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The effect of non-farm household enterprises on agriculture commercialisation in Uganda

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Abstract

The transition of smallholder agricultural production from subsistence to commercial agriculture is critical because it stimulates increased productivity and socio-economic transformation. This paper, therefore, examines whether a relationship exists between households earning non-farm household enterprise income and agricultural commercialisation using a sample of agricultural households from the recent Uganda National Panel Survey (UNPS) 2019-2020 dataset and logistic regression. The results show that households with non-farm enterprise income are less likely to transition to agricultural commercialisation. The negative influence of non-farm household enterprise income, as a component of off-farm income, on household market supply is consistent with the notion that off-farm income slows smallholder commercialisation. Therefore, an increase in incomes from off-farm enterprises may negatively affect market supply by increasing household demand for their products.

1. Introduction

Agriculture is a critical economic sector essential in realising the country's development objectives and overcoming rural poverty. Agriculture has been and continues to be the most crucial sector in Uganda's economy because it employs the most significant proportion, 68 percent, a primary source of export earnings (54%) and provides raw materials to the manufacturing sector (40%) (UBOS, 2021). Further, most women (83 percent) are employed in agriculture as primary producers.

The transition from subsistence to commercial agriculture has been proposed as crucial to socio-economic transformation. The economies of scale associated with agricultural commercialisation are expected to enhance production efficiency, which in turn is expected to improve household income and the prospects for economic growth. Significant gains are expected among rural households whose livelihood is directly derived from agriculture. Household income, consumption, food security and nutrition are expected to improve (Kilimani et al., 2022).

In anticipation of such benefits, many developing countries have embarked on agricultural commercialisation as a growth strategy. In Uganda, objective 3 of the country's National Agricultural Policy seeks to "promote specialisation in strategic, profitable and viable enterprises and value addition through agro-zoning". This is informed by the understanding that commodity specialisation and agro-zoning strengthen agri-business, enhance profitability and market access, and create farm and off-farm employment. The creation of additional employment opportunities necessitates increased commercialisation of agriculture and the establishment of industries to add value to agricultural products (GoU, 2013).

Uganda strives to transform the agriculture sector from subsistence to commercial agriculture to increase household incomes. The government has implemented several policies to increase agricultural commercialisation. In particular, the government interventions include the Poverty Eradication Action Plan (PEAP); the Plan for the Modernisation of Agriculture (PMA), the Agriculture Development Strategy and Investment Plan (DSIP); the Prosperity for All programme; the National Agriculture Policy (NAP); Emyooga, and the Parish Development Model (PDM). These government interventions aim to ensure farmers target home consumption and market production. Indeed, a commercial and modernised agricultural sector is a critical component of the Uganda Vision 2040: "a transformed society from a peasant to a modern and prosperous country by 2030." This is important to promote a shift from agriculture's prevalent, highly diversified and subsistence system to a more specialised and commercialised system.

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Despite the above interventions, subsistence and semi-subsistence farming still represent the major source of livelihood of most households, as farmers typically operate on a very small scale and sell a minimal share, if any, of their production. According to UBOS (2019), about two-thirds of the workers in agriculture are subsistence farmers, and nearly 45 percent of the working population in 2017 indicated subsistence agriculture as their only form of economic activity (Morando, 2023). Therefore, the transformation of subsistence, low-input, and low-productivity smallholder farming toward commercialisation is a top priority on the Ugandan government's development agenda within the NDPIV.

On the other hand, many rural households in sub-Saharan Africa do not limit labour allocation to agriculture but also operate and work in non-farm enterprises (Nagler and Naudé, 2017; Reardon et al., 2006). Over time, the contribution of these enterprises to household incomes and employment has increased rather than decreased, as some development economists in the 1960s and 70s expected (Lanjouw and Lanjouw, 2001, Start, 2001, Haggblade et al., 2010). This contribution is unlikely to diminish in the future, given that rural businesses will be needed to support the job creation for the new job seekers entering Africa's labour market.

Towards this end, household-based enterprises have increased as a non-farm livelihood strategy, with three in ten households in Uganda contributing nearly 52% of household income and further expected to increase with the implementation of programmes like the PDM and Emyooga. There are 2.7 million households (13.3 million persons) with HEs in Uganda, nearly 1.7 million of which are in rural areas (UBOS, 2019). While in absolute numbers, households with HEs are higher in the rural areas, the share is higher in urban areas at 39.5%. The number of households with such enterprises varies across and within regions, with more than 1 million households in the central region. Nevertheless, the growth and prevalence of household enterprises as sources of non-farm employment and income remain evident in Uganda.

Therefore, the contribution of household enterprises to boost a household's income, employment, and reduction in poverty is of interest to the government and the private sector alike (UBOS, 2021). This is in line with the NDPIV goal and Goal 8 of the Sustainable Development Goals - Target 8.3 urges explicitly all countries to promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro, small, and medium-sized enterprises, including through access to financial services. The implementation of the financial pillar of the Parish Development Model is expected to increase non-farm employment and income through engagement with household incomes.

There is growing literature on the role of the non-farm sector in household livelihood indicators (World Bank, 2008; Slesnick, 1994). In this regard, several studies have studied nonfarm-farm linkages, such as household welfare, poverty, food security and nutrition (Abbott et al., 2012; Alemu and Adesina, 2017; Seng, 2016; Hoang et al. 2014; and Akinlade, 2019). In Uganda, particular attention has been paid to its impact on poverty (e.g. Kijima et al., 2006), farm investment (e.g. Diiro and Sam, 2015), household welfare (Hill and Mejia-Mantilla, 2019; Kinuthia et al, 2019; Nagler and Naude, 2017; World-Bank, 2016; Kazungu and Guuroh, 2014; the MoFPED (2014); Mbalule, 2019; and Matsumoto, Kijima, and Yamano, 2006).

Notwithstanding the above, there is growing evidence of the role of a non-farm sector in agricultural commercialization. Specifically, the income earned from nonfarm activities holds the tendency to increase average household income and ultimately ease household capital and credit constraints and enhance farmers' ability to purchase farm inputs and adopt improved production technology (Dedehouanou et al. 2018; Babatunde 2015; Maertens 2009). This investment in farm enterprise enhances farm productivity and increases marketed surplus, encouraging farmers to participate in the market (Woldehanna 2000).

Nevertheless, various studies have also reported adverse effects of nonfarm activity engagements on farm activities. It has been reported that moving away resources, such as land and labour, previously used on-farm reduces farm productivity, which decreases the marketed surplus and thus dampens agricultural commercialisation by farmers (see, for example, Omiti et al. 2009; Pfeiffer et al. 2009). In addition, if used for consumption, nonfarm income reduces farm investment, decreasing farm productivity and, thus, marketing surplus (Babatunde 2015).

While several studies have examined the role of the non-farm sector in agricultural commercialisation, the majority remain descriptive, without estimating the causal effect of non-farm activity on agricultural commercialisation. For example, Kan et al. (2006), Tudor and Balint (2006), and Woldeyohanes et al. (2017) have conducted studies on the link between nonfarm activity and agricultural commercialisation. However, these studies are primarily descriptive or focus only on farmers who engaged in nonfarm activities. Other studies have examined the linkages among nonfarm activities, income inequality, poverty reduction, and food security (Alemu and Adesina 2017; Seng 2016; Hoang et al., 2014). On the other hand, the results on the effect of non-farm household enterprises on agriculture commercialisation remain inconclusive. For instance, studies such as Nkegbe et al. (2022); Abdullah et al. 2019; and Tudor and Balint 2006 find a positive effect of nonfarm activities or nonfarm income on agricultural commercialisation. On the contrary, studies such as Woldeyohanes et al. 2017; Canagarajah et al. 2001; Kan et al. 2006) find an adverse effect.

In light of the inconclusive nature of the evidence, this study aims to further understanding of the effect of non-farm household enterprises on agricultural commercialisation in Uganda, a country with both interventions likely to grow the non-farm enterprise economy and increase agricultural commercialisation.

The rest of the paper is organised as follows. Section 2 provides an overview of relevant theoretical and empirical literature. Section 3 presents the methodology and data, while Section 4 focuses on the empirical analysis and discussion of the results. Finally, Section 5 concludes the study.

2 Literature Review

2.1 Theoretical Literature

The theoretical relationship between non-farm household enterprise income and agricultural commercialisation can be explained within the framework of agricultural household models. Household economic theory distinguishes between unitary and collective approaches to household decision-making. The unitary model treats the household as a single decision-making unit that maximises a common utility function, while collective models recognise differences in preferences and resource allocation decisions among household members. Collective approaches include efficient cooperative models (Chiappori, 1992) and bargaining models (Manser and Brown, 1980; McElroy and Horney, 1981), while non-cooperative approaches provide an alternative representation of household decision-making (Lundberg and Pollak, 1993). The unitary model provides a relatively tractable framework for analysing household production and consumption decisions. However, its treatment of the household as a single decision-making unit may obscure differences in individual preferences and the allocation of resources within households (Alderman et al., 1995). Although collective models address these limitations, their empirical application may require detailed information on individual household members and intrahousehold resource allocation. Given the household-level focus of this study, the analysis draws on the agricultural household framework to explain the relationship between non-farm enterprise income and agricultural commercialisation.

Agricultural household models integrate household production, consumption and labour allocation decisions within a common optimisation framework. These models are broadly distinguished by whether production and consumption decisions are separable or non-separable. Under the separable agricultural household model, production decisions can be made independently of household consumption preferences when markets function competitively and households face no binding constraints in accessing productive inputs, labour and output markets (Singh et al., 1986). This assumes, among other conditions, that family and hired labour are perfect substitutes and that households can hire or supply labour at prevailing market wages. Under these conditions, household decisions follow a recursive process in which agricultural production and input allocation are first determined through profit maximisation, while consumption and labour supply decisions are subsequently determined by household income, preferences and market prices (Benjamin, 1992). Consequently, agricultural production decisions are independent of household consumption preferences, although the quantity of produce marketed may still depend on household consumption decisions.

In contrast, the non-separable agricultural household model recognises that production and consumption decisions are interdependent when markets are imperfect or incomplete. Non-separability may arise from constraints in agricultural labour markets, limited off-farm employment opportunities, imperfect substitutability between family and hired labour, and restricted access to credit and other productive inputs (de Janvry et al., 1991; Benjamin, 1992; Jacoby, 1993). Under these circumstances, household production decisions are influenced by consumption requirements, labour availability, household characteristics and other economic activities. Similarly, household labour allocation and consumption decisions depend on agricultural production opportunities and the availability of alternative sources of income. Therefore, agricultural production, consumption and labour allocation decisions cannot be treated as independent.

The non-separable agricultural household model provides a relevant theoretical foundation for examining the relationship between non-farm household enterprise income and agricultural commercialisation. Agricultural households typically allocate available labour, capital and other productive resources across agricultural and non-agricultural economic activities. Within the household optimisation framework developed by Singh et al. (1986), resource allocation decisions are influenced by household preferences, productive endowments, market conditions and the returns associated with alternative economic activities. Where production and consumption decisions are interdependent, household engagement in non-farm enterprises forms part of the broader allocation of resources between agricultural production, non-agricultural activities and household consumption. Consequently, decisions concerning agricultural production and the sale of agricultural produce may be associated with income earned from non-farm household enterprises.

In this study, non-farm household enterprise income refers to income generated from non-agricultural enterprises operated by agricultural households. These enterprises include petty trading, handicrafts, small-scale manufacturing, construction, repair services, transport and other non-agricultural business activities. Agricultural commercialisation, on the other hand, refers to the participation of agricultural households in output markets through the sale of agricultural produce. Although agricultural commercialisation encompasses different dimensions of market engagement, including the extent to which agricultural production is marketed (Otekunrin et al., 2019), market participation constitutes an important aspect of the commercialisation process. Barrett (2008) emphasises the importance of agricultural market participation in understanding the transition of smallholder households from subsistence-oriented towards market-oriented production. Agricultural commercialisation can therefore be examined through two related decisions: whether a household sells agricultural produce and, conditional on selling, the quantity or proportion of produce marketed. The present study focuses on the first decision, measuring agricultural commercialisation as a binary outcome indicating whether a household sells crop produce.

Accordingly, the theoretical relationship between non-farm household enterprise income and agricultural commercialisation is grounded in the interdependence of household economic decisions. Under the agricultural household framework, income earned from non-farm enterprises and decisions regarding agricultural production, consumption and output marketing are related to the allocation of household resources and prevailing economic opportunities. However, the direction of the relationship cannot be determined a priori because households differ in their resource endowments, consumption preferences, production conditions and access to markets. The theoretical

framework therefore provides the basis for empirically examining the relationship between earning non-farm household enterprise income and the probability of agricultural commercialisation among agricultural households in Uganda.

2.2 Empirical Literature

The rural non-farm sector may play a more critical role thanks to the emergence of non-farm activities observed in rural areas. Several factors in the literature have been identified to explain why farm households diversify their labour into nonfarm activities. From the observation of Barrett et al. (2001) and Reardon et al. (2007), nonfarm participation emanates from 'demand-pull' and 'distress-push' factors. Kilic et al. (2009) explain that when farmers allocate labour to nonfarm work because its returns to labour outweigh those from farm work, they are said to be pulled into nonfarm work.

On the other hand, Woldehanna and Oskam (2001) and Holden et al. (2004) explain that when farmers allocate labour to nonfarm work because they wish to steer away from shocks and risks from farming, they are said to be pushed to nonfarm work. Studies examine the determinants of engaging in nonfarm work. In this regard, studies mainly conclude that household characteristics such as education, ethnicity, skills, and gender, as well as assets, financial and social capital, and physical infrastructure and information, significantly affect participation in nonfarm work.

Conceptually, it is hypothesised that engagement in nonfarm work may encourage smallholder agricultural commercialisation if used as a liquidity source for investment in the farm, which may enhance yield and marketable surplus (Woldehanna 2000). On the other hand, if nonfarm income is used for consumption and other non-agricultural investments instead of farm investment, then nonfarm work becomes a competitor. This is because nonfarm work may compete with on-farm work for labour and other resources, a situation which, in turn, lowers production and marketable surplus.

Based on these hypotheses, several studies have investigated the linkage between the nonfarm engagement of farm households and their agricultural commercialization decisions. Using the sequential simultaneous equations model, Kan et al. (2006) reported that nonfarm income negatively affects agricultural commercialization. Woldeyohanes et al. (2017) adopted a double-hurdle model to examine the link between off-farm income and output agricultural commercialisation decisions. They reported that off-farm income does not significantly affect market participation in Ethiopia's output markets. Also, Abdullah et al. (2019) found that income from off-farm activities increased the likelihood of household agricultural commercialisation.

Further studies assessed the channels through which nonfarm engagement affects agricultural commercialisation, with different results. For example, Babatunde (2015) found that while nonfarm income reduces family labour use, it increases expenses on purchased inputs. Smale et al. (2016) observed an adverse effect of nonfarm income sources on fertiliser use in maize production in Kenya. In Senegal, Maertens (2009) found that nonfarm income increases household farm investment. Similarly, Dedehouanou et al. (2018) reported that nonfarm participation increases agricultural expenditure on purchased inputs and hired labour in rural Niger. In Ghana, Anriquez and Daidone (2010) observed that expansion of the nonfarm sector increases demand for agricultural inputs, including farmlands. Anang (2017) found that nonfarm participation positively affects productivity in Ghana, while Yang et al. (2014) found that technical efficiency increases for grain producers who engaged in nonfarm activities in China.

In contrast, Pfeiffer et al. (2009) indicated that nonfarm income is negatively associated with the value of agricultural output and family labour.

The review reveals that, comparatively, studies on nonfarm and farm linkages from the perspective of agricultural commercialisation (e.g., Woldeyohanes et al. 2017; Kan et al. 2006; Tudor and Balint 2006) are either merely descriptive or focus only on farmers who participated in nonfarm activities. The estimation techniques employed in previous studies failed to estimate the causal effect of nonfarm activity on agricultural commercialisation, a gap this current study seeks to address.

In Uganda, Mbalule (2019) examines the effects of non-farm income (wage employment, non-agricultural enterprises, transfers, property income, and remittances) on household welfare. Using data from three recent waves of the Uganda National Panel Survey (UNPS)—2011/12, 2013/14 and 2015/16—and applying a fixed effects panel model, the results indicate that; 1) having non-farm incomes has a significant positive differential effect on household welfare; 2) Having Non-agricultural enterprises is associated with the highest positive significant effects on welfare, and 3) higher level of education of the household head is associated with higher household welfare.

Khan and Morrissey (2019) used the six waves of national household surveys in Uganda, from 1992/3 to 2012/13, to study household income diversification for two decades, during which the country saw sustained economic growth and poverty reduction. The income sources were agriculture (farming), agricultural wage, self-employment (informal), wage employment and remittances. The authors found that households with more diversified income sources tend to lower consumption welfare, indicating diversification mainly due to push factors (the need for income pushing people into low-earning activities), with most diversification in the agricultural wage sector. Additionally, the study found that welfare (in terms of adult equivalent expenditure) is higher for households engaged in the non-agricultural wage sector. Still, growth in wage employment has been meagre.

Kinuthia et al. (2019) examined the factors influencing non-farm activities and their impact on agricultural production and farmers' welfare in Uganda and Tanzania. They used households and agriculture datasets from the Living Standards Measurement Study-Integrated Surveys for the two countries from 2008-2012. Results showed that both push and pull factors influence non-farm activities in each country, such as gender, education levels, marriage status and cost of inputs

and regions. The results showed that non-farm activities do not affect agriculture production in both countries, even when controlling for gender. In addition, non-farm activities do not positively and significantly impact welfare in both countries.

In rural Uganda, Kijima et al. (2006) used panel data for 894 rural Ugandan households in 2003 and 2005 to examine the role of non-farm employment in poverty reduction over a short period. The findings indicate that the flexibility of labour time allocation varies across non-farm jobs and that only low-skilled and low-wage jobs tend to be used to mitigate adverse shocks, especially among the asset poor. The study took advantage of the unique non-farm labour supply and income data by analyzing how households respond to adverse agricultural shocks, primarily through non-farm labour supply and income, to mitigate crop income loss.

2.3 Summary of Literature

The literature review reveals that while several studies have studied the role of the non-farm sector on agricultural commercialization, some are descriptive without the estimation of the causal effect of non-farm activity on agricultural commercialization. The results on the effect of non-farm household enterprises remain inconclusive. For instance, studies such as Nkegbe et al. (2022); Abdullah et al. 2019; and Tudor and Balint 2006 find a positive effect of nonfarm activities or nonfarm income on agricultural commercialization. On the contrary, studies such as Woldeyohanes et al. 2017; Canagarajah et al. 2001; Kan et al. 2006) find a negative effect.

In light of the inconclusive nature of the existing evidence, this study aims to enhance our understanding of the effects of non-farm household enterprises in Uganda, a country that has intensified interventions aimed at promoting the growth of the non-farm enterprise sector, as well as increasing agricultural commercialisation.

In Uganda, while several studies have considered nonfarm-farm linkages, there are scanty of studies that have examined the role of the non-farm sector on agriculture commercialization. Specifically, existing studies have, for instance, examined the effect of non-farm economy incomes on household welfare and food security (Mbalule.,2019; Hill and Mejia-Mantilla, 2019; Kinuthia, Araar, Maende, and Mariera, 2019; Nagler and Naude, 2017; Kazungu and Guuroh, 2014; the MoFPED, 2014). However, there is largely no existing study that has examined the role of non-farm income, particularly from non-farm household enterprises, on agricultural commercialization. Yet, agricultural commercialization is a critical component of Uganda's vision, which is "A transformed Ugandan society from a peasant to a modern and prosperous country".

3 Methodology

3.1 Theoretical Framework

The study adopts the basic non-separable farm household model (Singh et al., 1986) to drive household market supply. The basic assumption of the non-separable farm household model is that imperfect market conditions for product and factor markets make farm households' production and consumption decisions non-separable (Sadoulet and de Janvry, 1995; Singh et al., 1986). In this case, not only does the production decision affect consumption decisions, but consumption decisions also affect household production and, ultimately, output market supply decisions. This study recognises that, in a developing agricultural economy like Uganda, the context of the assumption of non-separability is likely to hold, so that households' socio-demographic characteristics will affect their desired level of output supply (de Janvry and Sadoulet, 2006). In addition to household demographic characteristics, off-farm income affects household output supply decisions in this setting (Woldeyohanes et al. 2017).

Given these assumptions, households are assumed to maximize utility concerning consumption (c_i), production (q_i), input use (k_i), sales (s_i) and purchase (b_i) of each good $i = 1,2, \dots, N$. The goods include all self-produced agricultural commodities, other market commodities and leisure. Household produces agricultural goods. (q_i) using land, labour and other variable inputs (k_i). The optimization problem is to maximize the utility function in eqn (3.1) subject to the liquidity (3.2), commodity balance (3.3), production technology (3.4) and non-negativity (3.5) constraints.

$$\max_{q_i, s_i, b_i, c_i, k} U(c, z_u) \quad 3.1$$

Subject to

$$\sum_i p_i^m (s_i - b_i) - p_i k_i + W \geq 0 \quad 3.2$$

$$q_i - k_i + E_i - c_i + b_i - s_i \geq 0 \quad 3.3$$

$$G(q_1 \dots q_n, k_1 \dots q_n; z_q) \equiv 0 \quad 3.4$$

$$q_i, s_i, b_i, c_i, k_i \geq 0; \text{ for } i = 1, \dots, N \quad 3.5$$

Where p_i^m denotes the market price for commodity i, E_i is the endowment of commodity i, W is exogenous off-farm income which could be earned or unearned and z_u and z_q represents household demographic and production characteristics, respectively. The cash budget constraint (3.2) states that households' purchase has to be less than or equal to sales of any or all i^{th} crops plus liquidity from off-farm income. The commodity balance in the constraint equation (3.3) states that total quantities consumed, used for input and supplied to the market are equal to or less than the total quantity produced, endowed and purchased from the market of each commodity i. The production technology

constraint (3.4) corresponds to a well-behaved production function that relates all the inputs to outputs. Equation (3.5) is the non-negativity constraint.

The above theoretical framework holds under the absence of transaction costs. However, recent empirical work on smallholder agricultural commercialization and agricultural supply response considered transaction costs as one possible factor underlying heterogeneous market access by smallholders (Alene et al., 2008; Barrett, 2008; Bellemare and Barrett, 2005; Holloway et al., 2001; de Janvry et al., 1991; Key et al., 2000). High transaction costs may widen the price margin between the effective price paid by buyers and the effective price received by sellers and ultimately determine households' market positions (Barrett, 2008; de Janvry et al., 1991; Key et al., 2000; Sadoulet and de Janvry, 1995). Differences in transaction costs and access to assets and services to mitigate these costs can explain why some farmers participate in market while others become self-sufficient (Woldeyohanes et al., 2017).

Let us consider a given household faces crop and household-specific transactions costs per unit of quantity sold and bought, which are equal to $\tau^c(Z, A, G, W)$. This involves proportional and fixed transaction costs that may depend on vector household demographic characteristics, Z, access to public goods and services, G, asset holding, A, and liquidity from farm income, W. Then, the cash budget constraint accommodating variable (τ^v)[2] and fixed (τ^f) transactions costs can be rewritten as:

$$\sum_i[(s_i(p_i^m - \delta_i\tau^v) + \delta_i\tau^f - b_i(p_i^m + \gamma_i\tau^v) - \gamma_i\tau^f)] - p_i k_i + W \geq 0 \qquad 3.6$$

δ_i takes the value 1 for the seller households and 0 for autarkic households for each good i, while γ_i takes the value 1 for buyer households and 0 for autarkic. This constraint equation suggests that when transaction costs are involved, the price received by the seller's household is lower than the market price. p_i^m by the amount of transaction costs. Whereas, for buying households, the market price for each unit bought increases by the transaction cost incurred. Buying and selling transaction costs are assumed to differ for the same household and commodity.

The first-order conditions of the maximization problem of utility function will yield the reduced form output market supply (3.7), conditional on the agricultural commercialization (3.6) (Goetz, 1992; Key et al., 2000).
Output agricultural commercialization decision:

$$q_{si}^{mp} = (p_i^m, \tau^f, \tau^v, z_u, z_q, W) \qquad 3.7$$

In equation (3.7) q_{si}^{mp} is households' discrete agricultural commercialization decision which is determined by comparison of the expected utility from alternative marketing regime (i.e., participation vs autarky). This will be affected by fixed and proportional transaction costs, market prices, household demographic and production characteristics, commodity endowment, and off-farm income.

3.2 Empirical Model Specification

The market decision process in equation (3.7) is specified along with the error terms as given in equation (3.8)

$$M_i^* = \alpha w_i + X_i'\beta + u_i \; and \; M_i = \{1 \; if \; M_i^* > 0; and \; 0 \; otherwise\} \qquad 3.8$$

Equation (3.8) is a binary choice of whether to participate in the market as a seller. M_i^* is a latent variable. The corresponding observed variable M_i^* takes the value 1 if individual i Participates in the crop output market as a seller and 0 otherwise.

The critical variable of interest capturing off-farm incomes is represented by w_i that takes value 1 for households with non-farm enterprise income; 2 for households without. . The coefficient estimates of α and their corresponding standard errors estimate the effect of off-farm incomes on smallholders' crop output agricultural commercialization decisions.

The vector of other explanatory variables that affect smallholders' crop agricultural commercialisation decision and the value of crop sold are represented by X_i, and β represents the vector of corresponding parameters. The selection of the vector of explanatory variables is based on related previous works (Alene et al., 2008; Gebremedhin et al., 2009) and pieces of literature on the determinants of smallholder commercialization (Jaleta et al., 2009).

Regarding the binary dependent variable, using the linear estimation techniques (Ordinary Least Squares or Linear Probability Model) yields biased results. Linear estimation techniques may yield a negative variance of the error term, and the probabilities may lie outside the reasonable range between zero and one. Therefore, the Maximum Likelihood Estimation (MLE) technique of Logit is more appropriate to examine the effect of non-farm household enterprise income on agricultural commercialization in Uganda. Therefore, this study employs the logit model to answer the third objective of examining the effect of non-farm enterprise income on agricultural commercialisation in Uganda. From equation 3.8 the effect of non-farm incomes is modelled as follows:

[2] Both variable (τ^v) and fixed (τ^f) transaction costs are a function of household demographic characteristics, Z, access to public goods and services, G, asset holding, A, and liquidity from off-farm income, W.

$$Prob\left(M_i = \frac{1}{X_t}\right) = Prob\left(M_i^* > \frac{0}{X_i}\right)\ldots\ldots\ldots

3.4 Definition of Variables and Data Sources

3.4.1 Measures of Agriculture Commercialisation – Dependent Variable

The concept of agricultural commercialisation is viewed in different ways by different authors (Otekunrin et al., 2019). However, it is generally observed to imply that farm households engage with markets as sellers or buyers (Barrett 2008). They participate as sellers to dispose of their surplus produce and participate as buyers to procure food and farm inputs. Agricultural commercialisation is also observed to embody two related decisions: farm households first deciding to sell their surplus produce and then deciding the quantity to sell in a second-place decision.

Previous studies have used either Heckman's (1979) sample selection (Alene et al., 2008; Bellemare and Barrett, 2005; Boughton et al., 2007; Ehui et al., 2003; Gebremedhin et al., 2009) or double hurdle and switching regression models (Goetz, 1992; Omiti, 2009) to estimate smallholder agricultural commercialisation. Others considered it a single-decision process and used a more restrictive Tobit model (Holloway et al., 2000). On the other hand, Woldeyohanes et al. (2017) adopt the two-part model (Double Hurdle model (DH) that relaxes these restrictive assumptions by allowing different mechanisms to determine the participation and amount of decisions.

However, in line with the definition of subsistence farming households (UBOS, 2021), the dependent variable of the study is a discrete agriculture commercialisation decision variable that takes a value of 0 if all the household members engaged in agriculture mainly for own or family use but partly for sale/barter and 1 if all household members engaged in agriculture only for sale/barter or mainly for sale/swap but partly for own or family use. The UNPS 2019/20 does not include data on market sales.

Therefore, the study focuses on the first-place decision to sell crop produce as the definition of agricultural commercialisation. This definition has been used in earlier studies (Nkegbe et al., 2022; Alhassan et al., 2020; Abu et al., 2016; Muamba, 2011). Nevertheless, the measurement of agricultural commercialisation presents some limitations. The binary indicator captures households' predominant orientation towards agricultural production for sale rather than the actual proportion or value of agricultural output marketed. Consequently, it does not account for variations in the intensity of commercialisation across households and may be subject to reporting and classification errors. Alternative measures based on the value and quantity of crop output sold were explored but were constrained by incomplete production and sales information, differences in crop measurement units, and limitations in price comparability. The findings should therefore be interpreted in terms of households' agricultural market orientation rather than the intensity of agricultural commercialisation.

3.4.2 Household Head Characteristics

The household head characteristics used in the study include a continuous household head age variable measured in years, a binary gender of the household head that takes a value of 0 if the household head is female and 1 if the household head is male, and household head years of schooling.

The age of the household head could have a positive or negative effect on participating in agricultural markets. It is a proxy experience and the availability of resources. Older, more experienced heads may make better production decisions and have more valuable contacts, allowing for the discovery of trading opportunities at a lower cost than younger heads (Martey et al., 2012). Alternatively, younger heads may be more dynamic in adopting innovations that would enhance their productivity and marketing at reduced cost (Enete and Igbokwe, 2009).

The education of the household head is expected to positively affect agricultural commercialisation. Enete and Igbokwe (2009), Southworth and Johnston (1967), Schultz (1945) and Ofori (1973) argued that education would endow households with better production and managerial skills. Education enables an individual to make independent choices and act on them, as well as to increase the tendency to cooperate with others and participate in group activities. It is also possible that education could increase the likelihood that of the household head earns non-farm income. This could reduce household dependence on agriculture and, thus, the need for agricultural commercialisation. Therefore, the direction of the effect is ambiguous (Martey et al., 2012).

3.4.3 Household Characteristics

The primary explanatory variable in the study is a binary indicator of whether the household has non-farm income, taking the value 0 if the household does not have non-farm income and 1 if it does. Some theoretical reasoning suggests that receiving non-farm income could positively and negatively affect agricultural commercialisation. For instance, according to Woldehanna (2000), non-farm income can enhance agricultural commercialisation if used as a liquidity source for farm investment, increasing productivity and producing a marketable surplus. This may increase the proportion of crops sold by smallholder farmers.

The other household-related characteristics include household size, which highlights the number of usual members in a household; a binary poverty status variable that takes a value of 0 if the household is non-poor and 1 if the household is poor; a variable that captures access to market information through ownership of radio. An increase in household size leads farmers to produce more for consumption, resulting in fewer sales of agricultural products (Hlatshwayo et al., 2022). Martey et al. (2012) assert that an increase in household size reduces the marketable surplus, thereby reducing farmers' income and hindering their ability to purchase healthy foods and be food secure.

3.4.5 Production and Community-related Characteristics

The production and community-related variables include household membership in a group, which takes the value of 1 if the household belongs to a group and 2 if it does not. The household membership of an association/group increases access to information necessary for production and marketing decisions (Olwande and Mathenge, 2011). Most farmer groups engage in group marketing and credit provision for their members. Therefore, household membership of the association/group is expected to positively impact agricultural commercialisation. The study also includes region dummies for Central, Eastern, Western, and Northern regions to examine regional disparities in agricultural commercialisation.

3.4.6 Data Sources

The study used a sample of 2,400 agricultural households from the recent Uganda National Panel Survey (UNPS) 2019-2020 dataset. The UNPS is carried out over twelve months (a "wave") on a nationally representative sample of households to accommodate the seasonality associated with the composition of and expenditures on consumption. The survey is conducted in two visits to capture better agricultural outcomes associated with the two cropping seasons of the country. The UNPS, therefore, interviews each household twice a year, in visits approximately six months apart. In 2009/10, the UNPS set out to track and interview 3,123 households that were distributed over 322 Enumeration Areas (EAs), selected out of 783 EAs that had been visited during the Uganda National Household Survey (UNHS) in 2005/06. The distribution of the EAs covered by 2009/10 UNPS was such that it included all 34 EAs in Kampala District and 72 EAs (58 rural and 14 urban) in each of the other regions, i.e. Central, Eastern, Western and Northern, which make up the strata. The data were collected across three main modules: the household (socio-economic) module, the agricultural module, and the community module. The household module captured data on each household member's employment and income, education, household asset holdings, consumption expenditure, and access to services. The labour force module collected information from all eligible household members aged 10 years and above. Specifically, the collected details whether the products obtained from this land of the household members were for sale/barter or mainly for their family consumption.

The Working Age Population (WAP) measures the number of potential workers in the economy. The international WAP, as per ILO, is 15 years and above. However, given the differences in socioeconomic, cultural and demographic characteristics among countries, it was recommended that each country sets the age range for its WAP (UBOS, 2021). Uganda's age range was set at 14-64 years. Data for compilation of labour market indicators were collected on all persons aged 10 years and above to allow for: Measurement of child labour (10-17 years), International comparison of key labour market indicators (15+ years), In-depth analysis of labour force characteristics of the WAP for Uganda (14-64 years). Lastly, the study utilised the agricultural module that collected data on agricultural production (agricultural inputs and technologies), land availability and land use, shocks and uncertainties, and agricultural extension services.

4 Analysis and Discussion of Results

4.1 Descriptive Statistics

The descriptive statistics for the variables used in the study are provided in Table 4.1 for all households, those receiving non-farm household enterprise income, and those households that do not. The descriptive statistics are necessary to understand the essential characteristics of the data to be used in the empirical econometric analysis. As indicated in Table 4.1, the descriptive statistics show that the mean falls within the maximum and minimum values of all the variables, thus a good measure of central tenden

Table 4.1: Descriptive Statistics of Variables

Variable	All households					Households Earning Non-Farm Enterprise Income					Households Not Earning Non-Farm Enterprise Income				
	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Agricultural commercialization (0=No)	2,400	0.724	0.447	0	1	303	0.779	0.416	0	1	2,097	0.716	0.451	0	1
Agricultural commercialization (1=Yes)	2,400	0.276	0.447	0	1	303	0.221	0.416	0	1	2,097	0.284	0.451	0	1
Household Head Age	2,400	54.62	14.153	18	97	303	50.98	12.707	26	89	2,097	55.145	14.28	18	97
Household size	2,400	6.242	2.965	1	19	303	6.505	2.664	1	14	2,097	6.205	3.005	1	19
Household Head Sex (0=Female)	2,400	0.351	0.477	0	1	303	0.343	0.476	0	1	2,097	0.352	0.478	0	1
Household Head Sex (1=Male)	2,400	0.649	0.477	0	1	303	0.657	0.476	0	1	2,097	0.648	0.478	0	1
Household Head years of schooling	2,390	5.862	3.787	0	17	303	6.485	3.619	0	14	2,087	5.771	3.803	0	17
Non-Agricultural Enterprise Income (0=No)	2,400	0.874	0.332	0	1	303	0	0	0	0	2,097	1	0	1	1
Non-Agricultural Enterprise Income (1=Yes)	2,400	0.126	0.332	0	1	303	1	0	1	1	2,097	0	0	0	0

Poverty Status (0=Non-Poor)	2,400	0.856	0.351	0	1	303	0.894	0.308	0	1	2,097	0.851	0.356	0	1
Poverty Status (1=Poor)	2,400	0.144	0.351	0	1	303	0.106	0.308	0	1	2,097	0.149	0.356	0	1
Membership in Group (1=Yes)	642	0.115	0.32	0	1	82	0.073	0.262	0	1	560	0.121	0.327	0	1
Membership in Group (2=No)	642	0.885	0.32	0	1	82	0.927	0.262	0	1	560	0.879	0.327	0	1
Ownership of radio (0=No)	2,400	0.429	0.495	0	1	303	0.406	0.492	0	1	2,097	0.432	0.495	0	1
Ownership of radio (1=Yes)	2,400	0.571	0.495	0	1	303	0.594	0.492	0	1	2,097	0.568	0.495	0	1
Region (1=Central)	2,400	0.179	0.383	0	1	303	0.257	0.438	0	1	2,097	0.167	0.373	0	1
Region (2=Eastern)	2,400	0.403	0.491	0	1	303	0.426	0.495	0	1	2,097	0.399	0.49	0	1
Region (3=Northern)	2,400	0.25	0.433	0	1	303	0.215	0.411	0	1	2,097	0.255	0.436	0	1
Region (4= Western)	2,400	0.169	0.375	0	1	303	0.102	0.304	0	1	2,097	0.179	0.383	0	1
Area of Residence (0=Rural)	2,400	0.864	0.343	0	1	303	0.815	0.389	0	1	2,097	0.871	0.336	0	1
Area of Residence (1=Urban)	2,400	0.136	0.343	0	1	303	0.185	0.389	0	1	2,097	0.129	0.336	0	1
Access to electricity (1=Yes)	2,400	0.083	0.276	0	1	303	0.119	0.324	0	1	2,097	0.078	0.269	0	1
Access to electricity (2=No)	2,400	0.917	0.276	0	1	303	0.881	0.324	0	1	2,097	0.922	0.269	0	1

Source: Author's Computation

Overall, there are 2,400 agricultural households, of which 72.4 percent do not engage in agricultural market commercialisation and 27.6 percent, on average, engage in agricultural commercialisation. Of these agricultural households, 87.4 percent do not receive income from non-farm household enterprises, and only 12.6 percent, on average, receive income from non-farm household enterprises. Regarding age and years of schooling, the household head has an average age of 55 years and 5.8 years of schooling. This corresponds to more than half of the duration for the basic primary level of education; however, it is lower than the 6.1 average years of schooling. This reveals that, on average, most of the labour force has not completed at least seven years of primary education. The average household size is 6.2. The sample further consists of males at an average of 64.9 percent compared to females at 35.1 percent.

In addition, 85.6 percent of the households were from non-poor households, and 14 percent were poor on average. The descriptive statistics show that most households participated in trainings organised by NAADS and belonged to particular member groups. Further, on average, 42.9 percent of the households that did not own a radio, and 57.1 percent owned a radio. In terms of regions to which the sample belonged, the findings in Table 4.1 show 18 percent of the households were from the Central region, 40 percent of the households were from the Eastern region, 25 percent of the households were from the Northern region while 17 percent of the households were from the Western region. Table 4.1 further disaggregates households that receive non-farm household enterprise income and those that do not. Overall, there are 2,097 households not earning non-farm household enterprise income, while only 303 households receive non-farm household enterprise income.

4.2 Diagnostic Tests

The diagnostic tests were conducted to build confidence in the estimates and identify any abnormalities in the data, model, or variables used in this study. Correlation analysis was conducted to assess the extent of linear association between any two variables in our study. This can also help reveal the possibility of multicollinearity in the regression. High multicollinearity tends to make t-statistics too small, resulting in wide confidence intervals for the coefficients. Variables were dropped to address multicollinearity. Afterward, the variance inflation factor (VIF) and the pairwise correlation matrix were used to detect multicollinearity.

The correlation matrix results indicate no collinearity problem among the explanatory variables, as all correlation coefficients are less than 0.8 in absolute terms (Gujarati and Porter, 2003). The results of the correlation matrix indicate a negative and statistically significant relationship between agricultural commercialisation and receipt of non-farm household enterprise income. However, the pairwise correlation matrix only provides the direction and strength of the relationships between variables. Thus, we cannot use it to assess the impact of the independent variables on the dependent variables; hence, the need to investigate these relationships empirically in a multivariate regression analysis. All variables passed the test, with VIFs below 10. The average VIF for the overall model is 1.275. The diagnostic tests proved non-problematic; therefore, the logit regression was used to generate coefficients, marginal effects, and odds ratios to interpret and discuss the results.

4.2 Estimation Results

4.2.1 Testing for Endogeneity

The main objective of this chapter was to understand the effect of non-farm household enterprise income on agricultural households' commercialization. However, the relationship between non-farm household enterprise income and agricultural commercialization may raise endogeneity concerns. In this regard, the first part of the analysis tests for endogeneity in non-farm household enterprise income, instrumented using access to electricity following Babatunde (2013). The first-stage regression evaluates whether the excluded instruments jointly explain the endogenous variable. The first-stage F-statistic of 25.87 exceeds the conventional threshold of 10 recommended by Staiger and Stock (1997), indicating that the instrument is sufficiently relevant and that weak-instrument bias is unlikely to be a major concern. The Durbin-Wu-Hausman test examines whether non-farm household enterprise income is endogenous. The null hypothesis is that non-farm household enterprise income is exogenous. The test did not detect statistically significant evidence of endogeneity, with the robust score test yielding a p-value of 0.5071 and the robust regression test yielding a p-value of 0.5085. Since both p-values are above the 5 percent significance level, the tests did not provide statistically significant evidence against the null hypothesis of exogeneity. Therefore, the logit model is retained as the principal empirical specification.

4.2.2 Empirical Results

Table 4.2 presents the estimated marginal effects of non-farm household enterprise income on agricultural commercialisation in Uganda. The results indicate that earning non-farm enterprise (NFE) income is negatively associated with agricultural commercialisation, with the relationship statistically significant at the one percent level. Households earning NFE income have a predicted probability of engaging in agricultural commercialisation that is 30.8 percentage points lower than that of households not earning NFE income, with other explanatory variables evaluated at their means. The negative influence of non-farm household enterprise income as a component of off-farm income on household market supply is consistent with the notion that off-farm income slows smallholder commercialisation. An increase in off-farm income may reduce market supply by increasing household demand for own production (Woldeyohanes et al., 2017). Moreover, suppose this off-farm income is allocated to consumption rather than to

investment in farm capital. In that case, off-farm work competes with agriculture for labour and other resources rather than complementing it. This, in turn, lowers production and marketable surplus.
Research findings by Alene et al. (2008) and Omiti et al. (2009) for Kenyan smallholder farmers also support this result. This is more evident when low-income people are pushed into off-farm activities due to small landholdings and drought. Non-farm income may also assist farmers in consumption smoothing when there are production and market-related risks following agricultural commercialisation (Evans and Ngau, 1991; Holden et al., 2004; Reardon et al., 1994). However, the findings deviate from those of Nkegbe et al. (2022), who find a positive and significant effect of nonfarm work participation on the probability of selling crops in Ghana.

Table 4.2: Logit Estimates (dy/dx) of the effect of earning non-farm household enterprise income on agriculture commercialisation among agricultural households in Uganda, Estimated Marginal Effects

Variables	dy/dx	St.Err.	[95% Conf	Interval]
Household Head Age	-0.013***	0.001	-0.015	-0.011
Household size	-0.006	0.005	-0.015	0.004
Household Head Sex				
Household Head Sex (1=Male)	0.250***	0.028	0.195	,0.306
Household Head years of schooling	0.007*	0.004	-0.001	,0.015
Non-Agricultural Enterprise Income				
Non-Agricultural Enterprise Income (1=Yes)	-0.308***	0.027	-0.361	-0.256
Poverty Status		.		
Poverty Status (1=Poor)	-0.364***	0.029	-0.420	-0.308
Membership in Group		.		
Membership in Group (1=Yes)	-0.115**	0.054	-0.222	-0.009
Ownership of radio				
Ownership of radio (1=Yes)	0.059**	0.029	0.002	0.117
Area of Residence		.		
Area of Residence (1=Urban)	0.163***	0.044	0.077	0.249
Region				
Region (2=Eastern)	-0.402***	0.029	-0.459	-0.346
Region (3=Northern)	-0.278***	0.042	-0.360	-0.196
Region (4= Western)	0.110**	0.044	0.024	0.196

Note: *, **, * indicate significance levels at 1%, 5% and 10% respectively.**
Source: Author's Computation

On the other hand, household size is negatively associated with agricultural commercialisation, although the relationship is not statistically significant. An additional household member is associated with a 0.6 percentage-point reduction in the probability of agricultural market participation. While statistically insignificant, the direction of the relationship is consistent with the findings of Nkegbe et al. (2022), Alhassan et al. (2020) and Abu et al. (2016), who argue that larger households have greater food consumption requirements, which may reduce the agricultural surplus available for sale. Similarly, poverty status is negatively associated with agricultural commercialisation, with poor households being 36.4 percentage points less likely to participate in agricultural markets than non-poor households, a relationship statistically significant at the 1 percent level. This may reflect the limited capacity of poor households to access productive inputs, finance agricultural activities and generate marketable surpluses beyond their subsistence requirements.

The gender of household heads is expected to capture differences in market orientation between males and females, with males having a higher propensity to participate in markets than females. The gender of the household head is positively and significantly associated with agricultural commercialisation. Male-headed households are 25.0 percentage points more likely to participate in agricultural markets than female-headed households, with the relationship statistically significant at the 1 percent level. This finding may reflect gender disparities in access to productive resources, agricultural information, financial services and marketing networks. As argued by Woldeyohanes et al. (2017), male farmers may benefit from stronger social networks and greater access to market information, enabling them to reduce transaction costs and participate more effectively in agricultural output markets. More importantly, the households belonging to farmers' groups are 11.5 percentage points less likely to participate in agricultural markets than non-member households, with the relationship statistically significant at the 5 percent level. This contrasts with the expectation that farmer groups promote commercialization but is consistent with evidence from Uganda that some group members prefer selling to private traders because of differences in prices and payment arrangements (Hill et al., 2021).

Similarly, cooperative costs and operational arrangements may constrain commercialization (Cheyo et al., 2024). Conversely, evidence from Tanzania shows a positive association between farmers' organisation membership and market access (Alex et al., 2024). These contrasting findings suggest that the effects of group membership depend on organisational effectiveness, marketing services and transaction costs. The observed negative association should therefore be interpreted in the context of the study rather than as evidence of a causal effect.

4.2.3 Post Estimation Tests

Hosmer and Lemeshow (1980) constructed a goodness-of-fit test for the logistic regression model, the Hosmer and Lemeshow test, which applies a Pearson test statistic to differences between observed and expected event counts, grouped by the ordered fitted values from the model. According to the analysis, the Hosmer and Lemeshow test statistic is 37.08, which is statistically insignificant, indicating that the estimated model has an adequate fit.

5. Conclusion

Agricultural commercialization is critical to smallholder agricultural production because it stimulates increased productivity and alleviates poverty. The transition from subsistence to commercial agriculture has been proposed as crucial to socio-economic transformation. The economies of scale associated with agricultural commercialization are expected to enhance production efficiency, which in turn is expected to improve household income and the prospects for economic growth. Significant gains are expected among households whose livelihood is directly derived from agriculture. Household income, consumption, food security and nutrition are expected to improve (Kilimani et al., 2022). As such, through the NDPIV, the government has prioritized accelerating the transformation of agricultural households from subsistence to commercial production by connecting smallholders with value chains. This is expected to reduce the percentage of households dependent on subsistence agriculture as a primary source of livelihood from the current 33 percent (UBOS, 2024). In particular, non-farm household enterprises (economy) play a significant role in integrating households into the value chains necessary for the transformation of agriculture. In light of the above, this chapter examined whether there is a relationship between households earning non-farm household enterprise income and agricultural commercialisation. The study therefore used a sample of 2,400 agricultural households from the Uganda National Panel Survey (UNPS) 2019-2020 dataset and logistic regression to examine the effect of non-farm income on the agricultural commercialisation among households. The results show that households with non-farm enterprise income are less likely to participate in the market. The negative influence of non-farm household enterprise income, as a component of off-farm income and engagement in non-farm household enterprise on household market supply, is consistent with the notion that off-farm income slows smallholder commercialisation. Therefore, an increase in off-farm income through engagement in non-farm household enterprises may reduce market supply by increasing household demand for their products. The results further indicate that household size is negatively associated with agricultural commercialisation, although the relationship is not statistically significant. In contrast, the sex of the household head significantly influences agricultural commercialisation, with male-headed households being 25 percentage points more likely to participate in agricultural output markets than female-headed households, a relationship statistically significant at the 1 percent level. Membership in farmers' groups is also negatively associated with agricultural commercialisation, with member households being 11.5 percentage points less likely to participate in agricultural markets than non-member households, a relationship statistically significant at the 5 percent level. This finding suggests that membership in farmers' groups does not necessarily translate into greater market participation, potentially reflecting differences in the functionality and market orientation of these groups. The relationship between farmer group membership and market participation may depend on the effectiveness of group management, the availability of marketing services, transaction costs, payment arrangements and access to reliable buyers.

Future research should move towards directly identifying the mechanisms through which non-farm household enterprise income shapes agricultural market participation. The most valuable contribution would come from datasets that record how households allocate family labour across farm and non-farm activities and how agricultural inputs are financed. With such information, researchers can test whether non-farm enterprise activity competes with agriculture for household labour or instead supplies the liquidity that funds productive agricultural investment, turning the proposed channels from theoretical possibilities into empirically estimated effects. A second priority is to measure agricultural commercialisation as a continuum rather than as a binary orientation towards the market. Future studies that assemble consistent and complete information on the value and quantity of output marketed can capture the intensity of market engagement, distinguishing households that sell a small share of their produce from those that are deeply integrated into agricultural markets. This would allow researchers to examine not only whether non-farm enterprise income influences the decision to participate in markets, but also how strongly it shapes the degree of participation. Finally, there is considerable scope to extend the analysis across time and across different types of households. Panel data that follow the same households over several seasons would allow researchers to trace how non-farm enterprise income and agricultural commercialisation evolve together and to establish the direction of causality more firmly. Complementary work that explores heterogeneity by farm size, agro-ecological zone, gender of the household head and distance to markets would reveal for whom and under what conditions non-farm enterprise income most strongly promotes agricultural commercialisation, offering better and informed guidance for rural livelihood and agricultural policy in a national and continental perspective.

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