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Who works in agriculture? Exploring the dynamics of youth involvement in the agri-food systems of Tanzania and Malawi

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Abstract

This analysis examines the age-structure and dynamics of employment in the agri-food system (AFS) in Tanzania and Malawi. Using integrated household and agriculture surveys – LSMS-ISA – we discover that the average age of a farmer is 34 years in Tanzania and 31 years in Malawi. Examination of the movements of youth (aged 15-24) and young adults (aged 25-34) in and out of AFS demonstrates a high degree of short-term stability for involvement in farming. We find that majority of rural youth (59% in Tanzania and 56 % in Malawi) are consistently engaged in farming. There is also a considerable mobility between different sectors of employment, but the movement into AFS outnumbers movement out of AFS. More than 57 per cent of the youth in non-AFS sectors entered into AFS, but only 12 per cent of the youth involved in AFS moved out of the sector. Even though the high degree of stability in farming participation is encouraging, it might be the results of poor economic prospects outside of farming. Given that increasing youth employment is a priority public policy, it is recommended that the countries attempt to diversify the rural economy by developing economic opportunities within the agri-food system.

JEL Codes: J13, J21, J43

Key words: agri-food system, employment, youth, sub-Saharan Africa, LSMS-ISA

1. Introduction

Are youth abandoning agriculture or will they be the modern farmers of tomorrow? This is a critical question for African governments to address as they aim to develop policies that promote youth employment in the agricultural sector. Many countries in sub-Saharan Africa have experienced profound economic transformation over the past 20 years. However, continuing lags in smallholder agricultural productivity and unprecedented population growth have intensified concerns on whether the current youth generation will increasingly seek employment opportunities outside the agricultural sector.

In response to the challenges of rising youth unemployment (ILO 2017) juxtaposed against strengthening the agricultural sector, policymakers are promoting the participation of youth in commercialized agriculture (Filmer and Fox 2014; World Bank 2013). Proposals to bolster participation in the agri-food system are motivated by unmet domestic demand for food. Domestic supply in sub-Saharan African countries is unable to meet rapidly growing domestic food demand as a result of the predominant use of traditional inputs, low yields and declining productivity (Jayne, Mather and Mghenyi 2010). Considering the increasing domestic demand, there is a huge potential for African youth to modernize the agricultural sector and capture returns that are currently gained by international traders.

It is acknowledged that enhancing meaningful participation in agriculture requires improved access to land, capital and relevant skills (Brooks, Zorya and Gautam 2013). Sustaining agriculture participation is challenging as long as agriculture remains to be a low-return and high-risk sector. Increasing rates of rural-to-urban migration are creating a rhetoric of concern that by moving to urban environments, youth are abandoning the agricultural sector (IFAD 2018)[1]. Expressions of lack of interest include citing the "dirty" or laborious nature of farming, coupled

[1] Although rural youth outmigration is common, this does not necessarily imply that the rural sector is being depleted of youth labour. A study of migration in 45 African countries spanning 1980 to 2015 (Menashe-Oren and Stecklov 2018) finds that across age cohorts, rural youth outmigration is just 3.3 per cent.

with concerns over opportunities for income generation and aspirations for professional, white-collar occupations, particularly among youth and young adults. As the lack of love for agriculture among the 15-24 cohort has evolved into a stylized fact among development practitioners, room has grown for rhetoric regarding the ageing agricultural workforce. At their most extreme, projections have claimed that the average age of the African farmer is approximately 65 years (FAO 2014).[2]

Efforts to either encourage young people into farming or kick-start agricultural modernization have only recently become part of policy discussions in several African countries, including Tanzania and Malawi (Ministry of Agriculture, Tanzania 2016; National Youth Council, Malawi 2013). With extensive support from the Food and Agriculture Organization of the United Nations (FAO), Tanzania has revised its national agricultural policy to include provisions for youth engagement in agriculture (FAO 2017). As the first step towards implementation of the revised policy, the Tanzanian government has recently launched a five-year programme, the National Strategy for Involvement of Youth in Agriculture 2016-2021. Similar efforts were made by Malawi as it launched the National Youth Policy in 2013 (National Youth Council, Malawi 2013). Both national programmes identify agriculture as a major pillar of youth employment.

If governments are to develop effective economic policies to strengthen the participation of youth in agriculture, it will be essential to systematize the empirical evidence. A critical starting point can be differentiating rhetoric about youth proclivity to participate in agriculture and their actual participation rates. A recent study in Malawi, Ethiopia and Kenya finds no definitive evidence that African youth are moving away from agriculture (Asciutti, Pont and Sumberg 2016). Even though the proportion of youth engaged in agriculture might have decreased over time, the absolute number of youth in agriculture has been increasing. In an analysis of nine sub-Saharan African countries, Yeboah and Jayne (2018) find that the mean age of farmers is not

[2] In its original context, this statistic probably referred to the head of farming household but has been interpreted by various platforms in a broader sense here.

rising, and is either remaining stable or falling, depending on the country. Using a full-time labour equivalent approach, they find that on-farm participation ranges from 35 to 54 per cent across the total population, while it ranges from 40 to 76 per cent among youth and from 20 to 60 per cent among young adults (aged 25-34 years).

Building on the existing evidence that there is a significant youth agricultural labour force, this paper studies the dynamics of youth participation in both on-farm agriculture and the broader agri-food system. As part of the transition from financial dependence to independence, youth are understood to be an economically mobile age cohort.[3] Understanding the stability of their participation in both spheres of agriculture is critical in order to design targeted policies. By quantifying movements into and out of the agricultural sector, we shed light on the extent of sustained individual-level participation in the agri-food system, which is not apparent from cross-sectional studies.

The rest of the analysis proceeds as follows. In section 2, we describe the data used in the analysis and population age structure in Tanzania and Malawi. Section 3 presents the definition of key variables and the methodology employed in the analysis. In section 4, we discuss results by first presenting descriptive statistics from dynamics analysis based on transition matrices, and then those from the regression analysis. Section 5 concludes with a summary and the implications of the findings.

2. Data

The data for this analysis come from two LSMS-ISA countries,[4] Tanzania and Malawi. Both datasets are nationally representative surveys implemented by the respective National Bureau of

[3] The definition of youth can vary by country or context but our definition is consistent with the international definition: individuals aged 15-24 are referred to as youth and individuals aged 25-34 are referred to as young adults.

[4] LSMS-ISA panel data are also available for Ethiopia, Niger, Nigeria and Uganda. Country inclusion was decided on the basis of data comparability for key indicators.

Statistics with technical support from the World Bank.[5] Multiple rounds of data are available, but only the data from the first two waves are used to construct a "baseline" and study short-term movements. The sample size and period of coverage varies by country, but the survey design and instruments are similar. The datasets include integrated household, agriculture and community components, and are standardized in their general format and methodology. This allows for cross-country comparisons.

Table 1 presents the details of cross-sectional and panel sample sizes for Tanzania and Malawi. Both datasets maintain a fairly low attrition rate of less than 4 per cent at the household level and about 7 per cent at the individual level. The first half of our analysis uses unbalanced panels to explore the patterns of the demographic structure, employment and involvement in the agri-food system over time. In the second half, we analyze the movements of individuals in and out of the agri-food system and therefore the analysis is restricted to balanced panels.

Table 1. Sample size and attrition

	Wave 1		Wave 2		Attrition	Panel
	Year	Sample size	Year	Sample size	(%)	Sample size
Tanzania						
Household	2008/2009	3 265	2010/2011	3 924	2.9	3 168
Individual		16 709		20 559	6.6	15 597
Malawi						
Household	2010/2011	3 246	2013	4 000	3.8	3 104
Individual		15 597		20 220	7.4	14 165

Notes: Both Tanzania and Malawi samples are nationally representative. In both countries, the sample size in the second wave includes split-off households. All second-wave households can be tracked back to baseline households.

[5] For more information on the LSMS-ISA initiative, see www.worldbank.org/lsms-isa

2.1. Population age structure

Interest in youth agricultural participation is premised on the trend of exponential demographic growth within youth cohorts perceived as well beyond "rate of replacement" or sustainable population growth. Table 2 presents population age structure in the selected countries during the first two waves of the LSMS-ISA survey. Following convention, age structure is divided into five groups: children (aged 6-14), youth (15-24), young adults (25-34), adults (35-64) and elderly (65 and over).

Table 2. Population age structure in Tanzania and Malawi

Age groups	Tanzania		Malawi	
	Wave 1	Wave 2	Wave 1	Wave 2
National				
Child (6-14)	33.9	33.3	33.9	35.9
Youth (15-24)	23.0	26.3	23.6	24.3
Young adult (25-34)	15.0	14.8	17.2	17.9
Adult (35-64)	22.6	21.0	20.6	17.9
Elderly (65 and over)	5.5	4.6	4.7	4.0
Observations	14 163	17 200	12 428	16 588

Note: Point estimates are population-weighted proportions.

Young children below the age of 6 are not included given the focus on distribution of labour activities. From the ages of 6 to 64, a skewed U-shaped pattern of population distribution is observed in both Tanzania and Malawi before tailing off for the population above age 65. The population age structure disaggregated by gender is presented as an age pyramid in the appendix (Figures A1 and A2)[6]. The statistics in Table 2 and the population pyramid in the appendix show that children make up the largest proportion of the population, followed by youth and young adults, but the proportion rises again for adults before tailing off for elderly people.

[6] Instead of the number of people for each age category, we present the percentage of male or female population for each age category across both baseline and follow-up waves.

When considering the relevance of these patterns for today's age structure, it is useful to bear in mind that the largest proportion of population in both countries (age cohort 6-14) would constitute the youth (15-24) sample today. As a result, the number of individuals currently entering the labour market or looking for employment is higher than ever. Given current estimates of age demographics and high birth rates in the last decade, it is expected that the general U-shaped age pattern will hold, leading to a rapid increase in labour supply in both Tanzania and Malawi. The proportion of individuals entering the labour market in the coming years is therefore expected to rise rapidly.

Beyond the relevance of the growing youth cohort is the trend of youth migration from rural to urban areas in search of enhanced economic prospects. The prospect of rural youth outmigration is of concern to policymakers because an increasing rate of rural outmigration is often associated with declining youth engagement in agriculture. We find that rural areas in Tanzania and Malawi still have a significant number of youth, and it is increasing over time. Table 3 presents the population age structure in Tanzania and Malawi disaggregated by rural and urban areas. Results show that by far the largest proportion of the rural population is comprised of individuals between the ages of 6 and 34 years. Existing evidence also points that, despite potential economic benefits associated with rural-to-urban migration, the rate of rural outmigration in sub-Saharan Africa is still low (de Brauw, Mueller and Lee, 2014; Kafle, Benfica and Winters, 2018).

Since the rural economy is more dependent on agriculture and the urban economy more on industrial and service sectors, the rest of our analysis focuses on rural areas as a means of understanding the relationship between population age structure and engagement in the agri-food system.[7]

[7] Results from descriptive and dynamics analysis are presented for the rural sample only but regression results are presented for the national sample. Descriptive and dynamics results for both national and urban samples are presented in the appendix.

Table 3. Rural-Urban age structure in sub-Saharan Africa

Age groups	Tanzania		Malawi	
	Wave 1	Wave 2	Wave 1	Wave 2
Rural				
Child (6-14)	36.0	35.4	34.6	36.7
Youth (15-24)	21.7	24.9	23.4	24.0
Young adult (25-34)	13.5	13.4	16.0	17.1
Adult (35-64)	22.8	21.3	20.8	17.8
Elderly (65 and over)	5.9	5.1	5.2	4.4
Observations	9 183	12 086	9 151	12 105
Urban				
Child (6-14)	27.0	27.8	30.3	31.7
Youth (15-24)	27.3	30.0	25.1	25.7
Young adult (25-34)	19.7	18.6	23.9	22.3
Adult (35-64)	22.1	20.3	19.1	18.6
Elderly (65 and over)	4.0	3.3	1.7	1.7
Observations	4 980	5 114	3 271	4 369

Note: Point estimates are population-weighted proportions.

3. Methodology

3.1. Conceptual definitions

Depending on the context, agriculture or farming can have both objective and subjective meanings. In this analysis, the definition of farming defers to a binary indicator for agricultural participation, which suffers from less ambiguity or contextual variation than using intensity of agricultural engagement. Here, agricultural participation is a binary indicator defined as engagement in own-farm agriculture during at least one agricultural season in the last 12 months.

For the purpose of this analysis, we consider everyone with at least one day of agricultural labour to be engaged in own-farm labour. Table 4 summarizes the conceptual definitions of the key variables used in the analysis. The first two employment panels in table 4 refer to the recall structure of the LSMS instrument: "Employment in the last 12 months" and

"Employment in the last 7 days". Employment in the last 12 months is further categorized into wage employment and self-employment. Individuals who have had regular employment in the last 12 months are considered wage employed. Wage employment refers to anyone who earns income at an enterprise that they do not own or manage. This ranges from professionals with fixed contracts to piece workers.

Similarly, individuals who worked as an owner or manager of a business or enterprise in the last 12 months are considered self-employed.[8] Given that respondents self-identify whether they have a household enterprise, this includes variety of enterprises, from a grocery-store owner to a street vendor. If an individual works in a household enterprise but is not acknowledged as the owner or manager, then they are considered wage labour. If an individual makes no contribution to a household enterprise through ownership, management or labour, then they are not counted in either category.

Apart from farming, wage employment, and self-employment, all remaining individuals are referred to as "unemployed". An unemployed person here may be a student, an unpaid apprentice or someone helping in daily household activities. The subsequent analysis does not focus on the unemployed individuals, given that we are interested in the dynamics of employment in agriculture compared with other income-generating sectors.

"Employment in the last 7 days" category is further divided in to wage labour, self-employment, and casual labour (Table 4). The wage labour subcategory is differentiated from casual labour, given that the former captures formal short-term labour, largely in the non-agricultural sector, but the latter captures seasonal wage work, mostly in the agricultural sector, such as *ganyu* labour in Malawi. Agricultural wage labourers are categorized as casual labour.

[8] It is important to note that between recall periods, the data on the frequency of certain labour or employment are not always comparable with other types of employment. For example, agricultural labour data are available as the number of days worked in the last two agricultural seasons, but employment in the last 12 months is available as the number of months worked.

Table 4. Variable definitions

Variables	Definition
Employment in the last 12 months	
Wage employment	Individual had regular employment in the last 12 months
Self-employment	Individual worked as an owner or manager of a business or enterprise in the last 12 months
Employment in the last 7 days	
Wage labour	Individual worked as a wage worker in the last 7 days
Self-employment	Individual worked as an owner or manager of a business or enterprise in the last 7 days
Casual labour	Individual worked as a casual or part-time worker (such as *ganyu* labour) in the last 7 days
Agri-food system involvement	
Single-occupation farming	Individual worked positive hours in own-farm activities in the last two seasons with no involvement in any self-enterprise or wage labour
Employed in an agri-food enterprise	Individual worked as a wage employee or self-employed in an agri-food enterprise in the last 7 days or last 12 months, or as casual labour in the last 7 days

Source: Authors' illustrations.

The third panel in Table 4 presents involvement in the agri-food system, which is further categorized into single-occupation farming and employment in an agri-food enterprise. The critical difference between the agri-food system and an agri-food enterprise is that an agri-food enterprise refers to any link in the agricultural value chain or agricultural subsidiaries related to both production and processing, while the agri-food system is an umbrella term including both the agri-food enterprise and single-occupation farming. Identification of businesses that count as agri-food enterprises is based on the International Standard Industrial Classification (ISIC), which acknowledges any activity from inputs to outputs as part of the agri-food system value chain. An individual who was wage-employed or self-employed in the agri-food enterprises (as identified in the ISIC) in the last 12 months or worked as a casual labour in the last seven days is considered to be employed in the agri-food enterprise.

We classify individuals to mutually exclusive employment categories following a hierarchical method. Individuals engaged in any form of wage employment, self-employment or

agricultural wage worker are classified as wage employed. Individuals who engage in self-employment or agricultural participation (but are not wage employed) are classified as self-employed. Individuals who participate in agriculture but are neither wage employed nor self-employed are classified as single-occupation farmers – those who work in agriculture and have no other forms of income generation. Specifying single-occupation farmers allows us to cleanly identify the proportion of the youth who are most interested in the sector.

3.2. Analytical methods

Transition matrices

The first part of the analysis uses mean estimates and transition matrices to examine patterns of employment and involvement in the agri-food system by age group over time. Transition matrices allow for the simple visual representation of movement across sectors, which provides deeper insight beyond sample averages across different points in time. Through the use of a transition matrix, we can identify sector-specific choices such as whether person *i* stayed in a particular sector or shifted to another one. Figure 1 provides a schematic representation of a transition matrix.

$Time\ 1$ \ $Time\ 2$	$\boldsymbol{X2}$	$\boldsymbol{Y2}$	
$\boldsymbol{X1}$	$X1_{X2}$	$X1_{Y2}$	$\sum X1$
$\boldsymbol{Y1}$	$Y1_{X2}$	$Y1_{Y2}$	$\sum Y1$
	$\sum X2$	$\sum Y2$	100

Figure 1. Simplified transition matrix

The matrix comprises two time periods, with mutually exclusive categories $\boldsymbol{X}$ and $\boldsymbol{Y}$. Person *i* can be in either category $\boldsymbol{X}$ or $\boldsymbol{Y}$ in Time 1, and similarly can be in either category in Time 2. In this two-category transition matrix, person *i* has two options in Time 2: either to stay in their original category or to move to the other category. For example, if person *i* started in category $\boldsymbol{X}$ and stayed in category $\boldsymbol{X}$, then they are in cell $X1_{X2}$.

The proportion of individuals who are in any particular category during Time *j* is denoted by the aggregation term $\sum Xj$ or $\sum Yj$, for *j* = 1, 2. All terms in the inner quadrant represent the totality of choices person *i* could make. Therefore, $X1_{X2}$ is the proportion of individuals who stayed in $\boldsymbol{X}$ and $X1_{Y2}$ is the proportion of individuals who moved from X to Y. The rows and columns add up to 100%.

Panel data estimators

In the second half of the analysis, we use panel data estimators to explore the relationship between the age group of individuals and their involvement in the agri-food system. First, we use a conditional lagged model to estimate the relationship between baseline age structure on second-wave employment outcomes. Second, we use panel data estimators to estimate the relationship between population age structure and employment outcomes over time.

$$Y_{it2} = \alpha_0 + \alpha_1 Y_{it1} + \beta_1 Age_{it1} + \beta_2 Age_{it1}^2 + \Theta X_{it1} + \varepsilon_{it} \quad (1)$$

where *i* indicates individual, *t* indicates survey period (t_1 indicates baseline and t_2 indicates follow-up round), and *Y* is the outcome of interest; in this case binary indicators for single-occupation farming and agri-food system employment, and count of own-farm labour days in a given season. Likewise, *X* is the vector of control covariates that includes per capita consumption, gender, education, household size, household head characteristics, and other demographic variables, and ε_{it} is an idiosyncratic error term. Equation 1 is estimated with a probit model for binary outcomes and ordinary least squares for labour days. The estimated coefficients β_1 and β_2

provide the relationship between age groups and probability of single-occupation farming or agri-food system employment. We use predicted conditional probabilities to understand the dynamics of agri-food system involvement for different age groups. The probability of labour outcome in the follow-up wave is contingent on the baseline status and estimated as follows:

$$P_r(Y_{it2}|Y_{it1} = 1) = \widehat{\alpha_0} + \widehat{\alpha_1} + \widehat{\beta_1}Age + \widehat{\beta_1}Age^2 + \widehat{\Theta}\bar{X}$$

$$P_r(Y_{it2}|Y_{it1} = 0) = \widehat{\alpha_0} + \widehat{\beta_1}Age + \widehat{\beta_1}Age^2 + \widehat{\Theta}\bar{X}$$

The panel fixed-effects model is used to estimate the relationship between intensity of single-occupation farming (labor days) and age structure (Equation 2). For binary outcome variables, the pooled probit model is used (Equation 3) which is estimated using the quasi-maximum likelihood estimation –the Chamberlin-Mundlak approach

$$Y_{it} = \alpha_0 + \beta_1 Age + \beta_2 Age^2 + \Theta X + \mu_i + \varepsilon_{it} \quad (2)$$

$$P(Y_{it}|x_{it}, \bar{x_\iota}) = \Phi(\beta_1 Age_{it} + \beta_2 Age_{it}^2 + \Theta X + \Pi\bar{X}) \quad (3)$$

where $\bar{X}$ is the vector of time-constant averages of all explanatory variables in the model, and μ_i is the individual specific effects. In the Chamberlin-Mundlak approach, the time-constant mean is assumed to be normally distributed with mean $\alpha_0 + \pi\bar{x_\iota}$ and variance σ^2 – i.e.

$$\mu_i \sim N(\alpha_0 + \pi\bar{x_\iota}, \sigma^2)$$

Predicted probabilities from equation 3 can be used to gauge the likelihood of certain types of employment by age cohort over time. The predicted probability is estimated as follows:

$$P_r(Y_{it}|x_{it}) = \widehat{\alpha_0} + \widehat{\alpha_1} + \widehat{\beta_1}Age + \widehat{\beta_1}Age^2 + \widehat{\Theta}X$$

4. Results

4.1. Descriptive statistics

Table 5 presents descriptive statistics for variables used in this analysis. Results show that the Tanzanian and Malawian populations are both quite young; an average individual is 26 years

old in the first wave and 28 years in the second wave. Household heads are also relatively young, with an average age of 48 years in Tanzania and 44 years in Malawi in the first wave. The population consists of slightly more females than males – 48 per cent males in Tanzania and 49 per cent in Malawi – but only about 20 per cent of the households are headed by females. An average household has about six to seven members, and household sizes remains more or less constant across waves.

We also present the summary statistics for participation in agriculture.[9] Participation in single-occupation farming is higher in Malawi than in Tanzania; it increases over time in both countries. Specifically in the case of Tanzania, participation in single-occupation farming increases from 43 per cent in wave 1 to 46 per cent in wave 2. In Malawi, it increased from 56 per cent in baseline to 64 per cent in the second wave. In contrast, involvement in an agri-food enterprise is higher in Tanzania than in Malawi; in Tanzania, it was 13 per cent in baseline and 18 per cent in the second wave, but it remains constant at 13 per cent in Malawi. This indicates that Tanzania's agricultural sector is more modern and expanding faster than Malawi's. In addition, the proportion of agricultural households is smaller in Tanzania than in Malawi and it has been decreasing over time in Tanzania but increasing in Malawi. A decreasing proportion of farming households coupled with an increasing trend in agri-food enterprise involvement in Tanzania indicates that Tanzanian farmers are moving from single-occupation farming to agricultural enterprises.

Table 5. Summary statistics

Variables	Tanzania		Malawi	
	Wave 1	Wave 2	Wave 1	Wave 2
Age in years	26.58	28.48	26.01	28.00
	(18.32)	(18.33)	(17.64)	(17.64)
Gender (1=Male, 0=Female)	0.481	0.480	0.492	0.491
	(0.500)	(0.500)	(0.500)	(0.500)
Head: Age in years	47.93	48.98	43.79	46.61
	(14.30)	(14.48)	(14.49)	(14.29)
Female head (1=Yes, 0=No)	0.203	0.212	0.192	0.196

[9] Note that these figures are from the unbalanced sample.

	(0.402)	(0.409)	(0.394)	(0.397)
Household size	6.549	6.787	5.932	6.196
	(3.736)	(4.205)	(2.491)	(2.447)
Single-occupation farming (1=Yes, 0=No)	0.429	0.460	0.564	0.641
	(0.495)	(0.498)	(0.496)	(0.480)
Agri-food enterprise involvement (1=Yes, 0=No)	0.129	0.188	0.137	0.135
	(0.335)	(0.391)	(0.344)	(0.342)
Total days worked in 2 seasons	32.87	28.87	25.86	31.09
	(61.19)	(48.31)	(36.97)	(40.05)
Agricultural household (1=Yes, 0=No)	0.750	0.713	0.775	0.791
	(0.433)	(0.453)	(0.418)	(0.407)
Livestock-keeping household (1=Yes, 0=No)	0.583	0.571	0.544	0.560
	(0.493)	(0.495)	(0.498)	(0.496)
Per capita consumption (LCU*), annual	551 044	627 329	164 195	157 319
	(559 564)	(572 649)	(226 892)	(197 790)
Currently attending school (1=Yes, 0=No)	0.339	0.327	0.398	0.368
	(0.473)	(0.469)	(0.489)	(0.482)
Rural (1=Yes, 0=Urban)	0.656	0.700	0.756	0.759
	(0.475)	(0.458)	(0.429)	(0.428)
Observations	13 223	13 223	10 266	10 266

Notes: Point estimates are means. Standard deviations are in parentheses.
*Local currency units: Tanzanian Shilling and Malawian Kwacha.

Youth participation in agriculture

Our emphasis on youth participation in agriculture is fueled by assumptions regarding young people's preferences and distaste for work that could be construed as "dirty". While it is reasonable that many youth may not share a passion for agricultural work, evidence does not substantiate the belief that they do not participate. Agriculture is the largest employer of youth (aged 15-24) compared with any other sector in both Tanzania and Malawi (Figure 2).

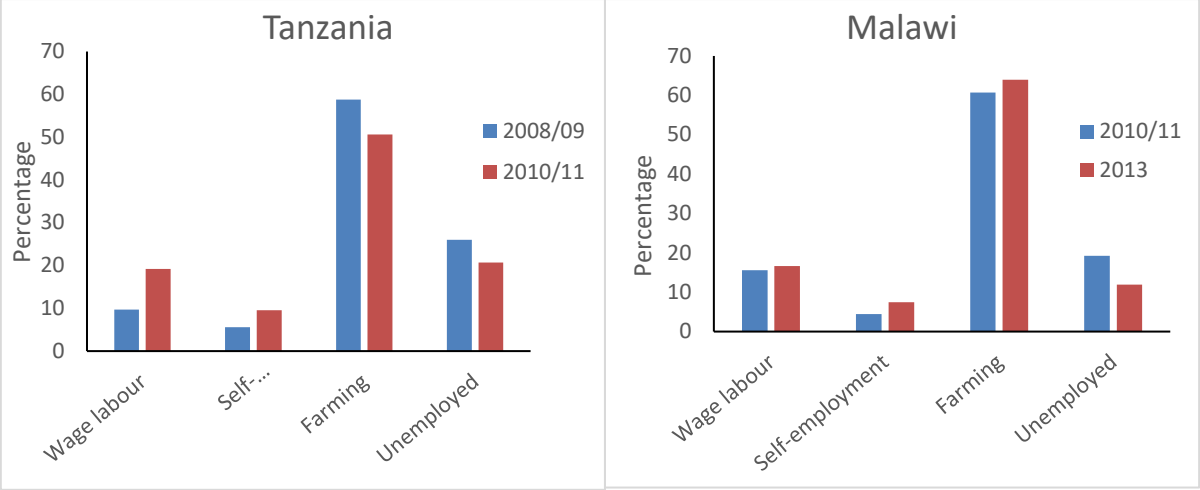


Figure 2. Rural youth participation in different sectors of employment

Using a balanced panel, Figure 2 shows that participation in single-occupation farming among rural youth (aged 15-24) is greater than 50 per cent in both countries. Our categorization of the employment sectors implies that any estimates of youth participation tend to be biased downwards because any individual who is employed in both own-farm agriculture and wage labour or self-employment would not be counted in the "farming" category. Rates of engagement in agriculture are decreasing in Tanzania (i.e. individuals are not necessarily leaving farming but are additionally engaging in wage labour or self-enterprises), yet 59 per cent of Tanzanian youth remained in single-occupation farming between 2009 and 2011. In Malawi, where over 60 per cent of youth are engaged primarily in farming, the sector not only grew, but 70 per cent of Malawian youth remained in farming between 2011 and 2013.

How old is the average farmer?

In 2011, youth and young adults in Tanzania and Malawi made up 47 per cent of the individuals engaged in single-occupation farming. In a pooled sample that contains individuals aged 5 years and above from Tanzania and Malawi, the average age of an individual who engaged only in agriculture is 32 years. We acknowledge that the "youth bulge" in the population distribution skews the sample, but the average age of a farmer holds firm regardless of how the population is

sliced up.[10] As illustrated in Figure 3, over 75 per cent of those involved primarily in single-occupation farming are under 50, making it difficult to support claims that the average age of African farmers is above 60. Given that these numbers reflect those that are only engaged in farming, we can expect that a new generation of farmers is in fact emerging in both Tanzania and Malawi.

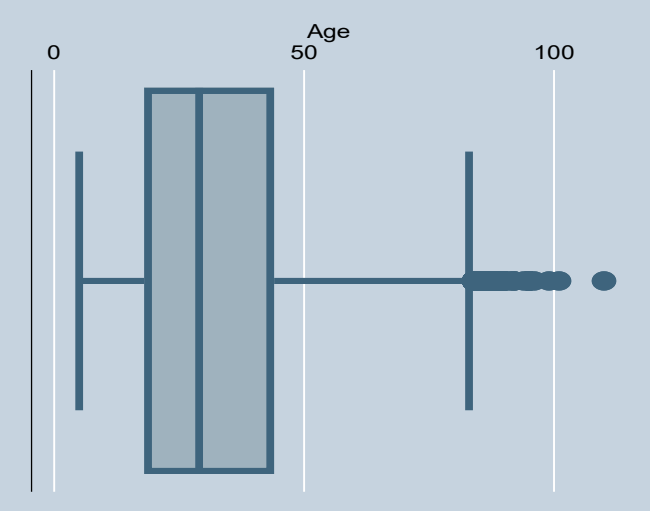


Figure 3. Box plot of engagement in single-occupation farming, by age

Rural youth are more likely to be involved in agriculture than be unemployed

Following the rhetoric that farming is dirty and undesirable, there is an implication that youth would rather be unemployed (or job-seeking) than engage in agriculture. Also, youth could consider agriculture as the last resort and may perceive their engagement in the sector as transitional and temporary. However, after taking into account on-farm and off-farm engagement, unemployment among rural youth in Tanzania and Malawi is relatively low.

In Tanzania, youth unemployment fell from 26 to 21 per cent in rural areas and from 65 to 56 per cent in urban areas between 2009 and 2011. In Malawi, the proportion of unemployed

[10] Though uncomfortable to account for, child labour (6-14) plays a large role in rural agriculture. The average age of a child engaged in agricultural activities in Tanzania and Malawi is 11, indicating that younger children also are engaged in agriculture, not simply those post puberty. When these individuals are dropped from the sample, restricting age to a minimum of 15 years, the new average age of a farmer increases to 36.

rural youth fell from 19 to 11 per cent between 2011 and 2013, while in urban areas it fell from 54 to 39 per cent. The decreases in the rate of youth unemployment coincide with increases in engagement in agriculture, given that about 40 per cent of the previously unemployed people in Tanzania engaged in single-occupation farming, while in Malawi this number is closer to 56 per cent. In comparison, less than 20 per cent of unemployed youth in both Tanzania and Malawi entered into either wage labour or self-employment, indicating that youth are more likely to enter farming than other sectors.

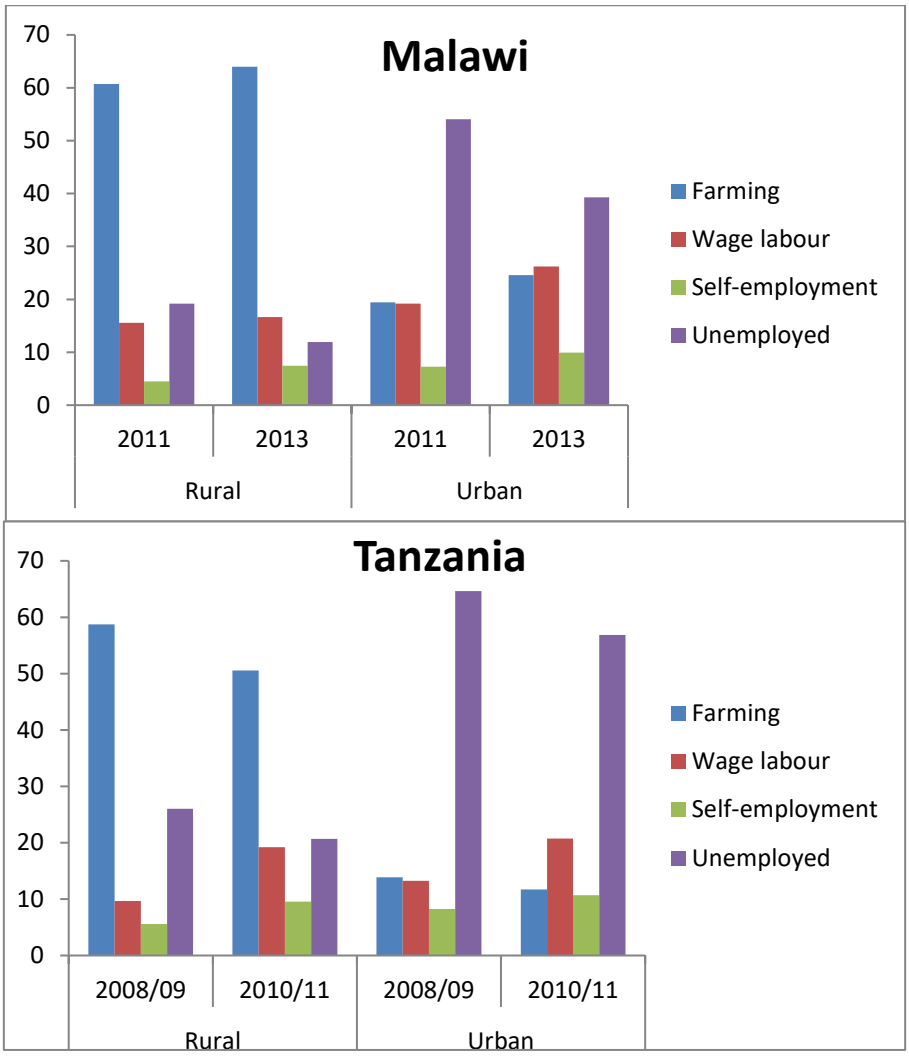


Figure 4. Dynamics of youth employment in rural and urban areas

Figure 4 shows that youth employment in Tanzania varies widely across rural and urban areas. Over time, only about 25 per cent of rural youth have no documented employment, whereas unemployment among urban youth is about 60 per cent. The high rate of

unemployment in urban areas is linked to the much lower participation of urban youth in farming compared with those in rural areas. More than half of rural youth engage in farming, compared with less than 15 per cent in urban areas. A similar pattern holds in Malawi; the proportion of rural youth who are unemployed is less than 20 per cent, compared with more than 45 per cent of urban youth.[11] Over time, unemployment decreases, along with an increase in wage employment and self-employment and a decrease in engagement in farming. This trend is consistent across both countries, indicating increased diversification of their local economies.

There is considerable mobility towards farming among youth

Table 6 provides figures that indicate the proportion of individuals who moved towards farming, given their previous occupation. The first column, "Farming", provides point estimates of the rate of retention in farming over time. In the subsequent columns, the point estimates are the percentage of the baseline occupation population who moved towards single-occupation farming, given the option to either stay in their baseline sector or move to any other sector – i.e. three options – with the fourth being the loss of a job or choosing not to work.

Table 6. Shifts towards farming given baseline occupation

	Movements			
	Farming	Wage labour to farming	Self-employment to farming	Unemployment to farming
Tanzania youth (%)	59	35	37	41
Tanzania young adult (%)	54	28	26	40
Malawi youth (%)	56	55	57	56
Malawi young adult (%)	69	38	47	38

Source: Authors' illustrations.

Assuming that each option carries equal probability (one in four), it can be seen that the choice of single-occupation farming beats every other option, for every single group and sector.

[11] It is yet to be assessed whether high unemployment rates in urban areas can be attributed to "true" unemployment or engagement in non-productive activities such as schooling. Future assessments will seek to ascertain this.

If we discount unemployment from the list of options, the probability of youth and young adults participating in farming is equal to or greater than their probability of moving into other sectors. In the case of Malawi, more than half of youth and young adults engaged in other sectors in baseline moved into single-occupation farming.

Table 7 presents point estimates of the movements of youth and young adults out of single-occupation farming to other income-generating sectors or unemployment. When considering the income-generating sectors (wage labour and self-employment), in Tanzania, about 17 per cent of youth engaged in farming in 2009 moved to wage employment in 2011, and 9 per cent moved to self-employment, while nearly 15 per cent became unemployed. Similar patterns hold for Malawian youth, but the point estimates are smaller for each movement, indicating that engagement in farming among youth is more stable in Malawi than in Tanzania.

Table 7. Movements out of farming to other sectors

	Movements		
	Farming to wage labour	Farming to self-employment	Farming to unemployment
Tanzania			
Youth (%)	17.5	9.05	14.7
Young adults (%)	24.7	15.5	5.9
Malawi			
Youth (%)	14.5	7.3	8.7
Young adults (%)	17.7	10.7	3.0

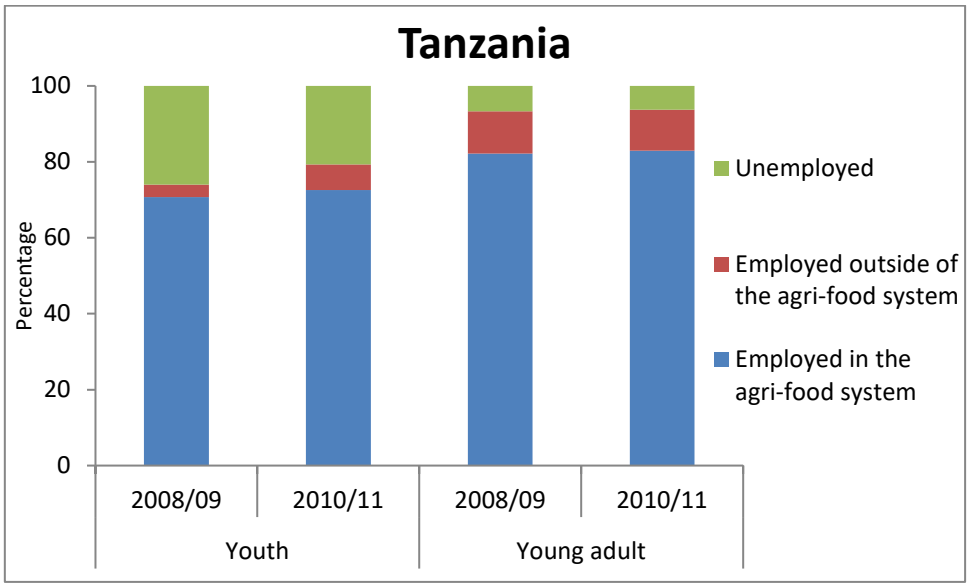
Source: Authors' illustrations.

In comparison, young adults in Malawi show more stability regarding participation in farming, but the proportion of young adults who moved from farming to unemployment is much smaller in both countries. In addition, the proportion of young adults moving out of farming to wage and self-employment is also higher than that of youth; for example, about 25. per cent young adults moved out of farming to wage employment, compared with 17 per cent of youth in Tanzania. Similarly, 15.5 per cent of young adults moved from farming to self-employment, compared with 9 per cent of youth. A similar pattern holds in Malawi. Results

indicate that the rate of retention in farming is higher among youth than among young adults, and both youth and young adults who move out of farming are more likely to enter other income-generating activities than remain unemployed. While the intensity of mobility towards single-occupation farming from other sectors is encouraging, it does not necessarily mean an increased attraction to farming. It is possible that shifts towards agriculture are largely a result of the loss of baseline livelihood options, rather than attraction to the sector for income-generating opportunities.

Youth participation in the agri-food system

Given the evidence that between 41 and 44 per cent of youth initially engaged in single-occupation farming moved to income-generating sectors, we now examine whether participation in wage labour or self-employment is still within the greater agri-food system or outside it. As previously described, the agri-food system encompasses single-occupation farming, casual labour in farming and engagement in agricultural value chain enterprises. The agri-food system casts a wide net to include all forms of inputs, intermediate outputs, final outputs and value-added services.



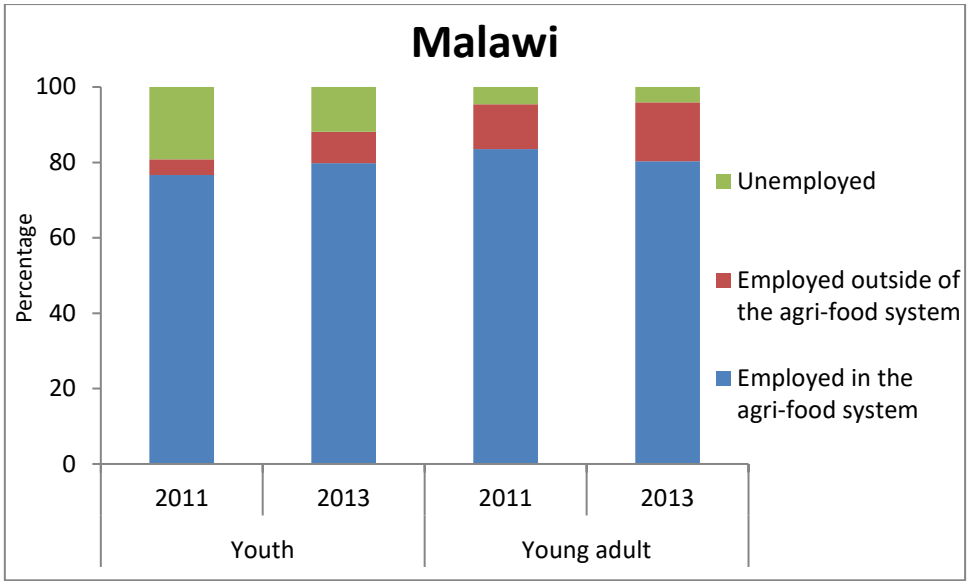


Figure 5. Participation by youth and young adults in the agri-food system

Figure 5 presents participation by youth and young adults in the agri-food system in Tanzania and Malawi. In Tanzania, about 71 per cent of youth are engaged in the agri-food system in 2008/2009 and the proportion increases slightly to 72 per cent in 2010/2011. Despite a small increase in agri-food system engagement, there is a big increase in agrifood enterprise employment. Youth employment in agri-food enterprises increases from 12 per cent in 2008/2009 to 22 per cent in 2010/2011, coupled with a decrease in farming from 59 per cent to 50 per cent. Youth participation in the agri-food system also increased in Malawi, from 77 per cent in 2010 to 80 per cent in 2013, but in contrast to Tanzania, the growth in agri-food system engagement comes exclusively from farming. Youth employment in agrifood enterprises remains stable over time at 15 per cent.

The discrepancy between countries persists over time and age groups. The employment dynamics of young adults are different from those of youth within each country, but the difference between countries is even bigger for young adults' engagement in the agri-food system. Even though about 80 per cent of young adults are engaged in the agri-food system in both Tanzania and Malawi, the composition of employment varies widely. In Tanzania, employment of young adults in agri-food enterprises increased from 29 per cent in 2008/2009 to

41 per cent in 2010/2011, but in Malawi, employment of young adults in agri-food enterprises remains stable at 24 per cent. The results confirm our finding that Malawi's rural economy is very much dependent on agriculture and much less diversified than Tanzania's.

4.2. Empirical results

Results from the empirical analysis are divided into two groups. First, we present the estimated results from the conditional lagged model (Equation 1). Results from the conditional lagged model highlight the dynamics (mobility versus stability) of employment and agri-food system involvement across different age groups. The second half of the empirical results presents the findings from panel data analysis.

Results from the conditional lagged model

Table 8 presents the results from the conditional lagged model. The estimated coefficients provide the probability of an average individual remaining in the baseline sector over time. Results show that the probability of engaging in farming significantly increases with an individual's age but at a decreasing rate. The quadratic relationship between age and farming or agri-food system employment suggests that as people get older they are less likely to enter or remain engaged in these sectors. Specifically, the probability of engaging in farming is higher for individuals from farming households, livestock-keeping households and rural households. As expected, this probability decreases with household well-being status because individuals from well-off households have less incentive (and higher opportunity cost) to work as farm labour. The probability of working in farming as own-farm labour or in the agri-food system also decreases with household size, confirming the hypothesis that family labour supply increases with household size.

We also examine the stability of engagement in a certain sector over time. In Table 8 the coefficient estimates on the first two variables show the probability of remaining in the baseline

sector in the follow-up wave. On average, the probability of engaging in farming in wave 2 is 0.82 points higher if an individual is already engaged in farming in wave 1. This indicates that involvement in farming is highly stable, irrespective of age groups. Such a probability is lower in agri-food system employment (0.76 in Tanzania and 0.46 in Malawi), suggesting that employment in the agri-food system is more stable in Tanzania than in Malawi. Stability (the probability of remaining in the baseline sector over time) does vary across waves. Figure 6 presents the probability of engaging in or entering farming as own-farm labour given baseline status. For all age groups, the probability of remaining in farming over time is always higher than the probability of entering farming in wave 2.

Table 8. **Probability of remaining in the baseline sector over time**

	Farming		Agri-food system (AFS) employment	
	Tanzania	Malawi	Tanzania	Malawi
Farming in wave 1	0.82***	0.81***	-	-
	(0.034)	(0.038)		
AFS involvement in wave 1	-	-	0.76***	0.46***
			(0.037)	(0.043)
Age	0.086***	0.091***	0.089***	0.058***
	(0.0035)	(0.0044)	(0.0040)	(0.0062)
Age^2	-0.001***	-0.001***	-0.001***	-0.0007***
	(0.00004)	(0.00005)	(0.0001)	(0.00008)
Log (consumption expenditure)	-0.23***	-0.14***	-0.093***	-0.11***
	(0.024)	(0.025)	(0.023)	(0.028)
Agricultural household (1=Yes, 0=No)	1.20***	0.60***	-0.087*	0.045
	(0.058)	(0.045)	(0.047)	(0.050)
Livestock household (1=Yes, 0=No)	0.20***	0.079**	0.062*	-0.097**
	(0.033)	(0.034)	(0.035)	(0.038)
Gender (1=Male, 0=Female)	0.035	-0.089***	0.12***	0.21***
	(0.028)	(0.030)	(0.029)	(0.035)
Head: Age in years	-0.0006	0.0011	-0.0038***	-0.0034**
	(0.0011)	(0.0013)	(0.0012)	(0.0016)

Head: Gender (1=Male, 0=Female)	-0.009	-0.036	0.19***	0.083*
	(0.036)	(0.040)	(0.036)	(0.045)
Household size	-0.033***	-0.037***	-0.0080*	-0.036***
	(0.0042)	(0.0070)	(0.0041)	(0.0081)
Currently attending school (1=Yes, 0=No)	0.22***	0.28***	-0.40***	-0.18***
	(0.037)	(0.048)	(0.045)	(0.062)
Rural (1=Yes, 0=Urban)	0.56***	0.58***	0.10**	-0.17***
	(0.040)	(0.045)	(0.043)	(0.052)
Constant	-0.14	-0.29	-1.17***	-0.34
	(0.33)	(0.32)	(0.32)	(0.35)
Observations	13 218	10 174	13 218	10 174

Notes: Standard errors in parentheses. Level of significance * $p < .10$, ** $p < .05$, *** $p < .01$.

The probability of remaining engaged in farming increases at an increasing rate for youth and is the highest for young adults in both countries. Similarly, the probability of entering farming (or own-farm agriculture) also increases at an increasing rate for youth and is the highest for young adults. This suggests that, contrary to the myth that young people have a distaste for agricultural work, both youth and young adults are more willing than any other age group to newly enter and remain engaged in own-farm agriculture. Similar results hold for agri-food system employment.

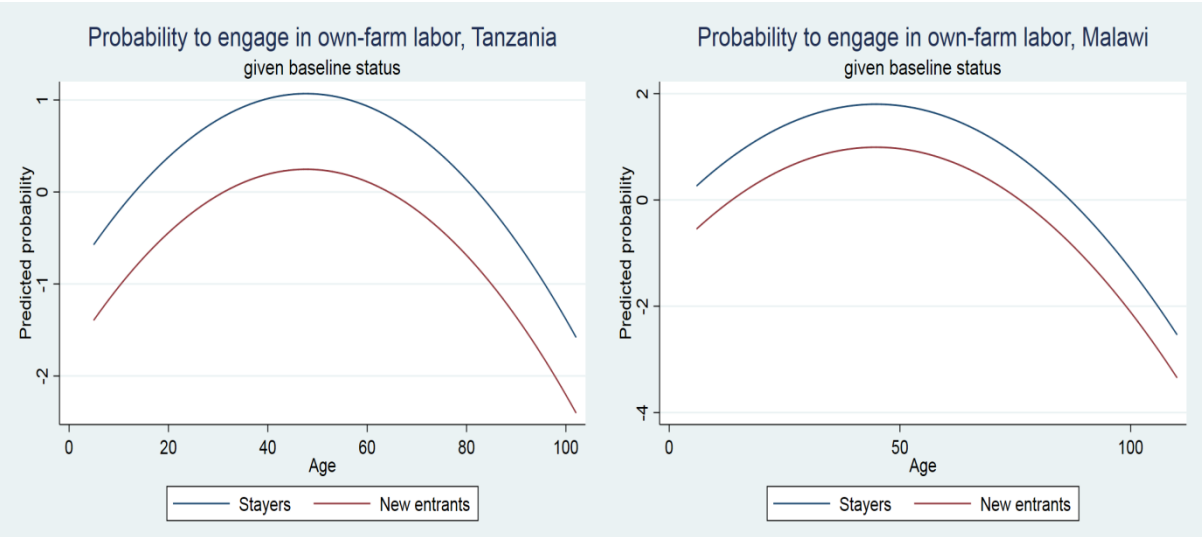


Figure 6. Probability of engaging in own-farm labour by individual's age

Results from panel data analysis

Table 9 presents the results from the panel data analysis. Our main objective is to estimate the probability of engagement in farming and agri-food system employment for different age groups. The estimated results confirm that the probability of engaging in both farming and agri-food system employment increases with age, but at a decreasing rate.

Table 9. Probability of engaging in a specific sector over time

	Farming		Agri-food system employment	
	Tanzania	Malawi	Tanzania	Malawi
Age	0.35***	0.40***	0.24***	0.13***
	(0.069)	(0.022)	(0.071)	(0.029)
Age^2	-0.0023***	-0.0048***	-0.003***	-0.0019***
	(0.0003)	(0.00034)	(0.0004)	(0.00040)
Agricultural household (1=Yes, 0=No)	1.84***	1.07***	0.010	0.11
	(0.093)	(0.064)	(0.075)	(0.067)
Livestock household (1=Yes, 0=No)	0.16***	0.12***	0.028	-0.040
	(0.044)	(0.043)	(0.047)	(0.045)
Log (consumption expenditure)	-0.021*	-0.060	0.017	0.055
	(0.011)	(0.039)	(0.010)	(0.041)
Gender (1=Male, 0=Female)	-0.11	-0.058	0.29	-0.40
	(0.25)	(0.43)	(0.30)	(0.38)
Head: Age in years	0.006**	-0.0050	-0.004	-0.0028
	(0.003)	(0.0042)	(0.003)	(0.0050)
Head: Gender (1=Male, 0=Female)	0.17*	0.0020	0.39***	0.30***
	(0.098)	(0.088)	(0.089)	(0.091)
Household size	-0.021*	-0.11***	-0.017***	-0.020
	(0.011)	(0.016)	(0.003)	(0.017)
Currently attending school	-0.049	-0.067	-0.54***	-0.27***
	(0.050)	(0.066)	(0.069)	(0.088)

Rural area	0.15**	0.79***	-0.085	0.028
	(0.068)	(0.14)	(0.058)	(0.14)
Constant	-5.91***	-2.22***	-2.49***	-1.15***
	(0.19)	(0.30)	(0.16)	(0.32)
Observations	26 346	20 384	26 346	20 384

Notes: Standard errors in parentheses. Level of significance * p < .10, ** p < .05, *** p < .01.

We calculate marginal effects of age for individuals aged 18 and 40 to understand the relationship between age and engagement in own-farming and employment in the agri-food system. For individuals aged 18, a one-year increase in age increases their probability of engaging in farming as own-farm labour by 0.27 points in Tanzania and 0.23 points in Malawi. For individuals aged 40, this probability is 0.17 in Tanzania and 0.016 in Malawi. A similar pattern holds for the probability of being employed in the agri-food system. For individuals aged 18, a one-year increase in age increases the probability of being employed in the agri-food system by 0.13 in Tanzania and 0.06 in Malawi. At age 40, a one-year increase in age has no effect on the probability for Tanzanian individuals and decreases the probability of employment in the agri-food system by 0.02 points for Malawian individuals.

Among other variables, the probability of engaging in single-occupation farming is higher for individuals from agricultural households, livestock-keeping households and rural households. However, none of these variables have a significant effect on the probability of being employed in the agri-food system suggesting that, unlike farming, employment in the agri-food system does not differ by rural area or if the individuals are from agricultural households. Interestingly, an individual's gender has no effect on their likelihood of either participating in farming or being employed in the agri-food system and household size decreases an individual's likelihood of participating in farming as own-farm labour or being employed in the agri-food system .

Table 10 presents the estimated relationship between different age groups and involvement in the agri-food system. We divide individuals into five different age categories and estimate the probability of engagement in farming and agri-food system employment across

different age groups. The base category is a group of children aged 6-10. Results show that the probability of engaging in farming is the highest for youth in both countries: 0.26 in Tanzania and 0.34 in Malawi. In contrast, the probability of being employed in the agri-food system is the highest for adults aged 35-64. Even though the probabilities for both own-farm labour engagement and agri-food system employment increase with age, being a child or a youth decreases the probability of being employed in the agri-food system.

Table 10. Relationship between age groups and engagement in the agri-food system (AFS)

	Farming		AFS employment	
	Tanzania	Malawi	Tanzania	Malawi
Children, 10-14	0.16***	0.16***	-0.015**	-0.006
	(0.012)	(0.015)	(0.0060)	(0.0075)
Youth, 15-24	0.26***	0.34***	-0.016	0.0007
	(0.020)	(0.023)	(0.012)	(0.015)
Young adult, 25-34	0.26***	0.29***	0.085***	0.037
	(0.027)	(0.031)	(0.021)	(0.024)
Adult, 35-64	0.23***	0.26***	0.13***	0.062**
	(0.032)	(0.036)	(0.027)	(0.031)
Elderly, 65 and over	0.26***	0.29***	0.10***	0.025
	(0.036)	(0.039)	(0.035)	(0.037)
Agricultural household (1=Yes, 0=No)	0.35***	0.31***	-0.029*	0.024*
	(0.017)	(0.017)	(0.015)	(0.014)
Livestock household (1=Yes, 0=No)	0.034***	0.030***	-0.0005	-0.0075
	(0.011)	(0.0093)	(0.0096)	(0.0086)
Log (consumption expenditure)	-0.0047	-0.0059	0.040***	0.011
	(0.0078)	(0.0085)	(0.0074)	(0.0078)
Sex (1=Male, 0=Female)	0.0039	-0.00093	0.010	-0.032
	(0.062)	(0.11)	(0.031)	(0.038)
Head: Age	0.0021***	0.0037***	-0.0004	-0.0004
	(0.0007)	(0.0009)	(0.0006)	(0.0008)

Head: Gender(1=Female, 0=Male)	0.047**	0.024	0.087***	0.053***
	(0.019)	(0.020)	(0.019)	(0.017)
Household size	-0.0026	-0.018***	-0.002	-0.0026
	(0.0024)	(0.0035)	(0.002)	(0.003)
Currently attending school	-0.018	-0.032*	-0.057***	-0.041***
	(0.013)	(0.018)	(0.0066)	(0.011)
Rural (1=Yes, 0=Urban)	0.0072	0.17***	0.0007	0.0081
	(0.012)	(0.032)	(0.011)	(0.031)
Constant	0.29***	0.10	0.19***	0.25***
	(0.063)	(0.069)	(0.056)	(0.058)
Observations	26346	20384	26346	20384
R^2	0.487	0.47	0.140	0.09

Notes: Standard errors in parentheses. Level of significance * $p < .10$, ** $p < .05$, *** $p < .01$.

In Figure 7 we present the estimated relationship between age structure and labour days in the agri-food system. In Tanzania, youth work the most days, and the estimated number of labour days is significantly positive for children, youth and young adults, but it is zero for adults and significantly negative for elderly people. In Malawi, the pattern is similar for the first three groups, taking an inverted U-shaped curve, but the estimated number of labour days starts increasing for adults and is the highest for elderly people. The results in the latter case could be concerning, but this result is driven by the fact that *ganyu* labour (the most common form of casual labour in Malawi) is included as part of the agri-food system.

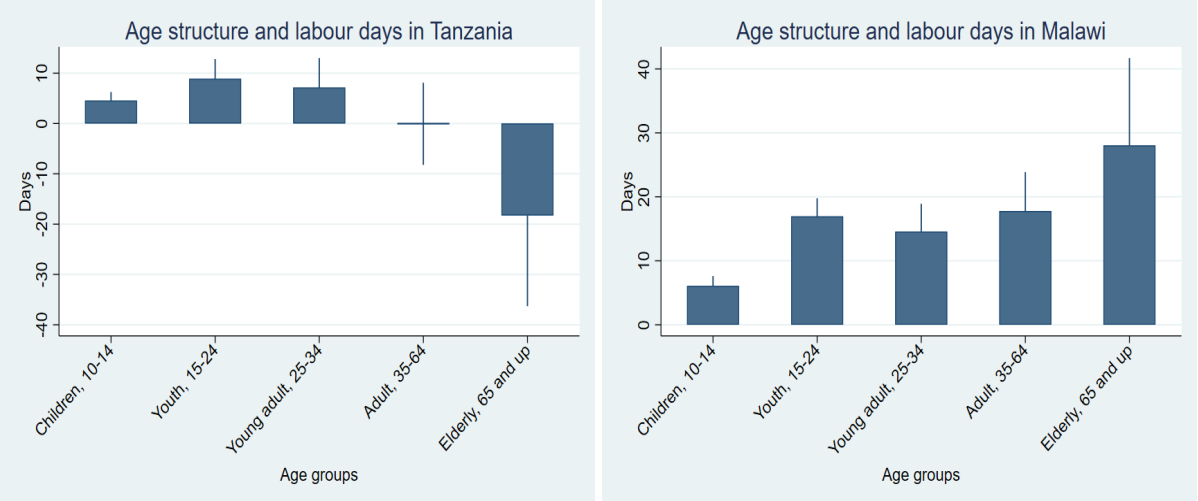


Figure 7. Estimated effects of age cohorts on labour days

5. Conclusion

This analysis examines the dynamics of age structure and employment in the agri-food system in Tanzania and Malawi. Using internationally comparable integrated household and agriculture surveys from Tanzania and Malawi, we discover that in contrast to the widely reported statistic that "the average age of an African farmer is 65 years", the average age of a person who is engaged in farming is 34 years in Tanzania and 31 years in Malawi. In Tanzania, about 12 per cent of the population was employed in the agri-food system, and 49 per cent of the population worked in agriculture by providing own-farm labour in 2008/2009. Categorizing employment into four groups (wage employment, self-employment, engagement in farming, and the residual unemployed category), we find that wage and self-employment of youth and young adults in rural areas has increased over time, along with a subtle decrease in engagement in farming and quite a large decrease in unemployment. Results also indicate that youth aged 15-24 and young adults aged 25-34 comprise more than 26 per cent and 30 per cent, respectively, of the population working in the agri-food system.

Examination of the movements into and out of the agri-food system reveals a moderate degree of stability of youth and young adult participation in farming in both countries. Specifically, 59 per cent of rural youth in Tanzania and 56 per cent of rural youth in Malawi are consistently engaged in farming over time. The perceived stability of youth engagement in farming may not necessarily imply attraction to agriculture because movements across sectors involve transaction costs and rural youth may be unable to afford such costs.

When movement between sectors is considered, interestingly, there is considerable mobility between different sectors of employment. Specifically, more than 57 per cent of the youth who were not involved in the agri-food system during the baseline entered the sector in the subsequent wave, and 12 per cent of the youth involved in the agri-food system during the baseline moved out of the sector in the subsequent wave. Similarly, 15.5 per cent of the youth

who worked in own-farm agriculture during the baseline took on wage employment in the agri-food system in the subsequent wave, and 58 per cent of the youth who were wage employed during the baseline started own-farming in the follow-up wave.

Movements from one sector of employment to another may be driven by push factors in the baseline sector or pull factors in the endline sector. Push factors include factors such as low profitability of agriculture and pull factors can include factors such as higher opportunity costs of staying in the current sector. While it is difficult to determine whether either push or pull factors are encouraging movement, it is understood that decisions are largely made between either staying in the baseline sector or moving into single-occupation farming.

Results from econometrics analysis largely confirm the findings from descriptive analysis. We find that the probability of engaging in farming and the larger agri-food system increases with age but at a decreasing rate. The probability of engaging in farming is highest for youth and young adults, but the probability of being employed in the agri-food system is highest for adults over the age of 40. We also find that the probability of engaging in farming (or the agri-food system) is highest for individuals who were engaged in farming (or in the agri-food system) in the previous period, confirming a high degree of stability in youth and young adult engagement in farming.

Overall, our findings suggest that youth are much more likely than young adults to move towards single-occupation farming as opposed to another income-generating sector. Even though this finding is encouraging for policymakers who are concerned about the lack of attraction to agriculture among youth, it is likely that the poor economic prospects outside farming are what is driving strong participation in single-occupation farming. Given that increasing youth employment is a priority public policy for the governments of Tanzania and Malawi, it is recommended that these countries attempt to diversify the rural economy by developing the many economic opportunities other than farming. If a wider set of economic

opportunities were available, youth and young adults would be more likely to seek opportunities to increase their participation in agriculture and in non-farm income-generating activities.

One of the limitations of this study is that the analysis makes use of only two rounds of data. The analysis presented in this paper provides a baseline of short-term mobility. Availability of data warrants future studies to determine mid-term retention rates of agricultural and agri-food system participation as well as any structural shifts in overall participation rates. Future studies should make use of longitudinal data over a longer period of time to investigate the dynamics of employment in the agri-food system.

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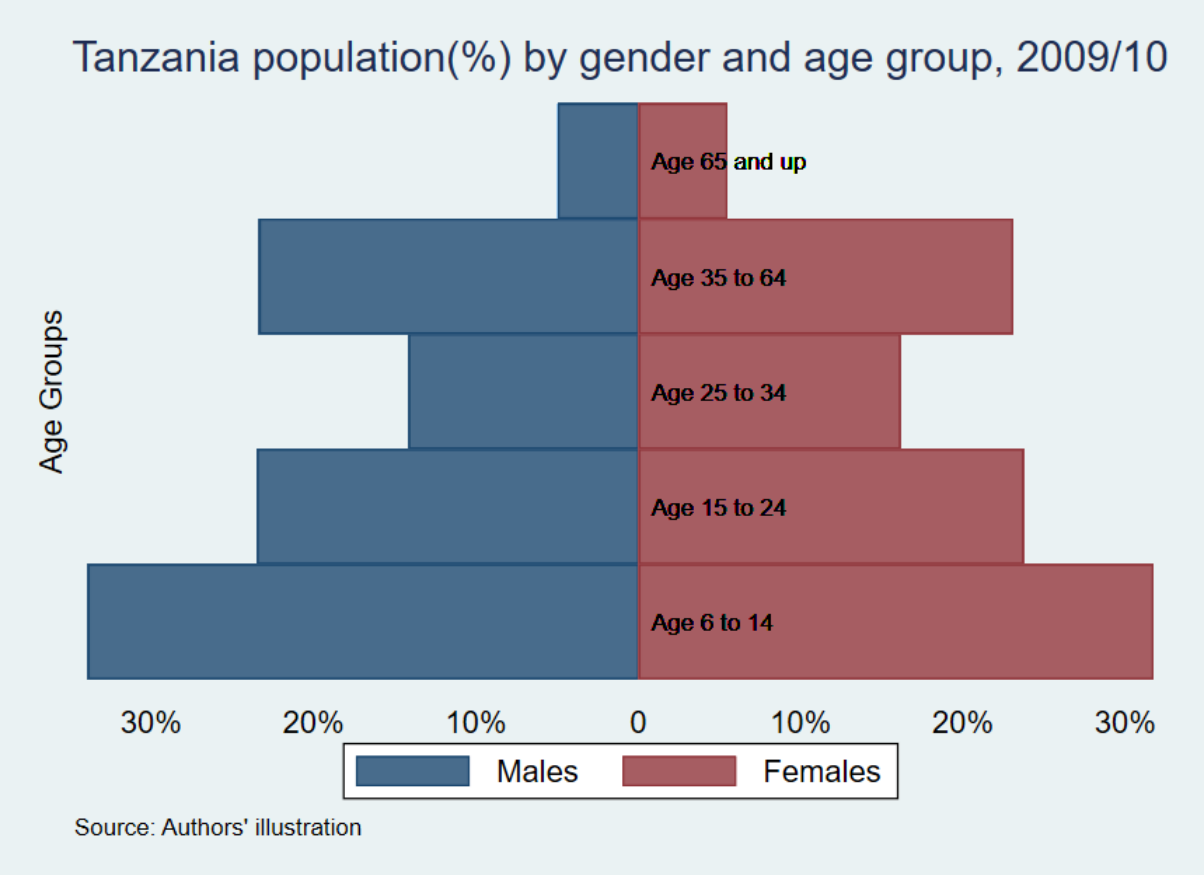
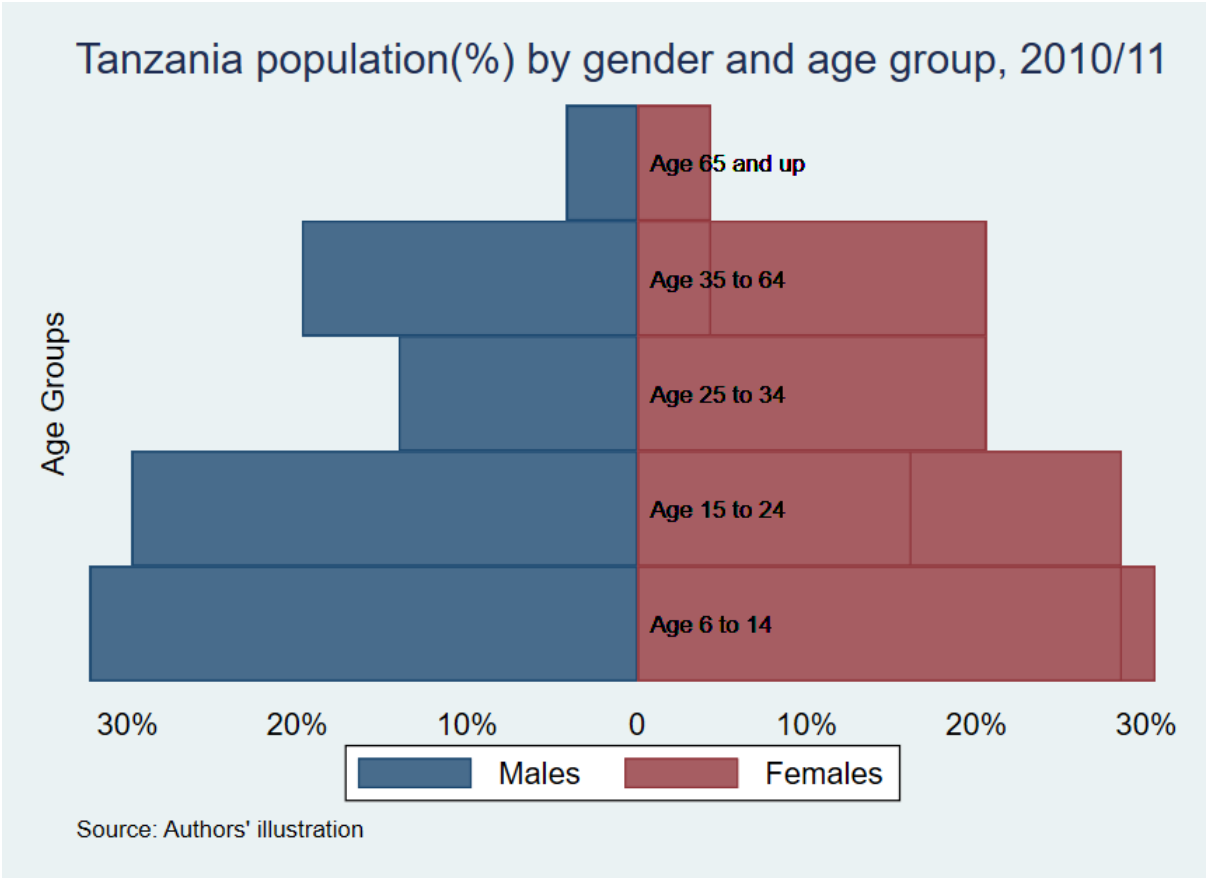
Appendix


Tanzania population(%) by gender and age group, 2009/10
Age 65 and up
Age 35 to 64
Age 25 to 34
Age 15 to 24
Age 6 to 14
Age Groups
30%
20%
10%
0
10%
20%
30%
Males
Females
Source: Authors' illustration



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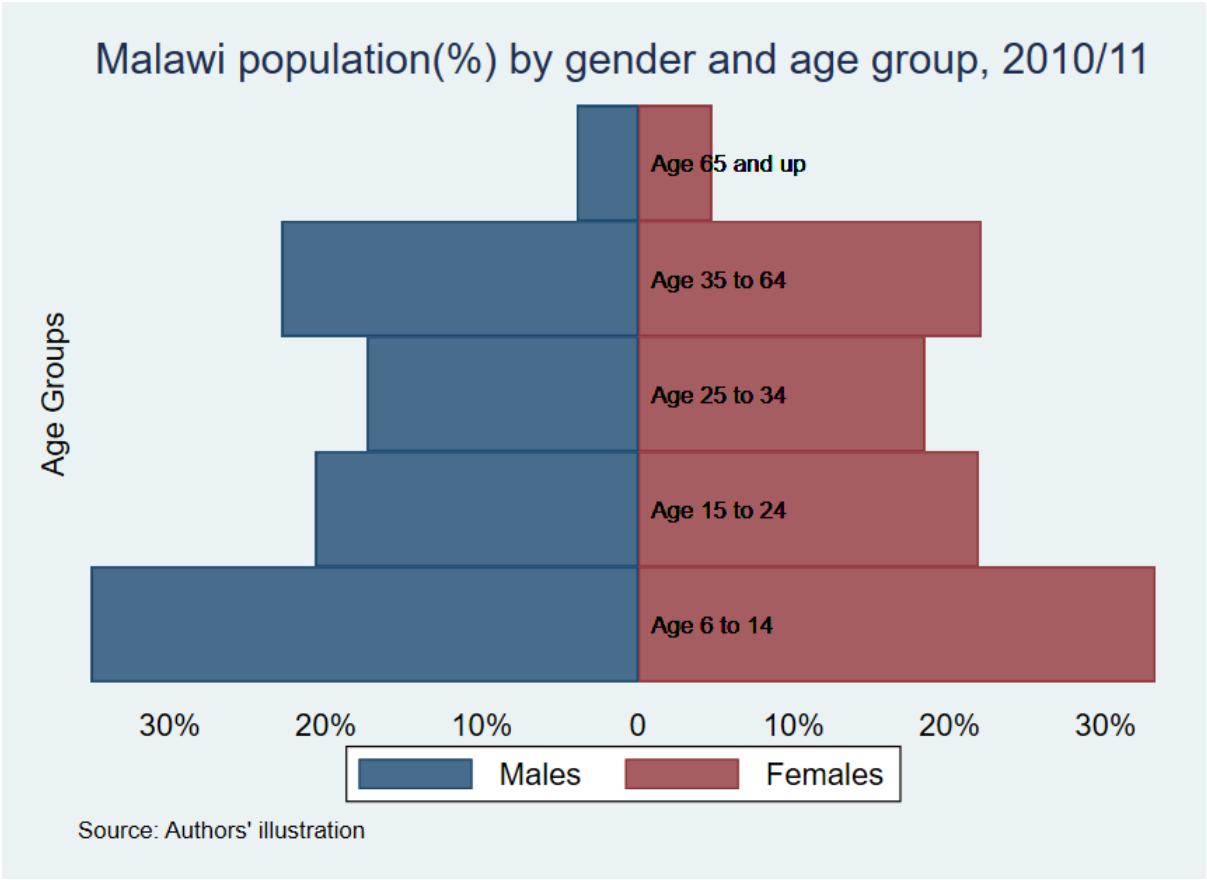
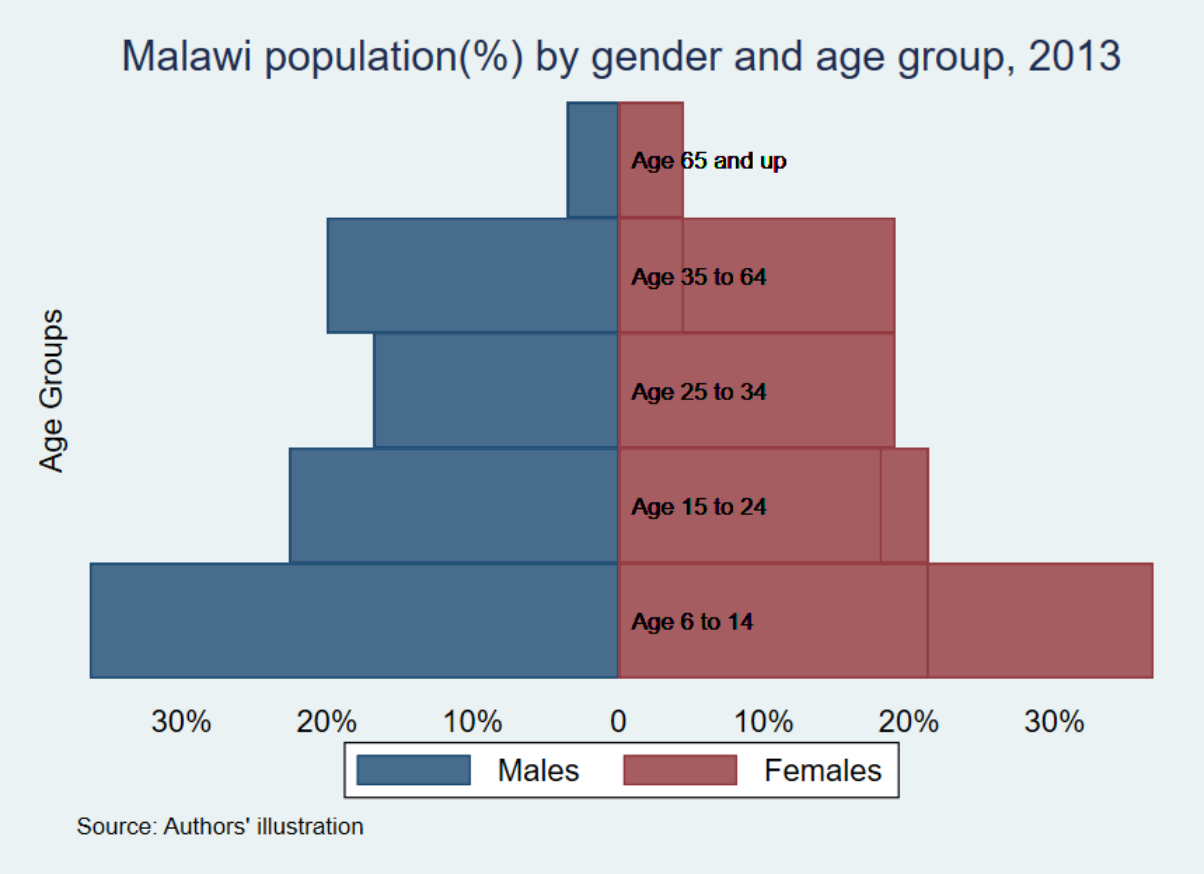


Source: Authors' illustration


Malawi population(%) by gender and age group, 2013
Age Groups
Age 65 and up
Age 35 to 64
Age 25 to 34
Age 15 to 24
Age 6 to 14
30%
20%
10%
0
10%
20%
30%
Males
Females
Source: Authors' illustration