Who works in agriculture? Exploring the dynamics of youth involvement in Tanzania's and Malawi's Agri-food system

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Abstract

This analysis examines the dynamics of employment in agriculture and the agri-food system in Malawi and Tanzania by assessing population age structure and movements of youth (15 to 24) and young adults (25 to 34) in and out of agriculture and the agri-food system. Using internationally comparable integrated household and agriculture surveys from Tanzania and Malawi, we discover that the average age of a person who works in farming as own-farm labor is 34 years-old in Tanzania and 31 years-old in Malawi. Examination of the movements into and out of the agri-food system demonstrates a high degree of stability of youth and young adult's participation in farming in both countries. Specifically, 59% of Tanzanian rural youth consistently engaged in farming over time and that number is 56% among rural Malawian youth. Yet, there is a considerable mobility between different sectors of employment. Specifically, more than 57% of the youth that was not involved in the agri-food system during the baseline entered the sector in the subsequent wave, and 12% of the youth involved in the agri-food system during the baseline moved out of the sector in the subsequent wave. Even though the high degree of stability in farming participation is encouraging, it is likely that poor economic prospects outside of farming are what is driving strong participation in single-occupation farming. It is also worrisome that youth and young adults are less likely to be employed in the agri-food enterprises compared to the adults. Considering increasing youth employment is a priority public policy for governments in Tanzania and Malawi, it is recommended that the countries should attempt to diversity the rural economy with multitude of economic opportunities other than farming.

JEL Codes: J13, J21, J43

Key Words: Agri-food system, employment, youth, sub-Saharan Africa, LSMS-ISA

1. Introduction

Agricultural transformation is often considered as one of the main pathways out of poverty. There has been significant study regarding the relationship between farmer or farm owner's gender and the agri-food system (crop production, livestock, and agricultural value chain), but empirical evidence on the relationship between agriculture and population age structure, such as average age of a farmer and youth involvement in agriculture is still in short supply. To our surprise, we find that several development organizations and governments have recognized that the average age of a farmer in sub-Saharan Africa is 65 (FAO, 2014). Despite the lack of statistical evidence, the speculated average age of an African farmer has received significant attention in policy discussions. As a consequence, it has been incredibly difficult to distinguish between myths and facts of agriculture. It is worrisome that agricultural policies based on imperfect information may lead to an unfavorable result.

In addition to the average age of a farmer, an equally important but little researched issue is youth involvement in the agri-food system. Researchers, policymakers, and development practitioners unanimously agree that youth can play a pivotal role in agricultural transformation and economic development. However, very little is known about the mechanics of youth involvement in the agriculture sector including farming (typically understood as own-farm labor) and the agri-food system. In the case of sub-Saharan Africa, the agricultural sector is increasingly being positioned as a major source of potential economic growth and a pathway for enhanced food security, but it is yet to be recognized as the major employer of African youths (Brooks, Zorya, and Gautam, 2013).

Simultaneously, increasing rate of rural to urban migration rates have development practitioners concerned that young people are abandoning underdeveloped rural areas in search of work that will provide a more comfortable life both in terms of the conditions of the job and the income it provides. Concerns therefore have developed based on rhetoric that 'there will be nobody left to farm'. Efforts to either encourage young people into farming, or kick-start the

modernization process have only recently been started by governments. However, in the absence of understanding the trajectories of this particularly mobile age-cohort, it will be difficult to develop effective policies.

Most countries in sub-Saharan Africa have a high rate of youth unemployment and at the same time, existing evidence indicates that agriculture production in the region is far from meeting it's potential (World Bank, 2013; Filmer and Fox, 2014). That countries with abundant labor supply (high youth unemployment) also have high unmet potential of agricultural production is a critical policy issue and also deserves further scrutiny. Are youth abandoning agriculture or are they the modern farmers of tomorrow? Governments and policy-makers are straddling the intersections of these two extremes with little available data on support. Smallholder agriculture in many African countries is characterized by low-yields, traditional inputs, and subsistence farming. Apart from using high yielding varieties and modern technology and inputs, one way to make agriculture dynamic and competitive may be reconsidering the conventional view that considers farming as the only component of agriculture. Including agricultural value chains and the agri-food system as part of '*agriculture*' may improve competitiveness of the agricultural sector and help to attract the youth into agriculture.

Considering the increasing domestic demand and consequent imports in sub-Saharan Africa, there is a huge potential for African youth to modernize the agriculture sector. Brooks, Zoya, and Gautam (2013) argue if the constraints on access to land, capital, and required skills are addressed on time, African agriculture can employ a large number of new job seekers, primarily youth. A recent study by Asciutti, Pont, and Sumberg (2016) provides a detailed review of existing evidence on youth involvement in agriculture in Malawi, Ethiopia, and Kenya, but finds no definitive evidence that African youth are moving away from agriculture. Asciutti, Pont, and Sumberg argue that even though the proportion of youth engaged in agriculture has been decreasing over time, the absolute number of youth in agriculture may be increasing due to increasing population.

Several countries in sub-Saharan Africa have revised their agricultural policies to encourage and increase youth involvement in the agri-food system. For example, with an extensive support and partnership from FAO, Tanzania has revised its national agricultural policy to include provisions for youth engagement in agriculture (FAO, 2017). As the first step toward implementation of the revision, the Government of Tanzania recently launched a '*National Strategy for Involvement of Youth in Agriculture 2016-2021'*. Similarly Malawi has launched its '*National Youth Policy of 2013'* that identifies agriculture as the major pillar for youth development (National Youth Council of Malawi, 2013). Despite a common push toward policies that try to increase youth engagement in farming and the agri-food system, definition of youth varies by country and context. In Malawi, the National Youth Policy of 2013 defines youth as all individuals ages 10 to 35 years. The policy considers youth as "a definitive social entity that has its own specific problems, concerns, needs, and aspirations." In Tanzania and Kenya, a youth is defined as an individual of age 15 to 35 (Republic of Kenya, 2017; The United Republic of Tanzania, 2016), whereas international organizations like the United Nations, the World Bank, and ILO consider youth as individuals ages 15 to 24. Our definition of youth is consistent with the international definition. In this study, individuals in age group 15 to 24 are referred to as youth and individuals in the age group 25 to 34 are referred to as young adults.

The recent policy shift toward 'youth and agriculture' warrants a comprehensive study of the relationship between population age structure and involvement in the agri-food system. This analysis uses Living Standard Measurement Study – Integrated Survey in Agriculture (LSMS-ISA) data from Tanzania and Malawi to explore 1) the age structure of African farmers and 2) the dynamics of youth involvement in agriculture and the larger agri-food system (AFS) in sub-Saharan Africa. Given the recent policy debates on youth employment and the lack of evidence on youth's role in African agriculture, understanding youth involvement in the agri-food system is both timely and critical. By quantifying movements in and out of the agricultural sector, we shed light on the levels of sustained individual-level interest which may not be apparent by

assessing cross-sectional averages. The first half of our analysis uses unbalanced panels to explore the patterns of the demographic structure, employment, and the agri-food system involvement over time. In the second half, however, we are interested in the movements of individuals in and out of the agri-food system and therefore the analysis is restricted to balanced panels.

The rest of the analysis proceeds as follows. In section 2, we describe the data and methods used in the analysis including some key variables. Section 3 presents the methodology employed for analysis. In section 4, we provide and discuss results. First, we present results from descriptive statistics and dynamics analysis based on transition matrices. The second half of the results section presents the regression results. Section 5 concludes with summary and implications of the findings.

2. Data

The data for this analysis come from two LSMS-ISA countries[1] in sub-Saharan Africa. Both datasets are nationally representative surveys implemented by the respective National Bureau of Statistics with technical support from the World Bank.[2] Multiple rounds of data are available but only the data from the first two waves in each country are utilized for the purpose of studying short-term movements. The sample size and the period of coverage vary by country but the survey design and instruments are similar. This allows for cross country comparisons, especially for survey year 2010/2011 which is included for both countries.

The datasets include integrated household, agriculture, and community components, and are standardized in their general format and methodology. These data therefore serve well for the study of labor and agriculture given that each dataset contains a similar labor module and

[1] LSMS-ISA panel data are additionally available for Ethiopia, Niger, Nigeria, and Uganda. Country inclusion determinations were made on the basis of data comparability for key indicators. Extensions of this work are likely to include Ethiopia and Nigeria.

[2] For more information on the LSMS-ISA initiative visit www.worldbank.org/lsms-isa.

separate agriculture module with information on own-farm agricultural labor as well as hired labor. Table 1 presents the details of cross-sectional and panel sample sizes as well as for Tanzania and Malawi. Both datasets maintain a fairly low attrition rate of less than 4% at the household level and about 7% at the individual level.

Table 1. Sample size and attrition

	Wave 1		Wave 2		Attrition	Panel
	Year	Sample Size	Year	Sample Size	(%)	Sample Size
Tanzania						
Household	2008/09	3265	2010/11	3924	2.9	3168
Individual		16709		20559	6.6	15597
Malawi						
Household	2010/11	3246	2013	4000	3.8	3104
Individual		15597		20220	7.4	14165

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.

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 healthy population growth. Table 2 presents population age structure in the selected countries during the first two waves of the LSMS-ISA survey. Age structure is divided into five groups, namely children (age 6 to 14), youth (age 15 to 24), young adults (age 25 to 34), adults (age 35 to 64), and elderly (age 65 and above).

Table 2. Population age structure in Tanzania and Malawi

Age groups	**Tanzania**		**Malawi**	
	Wave 1	Wave 2	Wave 1	Wave 2
National				
Child (6 to 14)	33.9	33.3	33.9	35.9

Youth (15 to 24)	23.0	26.3	23.6	24.3
Young adult (25 to 34)	15.0	14.8	17.2	17.9
Adult (35 to 64)	22.6	21.0	20.6	17.9
Elderly (65 and up)	5.5	4.6	4.7	4.0
Observations	14,163	17,200	12,428	16,588

Notes: Point estimates are population weighted proportions.

Young children, below the age of 6 are not included given the focus on distribution of labor 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. Children make up the greatest proportion of the population followed by youth and young adults, but the proportion rises again for adults before tailing off for the elderly.

In considering the relevance of these patterns for today's age structure, it is useful to recognize 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 entering the labor market or looking for employment at present 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 labor supply in both Tanzania and Malawi. As such, the proportion of individuals entering the labor market in the coming years is expected to rise rapidly.

Beyond the relevance of the increasing youth cohort is the trend of youth migration from rural to urban areas in search of enhanced economic prospects. The prospect of rural youth out-migration is of concern to policy-makers because increasing rate of rural out-migration is often associated with declining youth engagement in agriculture. There is evidence indicating a surge in economic migration of rural youth in African countries, but this does not imply that rural youth are moving away from agriculture.

Table 3 presents the population age structure in Tanzania and Malawi disaggregated by rural and urban areas. The point estimates are population weighted proportions. Results show

that an overwhelming majority of the rural population is comprised of individuals ages 6 to 34 years. As expected, urban areas in both countries are also young with the majority of population comprising individuals below 35 years of age. Even though population age structure in both rural and urban areas look more or less the same, employment and engagement in agriculture may look very different. Since rural economy is dependent more on agriculture and urban economy depends more on industrial and service sectors compared to rural areas, the rest of our analysis focuses on rural areas to understand the relationship between population age structure and engagement in the agri-food system.

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

Notes: 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. For example, land or agribusiness ownership, agricultural wage labor on someone else's farm, engagement in own-farm labor to varying extents (commercial, subsistence, and hobbyist) all can be considered farming. Complications arise particularly when classifying the intensity of farming and frequency of farm labor. Is it truly considered farming if someone only

casually grows some vegetables in their backyard? What if they have a non-agricultural primary occupation, but occasionally provide labor during peak farming periods such as planting and harvesting? How many hours in a day need to be devoted in order to qualify as a meaningful contribution? How many days in a year? Making such determinations is especially tricky given the realities of growing seasons whereby the maximum number of agricultural labor days may only constitute a third or half the year.

In this analysis, the definition of farming defers to 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 labor to be a farmer or more precisely own-farm labor because we are interested to understand young people's participation in the agri-food system. 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 datasets: 'Employment in the last 12 months' and 'Employment in the last seven days'. Employment in the last 12 months is further categorized in to *wage-employment* and *self-employment*. Individuals that have a 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 to be self-employed[3]. This can range from a grocery store owner to street vendor. Given that respondents self-identify whether they have a household enterprise, this controls for

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

the most informal of income generating schemes. Analysis takes place at the individual level, and as such owners and managers are identified separately from the entire household. If an individual works in a household enterprise but is not acknowledged as the owner or manager, then their livelihood status is counted as wage labor. If an individual makes no contribution to a household enterprise, then they are not counted in either category.

Apart from farming (own-farm labor), wage employment, and self-employment, all remaining individuals are referred to as 'unemployed'. The unemployed category should be understood as a residual category, indicating that an individual does not have a known source of income-generation and additionally does not participate in agriculture. 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 because we are interested to understand the dynamics of employment in agriculture across different age groups.

In the second panel in Table 4, 'Employment in the last 7 days' is presented. This category is further divided in to wage labor, self-employment, and casual labor. Wage labor sub-category is different from casual labor in that the former captures a more formal short term labor, mostly in the non-agricultural sector, but the latter captures seasonal wage work, mostly in the agricultural sector, such as *ganyu labor* in the case of Malawi.

Table 4. Variable definitions

Variables	Definition
Employment in the last 12 months	
Wage employment	Individual has a regular employment in a government or non-government organization 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 labor	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 labor	Individual worked as a casual or part time wage worker (such as *ganyu* labor) in the last 7 days

Agri-food system involvement	
Farming	Individual worked positive hours in own-farm in the last two seasons
Employed in the Agri-food enterprise	Individual worked as a wage employee or self-employed in the Agri-food enterprises in the last 7 days or last 12 months, or casual labor in the last 7 days

Source: Authors' illustrations

The third panel in Table 4 presents the agri-food system (AFS) involvement which is further categorized into farming and employment in the agri-food enterprise (AFE). The critical difference between the agri-food system and the agri-food enterprise is that the agri-food enterprise refers to the agricultural value chain or agricultural subsidiaries related to both production and processing, but the agri-food system includes both the agri-food enterprise and farming (own-farm labor). Identification of businesses and schemes that count as an AFE are 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.

Any individual who worked positive hours in own-farm in the last two seasons is defined as a farmer. Similarly, any individual who was wage employed or self-employed in the agri-food enterprises (as identified in the ISTC) in the last 12 months or worked as a casual labor in the last 7 days is considered to be employed in the agri-food enterprise. Using agricultural participation in this way allows for the determination of basic involvement in the agricultural sector in the absence of contextual information regarding a 'typical farmer'. Given that the LSMS-ISA instrument only asks households to recall the labor of family members that contributed the most,[5] other sources of agricultural participation are obtained from modules focusing on individual-level time-use.

[5] The cut-off for number of 'top' contributors considered differs between countries and is an important caveat when comparing the number of individuals engaged in agriculture. However, given that agricultural participation is based on data collected at both the household and individual level, it is assumed that differences in format at the household level do not unduly bias the results.

3.2. Analytical methods

This analysis takes advantage of longitudinal data and uses transition matrices to study the dynamics of youth involvement in the agri-food system. Data is utilized in two different capacities – transition matrix and panel data estimator – to understand the dynamics of youth involvement in the agri-food system.

Transition matrices

The first part of the analysis uses mean estimates and transition matrices to examine the patterns of employment and agri-food system involvement by age groups over time and to assess the dynamics of youth involvement in the agri-food system. Transition matrices allow for the simple visual representation of movement across sectors, which provide deeper insight beyond sample averages across different point 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. In addition to the knowledge of whether person *i* shifted sectors, the use of a transition matrix will enable us to understand which sector they shifted to. 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 is composed of two time periods, Time 1 and Time 2 with mutually exclusive categories ***X*** and ***Y***. Person *i* can either be in category ***X*** or ***Y*** in Time 1 and similarly can be in either category in Time 2. Original categorization in Time 1 is denoted in rows with the script 1,

while categorization in Time 2 is denoted in columns and the subscript ending in 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. If person *i* started in category $\boldsymbol{X}$ and stayed in category $\boldsymbol{X}$, then they are in cell $X1_{X2}$. Correspondingly, if person *i* started in category $\boldsymbol{X}$ and shifted to category $\boldsymbol{Y}$, then they are in cell $X1_{Y2}$.

The total number of individuals who are in any particular category during Time 1 are denoted by the aggregation term ($\sum X1$ or $\sum Y1$) in the final column. The total number of individuals who are in any particular category during Time 2 are denoted by the aggregation term ($\sum X2$ or $\sum Y2$) in the final row. All terms in the inner quadrant represent the totality of choices person *i* could make. As such, $X1_{X2}$ will provide the proportion of the sample that was originally in $\boldsymbol{X}$ and also stayed in $\boldsymbol{X}$. Just as the summation of $\sum X1$ and $\sum Y1$ will add up to 100 (the same for $\sum X2$ and $\sum Y2$), so will the inner quadrant.

Panel data estimators

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

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

where *i* indicates individual, *t* indicates survey period (t_1 indicates baseline and t_2 indicates follow up round), *Y* is the outcome of interest; in this case binary indicators for own-farm labor and AFS employment, and count of own-farm labor 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 probit model for binary variables (indicators for own-farm labor and AFS employment) and ordinary least squares for labor days. The estimated coefficients β_1 and β_2 provide the relationship between age groups and probability of own-farm labor or AFS employment. We use predicted conditional probabilities to understand the dynamics of agri-food system involvement for different age groups. The probability of labor outcome in follow-up wave contingent on the baseline status is estimated as follows:

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

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

We take advantage of the longitudinal data to estimate the relationship between age structure and agri-food system involvement over time. For continuous outcome variable, labor days in this case, panel fixed effects model is used to estimate the relationship between intensity of own-farm labor and age structure. Equation (2) presents the panel fixed effects model.

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

For binary outcome variables, a pooled probit model is used. The pooled probit model in Equation (3) is estimated using Quasi-maximum likelihood approach. Practically, time constant average of all explanatory variables are included in the model and estimated with the correlated random effect model, also known as Chamberlin-Mundlak approach.

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

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

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

Predicted probabilities from Equation (3) can be used to understand the likelihood of certain employment by age cohorts 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

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, there is no reason to believe that the distaste for agricultural work is restricted to youth only. In case of Tanzania and Malawi, the mythical belief that youth don't work is agriculture is not substantiated. Cross-sectional descriptive statistics illustrate that regardless of unobservable interest, agriculture is the largest employer of youth (ages 15-24) compared to any other sector in both Tanzania and Malawi (Figure 2).

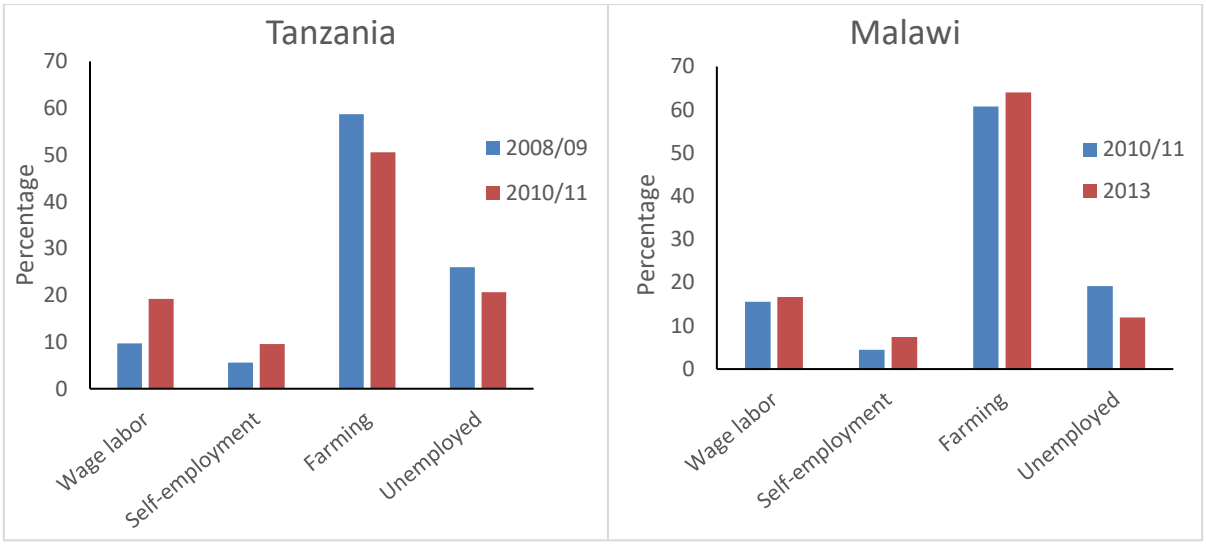


Figure 2: Rural youth's participation across different sectors of employment

Using a balanced panel, Figure 2 illustrates that participation in single-occupation farming among rural youth (15-24) is greater than 50% in both countries. Our categorization of the employment sectors implies that any estimates of youth participation tend to be downward biased because any individual who is employed in both own-farm agriculture and wage labor or self-employment would not be counted in the 'farming' category. As such, the appropriate interpretation of participation in farming is relegated to those that do not engage in farming only. As presented in Figure 2, rates of engagement in agriculture are decreasing in Tanzania (i.e. not necessarily leaving farming, but additionally engaging in wage labor or self-enterprises), and yet 59% of Tanzanian youth remained in single-occupation farming between 2009 and 2011. In Malawi where over 60 percent of youth are engaged primarily in farming, the sector not only grew, but 70% 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 percent of the individuals engaged in single-occupation farming. In a pooled sample that contains individuals ages five and up from Tanzania and Malawi, the average age of an individual that only engaged in farming is 32 years old. 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[6]. As illustrated in Figure 3, over 75% of those involved primarily in single-occupation farming are under 50, making it difficult to support rhetoric that the average age of African farmer 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 emerging in both Tanzania and Malawi.

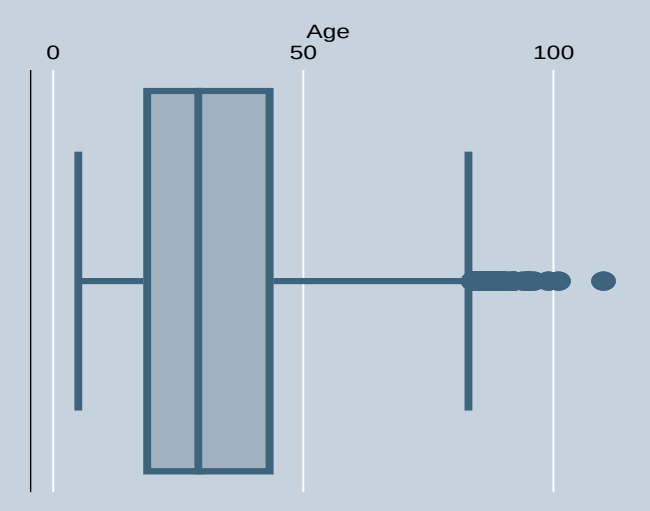


Figure 3: Box Plot of engagement in single-occupation farming, by age

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 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, taking on-farm and off-farm engagement together, unemployment among rural youth in Tanzania and Malawi is relatively low despite concerns regarding the dearth of employment opportunities. In Tanzania, youth unemployment reduced from 26 to 21 percent in rural areas compared to urban areas where it dropped from 65 to 56 percent between 2009 and 2011. In Malawi, the proportion of unemployed rural youth dropped from 19 to 11 percent between 2011 and 2013, while in urban areas it dropped from 54 to 39 percent. The decreases in

[6] Though inconvenient to account for, child labor (5-14) plays a large role in rural agriculture. The average age of a child 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.

the rate of youth unemployment coincides with increases in engagement in agriculture, given that about 40 percent of the previously unemployed people in Tanzania engaged in single-occupation farming, while in Malawi this number is closer to 56 percent. In comparison, less than 20 percent of unemployed youth entered into either wage labor or self-employment in both Tanzania and Malawi indicating that youth are more likely to enter farming than other employment sectors.

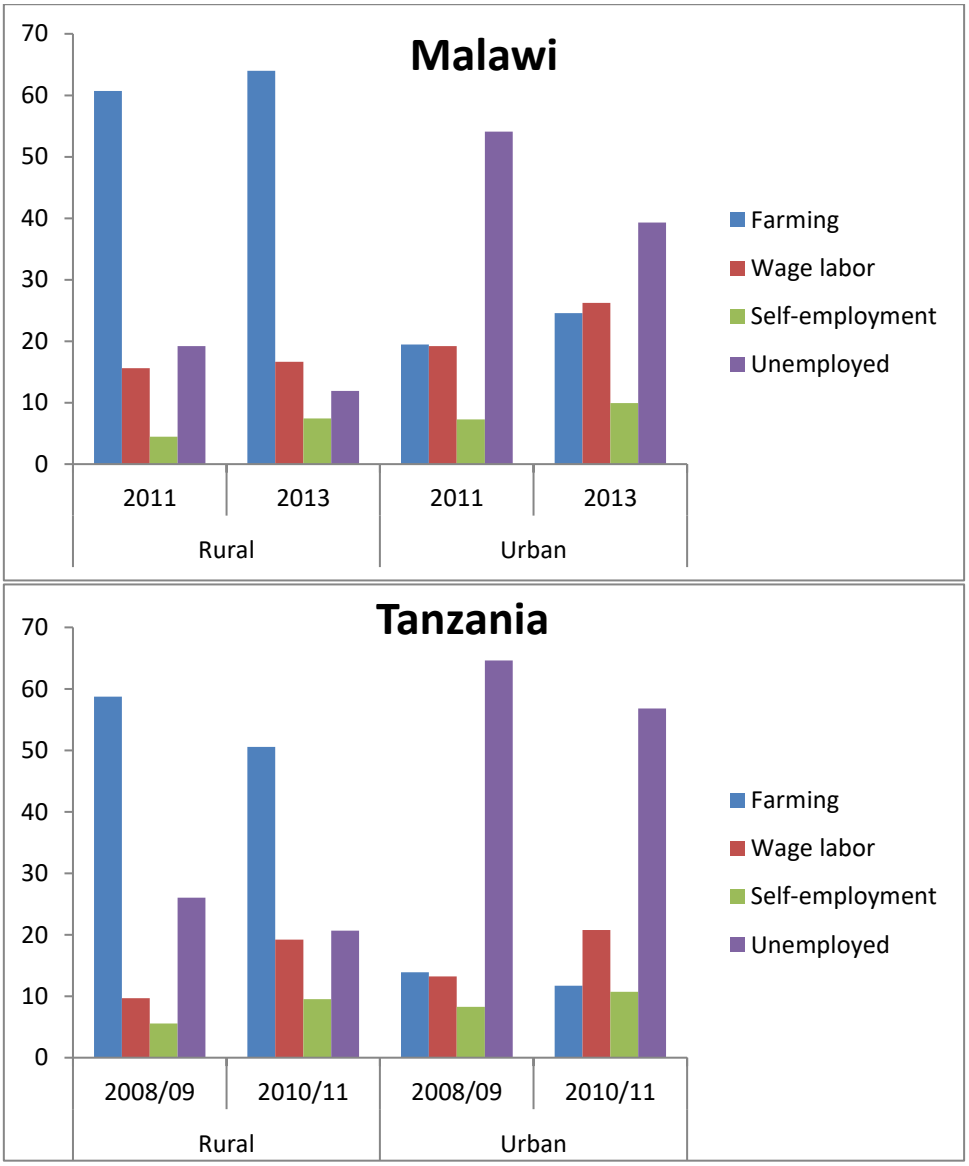


Figure 4: Dynamics of youth employment in Rural and Urban areas

Figure 4 shows that youth employment in Tanzania varies widely across rural and urban areas. Over time, only about 25 percent of rural youth have no documented employment unemployment among urban youth is about 60%. The high rate of unemployment in urban areas follows from a much lower participation of urban youth in farming compared to the rural areas.

More than half of rural youth engage in farming compared to less than 15% in urban areas. Similar pattern holds in Malawi too; proportion of rural youth that are unemployed is less than 20% compared to more than 45% of unemployment among urban youth[7]. Over time, unemployment is decreases along with increase in wage- and self-employment and a decrease in engagement in farming. This trend is consistent across both countries indicating increased diversification of the respective local economy.

From this we can determine that not only are youth in rural areas less likely to be unemployed, they also are less likely to stay unemployed. Furthermore, many of those who were previously unemployed were respectively more likely to enter agriculture than either obtain a wage employment or remain unemployed.

There is considerable mobility towards farming among youth

Table 5 provides figures that indicate the proportion of individuals that moved towards farming, given their previous occupation. The first column, Farming' provides point estimates on the rate of retention on farming over time. On the subsequent columns, the point estimates are the percentage of the population that 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 5. Shifts towards farming given baseline occupation

	Movements			
	Farming	Wage labor 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: Author's illustrations

[7] It is yet to be assessed whether high unemployment rates in urban areas are attributed to 'true' unemployment, or engagement in non-productive activities such as schooling. Future assessments will seek to tease this out.

Assuming that each option carries equal probability (one in four), it is observable that the choice of single-occupation farming beats out every option, for every single group and sector. If we discount unemployment from the list of options, the probability of youth's and young adults' participation in farming is equal to or greater than their probability to move 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 6 presents point estimates on youth and young adults' movements out of single-occupation farming to other income generating sectors or unemployment. When considering the income-generating sectors (wage labor and self-employment), in Tanzania, about 17% of youth engaged in farming in 2009 moved to wage-employment in 2011 and 9% of them moved to self-employment, while nearly 15% of them 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 6. Movements out of farming to other sectors

	Movements		
	Farming to wage labor	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

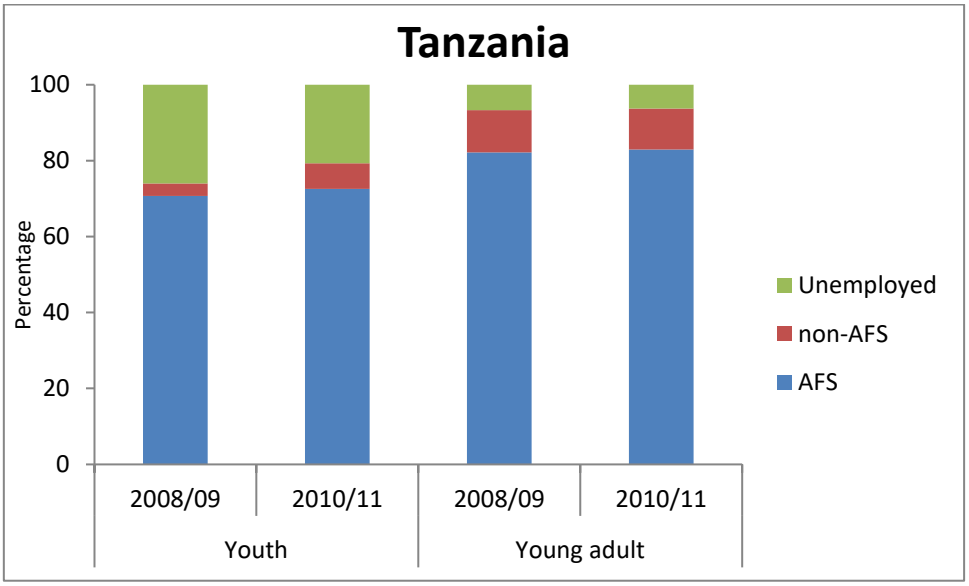
Source: Authors' illustrations

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% young adults moved out of farming to wage-employment compared to 17% of youth in

Tanzania. Similarly, 15.5% young adults moved from farming to self-employment compared to 9% youth. Similar pattern holds in Malawi too. Results indicate that the rate of retention in farming is higher among youth than in young adults and both youth and young adults who move out of faring 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 the increased attraction to farming. It is possible that shifts towards agriculture are largely a result of loss of baseline livelihood option, rather than attraction to the sector for income-generating opportunities.

Youth participation in the Agri-food System

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



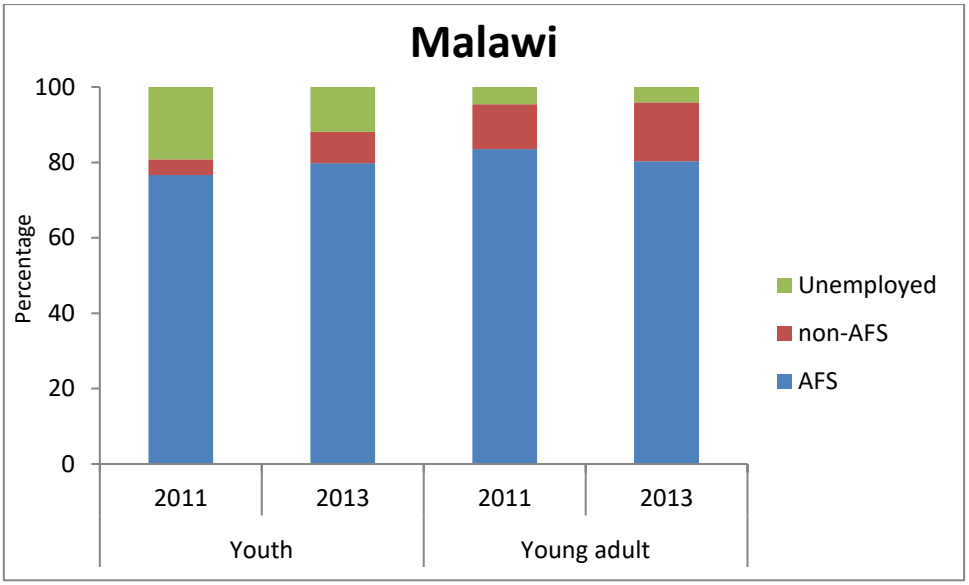


Figure 5. Youth's and Young adults' participation in the agri-food system

Figure 5 presents youth's and young adults' participation in the agri-food system in Tanzania and Malawi. In Tanzania, about 71% of youth are engaged in the agri-food system (AFS) in 2008/09 and the proportion increases slightly to 72% in 2010/11. Despite a small increase in AFS engagement, there is a big increase in the agri-food enterprise (AFE) employment. Youth employment in AFE increases from 12% in 2008/09 to 22% in 2010/11 coupled with a decrease in farming from 59% to 50%. Youth's AFS participation increased in Malawi too from 77% in 2010 to 80% in 2013, but in contrast to Tanzania, the growth in AFS engagement comes exclusively from farming. Youth employment in AFE remains stable over time at 15%.

The discrepancy between countries persists over time and age groups. Young adults' employment dynamics is different from that of youth within each country, but the difference between countries is even bigger in case of young adults' AFS engagement. Even though about 80% of young adults are engaged in the agri-food system in both Tanzania and Malawi, the composition of employment varies widely. In Tanzania, young adults' AFE employment increases from 29% in 2008/09 to 41% in 2010/11, but in Malawi, young adults' employment in AFE remains stable at 24%. The results confirm our finding that Malawi's rural economy is very much agriculture dependent 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 and stability) of employment and the agri-food system involvement across different age groups. The second half of empirical results present the findings from panel data analysis.

Results from conditional lagged model

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

Table 8. Probability to remain in the baseline sector over time

	Farming		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 households (1=Yes, 0=No)	1.20***	0.60***	-0.087*	0.045
	(0.058)	(0.045)	(0.047)	(0.050)
Livestock households (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)
Current student (1=Yes, 0=No)	0.22***	0.28***	-0.40***	-0.18***
	(0.037)	(0.048)	(0.045)	(0.062)
Rural area (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	13218	10174	13218	10174

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

We also examine the stability of engagement in 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 to engage in farming in wave 2 is 0.82 points higher if individual is already engaged in farming in wave 1. This indicates that involvement in farming is highly stable, irrespective of age groups. Such probability is lower in the AFS 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. The stability (probability to remain in the baseline sector over time) does vary across wave. Figure 6 presents the probability to engage or enter into farming as own-farm labor given baseline status. For all age groups, the

probability to remain as own-farm labor over time is always higher than the probability to enter into farming in wave 2. The probability to remain engaged in farming increases at increasing rate for the youth and is the highest for young adults in both countries. Similarly, the probability to enter into own-farming agriculture also increases at an increasing rate for youth and is the highest for the young adults too. This suggests that unlike the myth that young people have a distaste for agricultural work, both youth and young adults have higher willingness to newly enter and remain engaged in own-farm agriculture than any other age groups. Similar results hold for the agri-food system employment.

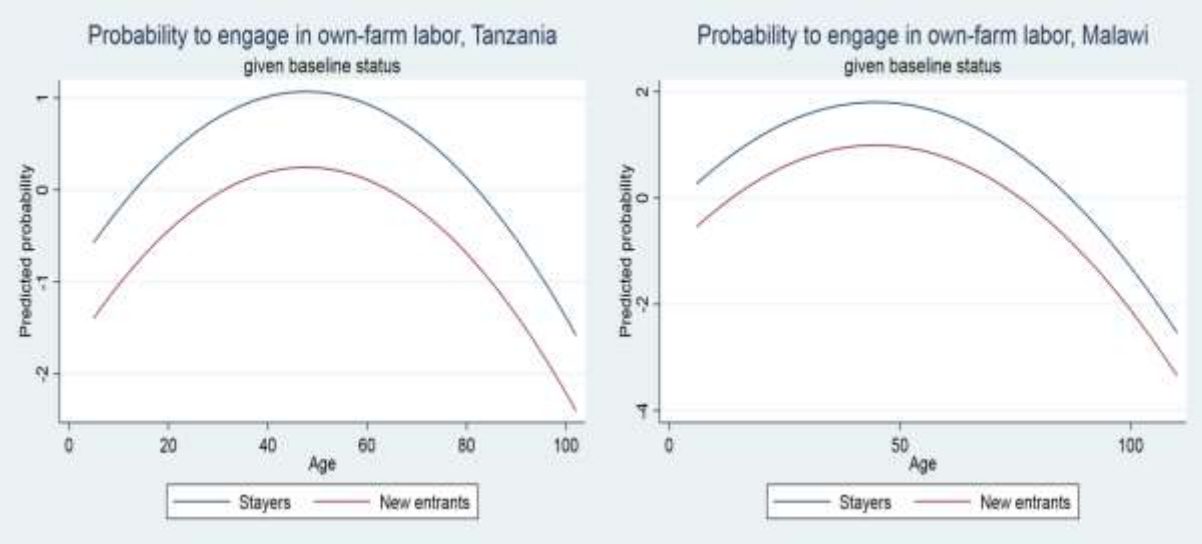


Figure 6. Probability to engage in own-farm labor by individual's age

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 the agri-food system employment for different age groups. The estimated results confirm that probability to engage in both farming and the agri-food system employment increases with age but at a decreasing rate.

Table 9. Probability to engage in a [sector] over time

	Farming		AFS 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 households (1=Yes, 0=No)	1.84***	1.07***	0.010	0.11
	(0.093)	(0.064)	(0.075)	(0.067)
Livestock households (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	26346	20384	26346	20384

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

We calculate marginal effects of age for individuals of ages 18 and 40 to understand the relationship between age and engagement in own-farming and the agri-food system employment. For individuals of age 18, a one year increase in age increases their probability to engage in farming as own-farm labor by 0.27 points in Tanzania and 0.23 points in Malawi. Such probability for individuals of age 40 is 0.17 in Tanzania and 0.016 in Malawi. Similar pattern

holds for the probability to be employed in the agri-food system. For individuals of age 18, one year increase in age increases the probability to be 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 the agri-food system employment by -0.02 points for Malawian individuals.

Among other variables, the probability to engage in farming as own-farm labor is higher for individuals from agricultural households, livestock keeping households, and rural households. However, none of these variables have significant effect on the probability to be employed in the agri-food system suggesting that unlike farming, employment in the agri-food system does not differ by rural areas or whether the individuals are from agricultural households. Interestingly, individual's gender have no effects on either own-farm labor or the agri-food system employment and household size decreases individual's likelihood of participation in farming as own-farm labor or the agri-food system employment.

Table 10 presents the estimated relationship between different age groups and the agri-food system involvement. We categorize individuals to five different age categories and estimate the probability of engagement in farming and AFS employment across different age groups. The base category is a group of children between 6 and 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 to be employed in AFS is the highest for adults of ages between 35 and 64. Even though the probabilities for both own-farm labor engagement and AFS employment increase with age, being children and youth decreases the probability of being employed in AFS.

Table 10. Relationship between age groups and the agri-food system engagement

	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 up	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 * $p < .10$, ** $p < .05$, *** $p < .01$

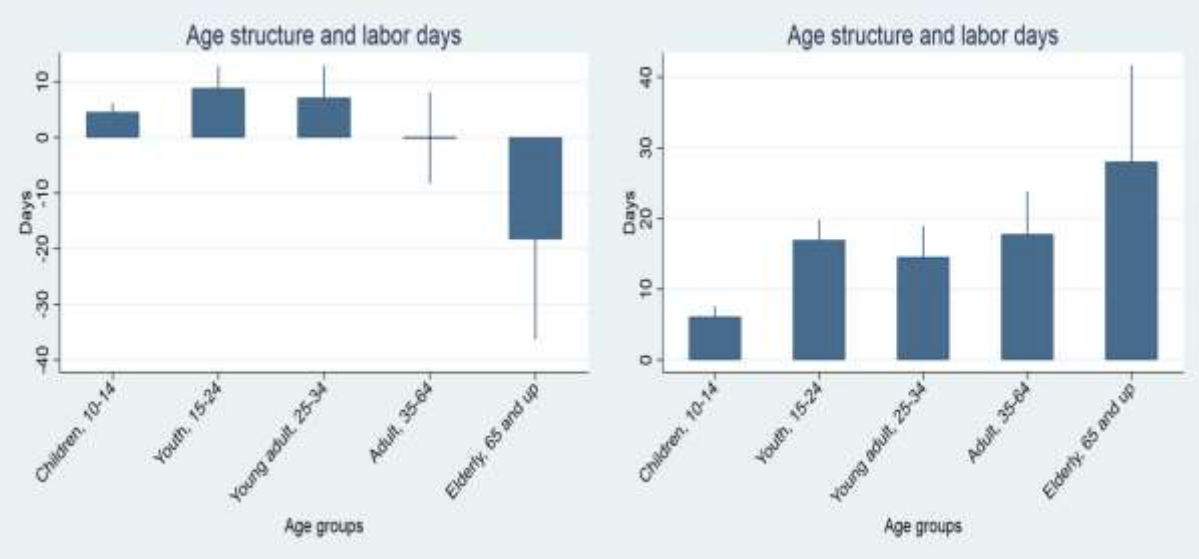


Figure 7. Estimated effects of age cohorts on labor days

5. Conclusion

This analysis examines the dynamics of employment in agriculture and the agri-food system in Tanzania and Malawi by assessing population age structure and movements of youth in and out of agriculture and the agri-food system. 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 above 60 years', the average age of a person who is engaged in farming is 34 years-old in Tanzania and 31 years-old in Malawi. In Tanzania, about 12% of the population was employed in the agri-food system, and 49% of the population worked in agriculture by providing own farm labor in 2008/09. Categorizing employment to 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 a quite large decrease in unemployment. Results also indicate that youth, ages 15 to 24, and young adults, ages 25 to 34, respectively consist of more than 26% and 30%of the population working in the agri-food system.

Examination of the movements into and out of the agri-food system demonstrates a high degree of stability of youth and young adult's participation in farming in both countries.

Specifically, 59% of Tanzanian rural youth consistently engaged in farming over time and that number is 56% among rural Malawian youth. The high degree of stability in youth engagement in farming may not necessarily imply attraction to agriculture because movements across sectors involves transaction costs and rural youth may be unable to afford such costs.

When movement between sectors is considered, interestingly, there is a considerable mobility between different sectors of employment. Specifically, more than 57% of the youth that was not involved in the agri-food system during the baseline entered the sector in the subsequent wave, and 12% of the youth involved in the agri-food system during the baseline moved out of the sector in the subsequent wave. Similarly, 15.5% of the youth that worked in own-farm agriculture during the baseline took on wage employment in the agri-food system in the subsequent wave and 58% of the youth that were wage-employed in 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 push or pull factors are the ones 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 to engage in farming and the larger agri-food system increases with age but at a decreasing rate. The probability to engage in farming is the highest for youth and young adults but the probability to be employed in the agri-food system is the highest for adults ages older than 40 years. We also find that the probability to engage in farming (agri-food system) is the highest for individuals who are engaged in the farming (agri-food system) in baseline confirming a high degree of stability in youth and young adult's engagement in farming.

Overall, our finding suggests that youth are much more likely to move towards single-occupation farming as opposed to another income-generating sector than young adults. Even though this finding is encouraging for policy-makers who are worried about youth's lack of attraction towards agriculture, it is likely that poor economic prospects outside of farming are what is driving strong participation in single-occupation farming. It is also worrisome that youth and young adults are less likely to be employed in the agri-food enterprises compared to the adults. Considering increasing youth employment is a priority public policy for governments in Tanzania and Malawi, it is recommended that the countries should attempt to diversity the rural economy with multitude of economic opportunities other than farming. If wider set of economic opportunities are provided, it would be likely that youth and young adults would seek opportunities to increase and intensify their participation in agriculture as well as non-farm income generating activities.

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