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## **The evolving role of farm and off-farm jobs in rural Africa**

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## **Abstract**

Livelihood sources in rural Africa are diverse and dynamic. Using recent primary data from four African countries — Kenya, Namibia, Tanzania, and Zambia — we consider regions with different conditions related to climate, agroecology, infrastructure, and nature conservation to analyze the role of various income sources for households and individuals. While most rural households are involved in small-scale farming, we challenge the conventional notion that own agricultural activities still constitute the main source of income. Off-farm sources account for 60% of total household income on average. The off-farm income share increases with total income, meaning that the poorest households are the ones most dependent on agriculture. These patterns are similar across all four countries. While the concrete off-farm activities differ by context, most off-farm jobs are self-employed activities in small informal businesses. More lucrative formal employment opportunities are rare and mostly pursued by individuals with post-secondary education and training. Males are more likely to be involved in wage employment than females. Furthermore, individual social networks and access to road and market infrastructure increase the likelihood of off-farm employment. These results emphasize the policy need to acknowledge the important role of rural off-farm jobs and to invest more into generating inclusive non-agricultural employment.

**Keywords:** Rural employment; Off-farm employment; Rural poverty; Gender; Rural transformation; Sub-Saharan Africa

**JEL Codes:** I31, J43, J46

# 1. Introduction

The landscape of income generation in rural Africa is undergoing significant change. While subsistence agriculture remains common, commercial farm and off-farm activities are gaining in importance (Barrett et al., 2001; Christiaensen and Maertens, 2022; Davis et al., 2017a; Khan and Morrissey, 2023; Mondal et al., 2021; Van Den Broeck and Kilic, 2019; Winters et al., 2009). Changes in household livelihood strategies away from farming are to a large extent driven by push factors, such as land scarcity and climate change (Amare et al., 2023; Talanow et al., 2021). At the same time, pull factors, such as improved access to education, information, and overall economic development, create new opportunities for people to enter into cash crop farming and/or non-agricultural employment (Asher and Novosad, 2020; Essers, 2016; Kelley et al., 2024; Wheeler et al., 2022).

Over the past two decades, the diversification of income sources in rural Africa has garnered considerable attention (Babatunde and Qaim, 2010; Corral and Reardon, 2001; D'Souza et al., 2020; Janvry and Sadoulet, 2001; Mishra et al., 2015; Pfeiffer et al., 2009; Rahman and Mishra, 2020; Ruben and Van den berg, 2001; Van Den Broeck and Kilic, 2019). This body of research suggests that off-farm income sources are gaining in importance but that agriculture remains the dominant source for most rural households. However, important knowledge gaps remain (Otsuka and Fan, 2021; Christiaensen and Maertens, 2022). First, given ongoing structural transformation, it not so clear whether agriculture is still the main income source for most households in rural Africa. Second, most existing studies take an aggregate household perspective, thus ignoring possible differences between individual household members (Davis et al., 2017; Van Hoyweghen et al., 2020; Yeboah and Jayne, 2018). Given that job opportunities and preferences may vary substantially by gender, age, or education levels, intra-household perspectives are important for a better understanding. Third, previous research often looks at farm and off-farm income as broad aggregates, without distinguishing between different sub-sectors, employment types, and activities. More disaggregated analysis can help to identify possible employment constraints and develop policies for more inclusive rural job futures.

Here, we address these knowledge gaps, using survey data collected in 2023 across various rural regions in four African countries, namely Kenya, Namibia, Tanzania, and Zambia. We pursue two main research objectives: First, we explore the role of different farm and off-farm income sources at the household level and for individual male and female adults. Second, we use regression models to investigate various socioeconomic factors that facilitate or prevent individual participation in the different types of income generation.

Our main data source is a survey of 2,685 households from the four countries and 6,722 adults living in these households. These data are supplemented with data from surveys of community

leaders (N=164) and rural employers (N=610) also carried out in 2023 in the same study regions. Our data are representative for the study regions but not for the study countries as a whole. Our intention is not to provide country-level analyses but to analyze the role of different employment sources in rural Africa under various climatic, agroecological, and infrastructure conditions.

The rest of this article is organized as follows. In Section 2, we present materials and methods, starting with a brief overview of the study regions in the four countries, and then explaining the data collection approaches and statistical methods used for data analysis. The empirical results are presented in Section 3, while Section 4 concludes with some broader discussion.



## 2. Materials and methods

### 2.1 Study regions

We use data collected in different rural regions of Kenya, Namibia, Tanzania, and Zambia. The study regions offer considerable climatic, agroecological, economic, and institutional heterogeneity and, together, they represent a wide range of conditions typical for rural parts of sub-Saharan Africa. The regions chosen are somewhat poorer than the rural averages in the four countries, which should be kept in mind for the interpretation of the findings. Further details of the conditions are provided below.

**Kenya.** In Kenya, our study focuses on Baringo County located in the Rift Valley. Baringo is among the poorest counties in Kenya. Many households in the region are involved in livestock keeping, especially cattle and goats. Some are also engaged in crop farming, including maize, beans, vegetables, and fruits. However, Baringo is prone to droughts, which presents a major challenge for crop farming. The natural vegetation comprises shrublands and forests, with prevalent acacia species and the invasive *Prosopis juliflora* (prosopis) that adversely affects agriculture and rangelands and contributes to environmental degradation. Charcoal production from prosopis has recently emerged as a livelihood strategy for local households and helps to mitigate the negative economic and environmental impacts.

Baringo has several projects related to thermal energy development. The main thermal energy initiative involves geothermal exploration and appraisal drilling, which also creates jobs in the region. However, given limited educational levels, local residents find employment in this project primarily as unskilled laborers in jobs related to manual work and security services. In addition, Baringo County has a few nature conservancies with wildlife, including elephants and various bird species, attracting mainly local tourists. The local tourism industry is not yet well developed and suffers from infrastructure constraints, including poorly maintained roads and limited access to electricity and mobile networks, and ongoing security concerns stemming from banditry.

**Namibia.** In Namibia, we focus on the Zambezi Region in the northeastern part of the country. The Zambezi Region is at the core of the Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA), which serves as a vital wildlife corridor in southern Africa. Common agricultural activities include cattle and goat keeping and the cultivation of maize and a few other crops. The region has several nature conservancies and national parks, attracting both domestic and international tourists. The tourism sector provides some employment opportunities as hotel and restaurant staff, tour guides, or administrative personnel.

The Zambezi Region is susceptible to floods due to wetlands and floodplains with annual flood pulses lasting five to eight months (Mabuku et al., 2018). The region also experiences prolonged droughts and increased temperatures, especially during the dry season. The local economy is therefore characterized by high unemployment rates (Hulke et al., 2022). To cushion people against poverty and food insecurity, the Namibian government is running a safety net program, including cash transfers for old people, parents with children, and families severely affected by drought or flood.

**Tanzania.** In Tanzania, we focus on Morogoro and Iringa, two neighboring regions in the mid-eastern part of the country, located within the Southern Agricultural Growth Corridor of Tanzania (SAGCOT). SAGCOT is a program aiming to enhance agricultural productivity, food security, and environmental sustainability. Local households produce maize, paddy, sorghum, sweet potatoes, and a number of other food crops. Some households in Morogoro and Iringa also produce cotton, coffee, sisal, onions, oilseeds, and cocoa. Local livestock production involves cattle, goats, poultry, pigs, and sheep. Furthermore, some households are involved in different food processing activities. Both regions, Morogoro and Iringa, have private and public forest reserves, yielding products like timber, firewood, and charcoal (Jha et al., 2021).

**Zambia.** In Zambia, our study focuses on the Western Province, bordering Angola to the west and Namibia to the south. As the Zambezi Region in Namibia, Zambia's Western Province is also located within the KAZA TFCA with private and communal nature conservancies. Western Province is among the poorest regions in Zambia with high poverty rates (Zambia Statistics Agency, 2022). Many households are involved in small-scale farming, growing food crops such as maize, cassava, and groundnuts, and rearing cattle. Conflicts with wildlife, resulting in crop and livestock losses, are common. Some of these losses for local farm households are compensated by the conservancies and national parks. Other economic activities for locals include jobs in the tourism sector, artisanal fishing, and the collection and marketing of various forest products.

## **2.2 Surveys**

Our analysis builds on cross-sectional data from a rural household survey conducted between April and August 2023. For each study region in the four countries, we followed a two-stage sampling procedure. First, within each region we randomly selected villages using a probability proportional to size approach. Thus, we selected 47 villages in Kenya (Baringo County), 45 in Namibia (Zambezi Region), 60 in Tanzania (Morogoro and Iringa), and 30 in Zambia (Western Province). Second, in each of these villages we created full household lists from which we randomly sampled 15 to 16 households. Our overall sample comprises 2,685 households: 703 in Kenya, 675 in Namibia, 870 in Tanzania, and 437 in Zambia. We also sampled male and female

adults (18 years and older) in these households, resulting in a total sample of 6,722 individuals: 1,717 in Kenya, 1,765 in Namibia, 2,086 in Tanzania, and 1,154 in Zambia.

The selected households and individuals were visited and interviewed with a structured questionnaire, which was almost identical in all four countries, with only small local adjustments. The interviews were conducted in local languages by a team of research assistants who were trained and supervised by the researchers. The questionnaire captured various farm, household, and contextual characteristics with a particular focus on the various economic activities and income sources. At the individual level, we asked various socioeconomic characteristics, such as age, gender, marital status, educational attainment, and participation in different types of social groups. Given our focus on individual employment patterns, we also asked for the involvement in different types of farming and off-farm activities.

The survey of households and individuals is complemented by a survey of village leaders in each of the sampled villages to better understand the different local livelihood strategies and employment opportunities. In addition, we conducted a survey of the main employers in the sampled villages and relevant surrounding areas (including nearby towns). The employers were not selected randomly, as complete lists of all local employers in formal and informal sectors were not available. Instead, using the information from the interviews with households and village leaders we tried to cover all relevant sectors and types of employers. In total, we sampled 610 employers: 136 in Kenya, 140 in Namibia, 220 in Tanzania, and 114 in Zambia. For the village leader and employer surveys we also used structured questionnaires.

### **2.3 Definition of farm and off-farm income sources**

We are particularly interested in the different income sources of households and individuals. The two main aggregate income sources are own farming (including food crop, cash crop, and livestock production) and off-farm sources (including wage employment, self-employment, and remittances and transfers) At the household level, we consider a household to be involved in a certain activity if at least one household member participated in this activity during the last twelve months prior to the survey. At the individual level, we define participation in own-farming as contributing to the family labor in any of the three farming activities – food crop, cash crop, or livestock production. In our study regions, traditional cash crops such as coffee, tea, sugarcane, or cocoa are not widely cultivated. However, several fruits, vegetables, and other crops are grown by households with the main intention to sell. Therefore, in our study we define cash crops as crops where more than 50% of the harvest was sold, whereas food crops are crops where more than 50% was kept for home consumption.

In terms of off-farm activities, individual wage employment is defined as having been employed at any time during the past 12 months in exchange for remuneration (either in cash or in kind)

paid by somebody from outside of the own household (Christiaensen and Maertens, 2022; Van den Broeck and Kilic, 2019). Wage employment can be in any sector, including agriculture (i.e., working on a farm not owned by the household), construction, manufacturing, services, etc., regardless of whether the employment contract or the business is formal or informal. A detailed classification of the sectors considered in our study is found in Table A1 in the Appendix. Households are considered to be involved in off-farm wage employment when at least one member participated in wage employment.

Self-employment at the individual level is defined as spending work time in a household-owned non-agricultural enterprise. This can either be the person owning and managing the enterprise or also another household member who had spent time on this enterprise during the past 12 months. We classify household members not owning the enterprise as self-employed too, as they actively contribute to the business and either receive payment or share the earnings or benefits with other household members. As for wage employment, we also break down self-employment into different sectors. Households involved in self-employment are those with at least one member participating in a self-employed activity.

Non-employment-related off-farm income includes remittances and transfers, either in-cash or in-kind. Remittances are defined as income received during the last 12 months from relatives or friends not permanently living in the household. Transfers are defined as income received during the last 12 months from government or non-governmental organizations. In our study, remittances and transfers are captured at the household level, as these are sources of income but not activities, and our analysis at the individual level is confined to activities.

## **2.4 Statistical approaches**

We explore patterns of rural income generation and involvement in different activities through descriptive analyses. At first, we analyze proportions of households involved in different types of own-farming and off-farm activities and income sources. Then we examine the contribution of each income source to overall household income for the sample as a whole, and also for three income terciles (lowest, middle, and highest) to better understand associations between different income sources and socioeconomic status. At the individual level, we analyze proportions of individuals participating in different activities, again for all individuals and also by income tercile.

Beyond the descriptive analyses, we explore key socioeconomic factors associated with individual participation in different activities using regression models. In particular, we use multivariate probit (MVP) models to account for potential correlation between the different activities (Cappellari and Jenkins, 2003). In a first model, we focus on five activities, including food

crop, cash crop, and livestock production, self-employment, and wage employment, using the following MVP specification:

$$Y_{ijD} = \alpha_D + \beta'_D \mathbf{X}_{ijD} + \varepsilon_{ijD} \quad D = 1, \dots, 5 \quad (1)$$

where  $Y_{ijD}$  is a binary variable showing whether or not individual  $i$  in household  $j$  participates in activity  $D$ . Individual and household characteristics are captured by the vector  $\mathbf{X}_{ijD}$ ,  $\beta'_D$  is a vector of parameters to be estimated, and  $\varepsilon_{ijD}$  is a normally distributed random error term. The vector  $\mathbf{X}_{ijD}$  includes socioeconomic variables such as age, gender, education levels, marital status, group membership, household size, household-level asset ownership, land size, access to electricity, and recent shocks experienced, including serious illness or death of a household member. A detailed description of these variables is provided in Table A2 in the Appendix.

In a second model, we use a similar MVP specification to analyze determinants of participating in various off-farm wage employment sectors, such as agriculture, retail business, other services (tourism, hospitality, and transport), construction, education, and public organizations (see Table A1 in the Appendix).

## **3 Results**

### **3.1 Socioeconomic characteristics of households**

Table 1 presents summary statistics of socioeconomic characteristics of the sampled households in the four study countries (individual-level characteristics are shown in Table A3 in the Appendix). The average age of household heads is 51 years. Around two-thirds of the household heads are male, 57% have completed secondary education, but only 3% have post-secondary education or training.

Table 1 shows that, on average, 77% of the sample households in the four countries are poor in terms of income poverty, meaning that they have less than 2.15 US dollars per capita and day in purchasing power parity (PPP) terms. In addition, the average income poverty gap stands at 57%, suggesting that poor households have an income that is 57% below the poverty line. These poverty rates are higher than the national averages from international statistics, which is due to two reasons. First, we only focus on rural areas of sub-Saharan Africa, where poverty rates are higher than in urban areas. Second, some of the rural regions we selected are among the poorer ones, as explained above. This means our country-level data should not be misinterpreted as nationally representative.

Table 1: Socioeconomic characteristics of sample households

| Variables   | All              | Kenya            | Namibia          | Tanzania         | Zambia           |
|---|------------------|------------------|------------------|------------------|------------------|
| Age of household head (years)                     | 51.50<br>(16.06) | 48.45<br>(15.74) | 53.22<br>(15.97) | 52.15<br>(15.13) | 52.51<br>(17.79) |
| Household head is male (dummy)                    | 0.67             | 0.72             | 0.56             | 0.72             | 0.68             |
| Household head is married (dummy)                 | 0.56             | 0.46             | 0.55             | 0.63             | 0.61             |
| Primary education of household head (dummy)       | 0.23             | 0.12             | 0.24             | 0.25             | 0.38             |
| Secondary education of household head (dummy)     | 0.57             | 0.38             | 0.56             | 0.73             | 0.57             |
| Post-secondary training of household head (dummy) | 0.03             | 0.02             | 0.06             | 0.01             | 0.03             |
| Household size (number)                           | 5.20<br>(2.49)   | 5.89<br>(2.63)   | 5.06<br>(2.38)   | 4.51<br>(2.12)   | 5.67<br>(2.70)   |
| Farm size (ha)                                    | 1.81<br>(2.92)   | 0.55<br>(0.71)   | 3.02<br>(4.76)   | 1.47<br>(1.36)   | 2.69<br>(2.84)   |
| Income poverty (dummy)                            | 0.77             | 0.75             | 0.70             | 0.76             | 0.92             |
| Income poverty gap (0-1)                          | 0.57<br>(0.39)   | 0.51<br>(0.39)   | 0.48<br>(0.40)   | 0.58<br>(0.40)   | 0.78<br>(0.30)   |
| Observations                                      | 2663             | 703              | 652              | 870              | 437              |

*Notes:* Mean values are shown with standard deviations in parentheses. Income poverty is calculated by first converting per capita income for each household to international dollars, using the purchasing power parity exchange rates for each country. The PPP rates for 2023 are 42.91 for Kenya, 7.14 for Namibia, 886.12 for Tanzania, and 6.61 for Zambia. Households are classified as poor if per capita income is less than the international poverty line of 2.15 dollars per day. The poverty gap is calculated as the difference between the poverty line and the per capita income of the poor, divided by the poverty line.

### 3.2 Household participation in different income sources

Table 2 provides an overview of the different income sources of households. As can be seen, farming is still very common in rural Africa: 72% of the sampled households have at least one household member involved in own farming activities. Most households are involved in food crop production (64% of all households, 92% in Tanzania). Yet, cash crop farming is also observed in one-third of all households. Almost half of the households are involved in livestock production. Comparing the countries, farming activities are less important in Namibia than in the other study regions, which may be due to frequent droughts and wildlife conflicts in the Namibian Zambezi Region.

Table 2 shows that off-farm income sources are also crucial for rural households. Around 63% of the sampled households derive income from at least one off-farm source; and in none of the countries is this proportion below 50%. Looking at the different employment types, self-employment is more important than wage employment. Many rural areas have limited wage employment opportunities, meaning that many people have to open up their own small businesses when they want to diversify their income sources. These small businesses include retail trade, artisanal crafts, and selling of forest products such as charcoal and timber. The large number of small businesses and their importance for the local economies is also reflected in the data from our community leader and employer surveys. More than half of the community leaders interviewed ranked small businesses as the second most important economic activities in their village after agriculture (Figure A1 in the Appendix). In the employer survey, the largest proportion of employers (around 40%) is running small businesses (Figures A2 and A3 in the



Appendix). These small businesses are mostly run by household members with only occasional employment of non-household members.

Table 2: Proportion of households involved in different income sources

|   | All  | Kenya | Namibia | Tanzania | Zambia |
|---|------|-------|---------|----------|--------|
| <i>Panel A: Own farm income sources</i> |      |       |         |          |        |
| Food crop activities                    | 0.64 | 0.49  | 0.28    | 0.92     | 0.88   |
| Cash crop activities                    | 0.33 | 0.21  | 0.22    | 0.43     | 0.48   |
| Livestock activities                    | 0.48 | 0.63  | 0.15    | 0.57     | 0.55   |
| Total own farm activities               | 0.72 | 0.69  | 0.29    | 0.96     | 0.91   |
| <i>Panel B: Off-farm income sources</i> |      |       |         |          |        |
| Self-employment                         | 0.23 | 0.23  | 0.15    | 0.32     | 0.17   |
| Wage employment                         | 0.14 | 0.22  | 0.15    | 0.10     | 0.10   |
| Total off-farm employment               | 0.35 | 0.41  | 0.29    | 0.39     | 0.24   |
| Remittances                             | 0.28 | 0.15  | 0.31    | 0.38     | 0.28   |
| Transfers                               | 0.16 | 0.10  | 0.38    | 0.05     | 0.18   |
| Total off-farm sources                  | 0.63 | 0.53  | 0.76    | 0.64     | 0.59   |
| Observations                            | 2663 | 703   | 652     | 871      | 437    |

*Notes:* Proportions are shown. All household income sources are measured as dummies.

Other important off-farm income sources are transfers and remittances, with more heterogeneity across study regions (

Table 2). Namibia has the highest proportion of households benefiting from transfers (38%), while in Tanzania only 5% of the households receive any transfers. As explained, in Namibia many households receive government transfers. In addition, transfers from NGOs to compensate households for wildlife-caused losses of crops and livestock are common (Hulke et al., 2022).

On average, 28% of the sample households receive remittances (

Table 2), with the highest rate in Tanzania and the lowest rate in Kenya. Many rural households send members to urban areas or foreign countries in order to work and send back remittances (Amare et al., 2023; Chamberlin et al., 2021; Christiaensen and Maertens, 2022; Kafle et al., 2020; Mulwa and Visser, 2020; Raycraft, 2019). That Kenya has the lowest proportion of households receiving remittances is somewhat surprising, given widely-used mobile money services in the country (Parlasca et al., 2022). However, mobile money services are now also widely used in many other African countries, facilitating the sending and receiving of money at low transaction costs.

### **3.3 The structure of income from different sources**

We now analyze the contribution of different income sources to overall household income. The left-hand side of Figure 1 pools the data from all four countries. Income from all off-farm sources combined accounts for about 60% of total household income. Each off-farm income source alone accounts for at least 10% of total income. On average, off-farm income has, therefore, overtaken agriculture in terms of income contribution in the study regions.

Figure 1 also shows the structure of household income by income tercile. As can be seen, the relative importance of off-farm income increases with total income. This pattern is driven by income from off-farm employment rather than by transfers or remittances. For the poorest households (lowest tercile), off-farm employment only accounts for 7% of overall income, while for the richest households (highest tercile) it accounts for more than 50%. Higher income from off-farm employment is associated with lower income shares from food crop and livestock production, but not from cash crop production.

The right-hand side of Figure 1 shows the structure of household income by study country. We find that each study region has its unique major source of income: livestock is the main source of income in the study region in Kenya, transfers in Namibia, self-employment in Tanzania, and food crop production in Zambia. But in all countries, off-farm income sources account for 50% or more of total household income on average. Contributions of the different income sources by tercile for each study country are shown in Figure A4 in the Appendix.

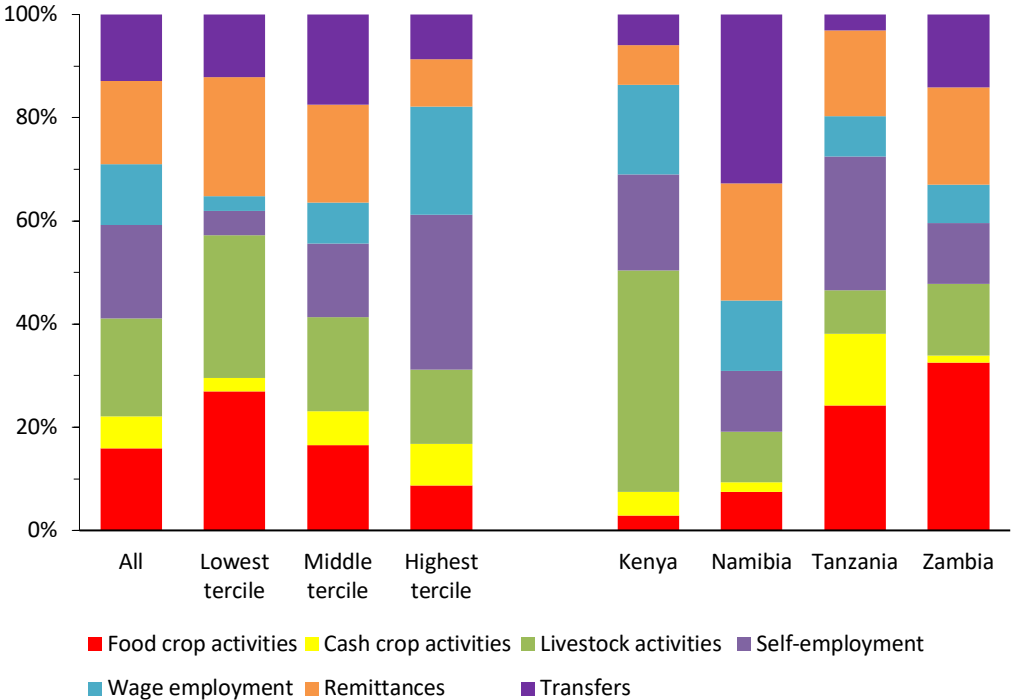


Figure 1: Structure of rural household income by income tercile and country

Notes: Farm and self-employment incomes are calculated as the value of all output minus production costs. N=2,663. Further details by country are shown in Figure A4 in the Appendix.

### 3.4 Individual participation in off-farm employment

We now look in more detail at individual-level involvement in different types of off-farm employment. Given the important role of self-employment, we start with self-employed activities. Figure 2 shows the proportion of individuals involved in different sectors of self-employment for the whole sample from all four countries (a breakdown by country is shown in Figure A5 in the Appendix). We only look at those individuals involved in self-employed activities. Figure 2 reveals that retail businesses are by far the most common type of self-employment. These retail businesses are often informal in nature and include small shops, market stalls, and roadside vendors selling food, household items, clothing, and sometimes also farm inputs such as fertilizers, seeds, or pesticides. Retail businesses are common among individuals in all income terciles, but they are most widely observed among individuals in the highest income tercile.

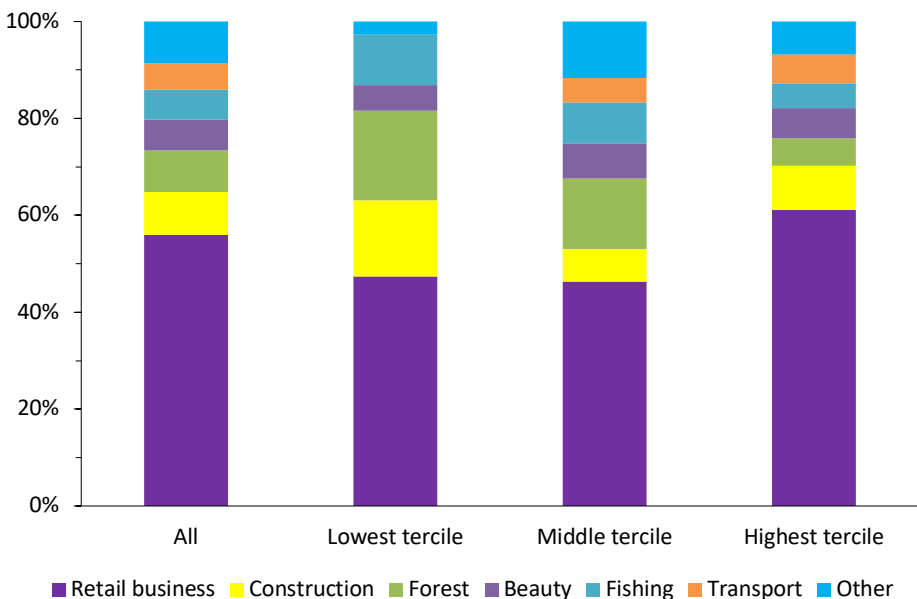


Figure 2: Proportion of individuals involved in self-employment sectors by income tercile

Notes: The sample only includes household members participating in off-farm self-employed activities (N= 694).

Other self-employment sectors widely observed in the study regions, especially among individuals in the lowest- and middle-income terciles, are fishing, forest, and construction. These are mostly informal small-scale and not very lucrative activities not much preferred by individuals from better-off households. Typical forest activities involve tree cutting, burning charcoal, or collecting firewood for sales to other local households or nearby restaurants. Forest activities are particularly relevant in the study region in Kenya (Figure A5), where prosopis and acacia trees are used to burn charcoal or as firewood and sometimes timber (Alvarez et al., 2019; Tabe Ojong et al., 2022). Small-scale fishing activities are more common in Namibia and Zambia due to the Zambezi River and other water bodies in the study regions. Typical self-employed activities in the construction sector are the preparation of structures for buildings in the community or the manufacturing and sale of bricks to other local households and businesses.

Self-employed activities in transport and other sectors (including beauty, health, hospitality, and tourism) exist in the study regions, but their importance is context-specific. For instance, the transport sector is a relevant source of self-employed income in the study regions in Kenya and Tanzania, especially for the youth who offer informal transport via motorbikes. These activities are less common in Namibia and Zambia. In Tanzania, almost 10% of the self-employed work is in the beauty sector, making it the third largest sector after retail business (66%) and construction (also around 10%). Tourism accounts for a maximum of 1% of self-employed activities, even in the regions close to national parks. While social media and online booking platforms now enable direct marketing of tourism services, it appears that rural households in the study regions have not yet been able to tap into this growing and potentially profitable sector.

Turning to wage employment, Figure 3 shows that rural wage employment occurs in a wide range of different sectors (a breakdown by country is shown in Figure A6 in the Appendix). Agriculture is the most common wage employment activity and is relevant especially in the lowest and middle income terciles. Individuals with wage employment in agriculture work on farms owned by someone else and conduct tasks such as plowing, planting, weeding, harvesting, or managing livestock. Often these employment contracts are informal and short-term.

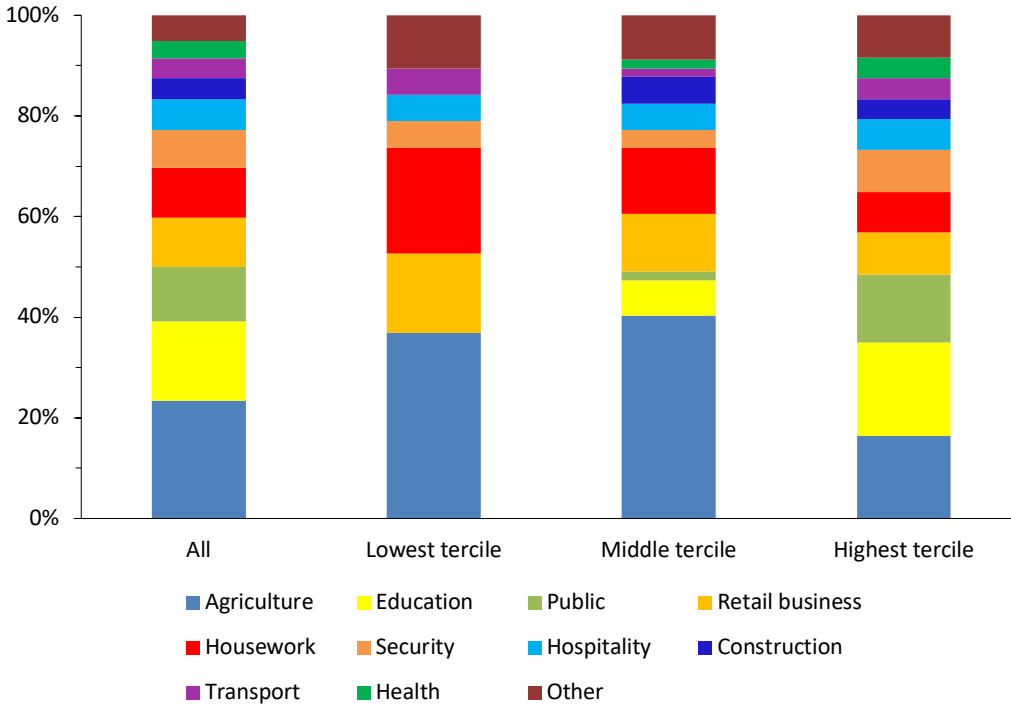


Figure 3: Proportion of individuals involved in wage employment sectors by income tertile

Notes: The sample only includes household members participating in off-farm employment activities (N=499).

Figure 3 also shows that education and the public sector are relevant for wage employment in the study regions. The education sector mainly refers to teachers working in public or private schools, while the public sector refers to work in other public organizations, such as local or national governments, administration, social institutions, public infrastructure, law enforcement, and agricultural extension. Employment in these two sectors often involves formal and longer-term contracts and more favorable wages than in informal sectors. Education and the public sector are most relevant for individuals in the highest income tertile. Strikingly, none of the individuals in the lowest tertile is employed in either of these two formal sectors.

Furthermore, Figure 3 shows that around 10% of the individuals are employed in the retail business sector, mostly as shop attendants. A similar proportion is employed as houseworkers, involving jobs in other households as maids, cleaners, or cooks. Evidence from the employer survey suggests that wages in retailing (commerce) and informal service sectors are low (Figure A7 in the Appendix), which may explain why we see more participation in these sectors in the lower income tertiles. There are also some differences across the study regions. For example, tourism is a relevant sector for wage employment in Namibia, while the housework sector is more relevant in Zambia (Figure A6).

### 3.5 Determinants of individual participation in different activities

We are now analyzing the socioeconomic factors influencing individual participation in different activities, using the MVP models explained above. The first model looks at the three own farm activities – food crops, cash crops, and livestock – and the two aggregates of off-farm employment – self-employment and wage employment. Table A5 in the Appendix confirms that the error terms of the individual equations are correlated, so the MVP approach is appropriate. The estimation results are shown in

The sex of the individual seems to be an important factor determining participation in various activities. Male individuals are significantly more likely to be involved in cash crop and livestock production than females. Males are also significantly more likely to be involved in wage employment. The estimates in Table 3 can be interpreted as marginal effects, meaning that males are almost 16 percentage points more likely to be involved in wage-employed activities than females. These gendered effects are likely due to women's larger involvement in household chores, including childcare and meal preparation, and possibly also other cultural restrictions for women to be involved in labor markets. Another significant determinant is the dependency ratio; a high ratio means that working-age adults have to care for more children or old family members. As can be seen from Table 3, a higher dependency ratio increases the likelihood of being involved in food crop and livestock production as well as in self-employed activities. This is a plausible result, as activities in own farming and self-employment at home are often better compatible with family care work than wage employment in rural Africa (Debela et al., 2021). Individual age is positively associated with all economic activities, but in a decreasing way at older ages, as indicated by the negative estimates for the square term of age.

Education is also a very important factor. It increases the involvement in most activities, but especially in off-farm activities. In comparison to not having completed primary education, which is the reference category in our model, secondary education increases the likelihood of being involved in off-farm self-employment and wage employment by 13.6 and 21.6 percentage points, respectively. Having post-secondary education increases the likelihood of wage employment by almost 50 percentage points. In terms of infrastructure, closer proximity to roads and markets significantly increases the likelihood of self-employment and wage employment (distance decreases the likelihood).



Farm size is positively associated with the likelihood of being involved in farming activities, which is not surprising. However, the magnitude of the farm-size effects is not very large. Each additional hectare of land increases the likelihood of being involved in crop and livestock farming by less than 2 percentage points (Table 3). Mean farm sizes vary by country, but most farms in our study regions are significantly smaller than 3 hectares. Furthermore, the results show that asset ownership is relevant for farming, especially cash cropping, and for self-employed off-farm activities, but not for wage employment.

Finally, being member of a group – such as farmer groups, church groups, self-help groups, etc. – tends to increase the likelihood of being involved in all economic activities, with the largest marginal effects observed for cash crop and livestock production. Group membership is typically associated with having larger social networks and better access to information, which is useful for pursuing various economic activities.

Table 3: Factors influencing individual participation in income-generating activities

|                                    | (1)<br>Food<br>crop  | (2)<br>Livestock     | (3)<br>Cash<br>crop  | (4)<br>Self-<br>employment | (5)<br>Wage<br>employment |
|------------------------------------|----------------------|----------------------|----------------------|----------------------------|---------------------------|
| Age (years)                        | 0.032***<br>(0.004)  | 0.025***<br>(0.002)  | 0.021***<br>(0.002)  | 0.046***<br>(0.006)        | 0.030***<br>(0.001)       |
| Age squared                        | -0.001***<br>(0.000) | -0.001***<br>(0.000) | -0.001***<br>(0.000) | -0.001***<br>(0.000)       | -0.001***<br>(0.000)      |
| Male (dummy)                       | 0.018<br>(0.002)     | 0.065***<br>(0.006)  | 0.034**<br>(0.003)   | -0.003<br>(0.000)          | 0.156***<br>(0.006)       |
| Married (dummy)                    | 0.185***<br>(0.020)  | 0.163***<br>(0.015)  | 0.120***<br>(0.009)  | -0.008<br>(0.001)          | 0.028<br>(0.001)          |
| Primary education<br>(dummy)       | 0.107***<br>(0.012)  | 0.018<br>(0.002)     | 0.073***<br>(0.006)  | 0.089***<br>(0.011)        | 0.186***<br>(0.008)       |
| Secondary education<br>(dummy)     | 0.039<br>(0.004)     | -0.015<br>(0.001)    | 0.058**<br>(0.005)   | 0.136***<br>(0.017)        | 0.216***<br>(0.009)       |
| Post-secondary training<br>(dummy) | -0.011<br>(0.001)    | -0.143***<br>(0.013) | -0.076*<br>(0.006)   | 0.007<br>(0.001)           | 0.473***<br>(0.019)       |
| Dependency ratio                   | 0.037***<br>(0.009)  | 0.024***<br>(0.002)  | 0.004<br>(0.024)     | 0.041***<br>(0.023)        | 0.007<br>(0.014)          |
| Asset ownership<br>(index)         | 0.005*<br>(0.001)    | 0.029***<br>(0.003)  | 0.039***<br>(0.003)  | 0.018***<br>(0.002)        | 0.006<br>(0.010)          |
| Farm size (ha)                     | 0.018***<br>(0.002)  | 0.011***<br>(0.001)  | 0.017***<br>(0.001)  | -0.012**<br>(0.002)        | -0.024***<br>(0.001)      |
| Illness/death (dummy)              | -0.008<br>(0.001)    | -0.019<br>(0.002)    | -0.028*<br>(0.002)   | -0.046**<br>(0.006)        | 0.023<br>(0.001)          |
| Group membership<br>(dummy)        | 0.069***<br>(0.008)  | 0.118***<br>(0.011)  | 0.133***<br>(0.010)  | 0.077***<br>(0.010)        | 0.096***<br>(0.004)       |
| Time to nearest road<br>(minutes)  | -0.012<br>(0.001)    | -0.002<br>(0.000)    | 0.009<br>(0.001)     | -0.026***<br>(0.003)       | -0.011<br>(0.000)         |
| Time to market<br>(minutes)        | 0.034**<br>(0.004)   | 0.026*<br>(0.002)    | 0.010<br>(0.001)     | 0.007<br>(0.001)           | -0.069***<br>(0.003)      |
| Country dummies                    | Yes                  | Yes                  | Yes                  | Yes                        | Yes                       |

Notes: Average marginal effects from MVP model are shown with standard errors in parentheses.

\*, \*\*, \*\*\* significant at the 10%, 5%, and 1% respectively. N=6,321, Log pseudo likelihood = -11491, and Wald  $\chi^2(85) = 3586$ .

### 3.6 Determinants of individual participation in different wage employment sectors

We now look at socioeconomic factors that influence individual participation in different wage employment sectors, using our second specification of the MVP model and only including wage-employed individuals. Table A6 in the Appendix confirms error term correlation between the different sectoral equations. The MVP estimation results are shown in Table 4: Factors influencing individual participation in different wage employment sectors

|                                 | (1)<br>Agriculture   | (2)<br>Retail        | (3)<br>Service       | (4)<br>Public       | (5)<br>Construction | (6)<br>Education    |
|---------------------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| Age (years)                     | -0.001<br>(0.001)    | -0.002<br>(0.001)    | 0.003<br>(0.002)     | 0.002**<br>(0.001)  | 0.001<br>(0.001)    | 0.003***<br>(0.001) |
| Male (dummy)                    | 0.020<br>(0.031)     | -0.093***<br>(0.025) | 0.121***<br>(0.042)  | 0.027<br>(0.025)    | 0.120***<br>(0.034) | -0.10***<br>(0.025) |
| Married (dummy)                 | -0.026<br>(0.043)    | -0.035<br>(0.028)    | 0.037<br>(0.049)     | -0.004<br>(0.033)   | -0.044<br>(0.038)   | -0.007<br>(0.031)   |
| Primary education (dummy)       | 0.017<br>(0.069)     | -0.109**<br>(0.046)  | 0.026<br>(0.085)     | -0.069<br>(0.071)   | 0.034***<br>(0.093) | 0.50***<br>(0.069)  |
| Secondary education (dummy)     | -0.009<br>(0.077)    | -0.069<br>(0.050)    | -0.068<br>(0.091)    | -0.003<br>(0.068)   | 0.052***<br>(0.098) | 0.636***<br>(0.083) |
| Post-secondary training (dummy) | -0.274***<br>(0.097) | -0.296***<br>(0.081) | -0.383***<br>(0.101) | 0.172***<br>(0.066) | 0.270***<br>(0.097) | 0.858***<br>(0.082) |
| Dependency ratio                | 0.003<br>(0.020)     | -0.012<br>(0.016)    | 0.003<br>(0.023)     | 0.027**<br>(0.013)  | 0.011<br>(0.018)    | 0.015<br>(0.015)    |
| Asset ownership (index)         | -0.024***<br>(0.009) | 0.008<br>(0.006)     | -0.009<br>(0.009)    | 0.013***<br>(0.005) | 0.014**<br>(0.006)  | 0.019***<br>(0.006) |
| Farm size (ha)                  | -0.023<br>(0.017)    | 0.005<br>(0.008)     | 0.009<br>(0.011)     | -0.004<br>(0.005)   | 0.003<br>(0.007)    | -0.003*<br>(0.005)  |
| Illness/death (dummy)           | -0.008<br>(0.044)    | 0.050<br>(0.029)     | -0.045<br>(0.047)    | -0.056*<br>(0.029)  | -0.019<br>(0.037)   | -0.004<br>(0.030)   |
| Group membership (dummy)        | 0.127***<br>(0.045)  | -0.059<br>(0.042)    | -0.041<br>(0.059)    | -0.055<br>(0.034)   | -0.083<br>(0.090)   | -0.003<br>(0.038)   |
| Time to nearby market (minutes) | -0.031<br>(0.021)    | 0.020<br>(0.014)     | -0.027<br>(0.021)    | 0.005<br>(0.012)    | -0.009<br>(0.016)   | 0.013<br>(0.013)    |
| Time to nearby                  | 0.049                | 0.041                | -0.075               | 0.027               | -0.047              | 0.061**             |

|                 |         |         |         |         |         |         |
|-----------------|---------|---------|---------|---------|---------|---------|
| market (hours)  | (0.039) | (0.029) | (0.048) | (0.023) | (0.031) | (0.026) |
| Country dummies | Yes     | Yes     | Yes     | Yes     | Yes     | Yes     |

Notes: Average marginal effects from MVP model are shown with standard errors in parenthesis \* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level. Only wage-employed individuals are included (N=450), Log pseudo likelihood = -1444, Wald  $\chi^2$  (97) = 355.

. Some interesting gender patterns are observed. Female individuals are more likely to be wage-employed in the retail sector and as teachers in education, whereas males are more likely to be wage-employed in other services sectors and in construction.

Table 4 also reveals that education is an important factor determining access to different types of wage jobs. Education does not seem to matter much for employment in agriculture and retailing. However, having completed primary and secondary education significantly increases the likelihood of having jobs in the education and construction sectors. The sectoral differences are even more pronounced for post-secondary education, which increases the likelihood of being employed in education, public organizations, and construction significantly and with large average marginal effects. For education and the public sector these results are unsurprising, as for jobs in these sectors specialized knowledge and training are typically required. For construction the result is perhaps more surprising, as construction may be associated with simple manual tasks. Yet, the small-scale construction sector in rural areas often involves jobs in masonry, carpentry, electrical wiring, plumbing, roofing, and welding, which do require at least some post-secondary level training. Our results also suggest that individuals with post-secondary education are significantly less likely to be wage-employed in agriculture, retailing, and other services sectors.

The results in Table 4: Factors influencing individual participation in different wage employment sectors

|                           | (1)               | (2)                  | (3)                 | (4)                | (5)                 | (6)                 |
|---------------------------|-------------------|----------------------|---------------------|--------------------|---------------------|---------------------|
|                           | Agriculture       | Retail               | Service             | Public             | Construction        | Education           |
| Age (years)               | -0.001<br>(0.001) | -0.002<br>(0.001)    | 0.003<br>(0.002)    | 0.002**<br>(0.001) | 0.001<br>(0.001)    | 0.003***<br>(0.001) |
| Male (dummy)              | 0.020<br>(0.031)  | -0.093***<br>(0.025) | 0.121***<br>(0.042) | 0.027<br>(0.025)   | 0.120***<br>(0.034) | -0.10***<br>(0.025) |
| Married (dummy)           | -0.026<br>(0.043) | -0.035<br>(0.028)    | 0.037<br>(0.049)    | -0.004<br>(0.033)  | -0.044<br>(0.038)   | -0.007<br>(0.031)   |
| Primary education (dummy) | 0.017<br>(0.069)  | -0.109**<br>(0.046)  | 0.026<br>(0.085)    | -0.069<br>(0.071)  | 0.034***<br>(0.093) | 0.50***<br>(0.069)  |
| Secondary                 | -0.009            | -0.069               | -0.068              | -0.003             | 0.052***            | 0.636***            |

|                                 |                      |                      |                      |                     |                     |                     |
|---------------------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| education (dummy)               | (0.077)              | (0.050)              | (0.091)              | (0.068)             | (0.098)             | (0.083)             |
| Post-secondary training (dummy) | -0.274***<br>(0.097) | -0.296***<br>(0.081) | -0.383***<br>(0.101) | 0.172***<br>(0.066) | 0.270***<br>(0.097) | 0.858***<br>(0.082) |
| Dependency ratio                | 0.003<br>(0.020)     | -0.012<br>(0.016)    | 0.003<br>(0.023)     | 0.027**<br>(0.013)  | 0.011<br>(0.018)    | 0.015<br>(0.015)    |
| Asset ownership (index)         | -0.024***<br>(0.009) | 0.008<br>(0.006)     | -0.009<br>(0.009)    | 0.013***<br>(0.005) | 0.014**<br>(0.006)  | 0.019***<br>(0.006) |
| Farm size (ha)                  | -0.023<br>(0.017)    | 0.005<br>(0.008)     | 0.009<br>(0.011)     | -0.004<br>(0.005)   | 0.003<br>(0.007)    | -0.003*<br>(0.005)  |
| Illness/death (dummy)           | -0.008<br>(0.044)    | 0.050<br>(0.029)     | -0.045<br>(0.047)    | -0.056*<br>(0.029)  | -0.019<br>(0.037)   | -0.004<br>(0.030)   |
| Group membership (dummy)        | 0.127***<br>(0.045)  | -0.059<br>(0.042)    | -0.041<br>(0.059)    | -0.055<br>(0.034)   | -0.083<br>(0.090)   | -0.003<br>(0.038)   |
| Time to nearby market (minutes) | -0.031<br>(0.021)    | 0.020<br>(0.014)     | -0.027<br>(0.021)    | 0.005<br>(0.012)    | -0.009<br>(0.016)   | 0.013<br>(0.013)    |
| Time to nearby market (hours)   | 0.049<br>(0.039)     | 0.041<br>(0.029)     | -0.075<br>(0.048)    | 0.027<br>(0.023)    | -0.047<br>(0.031)   | 0.061**<br>(0.026)  |
| Country dummies                 | Yes                  | Yes                  | Yes                  | Yes                 | Yes                 | Yes                 |

*Notes:* Average marginal effects from MVP model are shown with standard errors in parenthesis \* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level. Only wage-employed individuals are included (N=450), Log pseudo likelihood = -1444, Wald  $\chi^2$  (97) = 355.

also show that asset ownership is positively associated with higher-paying jobs in education, public organizations, and construction, and negatively associated with wage-employment in agriculture. Asset ownership is used here as a proxy of wealth with causality likely going in both directions. In any case, these findings align with the patterns observed in Figure 3, where individuals from the highest-income tercile were found to be more involved in jobs in education and the public sector, whereas individuals from the lower- and middle-income terciles were more likely to be employed in agriculture.

Table 4: Factors influencing individual participation in different wage employment sectors

|                                    | (1)<br>Agriculture   | (2)<br>Retail        | (3)<br>Service       | (4)<br>Public       | (5)<br>Construction | (6)<br>Education    |
|------------------------------------|----------------------|----------------------|----------------------|---------------------|---------------------|---------------------|
| Age (years)                        | -0.001<br>(0.001)    | -0.002<br>(0.001)    | 0.003<br>(0.002)     | 0.002**<br>(0.001)  | 0.001<br>(0.001)    | 0.003***<br>(0.001) |
| Male (dummy)                       | 0.020<br>(0.031)     | -0.093***<br>(0.025) | 0.121***<br>(0.042)  | 0.027<br>(0.025)    | 0.120***<br>(0.034) | -0.10***<br>(0.025) |
| Married (dummy)                    | -0.026<br>(0.043)    | -0.035<br>(0.028)    | 0.037<br>(0.049)     | -0.004<br>(0.033)   | -0.044<br>(0.038)   | -0.007<br>(0.031)   |
| Primary education<br>(dummy)       | 0.017<br>(0.069)     | -0.109**<br>(0.046)  | 0.026<br>(0.085)     | -0.069<br>(0.071)   | 0.034***<br>(0.093) | 0.50***<br>(0.069)  |
| Secondary<br>education<br>(dummy)  | -0.009<br>(0.077)    | -0.069<br>(0.050)    | -0.068<br>(0.091)    | -0.003<br>(0.068)   | 0.052***<br>(0.098) | 0.636***<br>(0.083) |
| Post-secondary<br>training (dummy) | -0.274***<br>(0.097) | -0.296***<br>(0.081) | -0.383***<br>(0.101) | 0.172***<br>(0.066) | 0.270***<br>(0.097) | 0.858***<br>(0.082) |
| Dependency ratio                   | 0.003<br>(0.020)     | -0.012<br>(0.016)    | 0.003<br>(0.023)     | 0.027**<br>(0.013)  | 0.011<br>(0.018)    | 0.015<br>(0.015)    |
| Asset ownership<br>(index)         | -0.024***<br>(0.009) | 0.008<br>(0.006)     | -0.009<br>(0.009)    | 0.013***<br>(0.005) | 0.014**<br>(0.006)  | 0.019***<br>(0.006) |
| Farm size (ha)                     | -0.023<br>(0.017)    | 0.005<br>(0.008)     | 0.009<br>(0.011)     | -0.004<br>(0.005)   | 0.003<br>(0.007)    | -0.003*<br>(0.005)  |
| Illness/death<br>(dummy)           | -0.008<br>(0.044)    | 0.050<br>(0.029)     | -0.045<br>(0.047)    | -0.056*<br>(0.029)  | -0.019<br>(0.037)   | -0.004<br>(0.030)   |
| Group membership<br>(dummy)        | 0.127***<br>(0.045)  | -0.059<br>(0.042)    | -0.041<br>(0.059)    | -0.055<br>(0.034)   | -0.083<br>(0.090)   | -0.003<br>(0.038)   |
| Time to nearby<br>market (minutes) | -0.031<br>(0.021)    | 0.020<br>(0.014)     | -0.027<br>(0.021)    | 0.005<br>(0.012)    | -0.009<br>(0.016)   | 0.013<br>(0.013)    |
| Time to nearby<br>market (hours)   | 0.049<br>(0.039)     | 0.041<br>(0.029)     | -0.075<br>(0.048)    | 0.027<br>(0.023)    | -0.047<br>(0.031)   | 0.061**<br>(0.026)  |
| Country dummies                    | Yes                  | Yes                  | Yes                  | Yes                 | Yes                 | Yes                 |

Notes: Average marginal effects from MVP model are shown with standard errors in parenthesis \* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level. Only wage-employed individuals are included (N=450), Log pseudo likelihood = -1444, Wald  $\chi^2$  (97) = 355.

## 4 Discussion and conclusion

Households in rural sub-Saharan Africa derive income from multiple sources. While most previous research suggests that agriculture is still the dominant source of rural incomes, our findings challenge this conventional wisdom. By using recent data from different rural areas in four African countries – Kenya, Namibia, Tanzania, and Zambia – we have analyzed household and individual participation in various economic activities and sectors. Estimating multivariate probit regression models, we have further examined different socioeconomic factors that facilitate or prevent the involvement in specific activities.

Our results show that off-farm income makes up around 60% of total household income across the four study countries. This share of off-farm income is higher than what is reported in most previous studies (e.g., Davis et al., 2017; Winters et al., 2009; Davis et al., 2010; Haggblade et al., 2010). We argue that the share of agricultural farm income is declining over time, due to continued population growth, land scarcity, and ongoing structural transformation in rural Africa. Furthermore, worsening climatic conditions and more frequent weather shocks are particular threats for agricultural income stability in the African small-farm sector.

The specific income-generating activities on-farm and off-farm can vary considerably from one region to the other, as our results also underline. However, the finding that the off-farm income share of rural households is large, and on average also larger than the income share derived from own farming, holds across all study regions and countries. Our results also show that the off-farm income share increases with total household income, meaning that the poorest households remain most dependent on agriculture. Even the off-farm jobs of the poorest households are often in the agricultural sector, leaving them most vulnerable to aggravating climatic conditions. Access to off-farm employment can be an important mechanism for smallholder farming households to cope with weather shocks (Musungu et al., 2023), but the poorest households often have very limited access to lucrative types of off-farm employment.

We have also looked at different types of off-farm employment and find that self-employment is the most common type for the majority of rural households. This is most likely due to limited wage employment opportunities in rural areas of sub-Saharan Africa. In contrast, the entry barriers for starting and operating small own businesses are relatively low (Nagler and Naudé, 2017). Moreover, given that most rural households remain in agriculture to some extent, and agricultural activities are seasonal in nature, self-employed activities in small own businesses are a useful complement, as these can typically be timed more flexibly than most wage employment relations.

Our results also show that most off-farm activities of rural households are informal in nature. Self-employed activities are mostly in small-scale retailing, fishing, collecting of firewood, or burning of charcoal. Wage employment is often in agriculture, small-scale retailing, housework (domestic workers), security (mostly private security companies), and the construction sector. Employment in higher-paying formal jobs is rare. These findings are in line with the existing literature, indicating that infrastructure conditions in most rural parts of Africa are underdeveloped, entailing unfavorable conditions for the establishment of larger industries and service businesses (Christiaensen and Maertens, 2022; Dercon and Gollin, 2014). Constraints in terms of access to roads, markets, and electricity discourage private-sector business investments, which are crucial for generating more formal employment opportunities.

Our regression analyses reveal that primary and secondary education are important for harnessing opportunities in off-farm self-employment and wage employment, whereas post-secondary education and training are key for accessing higher-paying wage jobs. Post-secondary training is especially important for wage employment in education, public organizations, and the construction sector. Previous studies also highlight the importance of education for off-farm employment, yet without a detailed breakdown by sector (Beyene, 2008; Dedehouanou et al., 2018; Van Den Broeck and Kilic, 2019; Winters et al., 2009).

Our study regions are not necessarily representative for all parts of rural Africa, even though we have tried to cover a wide range of typical conditions, so many of the general findings should also hold beyond the concrete study settings. One aspect to stress is that the regions we sampled are somewhat poorer than the national rural averages. However, given our finding that the poorest households are typically those depending most on agriculture and have the lowest shares of off-farm income, we expect that in many better-off rural regions of Africa the role of off-farm activities is equally high or even higher. Exceptions may possibly be a few high-potential agricultural regions with significant cash crop production.

While the concrete numbers should not be generalized, our broader findings are likely relevant for many African countries and settings currently undergoing rural transformation. It is evident that off-farm income sources are important for rural households and should be considered more explicitly in the formulation of rural development policies. One key policy recommendation is that more rural job opportunities need to be created, as most employment types currently observed are small, informal, and not very lucrative. This will require larger public and private investments in rural infrastructure, including roads, electricity, water, and network connections. Better off-farm employment opportunities can reduce households' vulnerability to climate change and can also help to reduce poverty, as households with larger off-farm income shares are typically less poor. Another important policy implication is to improve rural education and vocational training to facilitate people's access to higher-paying jobs. While agriculture remains



important, fair employment in various other sectors needs to increase for sustainable rural development.

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## Appendix

Table A1: Description of employment sectors

| Sector          | Description and examples  |
|-----------------|---|
| Agriculture     | Crop and animal production, hunting and related service activities, Support activities to agriculture   |
| Retail business | Retail sale of food, household equipment, textiles, hardware, stationary materials; sale of second-hand goods; buying of agricultural produce from farmers with the aim of selling to consumers. Retail trade can be in specialized or non-specialized shops, stalls or open-air markets            |
| Health          | Doctors, dentists, nurses, pharmacists, veterinarians, medical assistants, dental hygienists, lab technicians, medical sales professionals  |
| Education       | Pre-primary and primary education; Secondary education; Technical and vocational secondary education; Higher education; Cultural education; Educational support services  |
| Other public    | Individuals employed at central, state and local levels of government   |
| Construction    | Construction of buildings such as houses, malls; civil engineering – construction of roads and railways; specialized construction activities such demolitions, site preparation, electrical, plumbing and other construction installation activities; building completion and finishing activities. |
| Beauty          | Hairdressing and other beauty treatment   |
| Transport       | Passenger road transport, transport of cargo from one place to another; warehousing and support activities for transportation; postal and courier activities  |
| House work      | Activities of households as employers of domestic personnel   |
| Fishing         | Marine, lake or lake fishing; aquaculture (pond fishing)  |
| Forest          | Logging, Gathering of non-wood forest products, Support services to forestry  |
| Hospitality     | Short term accommodation activities; camping grounds; event catering and other service activities   |
| Tourism         | Activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure like watching wildlife visiting historical sites   |
| Other           | Religion-related activities like working as a priest and related activities; Funeral and related activities   |

Table A2: Definition of key variables

| Variable                                    | Definition   |
|---|--|
| <b><i>Socioeconomic characteristics</i></b> |  |
| Age   | Age of a household member in years   |
| Male  | =1 if a household member is male, 0 otherwise  |
| Married                                     | =1 if a household member is married, 0 otherwise   |
| Primary education                           | =1 if a household member has completed primary education, 0 otherwise                                    |
| Secondary education                         | =1 if a household member has completed secondary education, 0 otherwise                                  |
| Household size                              | Total number of household members  |
| Asset ownership                             | Asset index of a household calculated using principal components analysis                                |
| Electricity access                          | =1 if a household has access to electricity, 0 otherwise   |
| Time to nearest road                        | Time (in minutes) taken by individuals from homesteads to the nearest proper road                        |
| Time to nearest market                      | Time (in hours) taken by individuals from homesteads to the nearest market serving about 250,000 people. |
| Group membership                            | =1 if any household member belongs to any voluntary association in the village                           |
| Shock -illness/death                        | =1 if a household member was ill or died in the last 12 months, 0 otherwise                              |
| <b><i>Employment characteristics</i></b>    |  |
| Self-employment                             | =1 if a household member is self-employed, 0 otherwise   |
| Wage employment                             | =1 if a household member is wage employed, 0 otherwise   |
| Cash crop production                        | =1 if a household member practices cash crop farming, 0 otherwise  |
| Food crop production                        | =1 if a household member practices food crop farming, 0 otherwise  |
| Livestock production                        | =1 if a household member practices livestock farming, 0 otherwise  |

Table A3: Socioeconomic characteristics of individuals

|                             | (1)     | (2)     | (3)     | (4)      | (5)     |
|-----------------------------|---------|---------|---------|----------|---------|
|                             | All     | Kenya   | Namibia | Tanzania | Zambia  |
| Age (years)                 | 40.34   | 37.58   | 40.70   | 42.37    | 40.23   |
|                             | (18.08) | (17.02) | (18.37) | (17.74)  | (19.23) |
| Male (dummy)                | 0.46    | 0.48    | 0.44    | 0.47     | 0.47    |
| Married (dummy)             | 0.53    | 0.57    | 0.43    | 0.60     | 0.51    |
| Primary education (dummy)   | 0.37    | 0.27    | 0.19    | 0.67     | 0.24    |
| Secondary education (dummy) | 0.39    | 0.24    | 0.64    | 0.18     | 0.60    |
| Tertiary education (dummy)  | 0.05    | 0.10    | 0.07    | 0.02     | 0.02    |
| Household size (number)     | 5.20    | 5.89    | 5.06    | 4.51     | 5.67    |
|                             | (2.49)  | (2.63)  | (2.38)  | (2.12)   | (2.70)  |
| Asset index (index)         | 4.13    | 2.69    | 5.05    | 4.80     | 3.73    |
|                             | (2.64)  | (2.29)  | (2.70)  | (2.31)   | (2.63)  |
| Land size (ha)              | 1.69    | 0.52    | 2.73    | 1.42     | 2.54    |
|                             | (2.23)  | (0.62)  | (3.41)  | (1.18)   | (2.25)  |
| Illness/death (dummy)       | 0.33    | 0.20    | 0.41    | 0.31     | 0.49    |
| Group membership (dummy)    | 0.14    | 0.08    | 0.04    | 0.30     | 0.08    |
| Time to road (minutes)      | 4.98    | 3.19    | 8.16    | 6.00     | 5.58    |
|                             | (6.17)  | (2.41)  | (30.53) | (8.32)   | (7.58)  |
| Time to market (hours)      | 9.50    | 5.64    | 11.25   | 9.94     | 12.36   |
|                             | (3.19)  | (1.96)  | (1.84)  | (2.34)   | (1.45)  |
| <i>N</i>                    | 6722    | 1717    | 1765    | 2086     | 1154    |

Notes: Means are shown with standard deviations in parentheses.



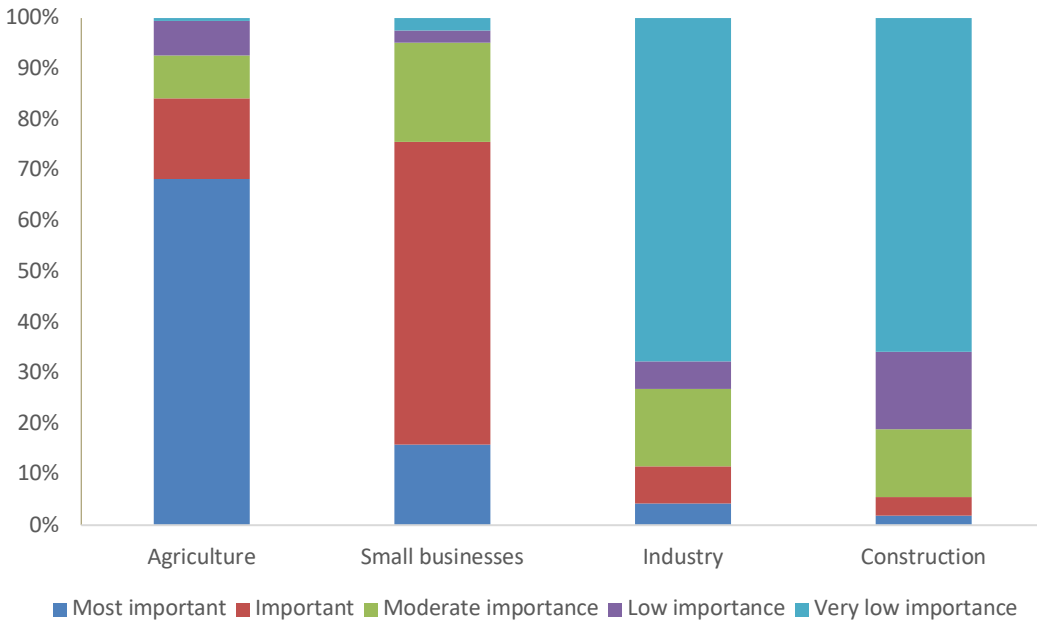


Figure A1: Ranking of the most important economic activities in the villages by village leaders (pooled sample, N=164)

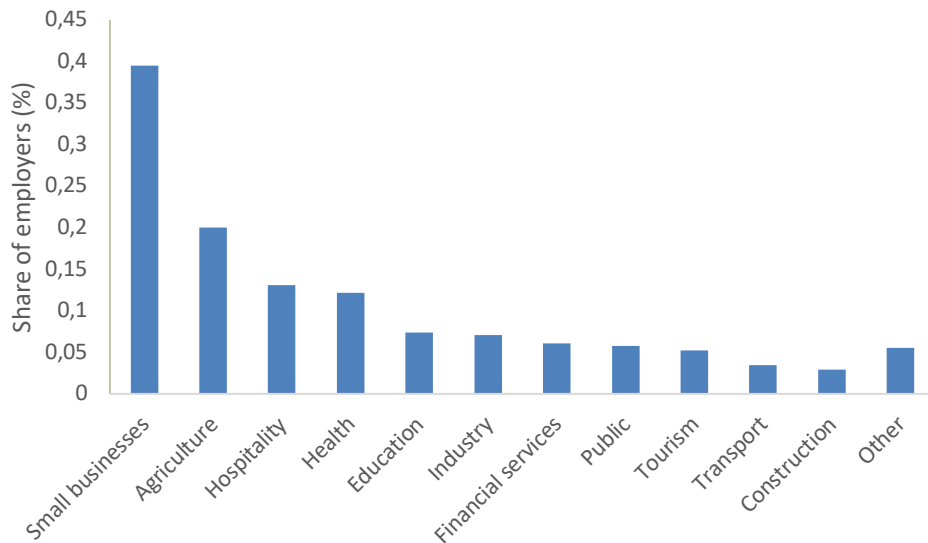
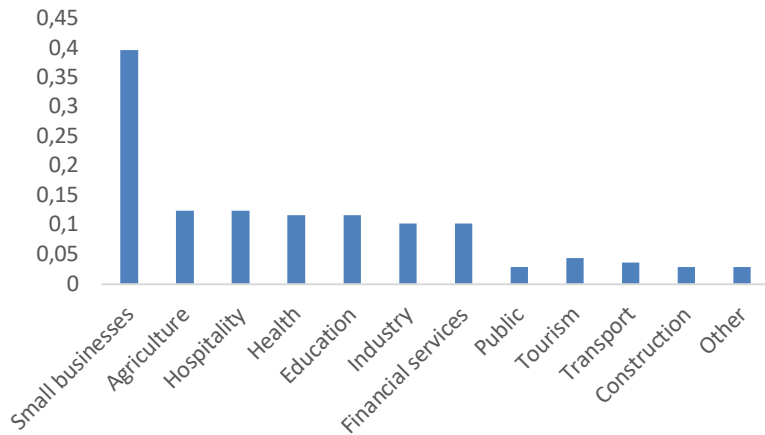


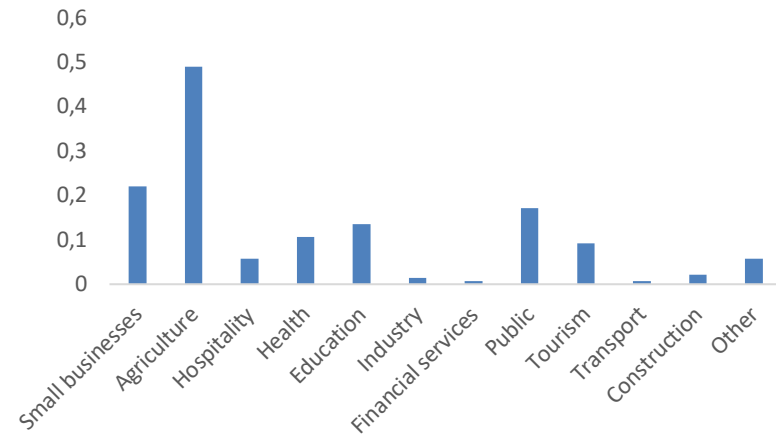
Figure A2: Proportion of rural employers in different sectors (pooled sample, N=610)

Notes: A further breakdown by country is shown in Figure A3. Small businesses include small-scale activities in trading, artisanal crafts, and selling of forest products such as charcoal and timber.

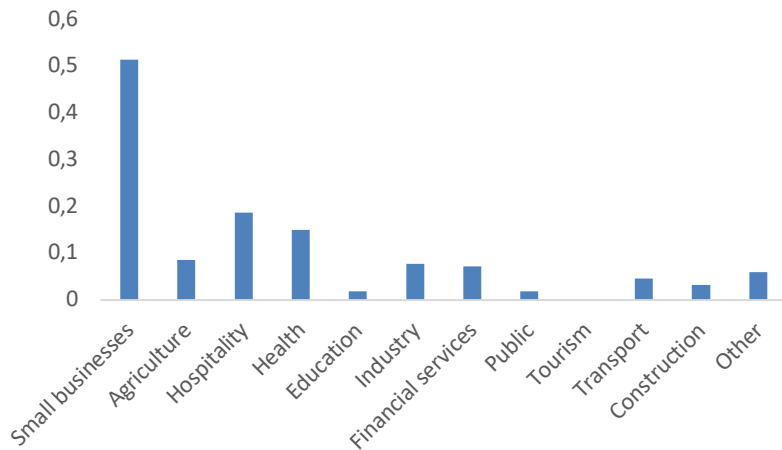
a. Kenya (N=136)



b. Namibia (N=140)



c. Tanzania (N=220)



d. Zambia (N=114)

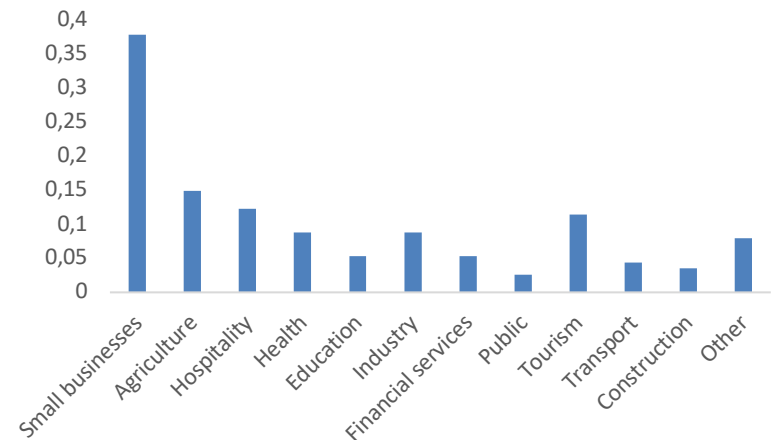
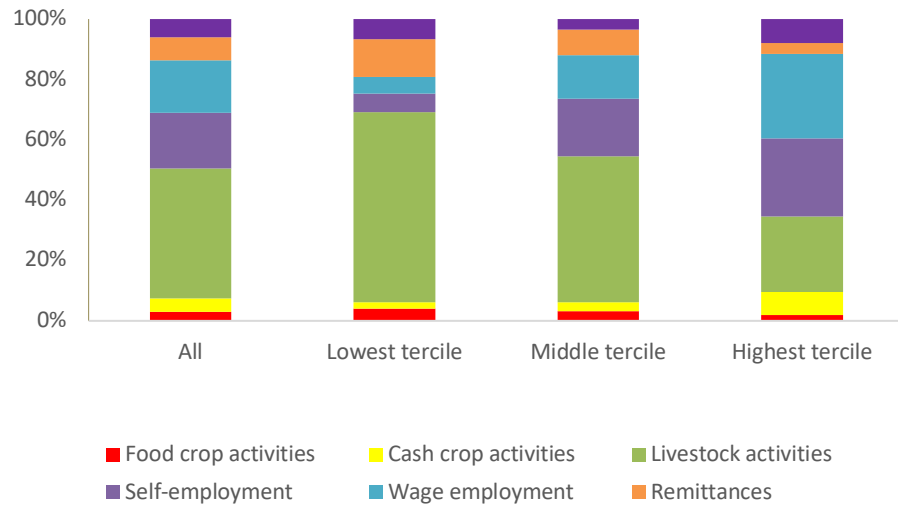
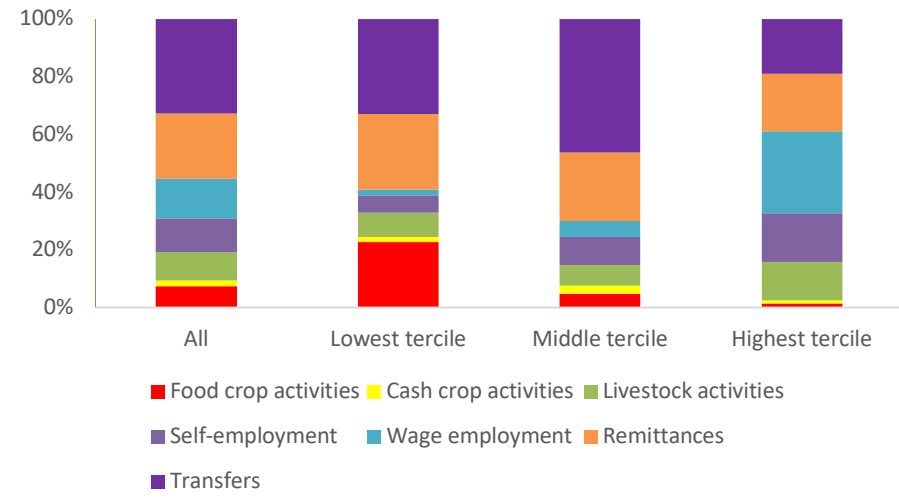


Figure A3: Proportion of rural employers in different sectors (by country)

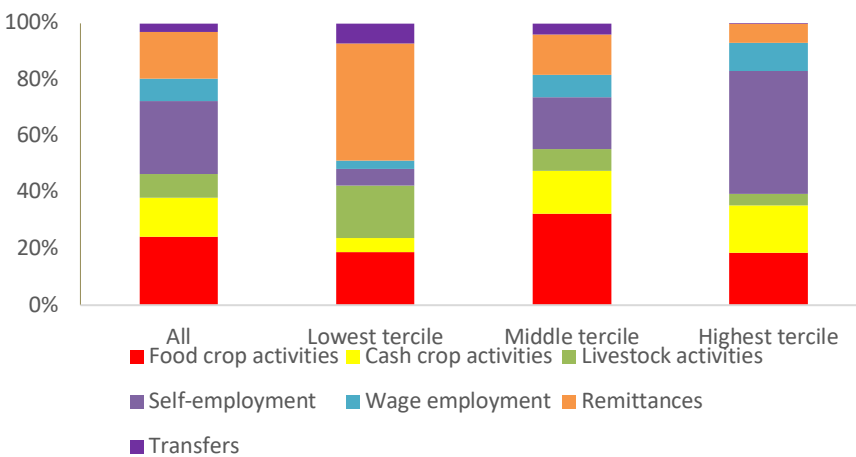
a. Kenya (N=703)



b. Namibia (N=652)



c. Tanzania (N=870)



d. Zambia (N=437)

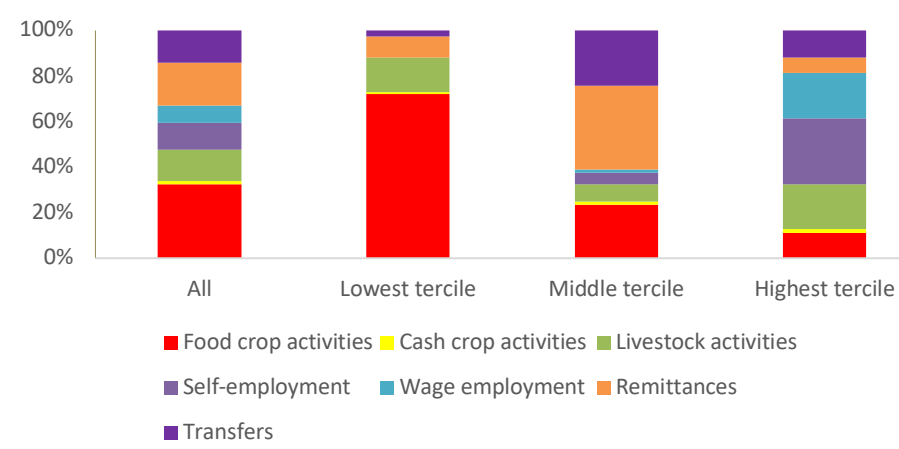


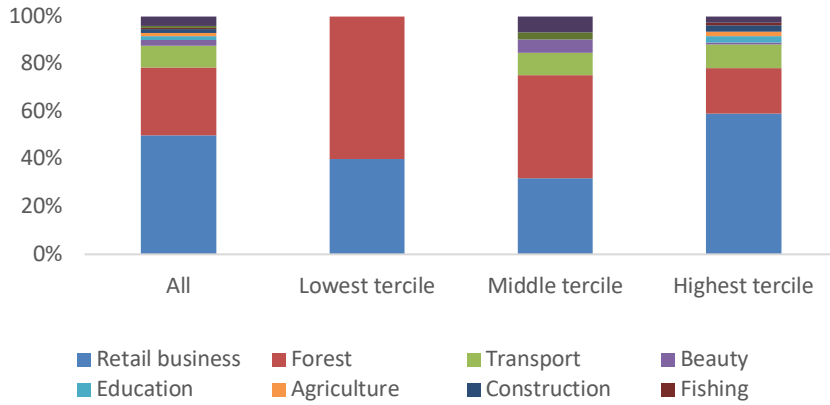
Figure A4: Structure of rural household income by income tertile by country

Table A4: Proportion of individuals participating in different activities by sex

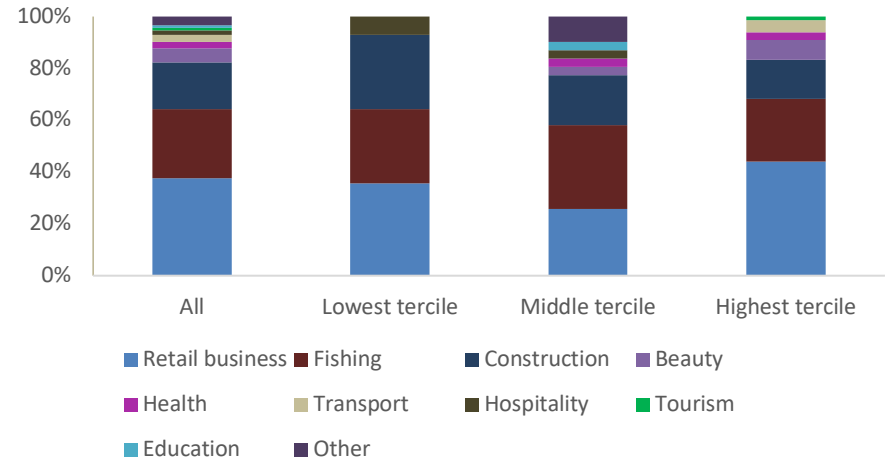
|                                     | Kenya |      |        | Namibia |      |        | Tanzania |       |        | Zambia |       |        |
|-------------------------------------|-------|------|--------|---------|------|--------|----------|-------|--------|--------|-------|--------|
|                                     | All   | Male | Female | All     | Male | Female | All      | Male  | Female | All    | Male  | Female |
| <i>Panel A: Off-farm employment</i> |       |      |        |         |      |        |          |       |        |        |       |        |
| Self-employment                     | 0.10  | 0.09 | 0.12   | 0.06    | 0.08 | 0.05   | 0.16     | 0.17  | 0.16   | 0.07   | 0.07  | 0.07   |
| Wage employment                     | 0.11  | 0.14 | 0.08   | 0.06    | 0.10 | 0.04   | 0.05     | 0.069 | 0.030  | 0.042  | 0.060 | 0.026  |
| Total off-farm employment           | 0.21  | 0.23 | 0.19   | 0.13    | 0.17 | 0.09   | 0.21     | 0.24  | 0.19   | 0.11   | 0.13  | 0.10   |
| <i>Panel B: Own farm activities</i> |       |      |        |         |      |        |          |       |        |        |       |        |
| Cash crop activities                | 0.15  | 0.18 | 0.13   | 0.14    | 0.14 | 0.13   | 0.32     | 0.36  | 0.29   | 0.38   | 0.36  | 0.40   |
| Food crop activities                | 0.36  | 0.40 | 0.31   | 0.17    | 0.17 | 0.16   | 0.70     | 0.70  | 0.70   | 0.72   | 0.70  | 0.74   |
| Livestock activities                | 0.45  | 0.53 | 0.38   | 0.08    | 0.10 | 0.06   | 0.39     | 0.37  | 0.41   | 0.39   | 0.45  | 0.34   |
| Total own-farm activities           | 0.49  | 0.57 | 0.41   | 0.18    | 0.18 | 0.17   | 0.74     | 0.74  | 0.73   | 0.75   | 0.73  | 0.76   |
| Observations                        | 1717  | 821  | 896    | 1765    | 771  | 994    | 2086     | 971   | 1115   | 1154   | 546   | 608    |

Notes: Proportions are shown with standard deviations in parentheses. The sample includes all individuals in the household aged 18 and above.

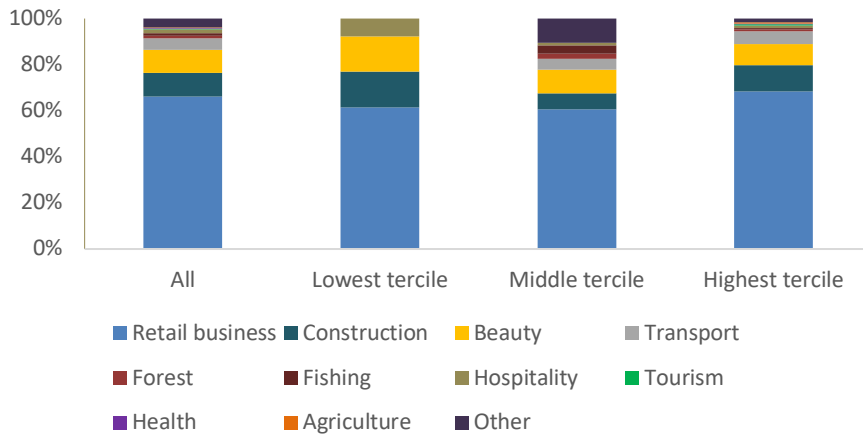
a. Kenya (N=172)



b. Namibia (N=108)



c. Tanzania (N=335)



d. Zambia (N=79)

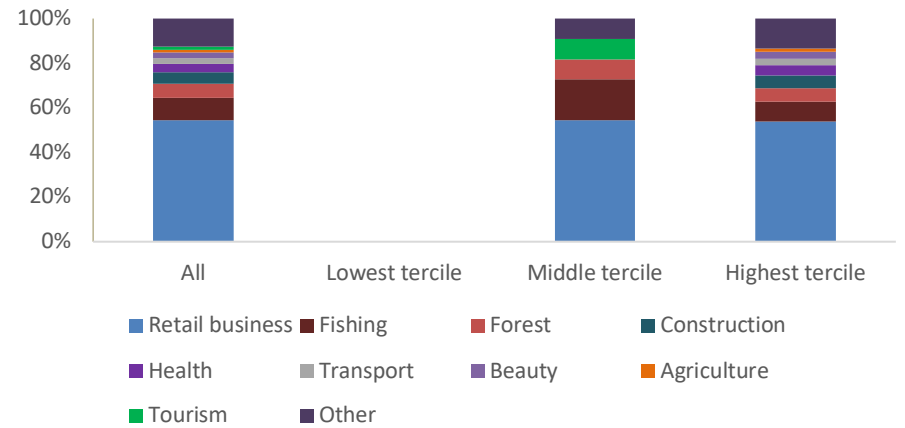
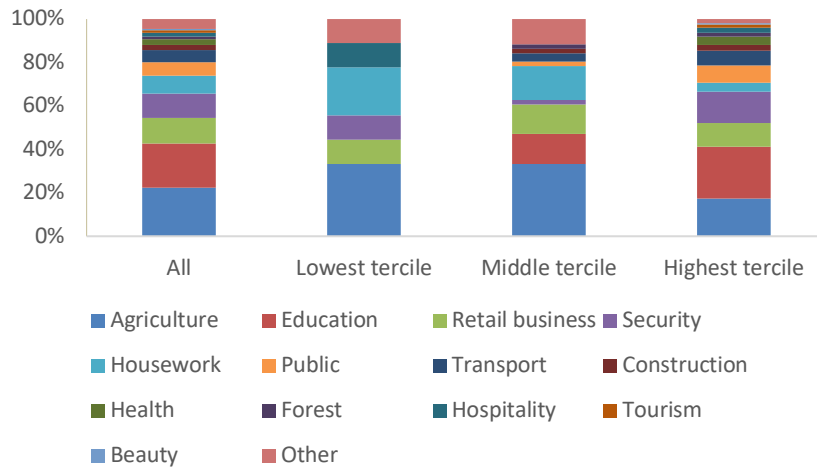
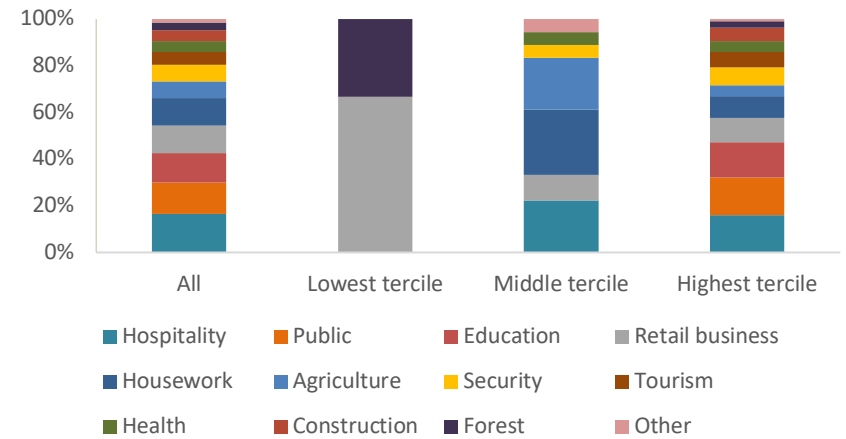


Figure A5: Proportion of individuals involved in self-employment sectors by country and income tertile (There are no self-employed individuals in the lowest tertile in Zambia)

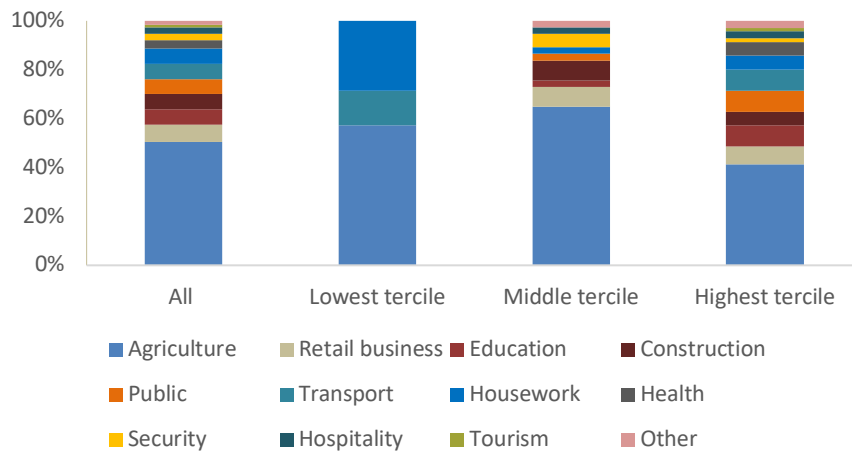
a. Kenya (N=196)



b. Namibia (N=112)



c. Tanzania (N=121)



d. Zambia (N=52)

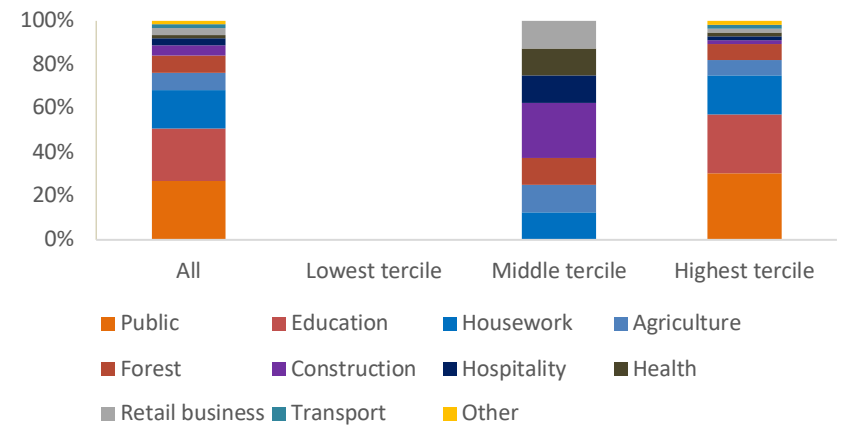


Figure A6: Proportion of individuals involved in wage employment sectors by country and income tertile (there are no wage employed individuals in the lowest tertile in Zambia)

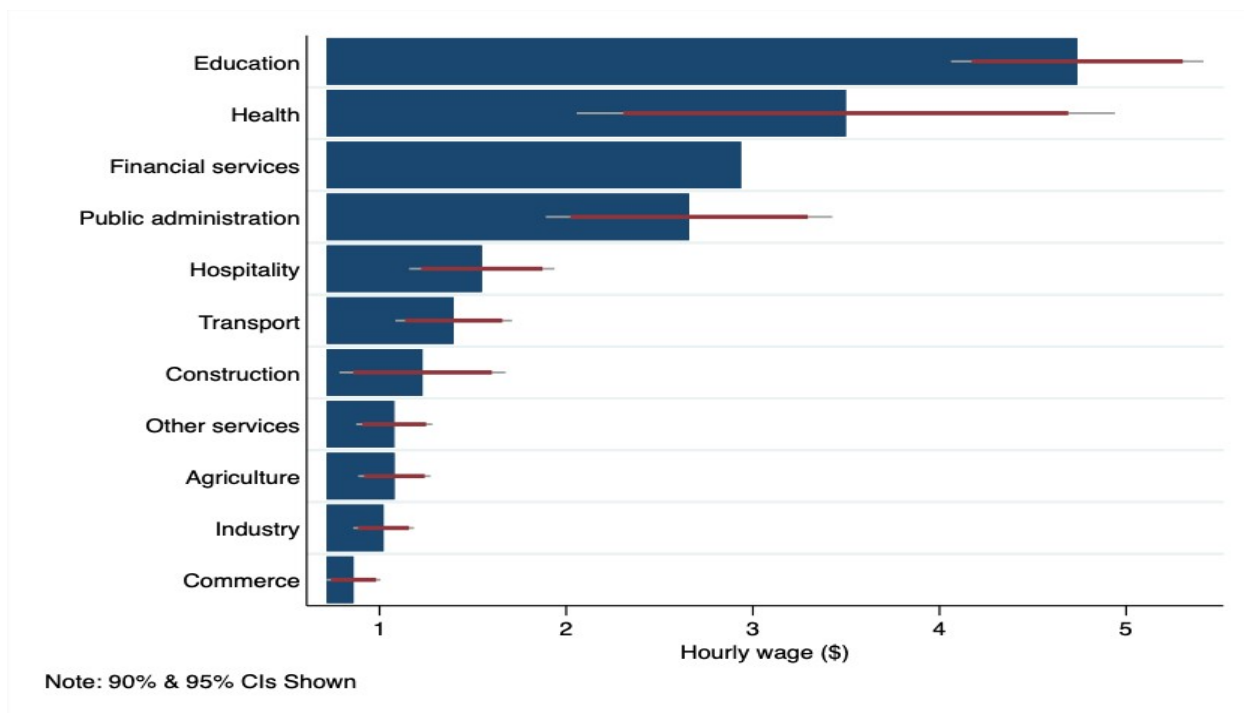


Figure A7: Hourly wage rates for individuals employed in different sectors (as reported by rural employers)

*Notes:* Wage rates are calculated by converting average salaries for each sector to international dollars, using the purchasing power parity exchange rates for each country. The PPP rates for 2023 are 42.91 for Kenya, 7.14 for Namibia, 886.12 for Tanzania and 6.61 for Zambia. The hourly wage rates presented here are from a sample of rural employers from the four countries.

Table A5: Correlation matrix from the multivariate probit (MVP) model estimating participation in different employment activities

|                      | Cash crop activities | Food crop activities | Livestock activities | Self-employment      |
|----------------------|----------------------|----------------------|----------------------|----------------------|
| Food crop activities | 0.794***<br>(0.03)   |                      |                      |                      |
| Livestock activities | 0.534***<br>(0.025)  | 0.894***<br>(0.029)  |                      |                      |
| Self-employment      | 0.04<br>(0.029)      | -0.029<br>(0.028)    | -0.002<br>(0.027)    |                      |
| Wage employment      | -0.049<br>(0.035)    | -0.099***<br>(0.035) | -0.130***<br>(0.035) | -0.293***<br>(0.031) |

Notes: Correlation coefficients are shown with standard errors in parentheses. The likelihood ratio test of zero correlation between the error terms is rejected at the 1% level;  $\chi^2(10)=2418$ . \* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level.

Table A6: Correlation matrix from multivariate probit (MVP) model estimating participation in different wage employment sectors

|                | Agricultural sector  | Retail sector        | Service sector       | Public sector        | Construction         |
|----------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Retail sector  | -0.293***<br>(0.026) |                      |                      |                      |                      |
| Service sector | -0.122***<br>(0.028) | -0.364***<br>(0.031) |                      |                      |                      |
| Public sector  | -0.358***<br>(0.032) | -0.274***<br>(0.031) | -0.281***<br>(0.034) |                      |                      |
| Construction   | -0.192***<br>(0.029) | -0.407***<br>(0.027) | -0.175***<br>(0.049) | -0.251<br>(0.027)    |                      |
| Education      | -0.166***<br>(0.030) | -0.246***<br>(0.025) | -0.088<br>(0.08)     | -0.294***<br>(0.026) | -0.194***<br>(0.018) |

Notes: Correlation coefficients are shown with standard errors in parentheses. The likelihood ratio test of zero correlation between the error terms is rejected at the 1% level;  $\chi^2(15) = 101$ . \* significant at the 10% level; \*\* significant at the 5% level; \*\*\* significant at the 1% level