrial sector currently is much smaller than either the agriculture or services sectors, particularly in terms of employment, so significant increases in productivity growth in industry results in smaller benefits overall than comparable increases in agriculture or services.

**Key words:** Computable General Equilibrium model, structural transformation, Malawi

# 1. INTRODUCTION

With a growing rural population, declining size of landholdings, and climate change, there are significant and intensifying restrictions on the income and, hence, the consumption that can be derived from agricultural livelihoods, especially for the almost two-thirds of Malawian households that rely on them. The ability in the longer term of the economy of Malawi to reliably and adequately supply for the basic needs of all the country's citizens will be dependent upon a successful structural transformation of the economy. This must involve sustained economic growth through increased economic productivity and considerable movement of labor and capital out of the agriculture sector and into industry and services sectors (Timmer 2015). While such a transformation can only occur over several decades, if not generations, efforts are now needed to build the momentum of the processes that will drive or facilitate this economic transformation.

Drawing primarily on historical analyses of countries that have successfully transformed their economies from being principally agrarian to industrial and service-oriented, there is a broad conceptual literature on how structural transformation might progress. Despite its breadth, however, there is not necessarily as much consensus on exactly what is the minimum set of public investments and actions needed to transform the structure of a country's economy and how such efforts should be sequenced (e.g., McMillan, Rodrik, and Sepúlveda 2017). Nonetheless, it is clear that a necessary driver in the sustained economic transformation of any economy is realizing increased economic productivity, including in agriculture. Increased output will generate surpluses that can be used to finance additional production, thereby expanding or increasing the enterprises responsible for that production and providing jobs offering higher returns to more workers.

A dynamic Computable General Equilibrium (CGE) model of the economy of Malawi was used to better understand the development gains that would be realized by 2030 through significantly increasing separately the productivity of each of the three sectors of the Malawian economy – agriculture, industry, and services. The scenarios run in the model involved increasing by 20 percent from current levels the annual growth rate in total factor productivity for each of the three sectors. The results of this modeling exercise are compared to a base, business-as-usual, simulation that projects recent economic performance through to 2030. The differences observed across the results of the simulations can provide guidance to policy makers as they decide how to allocate public resources across economic sectors to realize different objectives of the development vision for the country.

## 2. THE MODEL OF THE MALAWIAN ECONOMY

CGE models are useful for the analysis of sector changes in the economy as such models capture the functioning of the market economy in which the interactions of producers, households, government, and the rest of the world are mediated via prices and markets. Macroeconomic and resource constraints are respected. Such models can contain detailed information on sectors and households and so provide something of a 'simulation laboratory' for quantitatively examining how changes in the economy influence production, trade, employment patterns, and income distributions (Alton et al. 2014).

A dynamic recursive CGE model of the Malawi economy was developed by Benfica and Thurlow (2017) based on the structure of the economy in 2014. The 2014 social accounting matrix (SAM) of Malawi that is at the core of the model consists of 63 activities and 65 commodities (Thurlow 2017). The agriculture sector is disaggregated into 24 activities – 17 crop activities, 5 livestock activities, fishing, and forestry. The industry sector is disaggregated into 24 sub-sectors and the services sector into 11 sub-sectors. A distinction is made in the model between rural and urban labor and, within these categories, between several levels of skill, defined according to educational attainment. Rural

and urban households are disaggregated by their per capita consumption into quintiles, with a further distinction being made between rural farm and rural non-farm households. Additional details on the operation of the dynamic recursive CGE model of the Malawi economy are provided in the Appendix.

A snapshot of the Malawi economy as captured in the 2014 SAM is presented in Table 1. This provides the baseline conditions for the economy at the start of the model simulations.

**Table 1.** Structure of the Malawi Economy, 2014

	Share of total (%)					
	GDP	Employment	Exports	Imports	Export/ output (%)	Import/ demand (%)
<b>All sectors</b>	100.0	100.0	100.0	100.0	8.1	24.0
<b>Agriculture</b>	29.1	65.5	22.2	2.7	12.3	3.7
<b>Crops</b>	16.8	28.7	22.2	2.4	23.4	6.2
<b>Livestock</b>	2.9	14.1	-	0.2	-	2.2
<b>Forestry</b>	8.5	20.5	-	-	-	-
<b>Fishing</b>	0.9	2.2	-	-	-	-
<b>Industry</b>	16.5	6.4	69.4	84.1	18.2	52.2
<b>Mining</b>	1.5	0.4	3.1	0.1	30.3	4.1
<b>Manufacturing</b>	9.4	4.2	66.3	84.0	28.3	64.7
<b>Other industry</b>	5.6	1.8	-	-	-	-
<b>Services</b>	54.5	28.1	8.4	13.2	1.9	6.1
<b>Trade and hotels</b>	19.0	17.1	3.6	3.1	2.5	4.3
<b>Transport &amp; communication</b>	7.1	2.2	2.2	3.5	3.9	12.4
<b>Finance &amp; business</b>	15.0	1.1	2.0	4.8	1.9	8.7
<b>Government services</b>	8.5	5.7	0.6	1.2	0.6	2.5
<b>Other services</b>	4.9	2.0	-	0.6	-	3.8

**Source:** 2014 Malawi social accounting matrix (SAM).

**Note:** GDP is gross domestic product; employment is workers in primary jobs. The final two columns report the share of exports in total sectoral output and the share of imports in total commodity demand within the sector.

### 3. SCENARIOS AND ASSUMPTIONS

Three scenarios, designed to represent sector-targeted economic growth strategies for Malawi, are considered in this modelling exercise. The scenarios involve increasing the annual growth rate for sectoral total factor productivity by 20 percent.

1. **AGRI-LED:** Under this scenario, growth is led by the agricultural sub-sectors of Malawi's economy. This is achieved by increasing the total factor productivity growth rate of these sub-sectors by 20 percent.
2. **INDU-LED:** Growth is led by industrial sub-sectors in the economy. This is achieved by increasing the total factor productivity growth rate of all mining, manufacturing, and other industrial sub-sectors by 20 percent.

- SERV-LED: Growth in the Malawian economy is led by an expansion in services sector growth. Total factor productivity in the services sector is increased by 20 percent.

Such increases in total factor productivity growth are feasible for Malawi. The three economic sectors for Malawi generally have been underperforming compared to other countries in Africa south of the Sahara. Looking only at labor productivity by sector, Table 2 shows Malawi's performance relative to 43 other countries in Africa south of the Sahara over the four-year period from 2014 to 2017. For labor productivity in the agriculture and industry sectors, Malawi is in the bottom quartile of African countries, while for services, it is in the second lowest quartile.

**Table 2.** Average labor productivity by sector for Malawi and countries in Africa south of the Sahara, 2014 to 2017, value added per worker (constant 2010 USD)

Sector	Malawi		43 countries in Africa south of the Sahara (excluding Malawi)	
	4-year average USD	Rank out of 44 countries in Africa south of the Sahara (including Malawi)	Mean 4-year average USD	Median 4-year average USD
Agriculture	485	37	2,347	1,239
Industry	2,172	40	17,744	6,823
Services	3,271	30	7,574	4,525

**Source:** Analysis by the authors of World Development Indicators data (World Bank 2020).

The productivity of Malawi's economy has to grow to match levels of productivity attained by many of its peer countries in Africa. This will enable the country to better achieve the economic and human development goals to which it aspires. In the extensive research literature on the topic, five principal drivers of economic productivity growth are identified (e.g., Kim and Loayza 2019):

- ▶ innovation, to create or adopt new productive technologies;
- ▶ education, to enable the uptake and dissemination of these new technologies by workers in the economy;
- ▶ market efficiency, to ensure the effective allocation of resources to different economic actors;
- ▶ infrastructure – transportation, communication, energy, and other utilities, to enable efficient production; and
- ▶ political and legal institutions, to guide policy formulation, to regulate economic activities and enforce laws, and to safeguard basic rights.

Continued investments over the long term in all these supportive areas will be needed if significant improvements in the growth in productivity are to be seen across the Malawian economy.

We stress that these model scenarios are not directly comparable, since the costs of achieving the economic changes required for these scenarios will not be the same. For example, accelerating productivity in a sector that is already using the best production technologies will be harder or more costly than for those sectors that are further from the production frontier – that is, the maximum levels of technically efficient production. In this modelling exercise, we do not consider the costs of increasing productivity growth rates.

Moreover, the economy-wide impact of a 20 percent increase in total factor productivity growth in a sector will also be influenced by the initial size of the sector. Consequently, for example, the costs of increasing productivity by 20 percent in the services sector will be significantly greater than increasing productivity in the industrial sector by the same amount in part because the size of the services

sector in Malawi is over three times that of the industrial sector. Similarly, the magnitude of the impact on different development targets of actually increasing productivity growth by 20 percent in the respective sectors will differ simply because of their initial size.

The differences in results between the scenarios do provide, however, an indication of the impact that efforts to expand production in various sectors of the economy would have on growth, employment, and household welfare, including food security. Moreover, such CGE analyses allow us to trace out second-round effects on development outcomes of such changes in productivity.

**Base case:** To assess the implications of these scenarios, a business-as-usual case for the growth of the economy of Malawi through 2030 is needed as a counterfactual pathway of development in Malawi. This counterfactual, referred to as the base case, illustrates the potential path of development in Malawi to 2030 under current business-as-usual conditions in the absence of sector-focused economic growth strategies for Malawi. Table 3 presents the base case.

**Table 3.** Malawi base case, i.e., business-as-usual

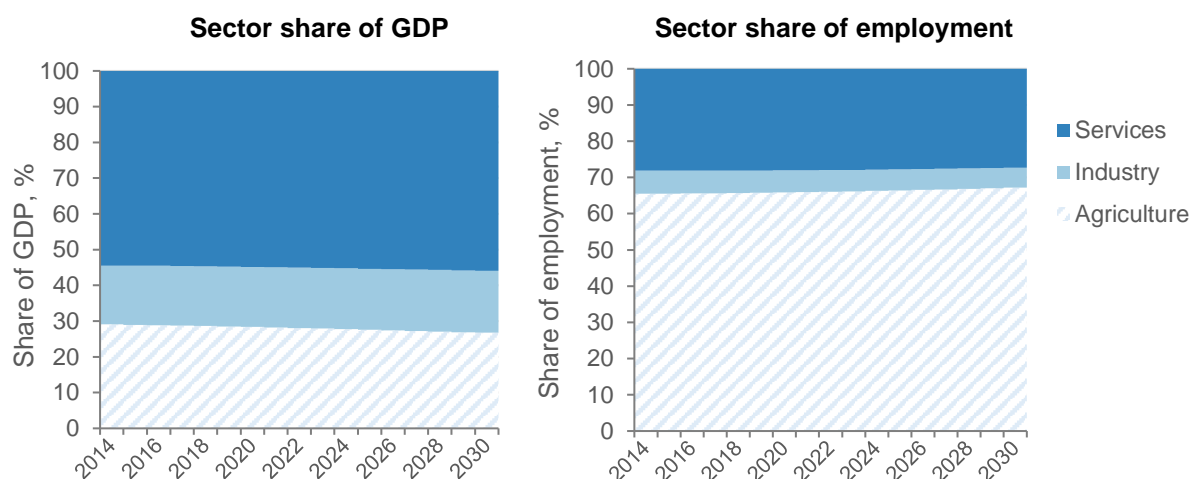
	Average annual change, %		
	2014	Base case 2014-2030	Observed trends 2003-2013
<b>Total population (000s)</b>	17,069	2.8	3.0
Rural	14,315	2.4	2.9
Urban	2,754	4.5	3.7
<b>Total GDP (billions of Kwacha)</b>	2,207	5.3	5.6
Agriculture	642	4.8	3.1
Maize	112	5.7	-
Tobacco	27	6.3	-
Industry	363	5.6	7.7
Services	1,202	5.5	5.8
<b>Employment (000s)</b>	6,894	5.0	
<b>Consumption (USD per capita annually)</b>	363	2.3	
Rural	236	2.6	-
Urban	1,027	0.5	-

**Source:** 2014 SAM, 2018 UN World Population Prospects, Malawi National Statistical office. Analysis by the authors using the economy-wide model for Malawi.

The real GDP growth rate for Malawi in the base case is based on the projections for growth of Malawi's economy by the International Monetary Fund (IMF). The IMF's April 2018 World Economic Outlook predicted an average annual growth rate of 4.5 percent per annum for the economy of Malawi over the 2014 to 2023 period. Given that the projection period for our analysis is to 2030, IMF's annual growth rate projection was extrapolated to 2030. As a result, the average annual growth rate in the base case is 5.3 percent between 2014 and 2030. Sector growth is determined within the model by accounting for growth in productivity and the availability of land, labor and capital. Labor supply is stipulated in the base case to grow at around 2.8 percent annually in line with population growth rate projections of the World Population Prospects of the United Nations (2018). Sector total factor productivity is adjusted to match historical trends and the targeted economic growth rate. In the case of agriculture, the total factor productivity growth rate is based on annual growth estimates of 1.11 percent for the period 2001 to 2012 (Benin and Nin-Pratt 2016).

By running the base case scenario in the economy-wide model for Malawi, we see that the share of agriculture in GDP decreases over the modelling period, falling 2.3 percentage points from 29.1 per cent in 2014 to 26.7 per cent in 2030 (Figure 1). The shares of GDP of the industry and the services sectors increase over this period. The services sector increases by the largest margin, 54.5 percent in 2014 to 55.9 percent in 2030. However, even as its share of GDP drops, the share of agriculture in total employment increases over the period from 65.5 to 67.2 percent as the sector becomes more labor intensive.

**Figure 1.** Sector share of GDP and employment in the economy of Malawi in the base, business-as-usual case, 2014 to 2030



**Source:** Analysis by the authors using the economy-wide model for Malawi.

Household welfare improves over the reference period with annual real GDP per capita rising nationally from US\$363 in 2014 to US\$829 in 2030. Given the significantly lower base for real GDP per capita in rural areas, annual growth rates are significantly higher for rural residents than for those in urban centers (Table 3).

## 4. RESULTS OF SECTOR-LED GROWTH SCENARIOS

The results from the three model scenarios are presented relative to the business-as-usual base (BASE) case by development objectives – GDP and employment, poverty and welfare, and food security.

**GDP and employment.** Table 4 presents the average annual real GDP and employment growth rates for the simulation period across the three scenarios. An increase in total factor productivity growth in the services sector results in the largest impact on both real GDP growth and employment. Under the SERV-LED scenario, annual real GDP growth increases by around 0.2 percentage points relative to the base case, while annual employment growth also is 0.2 percentage points higher. Increased production of services and employment in the sector leads to higher demand for food, so both agriculture and industrial production, particularly agro-processing, is higher under the services-focused scenario than under the base case. Even though this scenario only involved increased productivity in the services sector, there are important further second-round effects for production in the industry and agriculture sectors.

**Table 4.** Estimated impact of the Malawi CGE model scenarios on GDP and on employment growth between 2018 and 2030, average annual growth in percent

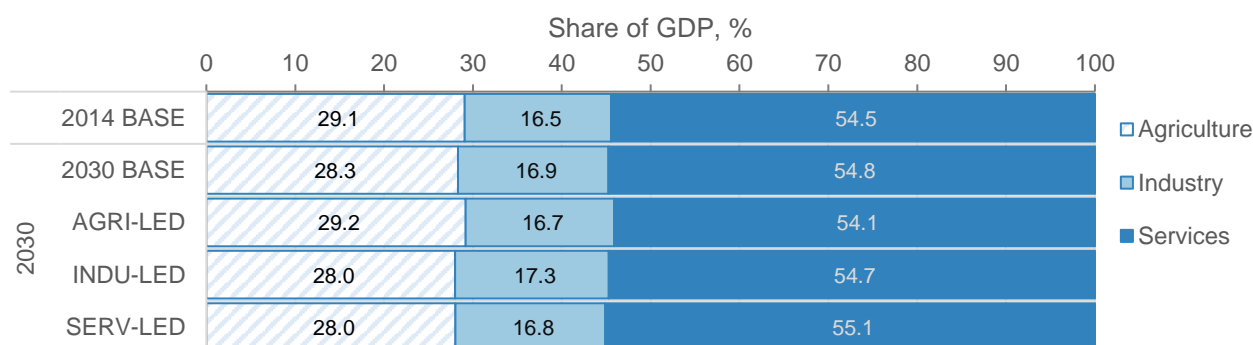
	GDP growth				Employment growth			
	BASE	AGRI-LED	INDU-LED	SERV-LED	BASE	AGRI-LED	INDU-LED	SERV-LED
<b>Overall</b>	5.5	5.6	5.6	5.7	5.2	5.3	5.3	5.4
<b>Agriculture</b>	5.3	5.7	5.3	5.4	5.4	5.5	5.5	5.6
<b>Industry</b>	5.7	5.7	6.0	5.8	4.2	4.3	4.1	4.5
<b>Mining</b>	5.6	5.6	6.0	5.6	4.4	4.4	4.4	4.5
<b>Manufacturing</b>	5.8	5.8	6.1	5.9	4.4	4.4	4.3	4.6
<b>Agro-processing</b>	5.9	5.9	6.2	6.1	4.5	4.4	4.4	4.8
<b>Other manufacturing</b>	5.6	5.6	5.9	5.7	4.1	4.2	4.0	4.3
<b>Other industry</b>	5.5	5.5	5.8	5.6	3.9	4.0	3.8	4.2
<b>Services</b>	5.5	5.6	5.7	5.8	5.0	5.0	5.1	5.0

**Source:** Analysis by the authors using the economy-wide model for Malawi.

An economic growth strategy focusing only on improvements in the productivity of the agriculture sector (AGRI-LED) has a similar impact on overall GDP and employment as one focusing on the industry sector (INDU-LED), but lower than the impact of the services-focused scenario. Gains in GDP under the AGRI-LED scenario are, however, concentrated in the agriculture sector, while, in contrast, under the INDU-LED scenario GDP gains extend across all sectors through significant second-round effects on those other sectors.

Figure 2 presents the gross value added (GVA) shares for each economic sector under each model scenario. While some slight structural change is apparent under the various scenarios, the magnitude of the impacts is limited.

**Figure 2.** Gross value added by sector of the economy for Malawi CGE model scenarios and base case, percentage share of total gross value added



**Source:** Analysis by the authors using the economy-wide model for Malawi.

**Poverty and welfare.** Table 5 presents the changes in poverty across the scenarios analysed. The AGRI-LED scenario has the largest impact across the three standard poverty measures presented. Although poverty declines are experienced in both rural and urban households according to all three measures, the reductions in poverty under the AGRI-LED and the SERV-LED scenarios are strongest in rural households. Most of Malawi's poor reside in rural communities where agriculture and service sector-based livelihoods dominate in local economies.

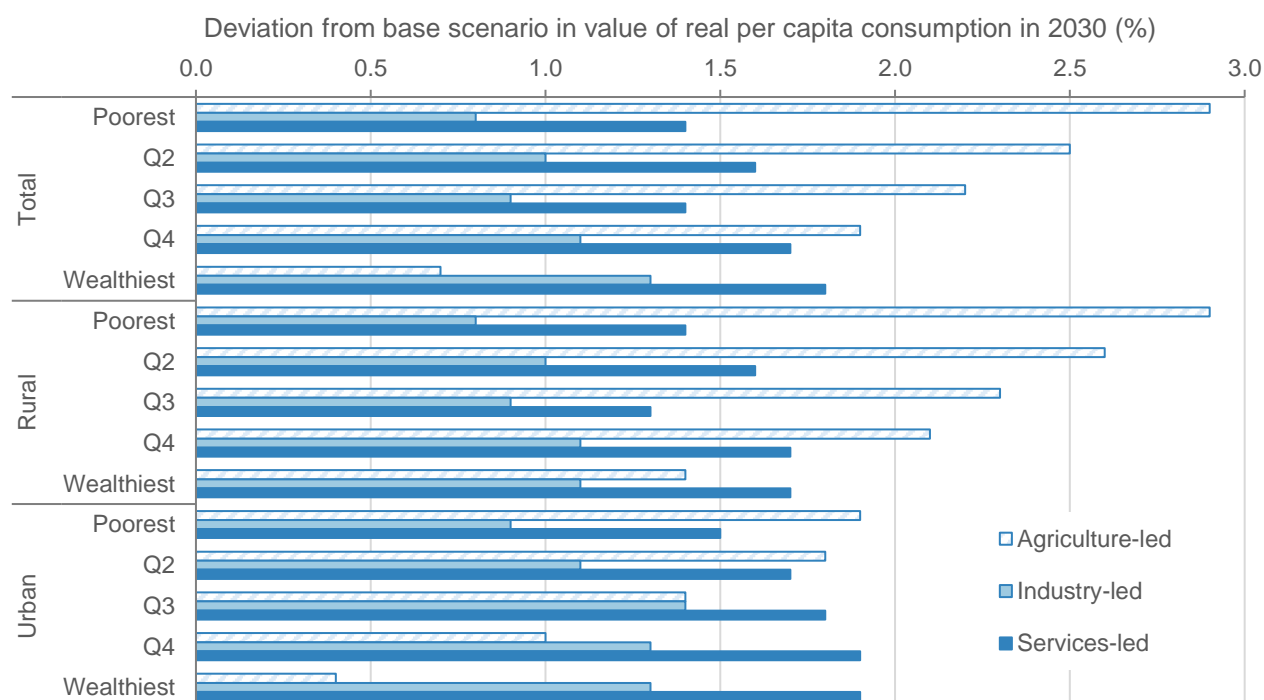
**Table 5.** Poverty changes under the Malawi CGE model scenarios by 2030 relative to the base business-as-usual scenario

	2030 BASE Level	AGRI-LED Change	INDU-LED Change	SERV-LED Change
<b>Poverty headcount (%)</b>	24.3	-1.4	-0.4	-0.7
<b>Rural</b>	26.6	-1.6	-0.4	-0.8
<b>Urban</b>	11.6	-0.5	-0.3	-0.3
<b>Poverty gap (%)</b>	7.0	-0.5	-0.1	-0.3
<b>Rural</b>	7.7	-0.6	-0.1	-0.3
<b>Urban</b>	2.9	-0.2	-0.1	-0.1
<b>Poor population ('000s)</b>	3,426	-203	-52	-101
<b>Rural</b>	3,176	-193	-46	-93
<b>Urban</b>	251	-10	-6	-7

**Source:** Analysis by the authors using the economy-wide model for Malawi.

Figure 3 presents welfare changes per scenario by per capita household consumption quintile. Welfare is higher in the three sector-focused scenarios than under the base case. The largest gains to total welfare are seen in the AGRI-LED scenario, although gains are more concentrated in rural and lower quintile households. In the SERV-LED and INDU-LED scenarios, larger positive gains are experienced by urban households with higher incomes. The differences in the welfare distribution are the result of the factor allocation of households. Agriculture labor, capital, and land, which are central to agricultural production, are primarily owned by rural households, whereas labor feeding into the industry and services sectors tends to be concentrated in households residing in urban areas.

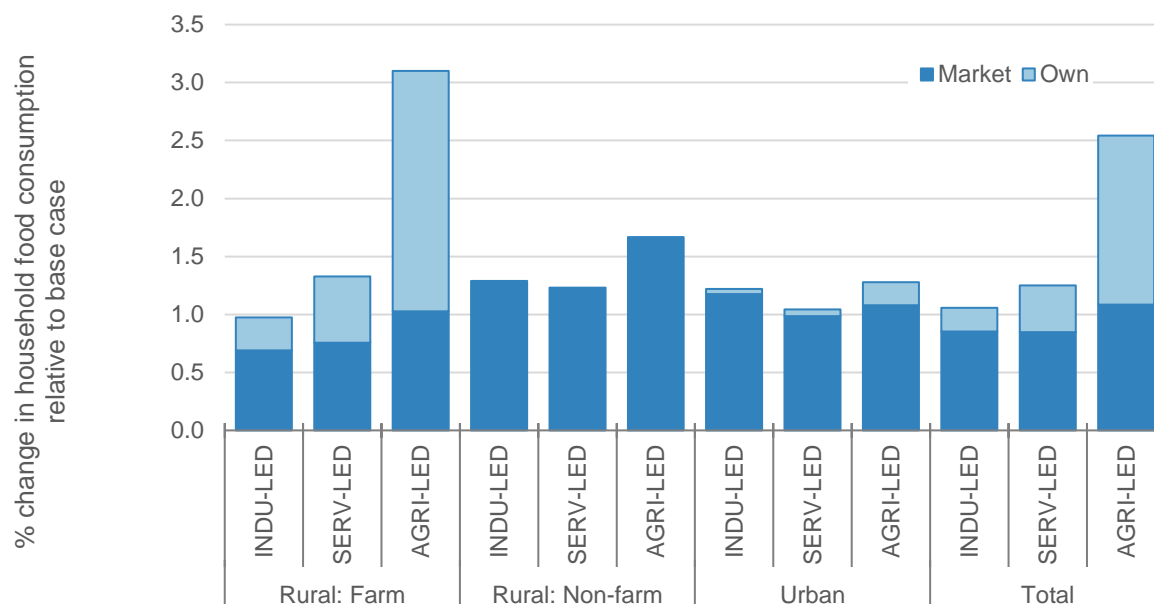
**Figure 3.** Welfare changes by per capita household consumption quintile under the Malawi CGE model scenarios in 2030 relative to the base scenario



**Source:** Analysis by the authors using the economy-wide model for Malawi.

**Food security.** Figure 4 presents the change in food consumption per capita relative to the base case scenario by household group and source of food consumed, i.e., purchased food = ‘Market’; own production = ‘Own’. Note that the 2014 Malawi SAM reports no own production consumption for rural non-farm households.

**Figure 4.** Changes in real per capita household food consumption under the Malawi CGE model scenarios in 2030 relative to the base scenario, by household group and source of food consumed



**Source:** Analysis by the authors using the economy-wide model for Malawi.

**Note:** The 2014 Malawi SAM (Thurlow, 2017) reports no own-production consumption for rural non-farm households, so no own-production is modelled for these households.

Total food consumption per capita is higher across all three sector-focused scenarios relative to the base case. The largest increase in real food consumption occurs in the AGRI-LED scenario. The increase in the AGRI-LED scenario is driven primarily by increases in food consumption from own-production, although market consumption also increases considerably. In the SERV-LED and INDU-LED scenarios, the rise in food consumption is driven principally by an increase in market food consumed.

The increase by 2030 in domestic demand for agriculture crops and livestock and manufactured food in all scenarios is met by both an increase in domestic production and in food imports. However, imports account for a very small share of additional domestic sales of these commodities across scenarios.

## 5. DISCUSSION

Guidance for sector-specific efforts to transform Malawi's economy and sustainably reduce food insecurity can be drawn from the results of these CGE model simulations.

- ▶ Significant investment in the services sector will do the most to drive economic growth and increase incomes. From a food security perspective, directing investments towards the services sector will provide the greatest increase in access to food due to the higher incomes workers will receive. Under the services-led scenario, both annual GDP growth and annual employment overall increase by around 0.2 percentage points relative to the base case. Increased production of services leads to higher demand for food and industrial goods, so both production and employment rise under the service-led scenario relative to the base case. Based on these metrics of Malawi's development, focusing on growth in the services sector will bring about greater shifts in the structure of the economy of Malawi than would investments in the agricultural or industrial sectors, even if these changes will need to be maintained over many years for any comprehensive changes to become apparent.

However, from an equity standpoint, higher investment in services will, at least through 2030, tend to benefit better-off Malawian households more than poorer ones. While all households will benefit, those benefits are greater for the already well-off. This holds in both rural and urban communities.

- ▶ Focusing investment in agriculture will result in lower incomes in aggregate than with the services-led scenario. However, significant benefits will still be realized, and they will be disproportionately directed towards poorer households. If equity considerations are important in the short term, an agriculture-led economic development strategy is superior to investments in other sectors of the economy in generating benefits for the poor.
- ▶ The industrial sector currently is much smaller than either the agriculture or services sectors, so significant increases in productivity growth in industry results in smaller benefits overall than comparable increases in productivity growth in agriculture or services.

If improving welfare and reducing poverty are the principal objectives of sectoral-specific development efforts, the agriculture-led scenario achieves the highest impact (Figure 3). Poorer households see appreciably larger improvements in their levels of consumption under the agriculture-led scenario than when public investments are concentrated in the other two sectors. The services-led scenario is shown to provide improved welfare for all but is only superior to the agriculture-led scenario for the wealthiest quintile of households.

For many households, the benefits to household welfare from an agriculture-led development program can only come about slowly through increased production by workers in the household, including in their subsistence-focused farm activities. Benefits can equally come about through lower prices, such as would result from increased production of food crops. Both increased production and incomes and lower prices are captured in how the Malawi CGE model calculates changes in household welfare under different scenarios. Consequently, in seeking to improve welfare and reduce poverty in Malawi, targeting agricultural productivity enhancement programs at poorer households may not be superior in achieving those aims to focusing such programs on the less-poor commercially-oriented smallholder farmers, particularly if Malawi's agricultural markets have been strengthened.

The Government of Malawi must ensure that its policies strengthen the drivers of economic productivity growth. This will involve fostering increased innovation, expanding educational opportunities for all, improving market efficiency, enlarging networks of various types of infrastructure, and strengthening administrative, political, regulatory, and legal institutions. However, the specifics as to

exactly how these sectoral increases in productivity by 20 percent will be achieved is not considered in this paper. Identifying effective strategies in the short to medium term to achieve such significant increases in output will be a significant challenge. In determining how best to invest for economic development, policy makers in Malawi need to be guided by a clear development vision. A services-focused strategy will result in higher economic growth overall and broadly rising incomes and will more effectively contribute to the transformation of Malawi's economy. National policies and regulatory efforts should recognize this developmental potential of an expanded and more productive services sector, as well as the tradeoffs that might come with it.

However, the poor will not as quickly share in the resultant benefits of an increased focus on services in the economy to the degree that wealthier households will. However, an agriculture-specific approach, while it better meets the needs of the poor and their access to food than does the services-specific approach, may result in continued lagging growth for Malawi's economy, with the result that it does not provide sufficient income and employment opportunities for the bulk of poor Malawian households to exit their poverty. Regardless of the development pathway followed, continued investments in the principal drivers of economic productivity growth – innovation, education, improved market efficiency, infrastructure, and political and legal institutions – will remain central to propelling economic growth, expanding employment, improving welfare, and realizing sustainable food security in Malawi.

Choosing how best to balance public investments in the various sectors to achieve robust economic growth, to meet the food needs of all Malawians, and to enable all to sustainably move out of poverty is not easy. It will require a clear vision of what Malawians want for their future and creative and compelling leadership to identify and prioritize the investments and actions that will achieve that vision and to effectively manage the trade-offs inherent to doing so. Moreover, making the changes need to ensure that Malawi's economy is growing and that all will increasingly have secure access to food will not be a costless process socially – there will be sections of Malawi's population that, at least in the short-term, will find that the livelihoods upon which they relied are no longer suitable in enabling them to reliably meet their basic needs, including for food. These individuals and households must be assisted to seize some of the new livelihood opportunities that emerge with the economic changes required. Structural transformation of Malawi's economy needs to be a central element in any longer-term human development vision for the country.

## APPENDIX: DETAILS ON THE ECONOMY-WIDE MODEL FOR MALAWI

The dynamic recursive CGE model of the Malawi economy was developed by Benfica and Thurlow (2017) based on a 2014 social accounting matrix (SAM) of the country (Thurlow 2017). The Malawi model is within the group of generic static and dynamic models described by Lofgren et al. (2002) and Diao and Thurlow (2012) and is a descendant of the class of CGE models introduced by Dervis et al. (1982).

Dynamic recursive CGE models allow for the analysis of changes over time. The model consists of within- and between-period components. Within each time-period, the model is solved subject to given levels of population, productivity; and labor, land, and capital supply. In 'between periods', the model is updated to reflect population growth, technical change, and capital accumulation. The latter is determined endogenously based on previous period investment levels. New capital is allocated to sectors based on their relative profit rates. Once invested, capital becomes sector-specific. This specification partly captures the adjustment costs associated with reorienting production across industries (Arndt et al. 2016).

The following macro-economic and factor closure rules are used for the model for Malawi. These are aligned with stylised facts for the operation of the Malawian economy.

- ▶ **Investment and savings:** The share of investment in absorption is fixed. The savings rate in the economy adjusts (scaled adjustment across institutions) to ensure that the supply of funds demanded for investment is available.
- ▶ **Government:** No fiscal rule is imposed in the model and the government balance is therefore flexible. All tax rates are kept constant.
- ▶ **Foreign savings:** A flexible exchange rate is included in the model. Foreign savings are therefore fixed.
- ▶ **Labor supply:** The model includes four labor groups classified according to education level. These are uneducated, primary, secondary, and tertiary. It is assumed that there is an ample supply of uneducated and primary skills available in the economy. Additional labor supply from these pools can therefore be drawn into the economy if demanded without any impact on the average wage of these skills groups. In the case of secondary- and tertiary-level educated labor, we assume these workers to be fully employed. This means that no additional supply can be added if demand increases – rather, the average wage increases.
- ▶ **Capital:** There are four classifications of capital in the model – capital for crops, livestock, mining, and other, which is used by all other sectors in the economy. It is assumed that capital in the crops and livestock sectors can move within sub-sectors of these sectors. In the case of mining and other capital, this is fixed within sub-sectors. No surplus capital is available in the economy. New capital will need to come from additional investments.

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