

**UNIVERSITY FOR DEVELOPMENT STUDIES**

**EFFECTS OF RURAL-URBAN MIGRATION ON AGRICULTURAL PRODUCTION  
AND HOUSEHOLDS' WELFARE IN NORTHERN BENIN**

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**DEPARTMENT OF AGRICULTURAL AND FOOD ECONOMICS**

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**BY**

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REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY DEGREE IN  
AGRICULTURAL ECONOMICS**

**FEBRUARY, 2026**



## DECLARATION

### DECLARATION

I, Crepin Kodjo Kotchekpe, hereby declare that this thesis on "*The effect of rural-urban migration on agricultural production and households' welfare in northern Benin*" is the result of my original work and that no part of it has been presented for another degree at this University or elsewhere.

Crepin Kodjo Kotchekpe



11/02/2026

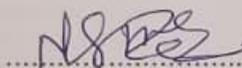
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I hereby declare that the preparation and presentation of the thesis were supervised under the guidelines on supervision of the thesis laid down by the University for Development Studies.

Prof. Franklin N. Mabe



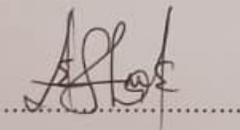
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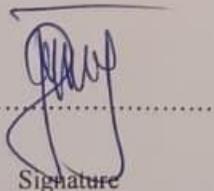
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## ABSTRACT

In Benin, approximately 70% of employment is in the agricultural sector, which is rural-based. Despite this, the labour force engaging in subsistence farming encounters seasonal variability due to rural-urban migration in the study area. Some studies have investigated the link between climate change and migration in Benin, without evaluating its impact on the left behind family. This study analyses the effects of rural-urban migration on agricultural production and households' welfare in northern Benin, using data from 400 farm households. This study has measured migration as categorical variable and has employed a treatment effect model for the analysis. Using multinomial logistic regression, the study found that factors such as age and sex of the household heads, household size and debt, access to migration information, rural unemployment, urban employment, agreement of the household's head, and family member at the destination are the factors influencing the internal migration in the study area. The study also estimated the efficiency level using stochastic frontier correcting for selection bias and found that the farm households with migrants are more efficient than the farm households without migrants (0.98vs0.60). Furthermore, the study estimates the impact of the type of migration on agricultural revenue and household welfare using the multinomial endogenous switching regression. The findings reveal that farm households with permanent migrants earn an average treatment effect of 0.705 CFA higher compared to farm households with temporary migrants, who earn 0.612 CFA. Concerning the welfare, permanent migrants earn an average treatment effect of 20,269 CFA, lower than the farm households with temporary migrants, 38,112.81 CFA. Also, the remittances analysis has shown that households with temporary migrants have received more income compared to their counterparts. The research concludes that, in general, rural-urban migration has a positive effect on the farm households in the study area, with the impact more pronounced on the agricultural revenue for those with permanent migrants, and on the farm households' welfare for those with temporary migrants. Therefore, the study recommends that farm household heads and potential migrants should make informed rural-urban migration decisions by carefully assessing potential benefits and risks using reliable information, while governments strengthen accessible information platforms on migration pathways, employment opportunities, and labour market conditions in the urban area to support such decisions.



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## DEDICATION

I dedicate this work to my family, especially my lovely wife, Eveline H. Bonou, and my boy, Nael J. K. Kotchekpe.



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## LIST OF ACRONYMS

AGVSA:	Analyse Globale de la Vulnérabilité et de la Sécurité Alimentaire
ATT:	Average Treatment Effect on Treated
ATU:	Average Treatment Effect on Untreated
AVP:	Agricultural Value Productivity
CFA:	Communauté Financière Africaine
DAAD:	German Academic Exchange Service
DSA:	Direction de la Statistique Agricole
ECOWAS:	Economic Community of West African States
FAO:	Food and Agriculture Organization
GDP:	Gross Domestic Product
GMM:	Generalized Method of Moments
IDP:	Internally Displaced Persons
IFAD:	International Fund for Agricultural Development
INSAE:	Institut National de la Statistique et de l'Analyse Économique
IV:	Instrumental Variable
LMIC:	Lower-Middle Income Country
MAEP:	Ministère de l'Agriculture, de l'Élevage et de la Pêche
MESRM:	Multinomial Endogenous Switching Regression Model
MIF:	Mo Ibrahim Foundation
NELM:	New Economics of Labour Migration
RGPH4:	4 <sup>e</sup> Recensement General de la Population et de l'Habitat
RUM:	Rural Urban Migration
SSA:	Sub-Saharan Africa
TI:	Technical Inefficiency
UDS:	University for Development Studies
UEMOA:	Union Économique et Monétaire Ouest-Africaine
WAC-SRT:	West Africa Center for Sustainable Rural Transformation
WDI:	World Development Indicators



## CHAPTER ONE

### 1.0 Introduction

In order to place the research in the proper context, this introductory chapter provides the study's background. The problem statement, research questions, and objectives are also covered in this presentation of fundamental data, along with the study's justification, boundaries, and chapter structure.

### 1.1 Background

Human migration and mobility are age-old phenomena, touching almost every society worldwide (Baby, 2024). Examining these shifts in scale, direction, demography, and frequency can help us understand how migration is evolving and can inform effective policies, programs, and operational responses on the ground (Migration, 2022). Currently, the United Nations' global estimates are around 281 million international migrants in the world in 2020, which amounts to 3.6 % of the world's population (Milan et al., 2024). This represents a small minority of the world's population, indicating that staying within one's country of birth remains, overwhelmingly, the norm (Africa Centre for Strategic Studies, 2024). The great majority of people do not migrate across borders; much larger numbers migrate within countries, although we have seen this slow over the past two years as COVID-19-related immobility has gripped communities everywhere (Migration, 2022). African migration continues to experience persistent upward pressures, extending a 20-year pattern (Bräunlich, 2022). Limited economic opportunity, conflict, repressive government, growing youth populations, and climate change are the primary drivers behind the approximately one million new migrants over the past year (Africa Centre for Strategic Studies, 2024). This adds to the estimated 43 million African migrants overall (Africa Centre for Strategic Studies, 2024). A majority of





these, mostly young and single migrants, remain on the continent seeking employment opportunities in urban areas (Foundation, 2019). However, others seek jobs outside the continent, primarily in the Middle East and Europe, though Africans comprise just 6.6 and 8.2 % of all migrants in those regions, respectively (Africa Centre for Strategic Studies, 2023). Also, Migration in Africa involves large numbers of international migrants moving both within and from the region (Migration, 2018). In 2020, around 21 million Africans were living in another African country, a significant increase from 2015, when around 18 million Africans were estimated to be living within the region (Schürmann et al., 2022). The number of Africans living in different regions also grew during the same period, from around 17 million in 2015 to over 19.5 million in 2020 (Migration, 2022).

A study showed that 647,723 people aged 15 or over left their households to settle outside Benin (Acaha-Acakpo & Yehouenou, 2019). Their first destination was other ECOWAS countries, more specifically Nigeria (54.1%), followed by other African countries (19.6%) and the UEMOA (19.2%) (Joseph et al, 2015). The rising cost of living in Benin is becoming increasingly worrying and could be a factor in emigration. Furthermore, climate change is increasing the degradation of already scarce arable land and accelerating the frequency of natural disasters. This phenomenon affects Benin, forcing populations into rural exodus and emigration (Todegnon, 2011).

Benin is a low-income, food-deficient country in West Africa, grappling with substantial hunger and agricultural productivity challenges. Around 25 % of Benin's 12 million inhabitants suffer from undernourishment, with higher rates in rural areas where poverty levels hover around 40 % (WFP Programa Mundial de Alimentos de las Naciones Unidas, 2020). Benin is a small, open economy in West Africa, and it has recently transitioned to a lower-middle-income status, achieving above-average growth over the last decade (World Bank, 2021). Despite the volatility



in growth over the last decade, the country's performance has been above average for sub-Saharan Africa (SSA) (World Bank, 2021). Real gross domestic product (GDP) growth averaged 5.2% over 2011-2022, making it one of the region's most dynamic economies. The services sector has risen to prominence partly due to the country's increasing role as a local trade and transit hub with Nigeria (World Bank, 2021). The continued scale-up of cotton production has also solidified its position as the leading cotton producer in West Africa for three consecutive years (2019-2021) (AfDB, 2025).

On the demand side, private consumption has remained the largest contributor to growth, and the contribution of investment, which has historically been marginal, has surged, driven by private investment. Private investment increased fourfold, from 3.6 % of GDP (2000-10 average) to 16.4 % over 2011-21 (World Bank, 2022). Growth performance has also been supported by prudent macroeconomic policies and political stability (World Bank, 2022). In 2020, Benin officially transitioned from a low-income to a lower-middle-income country (LMIC) (World Bank, 2023). The dimensions of accessibility and quality of services encompass public services such as health and education services, as well as access to drinking water and sanitation, electricity, the Internet, and civil registry (Large, 2020). This is the area in which Benin and its departments perform least well. The country must keep up its efforts to guarantee access to quality public services across its entire territory (World Bank, 2023). Littoral is the department with the best public services, with a score of 67.9 out of 100, while Alibori is below the national average, with a score of 26.5 out of 100 (World Bank, 2023). Despite a significant gap between the best and worst performing departments, the accessibility and quality of services have the lowest average deviation between Benin's departments (Zouhar, 2020). Because of all the differences between the two areas, the youth tend to migrate from the villages to the cities. All these affect agricultural labour, agricultural

production, and household welfare in northern Benin's rural areas, which explains the purpose of this study.

## 1.2 Problem Statement

Agriculture generates around 70 % of employment and 35 % of GDP in Benin, but is dependent on rainfall and vulnerable to climate change (WFP, 2023). According to the International Fund for Agricultural Development, an estimated 550,000 smallholdings averaging 1.7 hectares dominate the subsistence farming of cereals and tubers in Benin (Afrique, 2024). Rural-urban migration has been a key focus of economic historians and development economists for a long time (Paper, 2021). Benin's population problems are not limited to the worrying nature of international emigration. They are also related to strong urban growth resulting from a massive rural exodus. The metropolitan population is mainly concentrated in the four major cities with Cotonou (722,000 inhabitants), Porto-Novo (302,047 inhabitants), Abomey-Calavi (1,253,000 inhabitants), and Parakou (408,000 inhabitants) (Atchadé et al., 2023). All these cities in Benin hold the biggest companies and factories, hiring people for jobs. Also, all the universities, public and private, are in these big cities where the students are coming to study, and after completing, they do not want to go back to the village (rural areas) since there are more opportunities for getting a job in the cities (urban areas). Furthermore, young ladies are moving from the villages to the cities to work as house workers, most of the time, where they are also likely to get a husband at the end of the day and stay in the cities forever. In general, the migration of the youth does not give any hope of their return to the starting areas, which has an impact on their family's agricultural labour and then on the agricultural productivity.

During the Industrial Revolution in Europe and North America, internal migration triggered two fundamental and complementary processes: the structural transformation of employment from





agriculture to non-agricultural industries and services, and the subsequent economic growth associated with urbanization (Paper, 2021). So, rural-to-urban migration is presented as an equilibrating flow of a perfectly elastic supply of workers from a rural sector that has surplus labour towards a modern industrial sector located in cities, a transition leading to capital accumulation in cities and economic growth (Paper, 2021). It's no longer necessarily a question of crossing borders or going outside the country, because even within countries, migration is taking place towards major urban centres. More and more young people are leaving for the slums. There's no doubt that the mirage of the city is attracting a growing number of rural dwellers, and this exodus will have major social, economic, and environmental repercussions. However, the questions are: why do young people think happiness is everywhere but not at home? Why do young people think they can only find fulfilment elsewhere? There are several reasons for this. Among them, poverty is “a major and pervasive reason” that severely limits economic and professional opportunities in rural areas, causing young people's desire to travel and explore (Herve, 2014). Also, smallholder farmer labour migration and its relationship with climate change adaptation have received increasing attention, with migration often represented either as part of successful adaptive livelihood diversification or symptomatic of a lack of in-place adaptive capacity (Schmook et al., 2017).

As a consequence, migration from rural to urban areas has drastically decreased the amount of labour available for agricultural output. At the same time, for the remaining rural population, managing and efficiently allocating key production resources, such as land and labour, is crucial to cope with the changing environment (Kissi-Somuah, 2024a). The analysis of migration between regions in Benin shows that the characteristics of regions play a crucial role in internal migration. However, a careful analysis of the situation in the Littoral region reveals that the city of Cotonou

is indeed attractive, where Cotonou, an attractive city, is not the final destination for some migrants, but a transit zone (INStAD, 2024). Net migration shows that only four regions out of twelve are attractive, with positive net migration (Atlantique 18.71 %, Ouémé 2 %, Plateau 1.18 %, and Zou 1.26 %) (Démographiques et al., 2023).

Since migration is costly in both monetary terms and non-monetary disutility, households may migrate only when they are sufficiently unproductive and when their assets are too low for them to insure themselves against their current low productivity (Lagakos et al., 2023). Both domestic and international migration are commonplace in both developed and developing nations. National migration means the movement of people within the territory, and international migration means the movement of people from their native residence to any other region or country (TATARU, 2020). The internal migration has been the focus of researchers for the last many decades. So, movement from villages to cities is mainly because of scarce opportunities to improve their living standard; thus, in search of better socio-economic opportunities, people migrate from rural to urban areas (Nazesh, 2024). Migration has also been identified as a survival strategy utilized by the poor, especially the rural dwellers (Sanchi et al., 2022). The assessment of the effects of migration on rural areas has remained relevant since migration acts as a catalyst in the transformation process of not only the destiny of individual migrants but also the conditions of family members left behind, local communities, and the wider sending regions (Ajaero & Onokala, 2013). In the Republic of Benin, the rural population was 51.59 %, and the urban population was 48.42 % in 2020. After three years, the tendency has changed to a situation where the rural population was reported at 49.9 % and the urban population at 50.51 % in 2023 (Nations, 2022). All these statistics have shown that from 2020 to 2023, the rural population has decreased while the urban population has increased. This problem is explained by the rural-urban migration that constitutes a big issue



for Benin's agricultural households, especially in Northern Benin, where the main source of income is agriculture (Engel et al., 2017). Despite this, it is evident from the body of extant literature that the majority of Benin's migration studies, such as Mounirou (2022) and Mounirou & Yebou (2023), have treated migration as a binary phenomenon (migrant and non-migrant households) and ignored the implications of internal migrations on rural household welfare, agricultural labour allocation, and agricultural production. However, this study has improved its approach by distinguishing farm households with temporary migrants, farm households with permanent migrants, and farm households without migrants. Additionally, this study simultaneously evaluates the effect of migration on both agricultural production and farm households' welfare by employing a treatment effect model, such as multinomial endogenous switching regression, to account for endogeneity and selection bias. Finally, the study provides region-specific evidence from Northern Benin by linking migration decisions to agricultural production and efficiency outcomes.

In the context of Benin, this study specifically sought to answer the following queries:

1. What factors influence the decision of members of agricultural households in villages to migrate to cities in Northern Benin?
2. What is the efficiency level of farm households with migrants (temporary and permanent) and farm households without migrants in Northern Benin?
3. Is the farm revenue of households affected by the rural-urban migration?
4. What is the implication of rural-urban migration of members of agricultural households on household welfare?

### 1.3 Objectives of the Study

The purpose of this study is to investigate how northern Benin's agricultural output and household wellbeing are impacted by rural-urban mobility. In particular, the study aimed to:



1. Identify the factors influencing the internal migration status of members of agricultural households in Northern Benin.
2. Determine the efficiency level of farm households with migrants (temporary and permanent) and farm households without migrants in Northern Benin.
3. Estimate the effects of rural-urban migration on the revenue of the farm households.
4. Evaluate the impact of rural-urban migration on agricultural household welfare in Northern Benin.

#### **1.4 Justification of the Study**

Even though agriculture contributes significantly to the GDP and employs a sizable portion of the rural population in Benin (World Bank, 2023). However, it still faces the issue of migration as young people move from rural areas to urban areas in search of employment or a higher standard of living (Mounirou, 2022). It's important to remember that a variety of reasons can affect a migrant's choice to relocate from the rural to the cities. Because of this, the purpose of this study is to determine the factors that influence household members' decisions to migrate from rural to urban areas and to calculate the impact of this migration on the welfare and agricultural output of agricultural households in northern Benin. According to the World Bank (2023), given the Benin Republic's degree of economic development and the large contribution of agriculture to GDP, figuring out the answers to these questions will help us close the gap in the body of existing material. It will also assist policymakers in assessing how internal migration affects agricultural output. As a result, they can create and execute an effective policy for inclusive rural development.

#### **1.5 Delimitations of the Study**

The research was restricted to the agricultural households in the Northern Benin, Region of Atacora. It specifically focused on the rural-urban migration of one agricultural household member

and how it affects their productivity and, consequently, their welfare. The factors influencing the productivity and welfare of the agricultural household that participates in the migration may be different from the agricultural household that does not participate in migration. Therefore, this study has explored the effect of internal migration on the productivity and welfare of only agricultural households.

### **1.6 Organisation of the Thesis**

There were five chapters in this study. This study's first chapter began with an introduction, problem statement, research questions, goals, and study justification. A review of the literature on rural-urban migration, its impact on agricultural output, and the welfare of rural households in Northern Benin is covered in Chapter 2. The study area, data gathering tools such as questionnaires and interviews, and data analysis techniques were all covered in Chapter 3. Results and discussion comprised Chapter 4. The results, conclusions, and policy implications derived from the study's findings are summarized in Chapter 5.



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Introduction

The critical literature on household welfare, agricultural production, and rural-urban migration was evaluated in this chapter. It has specifically discussed the various forms of migration, the factors that influence rural-urban movement, and how these factors affect household welfare and agricultural output.

#### 2.1 Classification of the Concepts

##### 2.1.1 Rural and Urban Areas

Generally, the classification of rural and urban communities varies from country to country. However, different countries consider several features to classify the communities into rural or urban status (Tacoli, 1998). According to him, the economic and demographic characteristics on which the definition of rural and urban areas is based can differ significantly across multiple countries, making generalization challenging.

A study done by Deavers (1992) found that three characteristics of rural areas of the U.S. make them different from urban areas. For Deavers (1992), the first is their small-scale, low-density settlement, and the second defining characteristic of rural places is their distance from the large urban centres, and the specialisation of rural economics is the third defining characteristic of rurality.

While for Vlahov & Galea (2002), an urban area comprises a place and the adjacent densely settled surrounding territory that together comprise a minimum population of 50,000 people.

According to Belanche et al., (2021), the rural communities are frequently presented as *Gemeinschaft* places in which people know each other due to “binding, primary interaction





relationships based on sentiment”, whereas urban societies are described as Gesellschaft places, that is, as an anonymous and “interactional system characterized by self-interest, competition, and negotiated accommodation”.

In the 2010 Population and Housing Census, the Ghana Statistical Service divided communities into rural and urban areas according to population size. Localities with 5,000 population or more are categorised as urban, whereas communities having a population of less than 5,000 people are categorised as rural (Doan & Oduro, 2012).

In the context of the Republic of Benin, an urban area is defined as follows: any municipality as a chief town (former urban municipality of a former sub-district) with at least 10,000 inhabitants and at least one administrative infrastructure, any community with at least five administrative infrastructures and at least 10,000 inhabitants. Whereas a rural area is a community that does not meet any of the above conditions (INSAE, 2003). Also, rural areas can be defined as areas where agriculture is the main activity and source of income, there are low living conditions, bad housing quality, lack of water, electricity, sanitation, job opportunities for all and administration infrastructure, low ability to handle economic shocks and seasonal variation, and high effect of natural and environmental disasters. However, the urban areas are naturally well built with good infrastructure and all the opportunities that anyone can desire easily. In general, these gaps in opportunities and living conditions are the primary determinants of rural-urban migration that this study aims to examine in northern Benin.

### **2.1.2 Classification of the Migration**

According to the FAO (2016), the movement of individuals across national borders or inside a nation is referred to as migration. It encompasses all motions, regardless of their causes, length, or whether they are voluntary or involuntary. It encompasses economic migrants, distressed migrants,



internally displaced persons (IDPs), refugees and asylum seekers, returnees, and people moving for other purposes, including education and family reunification (Items et al., 2018).

Migration, whether internal (inside the nation) or external/international (between nations), is generally defined as the movement of people in relation to their primary place of residence (origin). Additionally, migration may be temporary or permanent, internal or foreign. After the definition of migration, it is important to distinguish between the different types of migration.

Internal migration is when a person moves from one place to another within a country, without crossing an international border, whereas international migration is when a person moves from one place to another between different countries and crosses an international border (FAO, 2020).

However, how long people have migrated can be classified into two categories. Either permanent when the migrant stays at his or her new destination for more than one year, or temporary when the migrant returns to the origin very early without doing a year (FAO, 2021). Also, there are two common examples of temporary migration, which can be seasonal or circular. Hence, the temporary migration is seasonal when the migrant moves for employment purposes, and migration is dependent on seasonal conditions and performed for only part of the year, while the circular migration is when the migrant moves repeatedly between countries, temporary or long-term (FAO, 2020). This type of migration can be managed through bilateral programs to address the labour needs in the country of origin and destination (FAO, 2016).

Finally, depending on where the choice was made, migration may be forced or voluntary. voluntary migration is when the decision to migrate is undertaken voluntarily, whereas forced migration is when the decision to migrate is affected by natural or man-made coercion, including threats to life and livelihood (FAO, 2016).



Hence, in the context of this study, temporary migration is defined as any movement from the original residence for at least six (6) months, but involves a return to the origin of migration (Bossavie & Özden, 2023). However, permanent migration is defined as movement from the original residence to another destination that does not involve a return to the origin of migration (Chen, 2023).

However, migration is transformative in the lives of the migrants, the economies, and societies that are simultaneously the origin and destination of the migration flows (Haas, 2022). For him, migration should be conceptualised as an intrinsic part of broader processes of development and social change, instead of the antithesis of development, as the dominant source holds (Haas, 2022). Furthermore, several studies Mansurov (2024); Schinkel & Van Reekum (2024) and Nash, (2024) have been conducted across the world on the matter of migration. However, this study will focus on rural-urban migration, which is the case of internal migration following Wen et al., (2024) and Kissi-Somuah, (2024b) in northern Benin. In this study, migration is defined as the movement of people from villages to cities (urban regions), whether permanent or temporary. It has researched migration in the study area, such as relocation from villages to major cities within the country.

A study conducted by Moussa (2017) on the city growth: issues and challenges of urban sustainability in the Republic of Benin using secondary data from INSAE found that Cotonou and Parakou are the cities where the immigration rate is high, Porto-Novo is also big city but the emigration is more than immigration (Porto-Novo is the capital city and very close to Cotonou the capital economic approximately 44 km which influences the immigration from Porto-Novo to Cotonou).



Also, according to (Au & International, 2024), like many other countries, Benin is experiencing a strong rural exodus, with young people leaving the village for the towns. In search of better salaries, these young people are helping to develop the towns, but they are also taking power away from agricultural activities in the rural areas, where the availability of labour is necessary and important for sustainable agriculture.

Finally, given that we understand what migration is and its various forms, this study will focus on rural-urban migration and its impact on rural communities in northern Benin. For this, a high proportion of migrants come from rural areas. Approximately 40% of overseas remittances are remitted to rural areas, reflecting the rural origins of many migrants. Furthermore, in several African countries, over half of rural household report having at least one internal migrant (FAO, 2016).

## **2.2 Advantages and Disadvantages of Migration**

### **2.2.1 Advantages of Migration**

Internal migration is a phenomenon that affects both the origin and destination of the migrant. However, in the case of this study, its impact on rural areas is the objective of discussing the benefits and downsides of rural-urban migration with references to rural areas.

According to the new economics of labour migration developed by Stark & Bloom (1985), where the decision to participate in migration belongs to the head of the household, who chooses to send a member to the urban areas to diversify the source of income and maximise the household welfare relying on the remittances. This is the advantage of participating in internal migration. Secondly, the use of remittances can be invested in farm activity, non-farm activity, education for the children, health care for the family, and all things that will increase the welfare of the household.



The Food and Agriculture Organization, which studies migration, agriculture, and rural development, discovered that mobility gives chances to rural areas as the origin of the migrants. So, if the credit and/or insurance markets in rural areas are absent or function poorly, remittances relax liquidity constraints, provide insurance in case of crisis/shocks, and foster investment in agriculture and other rural economic activities with potential for job creation (FAO, 2016). Moreover, migrant networks and return migrants can foster the transfer of skills, know-how, and technology, as well as investments that promote agricultural and rural development, including employment opportunities in the rural areas of origin (FAO, 2016).

Also, the results of the study conducted by Jayaweera & Verma (2024) on food security: the impact of migrants and remittances in Sri Lanka, show that migrants and remittances affect the food expenditure of the household. However, remittances promote healthy food consumption because migrants and remittances jointly affect households to purchase and consume calories from expensive food, indicating that remittances positively affect food diversity in terms of both expenditure and calorie consumption (Tamirat et al., 2024).

Research on the effect of foreign remittance on household healthcare status in the south-central region of Bangladesh has indicated that, over time, remittance received by households improved their access to drinking water, accommodation, and sanitation facilities, which also increases the household consumption and healthcare expenditure (Rahman & Sultana, 2023).

Shahi (2025), studying the contribution of remittance to the national economy of Federal Nepal, has discovered that Nepali youth are choosing foreign employment for job opportunities and better livelihoods in developed countries because remittance is the second largest contribution to Nepal's national economy, and even the main source for the government of Nepal.



A study conducted on immigration remittances, agricultural investment, and household wealth accumulation in developing countries revealed that migrant's remittances have a positive effect on agricultural investment and household wealth accumulation because remittances can help, especially when the household situation is worse (Djeunankan et al., 2023).

Teye et al. (2024) have conducted a study on the remittances and household expenditures on education in Ghana's Northern Region: why gender matters and found that regardless of the gender of the household head, households in which women are the primary recipients of remittances spend more than twice as much on education as households in which men are the primary recipients.

Additionally, a study trying to examine the rural-urban migration and welfare among farming households in Ogbomoso, Oyo State, in Nigeria, has found that poverty was higher among non-migrant households than households with migrants and was significantly reduced by rural-urban migration, up to 43% (Obi-Egbedi & Taiwo, 2023). Therefore, he suggests that poverty reduction policy should incorporate rural-urban migration of farming households through the provision of employment opportunities for members who are willing to migrate to urban centres (Obi-Egbedi & Taiwo, 2023).

In the same way, Salah (2025) researched the impact of remittances on economic growth in Nigeria from 2008 to 2023 and found that Remittances from workers abroad increased from \$19.2 billion in 2008 to \$20.5 billion in 2023 and proved a significant contributor to economic growth in Nigeria. He concluded that remittances had a favourable impact on household income, poverty reduction, exchange rate stability, investment, entrepreneurship, and unemployment.

### **2.2.2 Disadvantages of Migration**

Discuss the drawbacks of rural-urban migration, which refers to the negative impact on the origin of the migrants. According to the topic, we can see how migration could have a detrimental effect



on agricultural output and the well-being of migrant households. Firstly, talking about the rural-urban migration, we may see the negative effect on rural areas through agriculture, which reduces the labour available to sustain good productivity and meet food security. Most of the time, the out-migration concerns the young people who are supposed to take care of and develop agriculture to ensure the availability of food and promote food security. Then, the common negative effects of rural-urban migration are a decrease or lack of labour force for agricultural activities, use or implication of children and aged persons as labour for farm activities, and transfer of the household head's role from men to women (FAO, 2016). In the same way, several studies have supported this point of view.

Talking about the challenge of migration in rural areas, according to one study, migration will have an impact on the labour market, the associated skill mix, and the demographic makeup of the remaining population. While migration may reduce pressure on local labour markets and foster a more efficient allocation of labour and higher wages in agriculture, rural areas of origin risk losing the younger, most vital, and dynamic share of their workforce (FAO, 2016). Depending on the context, women who stay behind may gain greater control over productive resources and services, potentially helping to close the gender gap in agriculture (FAO, 2016).

A study conducted on structural strain, family control, and delinquency in China revealed that the rural-urban inequality and the resultant effects of rural-urban migration contributed to the structural family strains, mainly in the form of family poverty or dissolution, which had a negative effect on parental efficacy, and weakened parental efficacy facilitated adolescents' rebellion against parents, with delinquency serving as an important form (Gao et al., 2024).

Also, Rahman (2024), examining the impacts of rural-to-urban migration on family dynamics and social cohesion in rural Pakistan, researchers have discovered that shifting family responsibilities

within the household brought extra roles for women, whereas marital relationships became strained due to separation. Children had emotional challenges, and community cohesion was compromised. Brewer et al. (2024), studying the impacts of RUM on agriculture and land use using household panel data in combination with tree cover data from Uganda, have found that the labour loss and the inflow of remittances from RUM lead to a reduction in crop diversity, but no shift toward less labour-intensive crops or crops with high up-front investment.

### **2.2.3 Agriculture Production**

The agricultural sector is the biggest provider of foreign currency and gainful employment for the Beninese economy, as it is for some countries in the sub-region. However, Benin's economy is based on agriculture, with 45% of the population involved in primary agricultural production. Agriculture contributes about 25% of the national gross domestic product (GDP) (FAO et al., 2018). Cotton accounts for 40% of agriculture's contribution to GDP and 80% of official exports (Indicators, 2017).

The 2023-2024 crop year was characterized by a high cereal production estimated at 2,737,481 tons, compared with an average over the last five years of 2,219,312 tons, and a production of 2,297,373 tons in 2022. This production is the result of an increase in acreage, as well as yields, which have fallen overall for all cereal crops (DSA/MAEP et al., 2024).

Although the economic growth of the country is largely dependent on agriculture, fluctuations in rainfall amounts, declining soil fertility, limited access to high-quality seeds, the high cost of agricultural inputs, and the low level of mechanization negatively affect the country's agricultural growth and food security (FAO et al., 2018).

Agriculture is the mainstay of Benin's national economy, employing over 70% of the population. Agricultural practices are mainly rain-fed and characterized by small land holdings, low inputs,



with maize, sorghum, rice, cassava, yams, and groundnut as major food crops and cashew, shea nut, and cotton as major cash crops, and the major livestock include sheep, goats, cattle, pigs, and poultry (FAO et al., 2018). Furthermore, the southern regions focus on food crops like maize, cassava, and beans due to higher rainfall, the northern regions specialize in cotton production and livestock farming, and the central regions have a mix of both food and cash crops (FAO et al., 2018).

The agriculture sector is struggling to meet the food security needs of its growing population, particularly in the face of highly variable weather and changes in climate, where factors such as declining soil fertility, poor financial services, land tenure complications, limited infrastructure, and underdeveloped markets continue to hamper agricultural growth (FAO et al., 2018).

The region of Atacora focuses mainly on agricultural activities (74% of the department's workforce is employed in this sector). However, the productivity is not sustainable to meet food security because of some challenges that the sector faces. Then, among the challenges we have migration, which severely affects the labour available for agriculture, low productivity, change of activities, poverty in the rural areas, and the lack of financial support (Vodounou & Onibon Doubogan, 2016).

The agricultural sector of Benin faces many challenges, including Limited access to land in the peri-urban production zones and in some regions, such as Atacora and Couffo (where there is high pressure on land resources), it is one of the problems of crop intensification (Atchadé & Nougbodé, 2024).

In additionally, to the challenges faced by the agricultural sector in Benin, we also have unequal access to the means of production, access to mechanization, a major concern for farms, means of transport, another factor in farm differentiation, dependence on mineral fertilizers, dependence on

herbicides, paid labour is essential, but not always available at sowing and harvesting time (Taupin, 2023).

The lack of land titles by most smallholder farmers hinders their ability to invest in equipment such as irrigation facilities and on-farm machinery, including major agricultural challenges such as a poor agricultural credit system and market infrastructure, which limit market access to farmers (FAO et al., 2018). However, the Benin Republic, like many African countries, is exposed to the effects of climate change, including both droughts and floods, which have a great impact on the country's agricultural production and food security (Miassi et al., 2024).

A number of problems are preventing Benin's agriculture sector from expanding. According to the study, three main types of constraints have affected farming households over the past twelve months. These are drought and flooding, which are natural causes, the lack of agricultural inputs, which is technical, and finally, the lack of agricultural labour due to the rural exodus (AGVSA, 2017).

#### **2.2.4 Measurement of Agricultural Productivity and Agricultural Value Productivity**

Agricultural productivity and agricultural value productivity are two terms used interchangeably in research, but have a slight difference. However, agricultural productivity refers to the efficiency with which agricultural inputs (such as land, labour, capital, seeds, fertilizer, and machinery) are converted into agricultural outputs (such as crops, livestock, or other farm products), which represent the physical quantity (kg, tons, hectares, labour days) of crops, labour and other inputs (Wang, 2024). Furthermore, agricultural productivity is the ratio of agricultural output to input, measured by crop yield or seed ratio. While agriculture includes both crop production and livestock production, crop yield is preferred as a proxy variable for agricultural productivity (Mulusew & Hong, 2024). Additionally, the agricultural productivity can be assessed through the total factor

productivity, which is used to provide a comprehensive measure by considering both labour and capital inputs (Bocean, 2024).

However, agricultural value production focuses more on the financial or economic side of things. Furthermore, agricultural value productivity is defined as the monetary value of agricultural output per unit of input, which reflects the economic efficiency of resource use in farming (Hanumanthappa, 2014). The agricultural value productivity incorporates market prices to capture the financial worth of production, thereby linking farm performance to both technical efficiency and market conditions. In a study conducted in Mali by Fowowe (2025), agricultural productivity (AGRIPOD) was measured as the monetary value of gross output per hectare. The gross value of output per hectare was obtained by adding the values of all crops harvested on the plot and dividing this sum by the area of the plot (Kosmowski et al., 2021). In addition, Valea & Noufé (2025) have conducted a study on the gender gap and agricultural productivity in Burkina-Faso and used the value of production per farm worker as a measure of productivity. Also, Aguilar et al. (2015) have calculated agricultural productivity as the value of production per hectare during the last agricultural season, studying the decomposition of gender differentials in agricultural productivity in Ethiopia.

### **2.2.5 Household Welfare**

Household welfare refers to the overall well-being and quality of life experienced by the members of a household. It encompasses a broad range of factors that contribute to the economic, social, and physical conditions of a household. Furthermore, household welfare for agricultural households is defined as the combination of economic, social, and physical conditions that determine a farming family's standard of living and ability to meet their basic need (Khan, 2023). Then, it specifically includes farm income from agricultural production and sales, off-farm income





from supplementary activities, asset ownership, access to education for household members, healthcare accessibility, housing quality, and living conditions, access to water and sanitation, access to credit and financial services, and access to agricultural extension services (Dauncey et al., 2024).

Several approaches exist for measuring household welfare. According to Johanni (2011), Household welfare should be measured by happiness, contrary to economists who use financial indicators such as household income, GDP, or consumer confidence. Conversely, asset-based wealth indices are prominently employed as an alternative measure of welfare (Moratti & Natali, 2012). But, Seleka & Lekobane (2017) suggest that household consumption or income is the perfect measure of household welfare as it indicates an individual's ability to obtain goods and services. Hence, this study has used household consumption or income to measure the welfare of agricultural households in the study area, following the work of Fulea (2018).

### **2.2.6 Different Measures of Household Welfare**

When assessing household welfare, researchers and policymakers employ a variety of measurement approaches, each with unique strengths and limitations. Let's systematically explore the major types of household welfare measurement, citing a wide array of current research.

#### **Income-Based Measurements**

Income-based measures focus on aggregate or per capita household earnings from all sources, serving as a proxy for economic capability. However, income is a direct indicator of the means to acquire necessary goods and services. It's commonly employed in poverty analyses and social program targeting, such as in the calculation of poverty lines (Mogendi, 2024).

#### **Consumption or Expenditure-Based Measurements**



These measures household spending on goods and services, and are often considered a more stable welfare indicator than income. Consumption smooths over temporary income changes and reflects realized living standards. National household surveys commonly collect expenditure data to assess poverty and well-being (Ayu & Priliandani, 2024).

### **Asset or Wealth-Based Indices**

Instead of focusing only on cash flows, asset-based indices examine household ownership of durable goods, property, land, or savings as a long-term welfare indicator. However, asset indices are stable over time and beneficial for understanding structural poverty or vulnerability when income data is unreliable (Hoang et al., 2023). In Vietnam, asset indices are used as an alternative or supplement to income and expenditure measures to better reflect household welfare and its impact on outcomes like child health (Ngo et al., 2023).

### **Multidimensional Indices**

Multidimensional approaches incorporate multiple aspects of well-being, such as health, education, housing quality, access to services, and more. Also, recognizing that welfare extends beyond economics, multidimensional poverty indices (MPI) and well-being frameworks look at deprivations across several domains (Mekonnen, 2025). The Sustainable Development Goals (SDGs) advocate multidimensional measurements to capture a full picture of household and community welfare.

## **2.3 Empirical Review of the Determinants of Rural-Urban Migration**

Globally, rural-urban migration is a prevalent demographic phenomenon in emerging nations. Due to migration, many nations have seen the highest rates of urbanization over the past forty years. However, a number of factors influence a family member's or the family's decision to migrate,



which has prompted experts to look into the reasons why people from rural areas are compelled to move to cities.

Several studies on migration have always searched firstly for the factors driving rural-urban migration before examining its effects. For instance, a study conducted by Al-Maruf et al. (2022) on exploring the factors of the farmer's rural-urban migration decision in Bangladesh using primary data from 254 farmers, we have found that six dimensions: individual, household, economic, attitudinal, spatial, and climate-induced extremes significantly influence and contribute to rural-urban migration decisions for farmers. Further, their results indicated that age, agricultural knowledge, household debt, seasonal famine/poverty, unemployment in rural areas, availability of anticipated job opportunities in urban areas, shortage of agricultural inputs, and river erosion significantly influenced farmers' decisions to leave their farms in Bangladesh (Al-Maruf et al., 2022).

Also, according to Li & Zhang (2020), several factors have contributed to increasing the rural-urban migration in Bangladesh. According to them, the nation's textile industry is the main cause of internal migration, drawing millions of people from rural areas to metropolitan areas for work in the ready-made clothes sector. These individuals are mostly women and young people looking to become financially independent.

Chen et al. (2022) conducted a study on the determinants and consequences of rural-urban migration in China using data from a survey of internal migration and applying sequence analysis, which has shown that demographic characteristics, socioeconomic background, and hometown characteristics shape migration trajectories in complex ways, highlighting that social origin can substantially determine migration patterns in rural China.



Additionally, Tamirat et al. (2024) use cross-sectional field survey data, and the result of binary logistic regression analysis showed that age, educational status, landholding, credit use, soil infertility, access to information, off-farm activity, attitude of rural area, and distance to the nearest town were the factors significantly driving rural-urban migration. Also, his results revealed that there is food insecurity and poverty at the household level because of the lower income, which could lead to rural-urban migration (Tamirat et al., 2024).

In the context of Nigeria, Ovharhe et al. (2022) conducted a study on the rural-urban migration of farmers in Delta and Edo states, applying descriptive statistics. They found that rural-urban migration in the study area was caused by employment for youth at 80%. In the same way, Ayiti & Adedokun (2023) studying the impact of rural-urban migration on agricultural development in Ekiti State, Nigeria, have discovered that the major causes of rural-urban migration from the study area are: seeking urban jobs, seeking good education, lack of social amenities in the rural area, low income, seeking skills, and basic health care.

Studying the key role of agriculture and rural development for migration, found that the root causes of people deciding to move out of rural areas are as follows: rural poverty and food insecurity, lack of employment and income-generating opportunities, inequality, limited access to social protection, climate change, and depletion of natural resources due to environmental degradation (FAO, 2020).

In contrast to what the studies have found in the other countries, Azunre et al. (2021), using the push-pull theory as a conceptual and analytical prism, reveal that poorly designed housing policies, the informal economy, weak urban planning, political interferences, and political clientelism accelerate slum growth in Ghana. Additionally, Adom (2017), in his thesis for his Master's on the experience and perception of the youth out-migration and food supply in agricultural households

in Hohoe municipality in Ghana, has shown that 68 % of youth choose to migrate due to the lack of jobs in rural areas.

In conclusion, Au & International (2024) is trying to answer the question: why are more and more of Benin's young people flocking to the cities? Found that every year, tens of thousands of young Beninese leave the countryside for the cities. According to the National Statistics Institute, the population of Cotonou is set to increase by a factor of almost 2.5 between 2013 and 2030, mainly as a result of this rural exodus. Then, the first answers are mainly “failure in agriculture” and “family tensions” that lead young boys to leave their native villages to settle in Cotonou, Abomey-Calavi, or Porto-Novo despite the high cost of living. Also, the second answer concerns young girls, who are not spared this scourge. Often, they separate from their husbands and abandon their children to their grandmothers, moving to Cotonou, Abomey-Calavi, or Porto-Novo to work as waitresses, sales agents, or Mobile Money booth managers, to take care of themselves and, above all, send money to their children.

Generally speaking, even while scholars are focused on the topic of migration globally and within the subregion specifically, Benin lacks in-depth studies on the question of rural exodus, knowing that every year, young people leave the villages and towns of the north and centre to go to or settle in the attractive cities of the south of the country. However, the factors that influence young people to move from their home villages, either partially or permanently, deserve to be studied, so that the results can help the government implement policies to control migration. This will enable the population to be balanced across the country, while avoiding the concentration of young people in one city or region, diminishing the detrimental effects of youth mobility on agricultural output, which is the foundation of the Beninese economy.





## 2.4 Empirical Review of Migration and Efficiency Level of Farm Household

The relationship between migration and the level of efficiency among the farm households is, however, theoretically ambiguous. On one hand, migration may enhance efficiency through remittances that ease liquidity constraints, enabling households to invest in improved inputs, mechanization, or better farm management (Lucas, 2021). Remittances can also serve as insurance against shocks, allowing for more stable production decisions. On the other hand, migration may reduce efficiency if the departure of able-bodied household members leads to labour shortages, delays in farming operations, or lower managerial supervision, particularly in labour-intensive crops such as maize (Sauer et al., 2015). The net effect ultimately depends on the balance between capital accumulation and labour loss, as well as the household's ability to reallocate labour or hire substitutes.

Empirical evidence remains mixed. Studies in Eastern Europe and Central Asia report that migration negatively affects farm performance due to the loss of skilled labour and reduced on-farm time allocation (Sauer et al., 2015). Conversely, evidence from Sub-Saharan Africa and Asia suggests that remittance income can increase agricultural investment and efficiency when markets for credit and inputs are imperfect (Adams & Cuecuecha, 2013; Prah et al., 2025).

In the Ghanaian context, emerging evidence suggests that migration may play a productivity-enhancing role. Recent work by Prah et al (2025), employing a stochastic frontier model with sample selection, finds that rural-urban migration among maize farmers is positively associated with technical efficiency. Their results indicate that remittance income is often reinvested in agriculture, facilitating the adoption of improved inputs and enhancing farm-level efficiency. Additionally, related evidence from Nigeria suggests that off-farm and migrants' related income

activities can improve farm efficiency by easing liquidity constraints and enabling better input management, although the efficiency effects of remittances are context-specific (Shittu, 2014).

Furthermore, direct empirical studies on migration and farm efficiency remain scarce, but existing research suggests that migration primarily functions as a risk-coping and livelihood diversification strategy in response to low agricultural productivity and income volatility, rather than as an immediate driver of efficiency-enhancing investment (Monwanou & Akpa, 2025). Overall, the literature suggests that the efficiency effects of migration are ambiguous and conditional, depending on household characteristics, access to markets, and the extent to which remittances are productively reinvested in agriculture.

## **2.5 Empirical Review of the Effects of Rural-Urban Migration on Agricultural Production**

Agricultural production in many African countries is based in rural zones. Nevertheless, internal migration, sending out the labour availability for agriculture in the rural areas, will affect agricultural productivity and then household food security either positively or negatively. Above all else, the first intention of the scholars studying internal migration is to examine its effect on agricultural production. Hence, several studies have tried to find the influence of internal migration on agricultural production.

In India, a study conducted by Datta & Rajan (2024) on internal migration and development has revealed that migration harms agriculture, which is one of the major components of development. However, economic development has entailed the drive of workers from villages to the cities, from agriculture to industry, following Lewis's theory. Hence, it leads to the employment share of agriculture declining by twenty percentage points from 63% to 43% during the three-decade period, 1991–2022. Whereas the agriculture sector's contribution to income (GDP) declined by eleven percentage points, from 28% to 17%. Simultaneously, the share of employment in the



services sector increased from 22% to 31%, and that of income (GDP) increased from 38% to 48%.

The results of the study, *Men's Out-migration, Agricultural Feminization, and Agricultural Production Nexus: Case of Bac Ninh Province in Vietnam* conducted by Ninh (2024), showed that men's out-migration hurt agricultural production, and this impact was mediated by agricultural feminization. In households with men's out-migration, women increased their participation in agricultural labour and unpaid work in the households, as a means of coping with the loss of male family members and maintaining the household's livelihood. However, this increased involvement of women in agriculture also led to a labour shortage and reduced agricultural productivity, as women faced multiple constraints, such as a lack of access to resources, technology, training, and markets, and increased workload and time pressure (Ninh, 2024).

Understanding how internal labour migration affects the agricultural sector is important for all developing countries whose economy is agriculture-based (Djuikom, 2018). Even if the movement out of the agricultural sector can be viewed as a process to reach development for many African countries, this could lead to a negative effect on the rural economy in one way, which supports the study conducted by Djuikom (2018) on the incentive to labour migration and agricultural productivity revealed that, on average, internal labour migration positively and negatively influences agricultural productivity. Nevertheless, those households for which the effect is negative are mostly small farmers and cannot find a replacement labour force because of scarcity or the cost of the labour force, since they are more likely to be poor (Yacoub & Restiatun, 2024). On the contrary, the effect would be positive if the migrant-sending household could hire individuals on the local labour market to substitute for the migrant's labour force (Djuikom, 2018).





Alan (2014) has looked at the relationship between migration and agricultural productivity in Ethiopia and has shown that the correlation between the two variables is weaker, suggesting that migration does not harm the productivity impact, which means that households that migrants leave can shift resources on the intensive margin to maintain at least the same level of productivity. Alternatively, migrants may not have been productive agricultural workers before leaving (World Bank, 2020). Dzudzor (2019) studied for his Master's thesis the effect of rural-urban migration on agricultural productivity in the Ketu northern District in Ghana, and found that out-migration adversely affects agricultural labour availability and production levels, which increases the cost of hired labour and reduces the potential volume of production.

Also, for his master's project work in Ghana, Mahama (2013) revealed that the impact of out-migration on agriculture included decreased household sources of agricultural labour in both low and high-migration communities, resulting in high-level use of hired labour for farm activities, which led to the conclusion that out-migration affects agricultural productivity negatively, resulting in lower farm incomes and food production. Furthermore, the livelihoods have been less sustainable in high-migration areas, suggesting that out-migration has negative implications for agricultural productivity and livelihoods in the study area (Mahama, 2013).

In the same way as Mahama (2013) and Adom (2017) also discovered that the majority (94%) of the respondents in their research on the experiences and perceptions of youth out-migration and food supply in agricultural households in Hohoe municipality affirmed that migration of the youth negatively affects agricultural productivity and, to some extent, food supply in the households. Additionally, in the Northern region of Ghana, a study on the effect of rural-urban migration on agricultural production has found that the different types of migration from rural to urban areas have different effects on the agricultural production of the households at the origin of migration

(Adaku, 2013). A household member engaging in temporary migration significantly reduces household production by 55.4%, while permanent migration of a household member shows an insignificant increase in household production by 8.8% all other things being equal, which can be explained by the use of remittances since the household with a permanent migrant had the highest absolute net return, which supports the hypothesis of his study that loss of labour availability harms agricultural productivity and appears to keep farm households held down in poverty (Adaku, 2013).

On the contrary, Li & Wu (2024) reveal that the increase in the rate of remittance sent by the migrants will increase the total remittance of the migrant workers and increase the demand for agricultural producer services in the agricultural sector.

Research carried out in India by Swain et al. (2025) has shown that remittances exhibit a positive influence on the left-out members' labour market behaviour, which is reflected in agricultural production by the possibility of hiring labour to replace the loss of labour caused by the rural out-migration in the origin of the migrants.

In Pakistan, the results of Shair et al. (2024a) have revealed that external and internal remittance inflow increases the labour supply for the labour-participating individual, which leads to an increase in the likelihood of participation in self-employment rather than wage employment, and supports the positive effect of remittance inflow on labour supply. The higher internal remittances are associated with an increase in the likelihood of participation in farming, which may also increase agricultural productivity (Shair et al., 2024a).

A study examining the diaspora remittances and growth of the agricultural sector in Nigeria found that workers' remittances and migrant remittances have increased the output of the agricultural sector in Nigeria, and also concluded that for the period 1990-2022, remittances had enhanced the

output of the agricultural sector, with migrant remittances having the most effect in Nigeria (Mgbomene, 2024).

## **2.6 Empirical Review of the Effect of Rural-Urban Migration on Household Welfare**

The new economics labour migration theory has shifted the unit of analysis from the individual to the household level in migration analysis, and then focuses on the causes and impacts of migration on household welfare and production in sending origin areas (Eshetu et al., 2023). According to this theory, the decision of a household member to migrate doesn't belong to him but to the household head because the idea behind that migration is income diversification and risk management. So, the head of the family relies on the remittance that the migrant will send to maximize the welfare of the household. That is why the migration does not occur in a vacuum; it gives with one hand and takes with the other hand, implying that migration affects the migrant-sending areas via two channels: the remittance channel and the lost labour channel (Eshetu et al., 2023).

Furthermore, several scholars have studied the effect of remittance on the household migrant sending welfare in the matter of migration and have found that participation in migration has a positive and significant impact on the welfare of migrant-sending households (Agza et al., 2023). For instance, Marta et al. (2020) wanted to understand the migration motives and their impact on household welfare: evidence from rural-urban migration in Indonesia, and discovered that migration has a positive and significant impact on migrant household welfare based on investment motives, but an insignificant result regarding the impact of migration based on risk-coping motives.

According to Gavonel et al. (2021), studying the migration sustainability paradox: transformations in mobile worlds, they have discovered that migration represents an opportunity for sustainable





development, increasing aggregate well-being, reducing inequality, leading to diverse social benefits, and reducing aggregate environmental burden. Similarly, Raihan et al. (2022) examined the impact of migration on the expenditure of households using secondary data and propensity score matching in Bangladesh and found that international migration significantly increases expenditure on education, health, and food.

Also, a study on the determinants of rural-urban migration and its impact on migrant-sending households' livelihood security in the Gurage zone, has reveal that the impact of remittances on household livelihood security is positive and improved over time with relatively broad confidence ranges, increased the livelihood security of migrant-sending households by 13.6% and the overall population by 10.99%, and finally, the higher levels of remittance had a greater impact on household livelihood security, with a 40% local minimum dose (Agza et al., 2023).

According to Eshetu et al. (2023), participation in international migration significantly increases consumption per adult equivalent of households by 29.8% in the study area. Besides, participation in rural-urban and international migration significantly increases kilocalories per adult equivalent per day by 29.33 and 53.16%, respectively, and it also contributes positively to the welfare of migrant-sending households (Eshetu et al., 2023).

Additionally, Mohamed (2021) conducted a study on the effect of remittance on poverty using secondary data and propensity score matching in Somalia and found that the consumption of remittance-receiving households is higher compared to households without remittance. In the same way, Obiakor et al. (2021) conducted a study on the impact of migration on the consumption of households using secondary data and system-GMM for 17 sub-Saharan African countries and found that remittance was positively and significantly associated with the consumption of households.

On the contrary, some previous studies found a negative impact of participation in rural-urban migration on the welfare of migrant-sending households (Alleluyanatha et al., 2021; Lagakos et al., 2023). For instance, Alleluyanatha et al. (2021) conducted a study on the effect of youth migration and remittances on rural households' livelihoods in southeastern Nigeria using primary data from 714 households and found that households without migrants were better off than households with migrants. Likewise, Lagakos et al.'s (2023) research on the effect of migration on welfare in developing countries was conducted using cross-sectional data, and the results reveal that rural-urban migration significantly lowers the welfare of migrant-sending households.

## **2.7 Literature Review Conclusion**

From the literature review, we conclude that migration is classified into two groups, with each of them having a subgroup. However, there are external migration (international) and internal migration (within the country). Then, the internal migration is also divided into rural-urban migration, seasonal migration, and circular migration, which are influenced by socio-economic and demographic characteristics, farm and ecological factors, and social networks. Additionally, the literature has revealed several theories of migration used to support migration studies by many researchers. Furthermore, studying migration, the literature has shown the impact of internal migration on the origin of the migrated members, such as agricultural production, labour availability, and the welfare of the left behind households, which is the focus of this study in northern Benin.



## CHAPTER THREE

### METHODOLOGY

#### 3.0 Introduction

This chapter outlines the technique used for the study, including the data source, the sampling process and sample size calculation, the data collection method, and a description of the study area. The theoretical framework, the conceptual framework, and the econometric data analysis methodology are all included.

#### 3.1 Study Area

This study was carried out in the Benin Republic, and the northern region was selected as the study location because of the migration of people, particularly young people, from the northern region's rural areas to the southern region's cities.

Located in West Africa, the Benin Republic has a long frontier with its eastern neighbour, Nigeria, and is bordered by Togo to the west and Burkina Faso and Niger to the north (IFAD, 2024). Many of Benin's (10 million people) live in the port city of Cotonou, on the Gulf of Guinea (Afrique, 2024). Benin's population was 12.12 million people in 2020 and is projected to surpass 30 million people in 2030 and reach 46.83 million people by 2099, more than tripling its current population (Afrique, 2024). The agricultural sector is dominated by an estimated 651,000 smallholder farmers who produce for their family needs and markets. Of these, 85 % have less than five hectares, and the majority of cultivated plots are one to two hectares in size. The bulk of smallholder farmers practice labour-intensive agriculture using few modern technologies or improved inputs. Farming systems vary considerably, with different crop production and animal husbandry practices across the country. Maize is the most common crop, grown by 85 % of farmers. Other crops produced are cassava, yams, rice, sorghum, and vegetables. Only an estimated 11 % of farmers grow cotton, the





country's main cash crop. Livestock is also a component of farming systems, particularly in the north. Some 36 % of Beninese households engage in some form of raising livestock (Barry et al., 2022).

This study will be conducted in the Northern Region of the Benin Republic. However, this region is a wide part of the country and one of the highest agricultural Regions in Benin. According to the agricultural statistics for 2021, there are 926,539 farming households in Benin, out of a total agricultural population of 6,506,980 of Benin's total population. The Regions of Alibori, Atacora, Borgou, and Couffo account for over 45 % of this population. Among other migrants intending to migrate, the highest proportion is recorded among those currently residing in the departments of Couffo (27.8%), Zou (20.1%), and Atacora (70.7%) within the timeframes of less than 6 months, 6-11 months, and 2 years or more, respectively (Démographiques et al., 2023). This statistic has shown that the Atacora region is more involved in rural-urban migration than the others, with the highest period. Also, out of the 926,539 farming households, 72,4 % live in Benin's rural areas. Moreover, the wide agricultural regions in Benin are Alibori, 95,268; Atacora, 96,748; Borgou, 90,497; and Couffo, with 99,570 farming households respectively. However, because of its position (Northern region of Benin) and size, the department of Atacora will be chosen as the study area to conduct this research (Central & Recensement, 2021).

### **3.2 Presentation of the Atacora Region**

Located in the northernmost part of Benin's extreme west, the department of Atacora comprises nine (09) municipalities: Natitingou (department capital), Kerou, Kouande, Pehunco, Cobly, Boukoumbe, Materi, Toucountouna, and Tanguieta, and includes 384 communities (Djossè et al., 2022). It shares borders with Togo to the west, Alibori and Borgou to the east, Donga to the south, and the Republic of Burkina-Faso to the north. After Borgou (25,856 km<sup>2</sup>) and Alibori (26,242

km<sup>2</sup>), Atacora is the third largest department with a total surface area of 20,499 km<sup>2</sup>. Atacora provides Benin with access to Burkina-Faso, Togo, and other West African nations in the subregion, including Mali. The department's food product supply and demand are significantly impacted by this factor.

### **3.2.1 Natural Environment**

The Atacora mountain range, with an average altitude of 700 meters and a summit at Boukoumbe (835m), the big rivers of Benin and Togo (Oueme, Mono, Mekrou, Pendjari, and Oti, Kerou, or Kouamongou) flow from this water tower (Djossè et al., 2022). This physical feature explains not only the rugged nature of the relief but also insufficient arable land, which is also degraded by erosion, rendering it infertile and unsuitable for cultivation.

The hydrographic network is dominated by two main rivers: the Pendjari (135 km) and the Mekrou (410 km), and their tributaries, which flow through most communes except Cibly and Toucountouna. Throughout the department, 36 water reservoirs have promoted water management and the development of irrigated crops.

The Atacora department has a mainly Sudanian climate with two distinct seasons: the dry season, which lasts from November to May, and the rainy season, which lasts from June to October. Remarkable seasonal shifts can be observed as you move from Cibly to Pehunco, with earlier rains in the eastern part of the department than in the west. Harmattan has been a regular feature (November to February), becoming more noticeable in December. In the eastern localities (Kerou, Kouande, and Pehunco), the savannah is dotted with a few shea and néré trees. It becomes clearer as you move westwards, except for the Pendjari reserve, the classified forests of the Alibori superior in Kerou, and those of Kouande, which add a nuance to this observation.



In the Atacora department, there are three different types of soil: ferruginous tropical soils that have enough topsoil for annual crops in some areas; ferritic soils, particularly in the mountainous areas of Materi and Tanguieta; and light hydromorphic soils, which are mostly found in the lowlands or on the peneplains. This soil diversity from east to west makes it possible to grow legumes (soybeans), cereals (millet, maize, fonio, and sorghum), and tubers and root crops (yams, manioc, and sweet potatoes).

### **3.2.2 Demographic Characteristics**

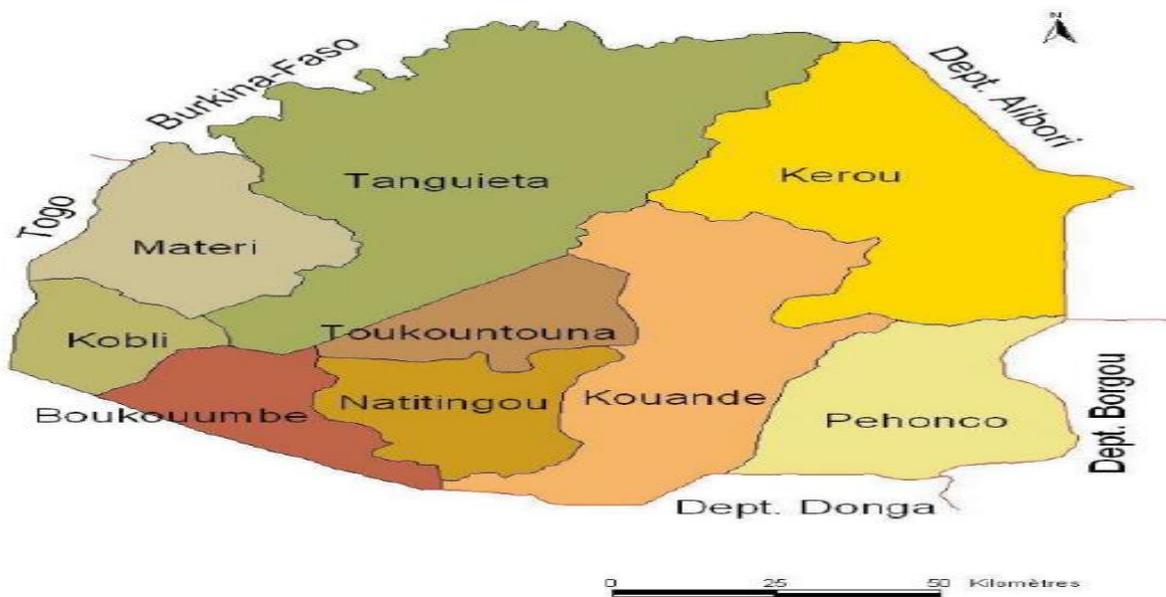
According to the RGPH4 of May 2013, the Atacora department has a population of 772,262 compared with 549,417 in 2002, with a density of 38 inhabitants per km<sup>2</sup>. However, women account for 50.73 % of the department's total population. There are 97.1 men for every 100 women. The rural population is 485,110 or 62.82 %, compared with 287,152 in urban areas (INSAE, 2016). The most prevalent ethnic groups are the Peulh or Peul 12.5%, the Bariba and related 19.0%, and the Gua or Otamari and related 59.3%. In terms of religious practice, Islam leads the way with 26.9% of the population, followed by Catholicism, 20.7% and other traditional religions, 18.0%. People with no religion make up 19% of the population of Atacora (INSAE, 2016).

### **3.2.3 Socio-Community Infrastructure**

Village health coverage in terms of health infrastructure is poor. For the 384 villages in the district, there are 21 dispensaries, 27 maternity units, and 40 health complexes. Also, access to drinking water still seems to pose enormous issues for the population. Barely one arrondissement in two in the department has a public water supply and boreholes.

### 3.2.4 Economic Activities

According to economic activity in the Atacora department, the main branches of activity are: “Agriculture, fishing and hunting” (77.2%), “trade, catering and accommodation” (7.9%), “other services” (5.4%), and “business industries” (5.1%). In all communes, more than 70% of the population is working in agriculture, fishing, and hunting, except in the commune of Natitingou (48.3%). The commune of Matéri is the most popular, with a percentage of 88.4%. The ‘commerce, catering and accommodation’ branch of activity is more preponderant in the communes of Kouandé (13.9%) and Natitingou (13.2%). Manufacturing industries employ 9.1% of the working population in the commune of Natitingou, 6.4% in Péhunco, and 6.2% in Kouandé. These proportions are very low in the communes of Boukoumbé (3.1%) and Matéri (3.1%) (INSAE, 2016).



**Figure 3.1: Map of Study Area**

### 3.3 Research Design

This study used a mixed research design combining qualitative and quantitative methods. Compared to using only one method, a mixed-method design offered a more reliable and clear

understanding of rural-urban migration (Creswell, 2013). To provide a more comprehensive response to the socio-demographic features of the respondents, as well as the effects and consequences of migration on agricultural production, and the reasons for youth to participate in rural-urban migration, the quantitative technique has been employed. To understand more about the manifestation of rural-urban migration, the perception of the head of the family, and the experience of the household about the rural-urban migration, a deeper discussion has been conducted with the head of the agricultural household through a qualitative approach. Consequently, the application of both research methodologies enhanced the validity of the study findings by complementing each other's advantages and disadvantages (Teye, 2012). By using both research methods, it simultaneously facilitates a thorough, comprehensive assessment and provides a better understanding of the effects of migration on agricultural production and household welfare in the study area (Mahama, 2013).

### **3.4 Data Collection Approach**

To achieve the objectives set in the study, a semi-structured questionnaire has been used to collect primary data from agricultural households in northern Benin, as used by Asefawu (2022) in the Northeast of Ethiopia. To solicit confidential information, an open and closed-ended questionnaire has been administered. The closed-ended questions restrict respondents from providing detailed answers to specific questions. In contrast, the open-ended questions allowed respondents to provide detailed information and express their opinions on the questions asked in the study. Discovering the work of (Hashim et al., 2022), the questionnaire has been pre-tested to get at the thinking behind the answers so that the auditor can accurately assess whether the questionnaire is being filled out properly, whether the questions are understood by respondents, and whether the questions ask what the auditor thinks they are asking.



Pre-testing has also helped to assess whether respondents are able and willing to provide the needed information, where 20 farm households were selected randomly in a community different from the study area, as noted in the work of Lenzner et al. (2023). The result showed that the language of the questionnaire, which was English, prevented the enumerators from being faster in the data collection, because they had to translate the questions from English to French before addressing them. To solve this, the whole questionnaire has been translated from English to French, which has facilitated the data collection. Also, the pre-test revealed that the head of the household can give all the information about the migrants.

### **3.5 Sources of Data**

For this research, the data were obtained from primary sources. Like Abdallah et al. (2023), primary data has been collected from agricultural households through the use of a semi-structured questionnaire, which was designed and used to solicit comprehensive information about socioeconomics and demographic factors, including age, household size, level of education, off-farm income; farm factors also including farming experience, farm size and other information required to answer the research questions. The questionnaires have therefore been administered in a face-to-face interview by experienced interviewers with close supervision, following the work of Seidu (2022). However, for this study, the unit was an agricultural household where at least one family member had migrated to urban areas six months ago or above six months (a household with a temporary or permanent migrant), and also an agricultural household where no member had migrated (a household without a migrant), following Agza & Alemu (2022).

### **3.6 Sample Size**

Principally, the sample size was important due to its effect on statistical power. The statistical power was the chance that a statistical test would indicate a significant difference when there is

one. So, a simplified formula from Taro Yamane, used by Kabatesi & Mbabazi (2016), was used to determine the required sample size for the sample to be statistically representative of the population. This technique was chosen for its ability to give an equal chance of being included in the sample to each member of the population.

$$n = \frac{N}{1+N(e^2)} \quad (1)$$

Where:  $n$  = is the sample size,  $N$  is the total number of farm households (Population within the study area), and  $e = 0.05$  is the level of precision defined to determine the required sample size at a 95% confidence level.

Therefore, according to the study areas (Atacora in northern Benin), there are 96,249 farming households (DSA/MAEP, 2024). Then, using the formula above, we have gotten:

$$n = \frac{96,249}{1+96,249(0.05)^2} \Rightarrow n = 398.35$$

However, since we are dealing with a household, and for the sake of good calculation, we have rounded it to 400 households as a sample size for this study.

### 3.7 Sampling Technique

For this study, a multi-stage sampling technique used by Dawuni et al. (2021) was employed. In northern Benin, there are four regions: Atacora, Alibori, Borgou, and Donga. However, in terms of agricultural production, the region of Atacora was the first, with 96,249 agricultural households. In the first stage, following the initiative of Giri (2024), the purposive sampling technique was used to select the Atacora region.

The region of Atacora contains nine municipalities with a significant number of agricultural households. In the second stage, reviewing Ahmed's (2024) work, a stratified sampling method was employed to select five municipalities, comprising the first two with high agricultural

households, one in the middle, and the last two with lower agricultural households. In the final stage, simple random sampling was employed to select individual respondents from the selected households, as described by Ovharhe et al. (2022). Hence, according to the statistics from DSA (2024), the number of farm households per community is: Materi (18,845), Boukoumbe (11,914), Nati (9,761), Pehunco (7,549), and Toucountounan (5,963). Then, within each municipality, one community has been chosen, and therefore, an agricultural family where at least one member has moved.

**Table 3.1: Sample Size Distribution Across the Communities**

Municipalities	Materi	Boukoumbe	Nati	Pehunco	Toucountounan	Total
Number of Agricultural HH	18,845	11,914	9,761	7,549	5,963	54,032
Percentage	35%	22%	18%	14%	11%	100%
<b>Sampling Size</b>	<b>140</b>	<b>88</b>	<b>72</b>	<b>56</b>	<b>44</b>	<b>400</b>

**Source: DSA 2024**

### 3.8 Conceptual Framework

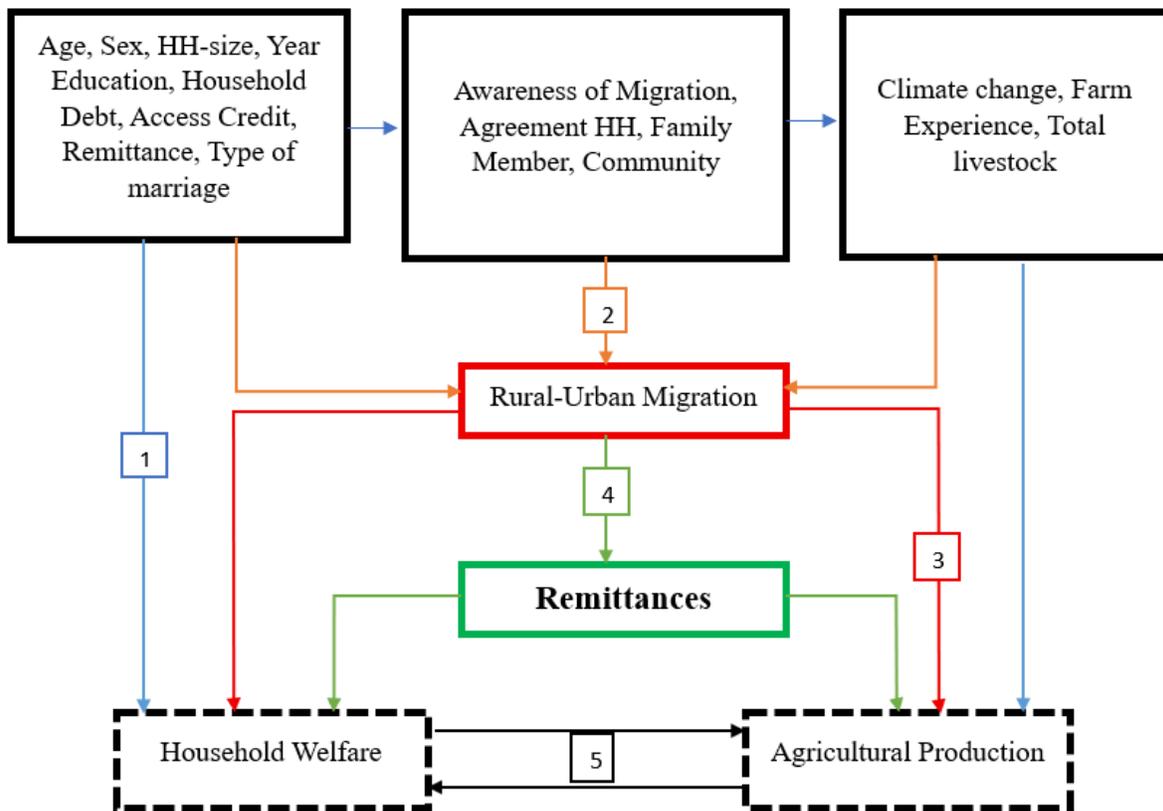
Understanding the determinants underlying rural-urban migration is important for reducing food insecurity and poverty through increased agricultural productivity (Tamirat et al., 2024). An important growing body of empirical literature focuses on the factors affecting rural-urban migration (Melesse & Nachimuthu, 2017; Nebebe, 2020b; Hailemari, 2021). Particularly, many studies have significantly contributed to the different aspects of internal migration in many African countries (Tamirat et al., 2024). However, studies such as Mounirou & Yebou (2023) and Mounirou (2022) are limited in their ability to identify the determinants of internal migration in northern Benin, while migration is still a problem faced by rural areas. Then, the conceptual framework of this study has been based on the theory of push-pull factors by Lee (1966) and the new economics



of labour migration theory by Stark & Bloom (1985) to determine factors driving rural-urban migration, and assess its impact on agricultural value productivity and household welfare in northern Benin, as employed by Saraswati et al. (2025). However, Figure 3.2 below presents an idea of how the factors affecting rural-urban migration have been determined and analysed.

According to this visual representation, the welfare and agricultural value productivity of the farm households can be affected by four channels. The first channel explains the mechanism by which the welfare and agricultural value productivity can be affected without migration. This is possible when the education level, farm size, family size, and credit access allow the household to adopt sustainable agricultural practices. This supports the findings of a study conducted by Midamba et al. (2024) in Uganda. The second channel presents the determinant of internal migration, where socio-economic factors, institutional and social network factors, farm and ecological factors, all classified under the push-pull factors, drive rural out-migration of youth. This is in line with the study conducted by Martey & Etwire (2025) in Ghana. Channel three shows how migration due to labour shortage increases the cost of production by hired labour; also, labour shortage can force aged heads of households and adolescents to work on the farm, reducing productivity and food security (FAO, 2016). Furthermore, channel four reveals the direct effect of internal migration on household welfare and agricultural productivity through the migrants' remittances, as discussed by (FAO et al., 2018). The remittance is expected to increase the welfare of the households and enhance the adoption of technology in agriculture (Salah, 2025). However, according to Martey & Armah (2021), internal migration may not always achieve its intended objectives through remittances due to factors such as discrepancies between perceptions and realities in destination areas, high initial migration costs, obligations to new families, and political conflicts. Lastly, channel five represents the interconnection between household welfare and agricultural value

productivity in farm households. This shows that wealthy households are more likely to invest in agriculture, which will result in high productivity (Weldemariam et al., 2023). Also, the households with high productivity are more likely to earn higher farm income, which will directly impact the welfare. This supports the result of Aremu & Reynolds (2024), who have found that access to extension services leads to high agricultural productivity and significantly increases the households' assets by 92-113% in Nigeria.



**Figure 3.2: Conceptual Framework**

**Source: Author's conceptualization (2025)**

### 3.9 Theoretical Framework

In the manner of rural-urban migration, several theories support it differently, namely, the gravity theory of migration (Ravenstein, 1885), the two sectors of labour migration theory (Lewis, 1954) the push and pull factors of migration theory (Lee, 1966), the human capital theory of migration (Harris & Todaro, 1970), the new economics of labour migration theory (Stark & Bloom, 1985) and the network theory of migration (Taylor & Wyatt, 1996) which explains the determinants of rural-urban migration and its effect on the migrants, the origin of the migrant and the destination of the migrant. However, to measure the impact of rural-urban migration on the rural areas through agriculture production and household welfare in the study area, the theory of Push-Pull factors and the New Economics of Labour Migration theory, as used by For et al. (2017), were jointly employed to favour this study.

#### 3.9.1 Push-Pull Theory

Lee's (1966) push-pull factors theory implies that rural-urban migration in Northern Benin is driven by negative conditions at the place of origin (push factors) as structural rural constraints, and the presence of strong urban pull factors that increase the opportunity cost of agricultural labour. Then, this migration leads to ambiguous but measurable effects: potential reductions in agricultural production due to labour loss, alongside improvements in farm household welfare through remittances and income diversification. Hence, the theory provides a strong conceptual basis for examining the trade-offs and complementarities between migration, agricultural productivity, and farm household welfare.

The out-migration of labour from villages to cities can be attributed to several factors. The reasons why people from rural communities move to metropolitan regions are explained by Lee (1966) 's



classic push-pull migration theory. However, Lee (1966) claims that the migratory process is caused by many variables, push factors, pull factors, personal factors, and intervening factors (EEA, 2022). The Push factors are all the variables or characteristics in rural areas that make people uncomfortable and decide to migrate. In contrast, the Pull factors are the characteristics of urban areas that attract people from rural areas (Dokubo et al., 2023). Similarly, most researchers who used the push-pull hypothesis presumed that different economic, environmental, and demographic factors play a pivotal role in migration decision-making (Awumbila et al., 2011). According to Yu et al. (2019), rural-urban migrants are mostly motivated by education and schooling, pulling migrants from rural areas to urban areas. Also, Nkabinde et al. (2024) have shown that schooling and education, road and transportation, and job opportunities are the pull factors that significantly make people participate in rural-urban migration. On the other side, the push factors in rural areas, Abdukadir & Osman (2024) have shown that poverty, unemployment, slow economic growth, low wages, land tenure issues, landlessness, mechanization of agriculture, depleting resources, lack of infrastructure, environmental degradation, natural disasters, food security, disease, climate change, and water scarcity. Finally, the push-pull theory, however appealingly straightforward, provides a valuable framework for classifying a variety of reasons promoting migration (Jones & Sumner, 2011).

### **3.9.2 New Economics of Labour Migration**

The new economics of labour migration argued that migration decisions are made collectively by households, instead of isolated individuals, to maximize household welfare rather than individual income. This theory considers the outcome of migration at the household level, such as farm income, consumption, food security, and welfare indicators, rather than focusing only on migrants themselves. Furthermore, Stark & Bloom (1985) argue that migration occurs due to missing or

imperfect markets, where access to formal credit and insurance is limited for households, and migration serves as a substitute risk-management tool, through remittances.

An equally important theory that explains why people migrate is the New Economics of Labour Theory (NELM), developed by Stark & Bloom (1985) and used by Adom (2017). According to him, unlike the push-pull factors theory, where the decisions of migration belong to an individual, joint decisions are taken by households, families, and sometimes communities when it comes to matters relating to migration. However, NELM conceptualises migration as a risk-diversifying strategy rather than only as a response to the income differentials or the relative differences in opportunities between origin and destination areas, as in the Neo-classical and push-and-pull theory (Zehraoui et al., 2024). Then, members of a household enter into a contractual agreement in which one or more members migrate to sectors with earnings either negatively correlated or not highly positively correlated with those of the origin sectors (Mukherjee & Fransen, 2024). Also, Stark & Bloom (1985) emphasise how both parties (migrating and non-migrating) benefit from this arrangement, as earned remittances are shared and provide coinsurance to the household. Furthermore, the rationale behind households making such decisions is about maximising profit, risk aversion, or risk sharing. Households appear to diversify resources, such as labour, better than individuals, to reduce risk. Who to send and where that person should go then becomes a matter of concern to the decision-makers. Since most deprived communities lack certain infrastructural development, such as banks, small-scale financial services, and insurance companies, migration therefore seems the best alternative to weather the storms in the unlikely event that there is crop failure or market failure (Massey et al., 1999). Based on this theory, people migrate to seek higher-paid employment opportunities. At the individual level, rural people will end up as rural-urban migrants if the wage information from previous migrants suggests that migration is a worthy



investment, while at the household level, the household migration decision is a self-enforcing contract that presents the bargaining power within the household (Chang & Zhang, 2024). Finally, with the growth of non-agricultural industries in rural areas, local wage employment and self-employment become core components of non-migrated people's livelihood choices, together with agricultural production (Chang & Zhang, 2024).

### **3.10 Method of Analysis**

For this research, after the data collection, the data were coded and entered using Excel. Then, Stata 17.0 was used for the analysis. Firstly, as stated by Tamirat et al. (2024), the descriptive analysis was used to describe and investigate demographic, socio-economic, institutional, and other characteristics of agricultural households and the migrant members using frequency, percentages, maximum values, minimum values, tables, averages, and standard errors. Secondly, appropriate econometrics models were used to assess each objective. Furthermore, the specifications of each econometric model are as follows.

#### **3.10.1 Multinomial Logit Model: Drivers of Rural-Urban Migration**

Firstly, this study aims to determine the factors influencing rural-urban migration in northern Benin. Following Ahamad et al. (2024), the multinomial logit model was used to assess this objective because the migration decision was a selection variable and the answer was categorical and unordered. So, the dependent variable was the decision of at least one member of an agricultural household choosing non-migration, temporary migration, or permanent migration. Then, the probability of at least one member of an agricultural household choosing one of the migration statuses was related to the  $\text{Prob}(Y_i = j/X)$ , which was the probability of the outcome  $j$ ,  $Y_i$  was the migration status as the dependent variable,  $X$  was the covariate, and  $j$  represents the number of alternative minus 1.

**Empirical Model:**

$$P(Y_i = j/X) = \frac{e^{X\beta_j}}{\sum_{k=0}^j e^{X\beta_k}} \tag{2a}$$

where  $Y_i$  is the migration outcome with categories like  $Y_1=0$  for non-migration,  $Y_2=1$  for Temporary migration, and  $Y_3=2$  for Permanent migration. According to the multinomial model's rule, one of the categories should be set as a baseline for the model. This study has set the first category (non-migration) as the baseline to measure the factors influencing temporary and permanent migration.

Then, the probability of choosing outcome  $j$  (relative to the baseline) is given by:

$$P(Y_i = j/X) = \frac{e^{X\beta_j}}{1+e^{X\beta_1}+e^{X\beta_2}} \text{ for } j=1,2. \tag{2b}$$

However, the multinomial logit model specifies two sets of equations (since the baseline is non-migration):

For Temporary Migration ( $Y=1$ )

$$\ln\left(\frac{P(Y=1)}{P(Y=0)}\right) = \beta_0^{(1)} + \beta_1^{(1)}X^1 + \beta_2^{(1)}X^2 + \dots + \beta_n^{(1)}X_n + \varepsilon_i \tag{3a}$$

For Permanent Migration ( $Y=2$ ):

$$\ln\left(\frac{P(Y=2)}{P(Y=0)}\right) = \beta_0^{(2)} + \beta_1^{(2)}X^1 + \beta_2^{(2)}X^2 + \dots + \beta_n^{(2)}X_n + \varepsilon_i \tag{3b}$$

Where the dependent variable  $Y_i$  is the migration outcome, which can be temporary or permanent.  $X_n$  are the independent variables, which can be socioeconomic factors, economic opportunities, infrastructure access, environmental factors, and social networks.  $\beta_0^{(j)}$  are the intercepts for the migration category  $j$  (temporary or permanent),  $\beta_n^{(j)}$  are the coefficients for predictor  $n$  in category  $j$ . The specific equation based on each category for this model is given by:



For Temporary Migration (Y=1) (4a)

$$P(StatutM = 1) = \beta_0^{(1)} + \beta_1^{(1)}\text{SexHH} + \beta_2^{(1)}\text{AgeHH} + \beta_3^{(1)}\text{Boukoumbe\_group1} + \beta_4^{(1)}\text{Materi\_group2} + \beta_5^{(1)}\text{Natitingou\_group3} + \beta_6^{(1)}\text{Pehunco\_group4} + \beta_7^{(1)}\text{SendingRem} + \beta_8^{(1)}\text{TotalLivestocks} + \beta_9^{(1)}\text{Hsize} + \beta_{10}^{(1)}\text{Tmarriage} + \beta_{11}^{(1)}\text{NonfarmAct} + \beta_{12}^{(1)}\text{YearEdu} + \beta_{13}^{(1)}\text{Hdebt} + \beta_{14}^{(1)}\text{AccessCredi} + \beta_{15}^{(1)}\text{AwareMigrat} + \beta_{16}^{(1)}\text{AgriEquip\_group1} + \beta_{17}^{(1)}\text{ClimatEffect} + \beta_{18}^{(1)}\text{RuralUnemploy} + \beta_{19}^{(1)}\text{UrbanEmploy} + \beta_{20}^{(1)}\text{FarmExp} + \beta_{21}^{(1)}\text{AgremHH} + \beta_{22}^{(1)}\text{FamilyMem} + \varepsilon_i$$

For Permanent Migration (Y=2): (4b)

$$P(StatutM = 2) = \beta_0^{(2)} + \beta_1^{(2)}\text{SexHH} + \beta_2^{(2)}\text{AgeHH} + \beta_3^{(2)}\text{Boukoumbe\_group1} + \beta_4^{(2)}\text{Materi\_group2} + \beta_5^{(2)}\text{Natitingou\_group3} + \beta_6^{(2)}\text{Pehunco\_group4} + \beta_7^{(2)}\text{SendingRem} + \beta_8^{(2)}\text{TotalLivestocks} + \beta_9^{(2)}\text{Hsize} + \beta_{10}^{(2)}\text{Tmarriage} + \beta_{11}^{(2)}\text{NonfarmAct} + \beta_{12}^{(2)}\text{YearEdu} + \beta_{13}^{(2)}\text{Hdebt} + \beta_{14}^{(2)}\text{AccessCredi} + \beta_{15}^{(2)}\text{AwareMigrat} + \beta_{16}^{(2)}\text{AgriEquip\_group1} + \beta_{17}^{(2)}\text{ClimatEffect} + \beta_{18}^{(2)}\text{RuralUnemploy} + \beta_{19}^{(2)}\text{UrbanEmploy} + \beta_{20}^{(2)}\text{FarmExp} + \beta_{21}^{(2)}\text{AgremHH} + \beta_{22}^{(2)}\text{FamilyMem} + \varepsilon_i$$

### 3.10.2 Stochastic Frontier Analysis: Efficiency Score and Factors Influencing the Value

#### Productivity of the Farm Households

Stochastic frontier analysis is widely used in the agricultural sector to examine the factors influencing output and evaluate the technical efficiency of farmers. In this study, based on the assumption that unobserved factors in the migration decision may be correlated with the noise in the frontier, resulting in selection bias, the Greene approach (2010), used by Azumah *et al.* (2019) and Abdulai *et al.* (2025), was employed to correct for the sample selection.

Greene's approach extends Heckman-style sample-selection corrections to stochastic frontier analysis by jointly modelling (a) the binary selection (migration decision) and (b) the stochastic frontier production function, allowing the unobservable in the selection equation to be correlated

with the stochastic terms in the frontier. This corrects selection bias in estimates of outcome and efficiency when migration is endogenous. This implies that the approach has two steps: the selection equation (migration decision) and outcome equation (frontier), which are stated as follows:

### Selection (migration decision) equation

This estimates whether the farm households  $i$  in the study area has a migrant member or not through the following equation.

$$M_i^* = \alpha_i X_i + \varepsilon_i \quad (5)$$

$$\text{And } M_i = \begin{cases} 1 & \text{if } M_i^* > 0 \text{ for Farm household with migrant} \\ 0 & \text{if } M_i^* \leq 0 \text{ for Farm household without migrant} \end{cases} \quad (6)$$

Where  $X_i$  represents the vector of variables determining migration decision,  $\alpha_i$  is the parameter vector, and  $\varepsilon_i$  is the selection error.

Given the explanatory variables, the empirical specification for the selection equation can be expressed as equation (7) below:

$$P(M_i = 1/X_i) = \alpha_0 + \alpha_1 \text{SexHH}_i + \alpha_2 \text{Hsize}_i + \alpha_3 \text{Tmarriage}_i + \alpha_4 \text{AgeHH}_i + \alpha_5 \text{NonfarmAct}_i + \alpha_6 \text{YearEdu}_i + \alpha_7 \text{Hdebt}_i + \alpha_8 \text{AccessCredi}_i + \alpha_9 \text{AwareMigrat}_i + \alpha_{10} \text{ClimatEffect}_i + \alpha_{11} \text{RuralUnemploy}_i + \alpha_{12} \text{UrbanEmploy}_i + \alpha_{13} \text{FarmExp}_i + \alpha_{14} \text{AgremHH}_i + \alpha_{15} \text{FamilyMem}_i + \varepsilon_i$$

### Stochastic Frontier Equation

As used by earlier research, the stochastic frontier usually employs an appropriate production function. However, the most common production functions used in estimating the efficiency are

Cobb-Douglas and Translog. Then, this study estimated the factors influencing migration decision in the study area and the efficiency level using both production function specification and tested for the appropriateness.

The general specification of the stochastic frontier for the production function can be expressed as follows:

$$Y_i = f(X_i\beta_i) * \exp (v_i - u_i) \tag{8}$$

The production frontier, denoted by the function  $(X_i\beta_i)$ , is an appropriate function for Cobb-Douglas or translog production functions, following the work of Motbaynor and Kumar (2023). Where  $Y_i$  is the output (agricultural revenue),  $X_i$  is a vector of inputs (Farm characteristics and Technologies used, etc.),  $\beta_i$  represents the vector of unknown parameters to be estimated,  $v_i$  is the random error term representing statistical noise, and  $u_i$  is captured as a non-negative random variable that represents the technical inefficiency, following Hussen and Tenaye (2025).

So, applying the logarithmic form to the production function using cross-sectional data and allowing different frontiers for adopters and non-adopters, assuming a half-normal distribution, we have:

$$\ln Y_{1i} = X_{1i}\beta_1 + v_{1i} - u_{1i} \quad \text{if } M_i = 1 \text{ (Farm household with migrant)} \tag{9}$$

$$\ln Y_{0i} = X_{0i}\beta_0 + v_{0i} - u_{0i} \quad \text{if } M_i = 0 \text{ (Farm household without migrant)} \tag{10}$$

Where  $Y_i$  is the agricultural revenue for the farm household  $i$ ,  $X_{1i}$  and  $X_{0i}$  are the vectors of inputs and observable covariates affecting the output,  $\beta_{1i}$  and  $\beta_{0i}$  represent the frontier parameters vectors for the farm household with migrants and the farm household without migrant,  $v_{1i}$  and  $v_{0i}$  are the



symmetric disturbance term following  $N(0, \sigma_v^2)$ , as well as  $u_{1i}$  and  $u_{0i}$  are one-sided inefficiency terms.

Furthermore, Greene allows the selection error  $\epsilon_i$  to be correlated with the symmetric noise  $v_{ji}$  (for  $j = 0,1$ ), which is measured as the coefficient of correlation (selectivity bias).

$$\begin{pmatrix} \epsilon_i \\ v_{ji} \end{pmatrix} \sim N \left( \begin{pmatrix} 0 \\ 0 \end{pmatrix} \middle| \begin{pmatrix} \sigma_\epsilon^2 & \sigma_{\epsilon v_j} \\ \sigma_{\epsilon v_j} & \sigma_v^2 \end{pmatrix} \right) \quad (11)$$

The key assumption of Greene about this approach is that the parameter  $\sigma_{\epsilon v_j}$  must be non-zero, indicating the presence of selection bias in the migration decision in the farm household in the study area, which justifies the use of this approach.

Given the explanatory variables, the similar empirical specification for farm household with migrants and farm household without migrants can be expressed as the equation (12) below:

$$\begin{aligned} \ln \text{AgriRev}_i = & \beta_0 + \beta_1 \ln \text{Farmsize}_i + \beta_2 \ln \text{CostSeed}_i + \beta_3 \ln \text{Costchemical}_i + \\ & \beta_4 \ln \text{CostLabor}_i + \beta_5 \ln \text{Farmsize\_sq}_i + \beta_6 (\ln \text{CostSeed\_sq})_i + \beta_7 (\ln \text{Costchemical\_sq})_i + \\ & \beta_8 (\ln \text{CostLabor\_sq})_i + \beta_9 (\ln \text{HoursLab})_i + \beta_{10} \ln \text{FarmsizeCostSeed}_i + \\ & \beta_{11} \ln \text{FarmsizeCostchemical}_i + \beta_{12} \ln \text{FarmsizeCostLabor}_i + \beta_{13} \ln \text{CostSeedCostchemical}_i + \\ & \beta_{14} \ln \text{CostSeedCostLabor}_i + \beta_{15} \ln \text{CostchemicalCostLabor}_i + v_i \end{aligned} \quad (12)$$

### 3.10.3 Multinomial Endogenous Switching Regression: Effects of Rural-Urban Migration on Agricultural Revenue

The third objective of this study is to assess the effect of internal migration on the agricultural revenue of the farm household in the study area. The Multinomial Endogenous Switching Regression model was used to account for endogeneity and estimate distinct agricultural value



productivity functions for households without migrants, households with temporary migrants, and households with permanent migrants, following the work of Wang et al. (2021). Then, after the first step, we have computed the actual and counterfactual agricultural value outcomes. We have assessed the true effect of migration on the agrarian value of the farm household by comparing the expected outcomes. As a key assumption of this model, an instrumental variable was used, which was tested and validated using a falsification test to address the endogeneity that may arise if unobserved factors influence both migration decisions and agricultural value outcomes. As used by Degfachew et al. (2025), a Multinomial Endogenous Switching Regression (MESR) was used to measure this impact.

### Empirical Model

#### ❖ The Migration choice model (Multinomial Logit)

The first stage models the household's choice of migration using a multinomial logit where the options are M=0 (non-migration), M=1 (temporary migration), and M=2 (permanent migration).

Then the probability of the household choosing the state j is expressed as follows:

$$P(M_i = j/Z) = \frac{e^{Z\alpha_j}}{\sum_{k=0}^j e^{Z\alpha_k}} \text{ for } j=0,1,2 \quad (13)$$

Where  $M_i$  is the migration status of household  $i$ ,  $Z_i$  represents the vector of the independent variable, and  $\alpha^j$  is the coefficient for migration category  $j$ . Therefore, by choosing M=0 (non-migration) as the baseline for the model, we have obtained:

For Temporary Migration (M=1)

$$\ln \left( \frac{P(M=1)}{P(M=0)} \right) = \alpha_0^{(1)} + \alpha_1^{(1)} Z_1 + \alpha_2^{(1)} Z_2 + \dots + \alpha_n^{(1)} Z_n + \vartheta_i^1 \quad (14a)$$

$$P(StatutM = 1) = \alpha_0^{(1)} + \alpha_1^{(1)} \text{ AgeHH} + \alpha_2^{(1)} \text{ Hsize} + \alpha_3^{(1)} \text{ NonfarmAct} + \alpha_4^{(1)} \text{ Hdebt} + \alpha_5^{(1)} \text{ AccessCredi} + \alpha_6^{(1)} \text{ AwareMigrat} + \alpha_7^{(1)} \text{ NoAgriEquip} + \alpha_8^{(1)} \text{ RuralUnemploy} + \alpha_9^{(1)} \text{ UrbanEmploy} + \alpha_{10}^{(1)} \text{ FamilyMem} + \alpha_{11}^{(1)} \text{ AgremHH} + \vartheta_i^{(1)} \quad (14b)$$

For Permanent Migration (M=2):

$$\ln \left( \frac{P(M=2)}{P(M=0)} \right) = \alpha_0^{(2)} + \alpha_1^{(2)} Z_1 + \alpha_2^{(2)} Z_2 + \dots + \alpha_n^{(2)} Z_n + \vartheta_i^{(2)} \quad (15a)$$

$$P(StatutM = 2) = \alpha_0^{(2)} + \alpha_1^{(2)} \text{ AgeHH} + \alpha_2^{(2)} \text{ Hsize} + \alpha_3^{(2)} \text{ NonfarmAct} + \alpha_4^{(2)} \text{ Hdebt} + \alpha_5^{(2)} \text{ AccessCredi} + \alpha_6^{(2)} \text{ AwareMigrat} + \alpha_7^{(2)} \text{ NoAgriEquip} + \alpha_8^{(2)} \text{ RuralUnemploy} + \alpha_9^{(2)} \text{ UrbanEmploy} + \alpha_{10}^{(2)} \text{ FamilyMem} + \alpha_{11}^{(2)} \text{ AgremHH} + \vartheta_i^{(2)} \quad (15b)$$

❖ **The Agricultural Value Outcome Equation (Switching Regression)**

The second stage consists of separate agricultural value equations for non-migration, temporary migration, and permanent migration of farm households as follows:

- Regime 1 for M=0 (non-migration in farm households):

$$Y_{0i} = \beta_0 X_{0i} + \varepsilon_{0i} \text{ if } M_i = 0 \quad (16a)$$

$$\ln \text{AgriRev}_i^0 = \beta_0^0 + \beta_1^0 \text{ AgeHH}_i^0 + \beta_2^0 \text{ Hsize}_i^0 + \beta_3^0 \text{ AwerMigrat}_i^0 + \beta_4^0 \text{ NonfarmAct}_i^0 + \beta_5^0 \text{ Hdebt}_i^0 + \beta_6^0 \text{ AccessCredi}_i^0 + \beta_7^0 \text{ NoAgriEquip}_i^0 + \beta_8^0 \text{ RuralUnemploy}_i^0 + \beta_9^0 \text{ UrbanEmploy}_i^0 + \beta_{10}^0 \text{ FamilyMem}_i^0 + \varepsilon_i^0 \text{ if } M_i = 0 \quad (16b)$$

- Regime 2 for M=1 (Temporary migration in farm households):

$$Y_{1i} = \beta_1 X_{1i} + \varepsilon_{1i} \text{ if } M_i = 1 \quad (17a)$$

$$\ln \text{AgriRev}_i^1 = \beta_0^1 + \beta_1^1 \text{ AgeHH}_i^1 + \beta_2^1 \text{ Hsize}_i^1 + \beta_3^1 \text{ AwerMigrat}_i^1 + \beta_4^1 \text{ NonfarmAct}_i^1 + \beta_5^1 \text{ Hdebt}_i^1 + \beta_6^1 \text{ AccessCredi}_i^1 + \beta_7^1 \text{ NoAgriEquip}_i^1 + \beta_8^1 \text{ RuralUnemploy}_i^1 + \beta_9^1 \text{ UrbanEmploy}_i^1 + \beta_{10}^1 \text{ FamilyMem}_i^1 + \varepsilon_i^1 \text{ if } M_i = 1 \quad (17b)$$

- Regime 3 for M=2 (Permanent migration in farm household):

$$Y_{2i} = \beta_2 X_{2i} + \varepsilon_{2i} \text{ if } M_i = 2 \quad (18a)$$

$$\begin{aligned} \ln AgriRev_i^2 = & \beta_0^2 + \beta_1^2 AgeHH_i^2 + \beta_2^2 Hsize_i^2 + \beta_3^2 AwerMigrat_i^2 + \beta_4^2 NonfarmAct_i^2 + \\ & \beta_5^2 Hdebt_i^2 + \beta_6^2 AccessCredi_i^2 + \beta_7^2 NoAgriEquip_i^2 + \beta_8^0 RuralUnemploy_i^2 + \\ & \beta_9^0 UrbanEmploy_i^2 + \beta_{10}^2 FamilyMem_i^2 + \varepsilon_i^2 \text{ if } M_i = 2 \end{aligned} \quad (18b)$$

Where the outcome variable is the agricultural value of the farm household, the Agreement of the head of household is the instrumental variable and  $\varepsilon_i^j$  is the error term. The validity of the IV was tested using the falsification test.

#### ❖ Treatment Effects

The Average Treatment Effect on the Treated (ATT) is the effect of migration decision (temporary or permanent) on the agricultural value of the farm household of those who have migrated members. It measures the increment or decrement of the agricultural value of a farm household due to migration decisions for households with migrants and is specified as follows:

$$ATT = E(Y_i^1 | M = 1) - E(Y_i^0 | M = 1) \text{ for temporary migration} \quad (19a)$$

$$ATT = E(Y_i^2 | M = 2) - E(Y_i^0 | M = 2) \text{ for permanent migration} \quad (19b)$$

Also, to evaluate the effect of migration on untreated (households with migrants), which is Average Treatment Effect on Untreated (ATU), we calculated it as follows:

$$ATU = E(Y_i^1 | M = 0) - E(Y_i^0 | M = 0) \text{ for temporary migration} \quad (20a)$$

$$ATU = E(Y_i^2 | M = 0) - E(Y_i^0 | M = 0) \text{ for permanent migration} \quad (20b)$$

Where  $Y_i^j$  is the Actual agricultural value under migration state j (temporary or permanent),  $Y_i^0$  counterfactual agricultural value if the same household had not migrated, member (households without migrants) observed migration status j, and  $M = 0$  for non-migration decision.



Also, the heterogeneity effect that can arise due to unobservable effects, regardless of the migration decision, has to be taken into account (Degfachew et al., 2025). Therefore, we measure the heterogeneity effect for households with migrants as follows.

$$HE_1 = E(Y_i^1 | M = 1) - E(Y_i^2 | M = 1) \quad (21a)$$

If households with temporary migrants were to have permanent migrants.

$$HE_2 = E(Y_i^2 | M = 2) - E(Y_i^1 | M = 2) \quad (21b)$$

If households with permanent migrants were to have temporary migrants.

### **3.10.4 Multinomial Endogenous Switching Regression: Impacts of Rural-Urban Migration on Household Welfare**

The final objective of this study is to assess the impact of internal migration on the welfare of agricultural households. However, the Multinomial Endogenous Switching Regression model was used to account for endogeneity and estimate distinct welfare functions for non-migrants, temporary migrants, and permanent migrants. Then, by comparing actual and counterfactual welfare outcomes, we have evaluated the true impact of migration on farm household welfare. To address the endogeneity that may arise if unobserved factors influence both migration decisions and welfare outcomes, we have used an instrumental variable, which was tested and validated. So, like used by (Bessie et al., 2024), the Multinomial Endogenous Switching Regression (MESR) was used to measure this impact.

#### **Empirical Model**

##### **❖ The Migration choice model (Multinomial Logit)**

The first stage models the household's choice of migration using a multinomial logit where the options are  $M=0$  (non-migration),  $M=1$  (temporary migration), and  $M=2$  (permanent migration).

Then the probability of the household choosing the state  $j$  is expressed as follows:

$$P(M_i = j/Z) = \frac{e^{Z\alpha_j}}{\sum_{k=0}^j e^{Z\alpha_k}} \text{ for } j=0,1,2 \quad (22)$$

Where  $M_i$  is the migration status of household  $i$ ,  $Z_i$  represents the vector of the independent variable, and  $\alpha^j$  is the coefficient for migration category  $j$ . Therefore, by choosing  $M=0$  (non-migration) as the baseline for the model, we have obtained:

For Temporary Migration ( $M=1$ )

$$\ln\left(\frac{P(M=1)}{P(M=0)}\right) = \alpha_0^{(1)} + \alpha_1^{(1)} Z_1 + \alpha_2^{(1)} Z_2 + \dots + \alpha_n^{(1)} Z_n + \vartheta_i^1 \quad (23a)$$

$$P(StatutM = 1) = \alpha_0^{(1)} + \alpha_1^{(1)} \text{AgeHH} + \alpha_2^{(1)} \text{Hsize} + \alpha_3^{(1)} \text{NonfarmAct} + \alpha_4^{(1)} \text{Hdebt} + \alpha_5^{(1)} \text{AccessCredi} + \alpha_6^{(1)} \text{AwareMigrat} + \alpha_7^{(1)} \text{NoAgriEquip} + \alpha_8^{(1)} \text{RuralUnemploy} + \alpha_9^{(1)} \text{UrbanEmploy} + \alpha_{10}^{(1)} \text{FamilyMem} + \vartheta_i^{(1)} \quad (23b)$$

For Permanent Migration ( $M=2$ ):

$$\ln\left(\frac{P(M=2)}{P(M=0)}\right) = \alpha_0^{(2)} + \alpha_1^{(2)} Z_1 + \alpha_2^{(2)} Z_2 + \dots + \alpha_n^{(2)} Z_n + \vartheta_i^{(2)} \quad (24a)$$

$$P(StatutM = 2) = \alpha_0^{(2)} + \alpha_1^{(2)} \text{AgeHH} + \alpha_2^{(2)} \text{Hsize} + \alpha_3^{(2)} \text{NonfarmAct} + \alpha_4^{(2)} \text{Hdebt} + \alpha_5^{(2)} \text{AccessCredi} + \alpha_6^{(2)} \text{AwareMigrat} + \alpha_7^{(2)} \text{NoAgriEquip} + \alpha_8^{(2)} \text{RuralUnemploy} + \alpha_9^{(2)} \text{UrbanEmploy} + \alpha_{10}^{(2)} \text{FamilyMem} + \vartheta_i^{(2)} \quad (24b)$$

#### ❖ The Welfare Outcome Equation (Switching Regression)

The second stage consists of separate welfare equations for non-migration, temporary migration, and permanent migration of agricultural households as follows:

- Regime 1 for  $M=0$  (non-migration in agricultural households):

$$Y_{0i} = \beta_0 X_{0i} + \varepsilon_{0i} \text{ if } M_i = 0 \quad (25a)$$



$$\begin{aligned} \ln PerCapita\_Incom_i^0 = & \beta_0^0 + \beta_1^0 AgeHH_i^0 + \beta_2^0 Hsize_i^0 + \beta_3^0 AwerMigrat_i^0 + \\ & \beta_4^0 NonfarmAct_i^0 + \beta_5^0 Hdebt_i^0 + \beta_6^0 AccessCredi_i^0 + \beta_7^0 NoAgriEquip_i^0 + \beta_8^0 RuralUnemploy_i^0 + \\ & \beta_9^0 UrbanEmploy_i^0 + \varepsilon_i^0 \text{ if } M_i = 0 \end{aligned} \quad (25b)$$

- Regime 2 for M=1 (Temporary migration in agricultural households):

$$Y_{1i} = \beta_1 X_{1i} + \varepsilon_{1i} \text{ if } M_i = 1 \quad (26a)$$

$$\begin{aligned} \ln PerCapita\_Incom_i^1 = & \beta_0^1 + \beta_1^1 AgeHH_i^1 + \beta_2^1 Hsize_i^1 + \beta_3^1 AwerMigrat_i^1 + \\ & \beta_4^1 NonfarmAct_i^1 + \beta_5^1 Hdebt_i^1 + \beta_6^1 AccessCredi_i^1 + \beta_7^1 NoAgriEquip_i^1 + \beta_8^1 RuralUnemploy_i^1 + \\ & \beta_9^1 UrbanEmploy_i^1 + \varepsilon_i^1 \text{ if } M_i = 1 \end{aligned} \quad (26b)$$

- Regime 3 for M=2 (Permanent migration in agricultural household):

$$Y_{2i} = \beta_2 X_{2i} + \varepsilon_{2i} \text{ if } M_i = 2 \quad (27a)$$

$$\begin{aligned} \ln PerCapita\_Incom_i^2 = & \beta_0^2 + \beta_1^2 AgeHH_i^2 + \beta_2^2 Hsize_i^2 + \beta_3^2 AwerMigrat_i^2 + \\ & \beta_4^2 NonfarmAct_i^2 + \beta_5^2 Hdebt_i^2 + \beta_6^2 AccessCredi_i^2 + \beta_7^2 NoAgriEquip_i^2 + \beta_8^2 RuralUnemploy_i^2 + \\ & \beta_9^2 UrbanEmploy_i^2 + \varepsilon_i^2 \text{ if } M_i = 2 \end{aligned} \quad (27b)$$

Where the outcome variable is the per capita income as the proxy of the household's welfare,

having a family member at the destination was the instrumental variable and  $\varepsilon_i^j$  error term. The validity of the IV was tested using the Sargan and Basman test.

#### ❖ Treatment Effects

The Average Treatment Effect on the Treated (ATT) is the impact of migration decision (temporary or permanent) on the agricultural household welfare of those who have migrated. It measures the increment or decrement of agricultural household welfare due to migration decisions for households with migrants and is specified as follows:

$$ATT = E(Y_i^1 | M = 1) - E(Y_i^0 | M = 1) \text{ for temporary migration} \quad (28a)$$

$$ATT = E(Y_i^2 | M = 2) - E(Y_i^0 | M = 2) \text{ for permanent migration} \quad (28b)$$

Similarly, to see the effect of migration on untreated (non-migrant households), which is Average Treatment Effect on Untreated (ATU), we calculated it as follows:

$$ATU = E(Y_i^1 | M = 0) - E(Y_i^0 | M = 0) \text{ for temporary migration} \quad (29a)$$

$$ATU = E(Y_i^2 | M = 0) - E(Y_i^0 | M = 0) \text{ for permanent migration} \quad (29b)$$

Where  $Y_i^j$  is the Actual welfare under the migration state  $j$  (temporary or permanent),  $Y_i^0$  counterfactual welfare if the same household had not migrated (non-migrant state),  $M = j$  observed migration status  $j$ , and  $M = 0$  for non-migration decision.

Also, the heterogeneity effect that can arise due to unobservable effects, regardless of the migration decision, has to be taken into account. Therefore, we measure the heterogeneity effect for households with migrants as follows.

$$HE_1 = E(Y_i^1 | M = 1) - E(Y_i^2 | M = 1) \quad (30a)$$

if households with temporary migrants were to have permanent migrants.

$$HE_2 = E(Y_i^2 | M = 2) - E(Y_i^1 | M = 2) \quad (30b)$$

if households with permanent migrants were to have temporary migrants.

### 3.11 A priori Expectation of the Variables

Table 3.2 displays the variable's a priori expectation for this investigation. Nonetheless, the following subsection describes the dependent and independent variables.

#### 3.11.1 Dependent Variables

The dependent variable in the first model is the migration status in agricultural households, measured as a categorical variable (non-migration, temporary migration, and permanent migration). Hence, in the study area, a member of an agricultural household is likely to choose one of the migration categories based on certain socioeconomic, demographic, and farm

characteristics, which justify the use of a multinomial logit model to capture the factors influencing the decision to migrate.

In the second model, the dependent variable is the agricultural value productivity of a household involved in migration or not. This variable is continuous and measured as the total value of agricultural output over the total amount of agricultural input.

Lastly, the per capita income of the farm households was used as a measure of household welfare. Then, we examined the effect of participating in rural-urban migration on it using a Multinomial Endogenous Switching Regression for the last two objectives.

### 3.11.2 Independent Variables

**AgeHH:** The variable is measured in years. As the head of the household is advanced in age, the agricultural household's capacity to meet financial needs and feed all its members decreases. Also, older household heads often have larger families, which can increase the economic burden on the family unit (Bitana et al., 2024). Hence, the young members (guys and ladies) might try to find an alternative way to achieve their goals and support their parents by deciding to migrate (Vo, 2024).

**SexHH:** The variable is dummy, which assumes the value “1” if the head of the family is a Male and the value “0” if he/she is a Female. However, the variable is hypothesised to affect the migration of household members if the head of household is male and to have a positive effect if female (Alleluyanatha et al., 2021). This is because the male head of household is expected to need family labour in farming more than the female head of household, due to the farm size covered.

**Hsize:** This refers to the number of people staying together in the same household and depending on the same head of household in all ways, where the size of an agricultural household is seen to be highly positively correlated with the decision to migrate (Kuznetsov, 2022). The larger the size

of the household, the higher the rate of migration in the households due to financial issues and poverty (Ahmed et al., 2024).

**SendingRem:** This variable is binary with the value “1” if the migrated member is sending remittances and the value “0” if not. The first intention of a head of household to allow his member to migrate is that he is relying on the remittance that the member will send as income diversification or a household strategy to cope with the financial situation of the household (Prasertsoong, 2025). This also follows the theory of the new economics of labour migration, which supports the idea of remittance as income diversification for households, where the remittance allows access to healthcare, education of the children, and even to start a business (Khan, 2024). So, the probability of a member migrating and the head of households agreeing will increase due to remittance.

**NonfarmAct:** The variable represents the non-farm activity of an agricultural household. For an agricultural household, having an off-farm activity is the best alternative for earning income that supports the sustainability of the household financially. According to (Duong et al., 2021) Off-farm activities improve income, ensure food security, and contribute to poverty alleviation by keeping the youth in the rural areas. Then, it will moderate the decision of the members to migrate.

**Hdebt:** This refers to the financial situation of the household, whether the household has a debt or not, and it measures binary, where “1” denotes having debt and “0” denotes no. However, this variable is expected to have a positive effect on the migration decision according to the theory of new economic of labour migration. The higher the debt of household, the greater the agreement of the head of household to send a member to an urban area for income diversification (Al-Maruf et al., 2022).





**AccessCredi:** The variable measures whether the household has access to credit to support their activities. Having access to credit is a better opportunity for an agricultural household to manage its financial situation and reduce poverty, which will prevent the young members from leaving the family. Then, it's expected to decrease the probability of participation in migration (FAO et al., 2018).

**RuralUnemploy:** The variable is a dummy, and it measures the availability of jobs in rural areas, which is the most important for the youth in rural areas (Pattanaik, 2025). It's coded "1" if there is a job and "0" if not. This is one of the push factors in the push-pull theory of migration in rural areas (Khan et al., 2023). Therefore, this variable is the most influential positive element of youth migration.

**UrbanEmploy:** This variable represents the availability and sustainability of jobs in the urban area, which is the most attractive factor for the youth. It's denoted "1" if there is a job and "0" if not. Furthermore, it is one of the pull factor elements in the push-pull theory of migration in urban areas (Urbański, 2022). Hence, according to Pattanaik, (2025) the availability of employment in urban areas is also one of the most influential positive factors of internal migration.

**AgremHH:** The variable is dummy and measures the agreement of the head of household with the migrated member. It's coded "1" if the head of household agrees and "0" if not. According to the new economics of labour theory of migration, the entire family agrees to send one member in migration to search for a job and be able to support the family by sending remittances (ZEHRAOUI et al., 2024). It is anticipated that the head of the family's agreement will positively impact migration decisions.

**FamilyMem:** This refers to the social network between the rural household and the urban household. It's denoted "1" if the household or the migrated member has a family member at the



destination of the migration, and “0” if not, which facilitates access to migration information and all the opportunities for jobs in the urban areas (Reja, 2022). Furthermore, this variable is also one of the factors of the theory of new economics of labour migration, where the head of household is convinced that there is one family member at the destination of the migration before agreeing, which is expected to increase the probability of migration in the household, according to Chang & Zhang (2024).

**Farm Size (Land area, ha):** It represents the number of hectares the households cultivate. Then, larger farms are expected to produce higher output value. Land is a core input in agricultural activity, which implies that increasing the amount of land directly increases yield and therefore the farm revenue.

**Cost of Chemical (Value):** The use of chemicals in agricultural production commonly involves the combined application of fertilizer and pesticides to enhance crop production. However, fertilizer is applied to supply essential plant nutrients, which are critical for crop growth, development, and yield formation. Similarly, pesticides are used to protect crops from biotic stresses that adversely affect agricultural productivity. The cost of these chemicals is expected to influence the revenue from agriculture.

**Cost of Seed (Value):** Seed represents the second input after the land in agricultural activity. More and better-quality seed increases yield potential. However, in the production function, seed input should positively affect output and then the farm revenue, but efficiency depends on whether the seed is appropriate.

**Cost of Labour (Value):** As a part of human effort in agricultural production procedure, the time spent in farm is very important, even in modern agriculture. Labour contributes to land preparation,

planting, weeding, and harvesting. So, more labour should increase the output and then the value productivity, but overuse may lower efficiency due to redundant effort.



**Table 3.2: Description and a Priori Expectation of Key Variables**

Variables	Measurement	Multinomial Logit	SFA		MESR	MESR
		Migration Status	Probit	AgrRev	AVP	Household's Welfare
<b>AgeHH</b>	Number of years	+	+	NA	+	+
<b>TotalLivestock</b>	In CFA	-	-	NA	NA	NA
<b>Hsize</b>	Number of persons	+	+	NA	+	-
<b>YearEdu</b>	Years/Education	+/-	+/-	NA	NA	NA
<b>FarmExp</b>	Years/farming	-	-	NA	NA	NA
<b>SexHH</b>	Male=1 and Female=0	+/-	+/-	NA	NA	NA
<b>Boukoumbe_group1</b>	Yes=1 and 0=No	+	+	NA	NA	NA
<b>Materi_group2</b>	Yes=1 and 0=No	-	-	NA	NA	NA
<b>Natitingou_group3</b>	Yes=1 and 0=No	-	-	NA	NA	NA
<b>Pehunco_group4</b>	Yes=1 and 0=No	+	+	NA	NA	NA
<b>SendingRem</b>	Yes=1 and 0=No	+	+	NA	NA	NA
<b>Tmarriage</b>	Mono=1 and Poly=2	+	+	NA	NA	NA
<b>NonfarmAct</b>	Yes=1 and 0=No	-	-	NA	+	+
<b>Hdebt</b>	Yes=1 and 0=No	+	+	NA	-	-
<b>AcessCredi</b>	Yes=1 and 0=No	-	-	NA	+	+
<b>AwareMigrat</b>	Yes=1 and 0=No	+	+	NA	+/-	+/-
<b>NoAgriEquip</b>	Yes=1 and 0=No	+	+	NA	-	-
<b>ClimateEffect</b>	Yes=1 and 0=No	+	+	NA	NA	NA
<b>RuralUnemploy</b>	Yes=1 and 0=No	+	+	NA	-	-
<b>UrbanEmploy</b>	Yes=1 and 0=No	+	+	NA	+	+
<b>AgremHH</b>	Yes=1 and 0=No	+	+	NA	NA	NA
<b>FamilyMem</b>	Yes=1 and 0=No	+	+	NA	-	NA
<b>FarmSize</b>	Ha	NA	NA	+	NA	NA
<b>Cost_Chemical</b>	CFA	NA	NA	-	NA	NA
<b>Cost_Seed</b>	CFA	NA	NA	+	NA	NA
<b>Cost_Labour</b>	CFA	NA	NA	-	NA	NA

Source: Author's hypothesis



## CHAPTER FOUR

### RESULTS AND DISCUSSIONS

#### 4.0 Introduction

This chapter illustrates the results and discussion of the study on the effect of rural-urban migration on agricultural value productivity and household welfare in Northern Benin. The chapter is categorically presented into sections. After outlining the chapter, section 4.2 highlights the descriptive statistics of the heads of household, section 4.3 the descriptive statistics of the migrants' socio-economic and demographic characteristics, and finally, the migration information. Section 4.4 presents the empirical results and discussion on the factors influencing the rural-urban migration in northern Benin using the multinomial logistic regression, while Section 4.5 shows the efficiency level of the farm household with migrants and the farm households without migrants using the stochastic frontier with sample selection. Lastly, Sections 4.6 and 4.7 present the results and discussion of the impact of rural-urban migration on agricultural revenue on one side and on the households' welfare on the other side using the multinomial endogenous switching regression.

#### 4.1 Descriptive Statistics of Socio-Economics of the Respondents

##### 4.1.1 Summary Statistics of Continuous Variables

To validate a statistically significant difference between the continuous variables of households without migrants and households with migrants, a Student's t-test was employed, as used by (Mesfin & Alamirew, 2022.). However, the result of this test is shown in Table 4.1, out of 400 farm households selected in the study area, 154 respondents, representing 38.5%, are households without migrants, as opposed to 246 respondents, representing 61.5%, who are households with migrants, implying that internal migration is a problem faced by the study area.



From Table 4.1 below, the difference between the average age of the heads of the two groups of households is not statistically significant. However, the heads of households without migrants are aged an average of 46.61 years, whereas their counterparts are aged 46.45 on average, implying that households with older heads are more likely to participate in rural-urban migration, which is in line with (Duong et al., 2021).

**Table 4.1: Summary Statistics of Continuous Variables**

Variables	Households without migrants (154)		Households with migrants (246)		Dif.	t-value
	Mean	Std. Err.	Mean	Std. Err.		
Age (years)	46.454	0.575	46.617	0.603	-0.163	-0.183
Year of Education	4.467	0.296	4.276	0.246	0.191	0.489
Household size	5.792	0.128	5.788	0.104	0.003	0.021
Farm Size (Acres)	3.441	0.143	2.979	0.091	0.461	2.848***
Farm Experience	24.474	0.365	24.764	0.293	-0.290	-0.617
Distance_Farm (km)	2.253	0.083	2.597	0.067	-0.344	-3.185***
Households Income()	536,026	27,561.96	418,034.6	12,322.4	117,991.4	4.404***

Source: household survey, 2025. \*\*\*, \*\* and \* means significant at the 1 %, 5 % and 10 % probability levels, respectively.

Talking about education, the statistics have highlighted that the households without migrants are different from the households with migrants, but not statistically significant. However, the heads of households without migrants have an average of 4.46 years of education, while the heads of households with migrants have 4.61 years of education on average. This implies that heads of households with migrants are more likely to understand easily the advantage of sending a family member to the city as an income diversification strategy, which supports the finding of (Wondimagegnhu & Fantahun, 2023).



In terms of household size, there is no statistically significant difference between the two groups of households, and the data have shown that, approximately, the two groups of households have the same average, which is in line with (Mahama, 2013).

According to Gomina et al. (2024), agriculture is the main source of income and employs a good percentage of people in rural areas. Then, the number of acres a household is cultivating shows its level of wealth. According to this, the data has shown a statistically significant difference at 1% level between the farm size of households without migrants and the households with migrants. On average, 3.44 acres are cultivated by a household without migrants, whereas 2.97 acres an average is farmed by a household with migrants. This indicates that having a migrant member is more likely to lead to farm size reduction, which is more likely to reduce agricultural productivity, food availability, and even lead to food insecurity in the study area.

Farm experience, which represents the number of years the household is engaged in agriculture, has shown a slight difference between the two groups, but no statistically significant difference. It highlights that the family with migrants has an average of 24.76 years of experience in farming, whereas the households without migrants have an average of 24.47 years of experience, showing that the households with more farm experience are likely to participate in internal migration, which is consistent with Liu (2017).

From the table, the family with migrants has an average distance of 2.59 km from their residence to the farm, which is a statistically significant difference at 1 % level from the average distance for households without migrants, which is 2.25 km. This indicates that families with a higher distance to the farm are likely more engaged in internal migration in the study area.

The household income, which measures the financial well-being of the household, is the sum of the farm income and the non-farm income in the rural area (Watema et al., 2025). According to



Table 4.1 above, there is a discrepancy between the mean household income of those without migrants and those with migrants, which is statistically significant at 1% level. The data have shown that on average, the average household income of those without migrants is 536,026 CFA, while those with migrants have a mean household income of 418,034.6 CFA, highlighting that households with lower income have a higher probability of participating in rural-urban migration than their counterparts with the highest income.

#### 4.1.2 Summary Statistics of Discrete Variables

As shown in Table 4, 90.09% of the participants, as the heads of households without migrants are males, while 71.1% of the heads of households with migrants are also males. Then, the percentage of male heads of households without migrants is statistically and significantly different from that of their counterparts with migrants, indicating that households without migrants are considerably more likely to be male-headed.

An average of 88.31% of heads of households without migrants are married, whereas an average of 81.30% of heads of households with migrants are married. There is a statistically significant difference between the two types of households in the study area. This implies that the majority of the heads of households who participate in rural-urban migration are married, which supports the finding of (Mahama, 2013).

Also, Table 4.2 highlights that an average of 12.9% of households without migrants have debt, while an average of 36.9% of households with migrants have debt. There is a statistically significant difference between the two groups of households in the study area, indicating that households with financial issues are more likely to participate in rural-urban migration (Eshetu et al., 2023). All these imply that household debt is a driver of moving from the village to the cities in the study area.



Access to credit is a kind of financial support that can alleviate poverty in rural communities. Based on this, the data show that an average of 29.8% of the households without migrant have access to credit, whereas an average of 29.2% of their counterparts have access to credit in the study area. However, the difference is not significant, but it implies that households that have access to credit are less likely to participate in rural-urban migration, which indicates that access to credit in rural areas is likely to decrease the decision to send a family member to the city (Mesfin & Alemu, 2022) .

In a community, indigenous and settler peoples coexist. The data revealed that an average of 68.1% of households without migrants are indigenous, while an average of 75.6% of households with migrants are indigenous. A statistically significant difference exists between the groups in the study area, suggesting that indigenous peoples are more likely to engage in rural-urban migration than settlers.

The main activity in the study area is agriculture, and having access to extension services is likely to increase agricultural production due to the use of agricultural practices. However, the descriptive statistics highlight that an average of 38.3% of households without migrants have access to extension services, whereas an average of 28% of households with migrants have access to extension services. This has shown a statistically significant difference between the households without migrants and their counterparts, implying that families with access to extension services are more likely to get a better yield and have a lower probability of engaging in rural-urban migration, in line with the findings of Konja (2025).

**Table 4.2: Summary Statistics of Discrete Variables**

Variables	Households without migrants (154)		Households with migrants (246)		Dif.	t-value
	Mean	Std. Err.	Mean	Std. Err.		
Sex	0.909	0.023	0.711	0.028	0.197	4.827***
Marital Status	0.883	0.025	0.813	0.024	0.070	1.864**
Household Debt	0.129	0.027	0.369	0.030	-0.240	-5.390***
Access Credit	0.298	0.037	0.292	0.029	0.006	0.128
Status in Community	0.681	0.037	0.756	0.027	-0.074	-1.624**
Extension Services	0.383	0.039	0.280	0.028	0.102	2.148**
Type of Labour	0.383	0.039	0.402	0.031	-0.019	0.383

Source: household survey, 2025. \*\*\*, \*\* and \* means significant at the 1 %, 5 % and 10 % probability levels, respectively.

Commonly in the agriculture field, the rural communities are likely to use family labour or hired labour according to some traits of the households' concerns. As shown in Table 4.2, an average of 38.31% of households without migrants were using hired labour, while an average of 40.24% of households with migrants were using hired labour. However, the difference is not statistically significant, but it indicates that households with migrants are likely to use more hired labour compared to the other group.

#### 4.1.3 Descriptive Statistics of the Migrants in the Study Area

Also, a student t-test was used to investigate whether or not there is a statistically significant discrepancy between the two groups of migrants in the study area, such as temporary migrants and permanent migrants. The result of this test in Table 4.3 indicates that out of 400 farm households interviewed, 246 of them have migrants, where 79 are temporary migrants, and 167 are permanent migrants. This represents 19.45% and 41.75%, respectively, of the respondents.



**Table 4.3: Summary Statistics of migrants**

Variables	Temporary migrants (79)		Permanent migrants (167)		Dif.	t-value
	Mean	Std. Err.	Mean	Std. Err.		
Age	28.582	0.975	26.353	0.563	2.228	2.105**
Sex	0.756	0.048	0.716	0.035	0.039	0.646
Education Status	0.962	0.021	0.952	0.016	0.009	0.350
Agreement of HH	0.835	0.041	0.725	0.034	0.110	1.908*
Family Member	0.734	0.050	0.724	0.034	0.009	0.157
Remittance Income	34,911.39	4767.363	18,035.93	743.725	16,875.46	4.897***

Source: household survey, 2025. \*\*\*, \*\* and \* means significant at the 1 %, 5 % and 10 % probability levels, respectively.

Table 4.3 above shows that the average age of temporary migrants is 28.58 years, whereas the mean age of permanent migrants is 26.35 years. This shows a statistically significant difference at 5% level, indicating that older migrants are more likely to choose temporary migration than permanent migration in the study areas. This may be because temporary migration is a group of circular migration, short-term migration, and seasonal migration (Adams & Kay, 2019).

Concerning sex and the education level of the migrants, there is no evidence of discrepancy between the two types of migration. However, the statistics have shown that male and educated migrants are more likely to choose temporary migration than permanent migration.

The agreement of the head of households and having a family member at the destination are the most important variables in migration studies, according to the new economic theory of labour migration developed by Lee (1986). From this theory, the choice of an individual within a household to move from the village to the cities belongs to the head of household as a strategy to cope with poverty by diversifying the income source. Above all, the head of household makes sure that there is at least one family member at the destination, as the social network facilitates job opportunities for the migrants. Hence, from the Table above, we conclude that household heads



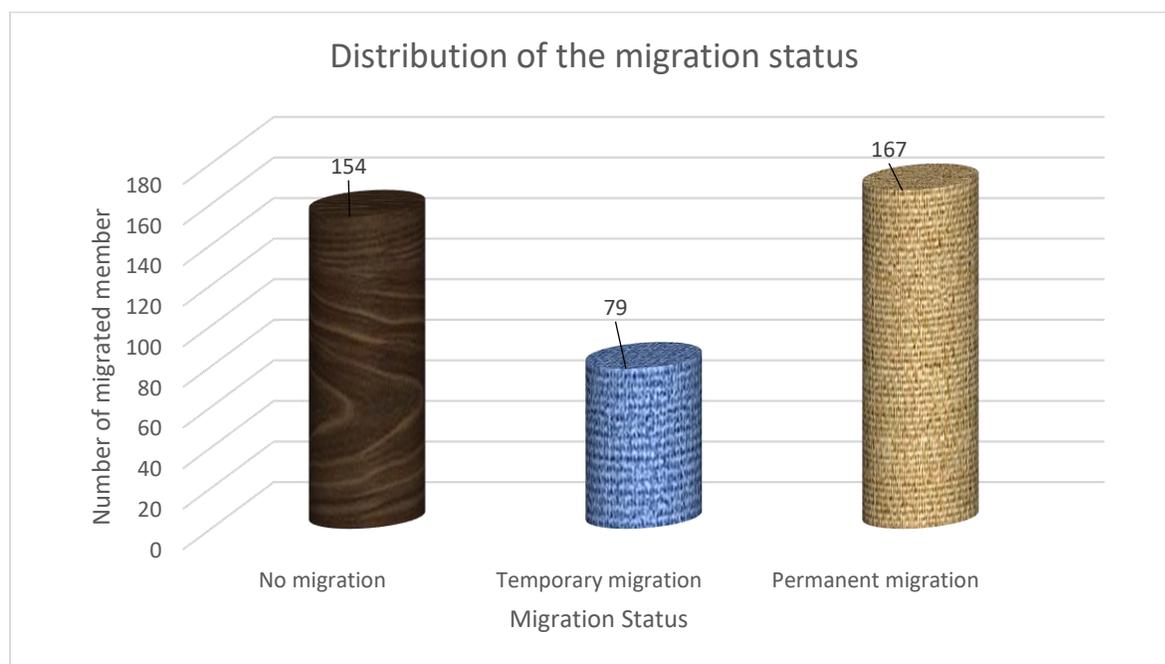
are significantly more likely to approve of temporary migration than permanent migration. This may reflect a preference for migration that doesn't permanently remove household members.

Lastly, there is a statistically significant discrepancy at 1% level between the remittances sent by temporary migrants and permanent migrants. On average, a temporary migrant has sent 34,911.39 CFA to the left-behind family, whereas a permanent migrant has sent 18,035.93 CFA on average. This has shown that families with temporary migrants are more likely to receive the highest remittance income than their counterparts, indicating that the goal of sending migrants to the city is achieved.

## 4.2 Migration's Characteristics

### 4.2.1 Distribution of the Migration Status in the Households

The following histogram describes the distribution of the migrated members according to the status of migration chosen.



**Figure 4.1: Distribution of the Migration**

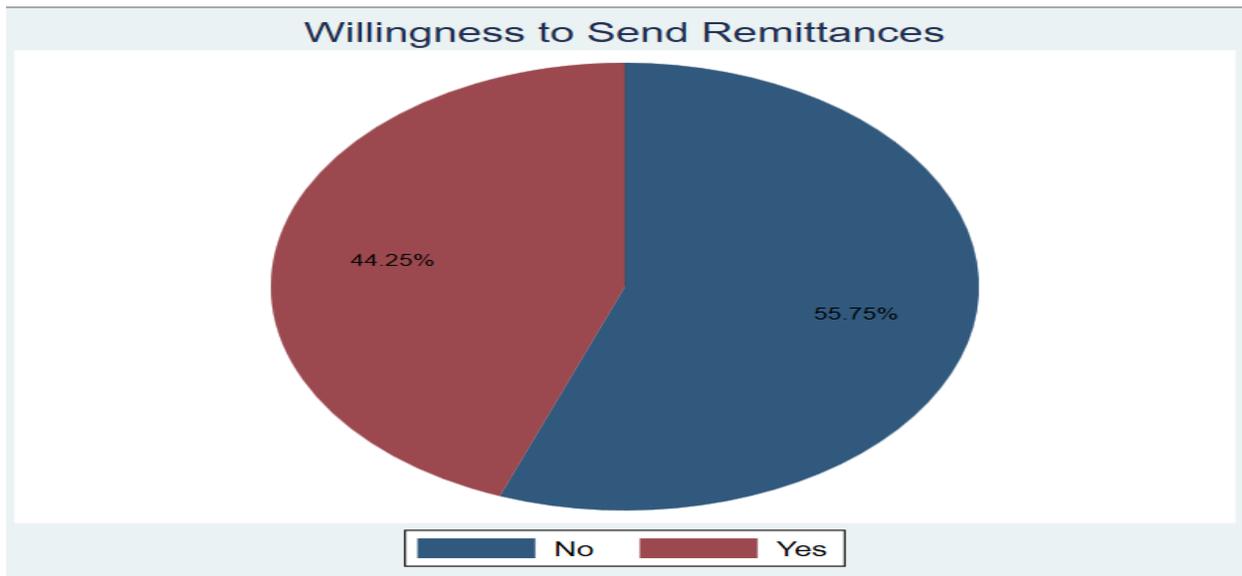
**Source: Household survey, 2025.**



According to Figure 4.1, 154 agricultural households don't participate in rural-urban migration, while 167 of them have their member migrate permanently and 79 temporarily in the study area. However, it should be remembered that permanent migration is when the migrant moves from his/her origin and stays at their new destination for more than one year, and temporary migration is when the migrant returns to their origin very early without doing a year (FAO, 2016). To better understand this concept of internal migration, this study defines the period of permanent migration as more than six months and less than six months for temporary migration. So, we can conclude that permanent migration is the most chosen in the study area, while it might have a strongly negative impact on household agriculture due to the lack of labour for good productivity.

#### 4.2.2 Distribution of the Willingness to Send Remittances by the Migrants

This highlights the number of migrated members from an agricultural household that has sent remittances to the family. The remittance income is seen as a family's strategy to diversify its income and cope with poverty.



**Figure 4.2: Willingness to send remittance**

**Source: Household survey, 2025.**

According to the theory of new economics of labour migration, which is used to back this research, the family agrees to send one member to the urban area because of the remittances that will be received as income diversification. However, out of 245 migrants who have travelled based on the head of households' decision, 146 of them, representing 60%, have really sent remittances to their left behind family. This supports the study conducted by Idun & Mazzucato (2025) in Ghana, who found that 54% of households reported receiving cash remittances from migrants.

#### 4.2.3 Amount of the Remittance Sent by the Migrated Member

Table 4.4 below shows the minimum, maximum, and mean of the amount of remittance sent to the household.

**Table 4.4: Descriptive Statistics of the Amount of Remittance Sent by the Migrants**

Variable	Min	Mean	Max
Amount of remittance	5,000CFA/GHC100	27,689.27CFA/GHC506	300,000CFA/GHC5,480

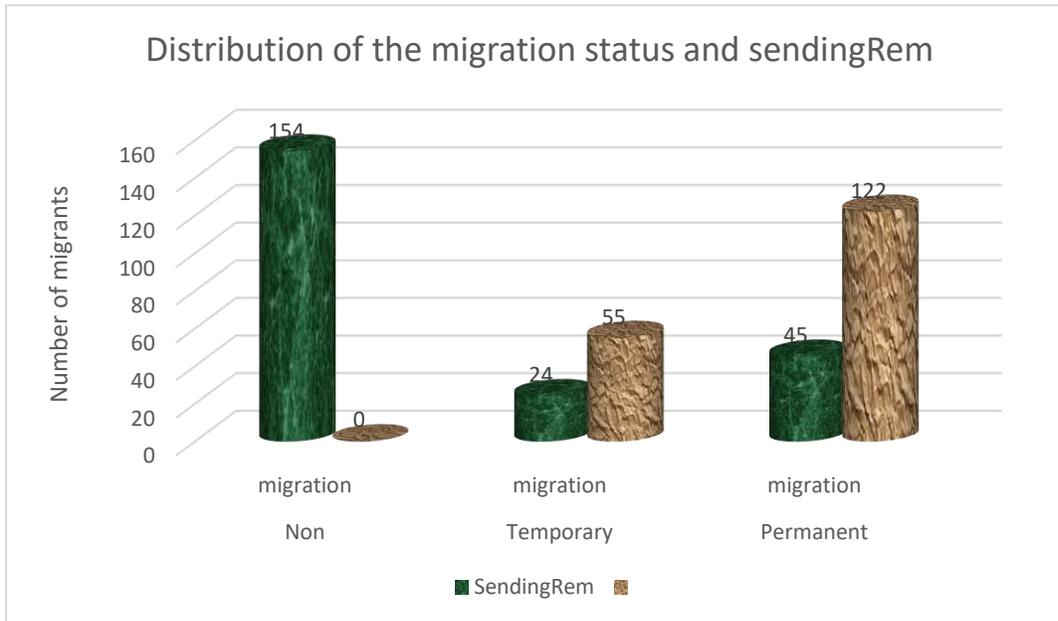
**Source: Household survey, 2025.**

From the table above, the mean of the remittances sent to the family by the migrant member is 27,689.27CFA/GHC100, while the minimum and the maximum are respectively 5,000CFA/GHC506 and 300,000CFA/GHC5,480. However, the maximum amount of remittance is often sent yearly, while the other is sent monthly and is used mostly for the good of the whole family. This result supports the findings of the study conducted by Swai et al. (2025), who found that whatever the frequency of the remittance sent by a migrant, it significantly increases the total household income of the migrant's family, which positively impacts the household's well-being.



#### 4.2.4 Distribution of the Migration Status and the Willingness of the Migrants to Send Remittances

Figure 4.3 shows how many migrants of each migration status are sending remittances to their families left behind.

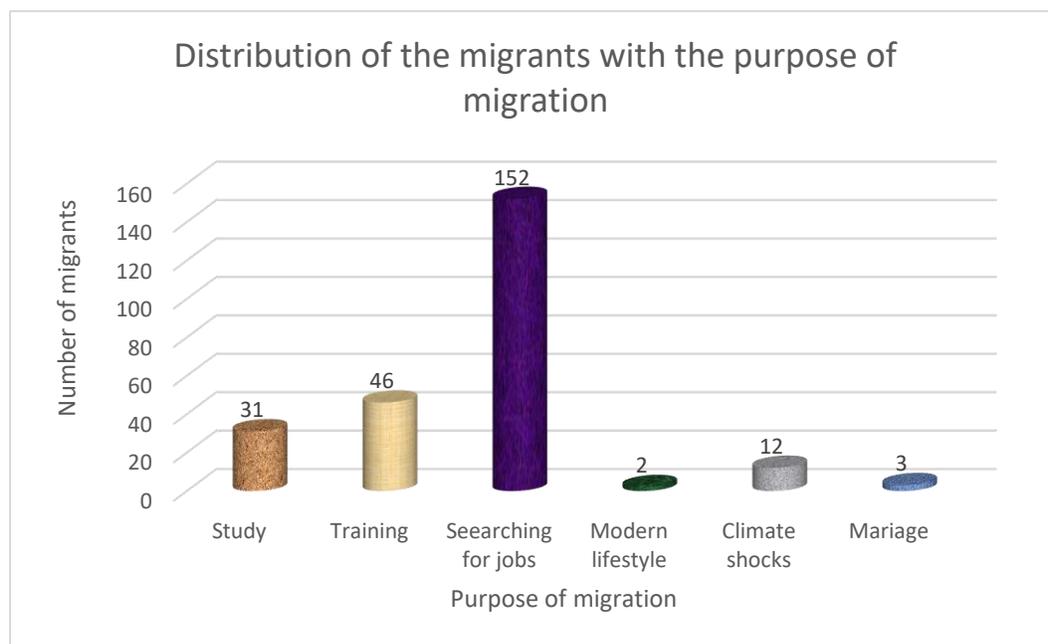


**Figure 4.3: Distribution of the Migration Status and Sending Remittances to the Household**  
Source: household survey, 2025.

This figure illustrates the migration status, specifically the migrant's willingness to send remittances. Then, 154 households don't participate in migration, and don't receive remittances. However, among 79 temporary migrants in the study area, only 55 of them have sent remittances, while 122 migrants have sent remittances among 167 permanent migrants. Therefore, it implies that only 55 and 122 agricultural households, which have respectively temporary and permanent migrants, have experienced the effect of remittances on their incomes and the families' well-being.

#### 4.2.5 Distribution of the Migrants with the Purpose of Migration

In this study, the purpose of migration is the goal for which the migrants have moved from the villages to the cities. However, these purposes are the same as the push factor, which forces youth to leave their rural area, and the pull factor, which attracts youth to the urban area.



**Figure 4.4: Distribution of the Migrants with the Purpose of Migration**

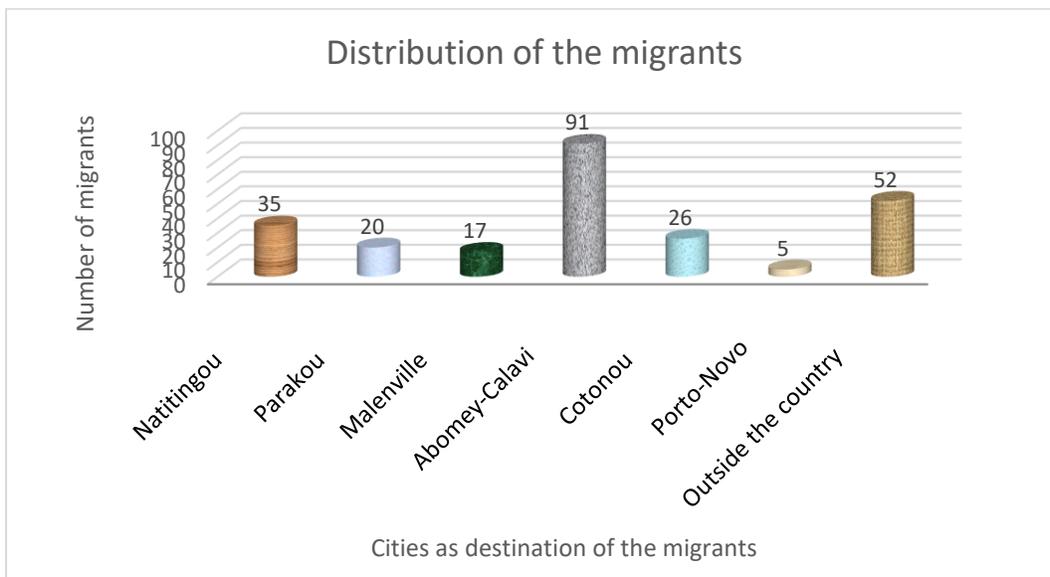
**Source: household survey, 2025.**

From Figure 4.4, most of the migrants, 152, 46, and 31, respectively, have moved to cities to search for jobs, follow training courses, and pursue further studies. At the same time, 12, 3, and 2 of them have left their families respectively because of climate shock, which affects agriculture, marriage for the young ladies, and modern lifestyle for those who like the attractive environment of the cities. This is in line with the findings of Asiimwe & Musinguzi (2024) on the analysis of the push and pull factors affecting migration in Uganda. Also, according to several studies, searching for jobs (availability of employment in the cities) and pursuing study (education) are the most attractive or pull factors of migration (Agza et al., 2023; Nebebe, 2020a). Hence as possible, these

factors would be found in the cities (urban area), and rural-urban migration of youth cannot be stopped.

#### 4.2.6 Distribution of the Migrants to the Cities of Destination

In the manner of migration study, all types of migration have their destination (cities) in the urban area according to the level of the pull factor existing that attracts people to that city. The figure below represents the cities of destination of all migrants in the study area.



**Figure 4.5: Distribution of the Migrants' Destination**

**Source: Household Survey, 2025.**

From this figure, destinations like Abomey-Calavi, Natitingou, and outside the country are the most attractive places for the rural migrants, followed by Cotonou, Parakou, and Malenville. However, it is important to highlight that cities like Natitingou, Parakou, and Malenville are in the northern part of the country. Also, Natitingou is one of the biggest cities in the northern region and part of the study area. On the other side, Abomey-Calavi, Cotonou, and Porto-Novo are the biggest places of destination for the migrants in the south and the most attractive cities in the country. Furthermore, Abomey-Calavi and Cotonou hold almost all the universities, Ministers, Industries,



and good infrastructure of the country, which always attracts students and workers across the country.

### 4.3 Factors Influencing Rural-Urban Migration

In this section, the multinomial framework is used to classify and compare different migration statuses. According to multinomial's methodology, the outcome variable is divided into three categories: non-migration ( $j=0$ ), temporary migration ( $j=1$ ), and permanent migration ( $j=2$ ). So, this regression examines the probability of agricultural households belonging to each category based on the explanatory variables such as socioeconomics and demographic status of the household, following the work of Degfachew et al. (2025). However, the findings highlight significant factors that influence migration decisions in the study area, using the household without migrants as the reference category, and then the likelihood ratio test for the model's validity was confirmed with  $\chi^2 = 573.15$  ( $p\text{-value} < 1\%$ ), implying that the multinomial logit model fits well the data, as obtained by Widaryoko et al. (2025). Also, the pseudo- $R^2 = 68.07$  shows a good fit of the model, suggesting that the covariate used in the model has explained the migration status at 68.07 % in the study area. Additionally, the result of the Hausman test ( $\text{Chi}^2 \{20\} = 0.00$ ;  $p\text{-value} = 1$ , for all alternatives) indicates that the independence of irrelevant alternatives (IIA) was not violated. This suggests that the estimated results were valid, and the multinomial logit results are valid under the IIA assumption that the characteristics of one choice alternative do not impact the relative probability of other alternatives.

The multinomial logistic regression results have offered insights into the relationship between variables and migration outcomes. A variety of independent variables have been found as significant factors of migration in the study area, giving positive and negative directions. Furthermore, we are interested in the magnitude of the effect, which leads us to generate the





marginal effect of the variables. Then, the discussion of the marginal effect of the significant variable is presented as follows, based on Table 4.5.

From the marginal effect, we see that being a male head of household increases the average probability of having a non-migrant in his household by 0.11, while decreasing the probability of permanent migration by 0.12, but does not affect the probability of temporary migration. This shows that in the male head of an agricultural household, the youth do not participate in rural-urban migration compared to the counterfactual female head of an agricultural household due to the need for the family labour on the farm for good productivity. The finding above is not in line with Alleluyanatha et al. (2021), where household with female heads decreases the youth migration in Anambra State.

Regarding the variable age of the household head, it is statistically significant in decreasing the average probability of having non migrant in the household. This implies that as the age of the family head increases, the probability of the youth staying with the family in the rural area decreases by 0.004, but there is no statistically significant effect on either migration status. This result supports the finding of Alleluyanatha et al. (2021) where the age of the migrants' fathers increases the youth migration in Anambra State.

As established by the results, living in the municipalities of the study area increases the average probability of having non-migrants and temporary migrants in the family, but decreases the probability of having permanent migrants. This means in the study area, a migrant in an agricultural household usually migrates temporarily rather than permanently. This allows us to understand that temporary migration is better for an agricultural household in such a way that the migrant will move away from the family during the off-farm period and return for the next season's activities.

**Table 4.5: Marginal Effect from the Multinomial Logit**

Explanatory Variables	Migration Decision					
	Non-Migration		Temporary Migration		Permanent Migration	
	Marginal Effect	Z-value	Marginal Effect	Z-value	Marginal Effect	Z-value
SexHH	0.105** (0.046)	2.260	0.019 (0.051)	0.360	-0.124** (0.061)	-2.040
AgeHH	-0.004* (0.002)	-1.900	-0.001 (0.003)	-0.230	0.004 (0.003)	1.440
Boukoumbe_group1	0.097* (0.055)	1.780	0.271*** (0.086)	3.170	-0.368*** (0.093)	-3.950
Materi_group2	0.097** (0.041)	2.370	0.136* (0.070)	1.940	-0.234*** (0.076)	-3.070
Natitingou_group3	0.085** (0.043)	1.990	0.248*** (0.064)	3.880	-0.333*** (0.071)	-4.720
Pehunco_group4	0.142*** (0.044)	3.250	0.159** (0.067)	2.380	-0.301*** (0.072)	-4.150
SendingRem	-0.294 (20.287)	-0.010	0.005 (4.746)	0.000	0.289 (15.541)	0.020
TotalLivestocks	0.000 (0.000)	1.300	0.000 (0.000)	0.090	-0.000 (0.000)	-0.660
Hsize	-0.020* (0.011)	-1.930	-0.023* (0.014)	-1.660	0.043*** (0.016)	2.740
Tmarriage	0.018 (0.023)	0.780	-0.075 (0.045)	-1.660	0.057 (0.048)	1.170
NonfarmAct	0.016 (0.024)	0.650	0.043 (0.041)	1.050	-0.059 (0.045)	-1.310
YearEdu	0.004 (0.004)	1.170	0.013*** (0.004)	2.960	-0.018*** (0.005)	-3.350
Hdebt	-0.080*** (0.022)	-3.620	0.095** (0.040)	2.360	-0.015 (0.042)	-0.360
AccessCredi	0.009 (0.018)	0.490	-0.054 (0.042)	-1.300	0.045 (0.043)	1.040
AwareMigrat	-0.104*** (0.031)	-3.330	-0.172 (0.130)	-1.320	0.277** (0.134)	2.060
NoAgricEquip	-0.059** (0.026)	-2.240	0.118** (0.055)	2.140	-0.059 (0.058)	-1.010
ClimatEffect	-0.056** (0.028)	2.000	-0.021 (0.049)	-0.440	0.077 (0.053)	1.450
RuralUnemploy	-0.055** (0.022)	-2.490	0.183*** (0.061)	3.010	-0.129 (0.062)	-2.070
Urbanemploy	-0.063*** (0.019)	-3.260	0.019 (0.044)	0.420	0.044 (0.046)	0.970
FarmExp	0.002 (0.003)	0.870	0.002 (0.004)	0.580	-0.005 (0.004)	-1.030
AgremHH	-0.079*** (0.028)	-2.780	0.126*** (0.044)	2.840	-0.047 (0.048)	-0.970
FamilyMen	-0.150*** (0.032)	-4.740	0.112*** (0.041)	2.760	0.038 (0.046)	0.830

**Source: Author's Analysis from Household Survey, 2025.**

\*\*\*, \*\* and \* means significant at the 1 %, 5 % and 10 % probability levels, respectively. The numbers in the parentheses are standard errors.





As shown in the result, the number of members in a household is also statistically significant in migration decisions. Then, a larger agricultural household has, respectively, the probability of non-migration and temporary migration decreased by 0.020 and 0.023, but the probability of permanent migration is increased by 0.043. It means that in a larger household, the family used to migrate permanently. This confirms the finding of Agza et al. (2023), which reveals that family size is a factor driving rural-urban migration in Ethiopia.

The level of education of the household head plays an important role in the decision of family members' migration. According to the result, as the year of education of the household head increases, the probability of the migrant choosing temporary migration also increases by 0.013, while the probability of choosing permanent migration decreases by 0.018, but does not affect non-migration. The above finding is in line with Alleluyanatha et al. (2021), which found that the level of education of the household head instigates migration decisions among family members.

Regarding the household debt, which represents the financial situation of the household, it decreases the probability of the household having a non-migration status by 0.080 and increases the probability of choosing temporary migration by about 0.095, but doesn't affect permanent migration. This shows that a migrant in an agricultural household in a debt situation will choose a temporary status rather than a permanent one with a 95% chance. This result supports the finding of Nupur & Dutta (2024) in India, where Household debt also triggers short-term migration from poor households.

The variable *AwareMigrat*, which measures the access to migration information in the household, significantly decreases the chance of having an agricultural household without a migrant by 0.104 while increasing the chance of choosing permanent migration rather than temporary about 0.28. It implies that most of the households that have access to migration information usually have a

migrant who has travelled for a long time. This is in line with the findings of Tamirat et al. (2024), where access to migration information significantly increases the probability of outmigration of household members.

In an agricultural rural area, the agricultural equipment is a mechanization factor that is very important to switch some of the manual work to machine work. This variable significantly affects whether a household has a migrant or not. Based on the result above, it decreases the probability of a household having a non-migrant family member by about 0.054 and increases the chance of migrating temporarily rather than permanently by 0.118.

Also in agricultural production, some factors are internal and external to the household. However, one of the external factors is climate change, which is a worldwide issue in agriculture. In this study, the climate change effect significantly decreases the chance of having an agricultural household without migrants by about 0.056. This means that in the study area, the climate change effect is likely to increase the probability of rural-urban migration. This is in line with the findings of Fernández et al. (2024), revealing that climatic shocks, which negatively affect economic security, are significant drivers of migration in Bangladesh.

The most important variables in the out-migration research are rural unemployment and urban employment. These variables have been captured in this study, and they are statistically significant. Then, based on the results, rural unemployment and urban employment decrease the probability of the household having their migrant members stay in the rural area, respectively, by 0.055 and 0.063, while only rural unemployment increases the chance of migration being temporary rather than permanent. But urban employment is not statistically significant for both migration statuses. The results above agree with Asimwe & Musinguzi, (2024), showing that unemployment is a push factor, and job attractiveness is a pull factor that drives migration in Uganda.

Lastly, the agreement of the household head and the social network (Family member at the destination place) has a significant effect on the probability of migration in the study area. However, these variables have reduced the chance of the household choosing non-migration status by 0.078 and 0.150 while increasing the probability of having temporary migrants by about 0.126 and 0.112, respectively. But they do not affect permanent migration. It means that in the study area, the household head used to prefer temporary migration over permanent migration. This result supports Attah-Otu et al. (2024) findings, which reveal that migration decision is a rational choice made collectively at the household level, considering socio-economic outcomes. Additionally, social networks (such as family members at the destination place) facilitate migration arrangements and job connections.

To conclude this discussion, we estimated the marginal effect of all the explanatory variables on the various migration statuses. This represents the average predicted probability of the migrants to choose each category of migration.

**Table 4.6: Average Predicted Probability**

Categories	Margins	Standard Error	Z-value
Non-migration	0.39***	(0.007)	52.70
Temporary migration	0.20***	(0.016)	12.21
Permanent migration	0.42***	(0.016)	24.63

**Source: Own survey result, 2025.**

\*\*\*, \*\* and \* means significant at the 1 %, 5 % and 10 % probability levels, respectively. The numbers in the parentheses are standard errors.

From the result above, we can see that all the probabilities are statistically significant at 1%, showing the level of occurrence for each of them. However, the probabilities for the migrant to stay in the rural area with their family and migrate permanently are quite close, while the probability of choosing temporary migration is low. This implies that if the migrants were to

migrate, they would choose permanent migration, which supports the result of Saraswati et al. (2025) in Indonesia, where students prefer permanent migration over circular migration.

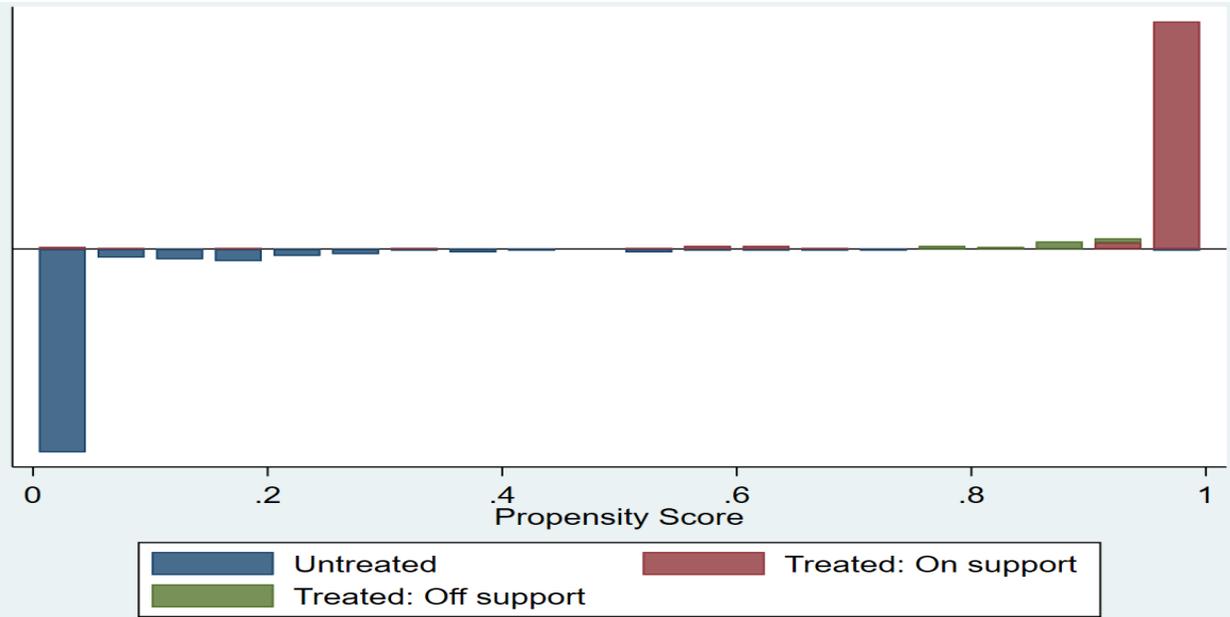
#### **4.4 Efficiency Level of the Farm Households with Migrants and Farm Households without Migrants**

To determine the efficiency level of the farm households with migrants and farm households without migrants in the study area, the stochastic production frontier with sample selection was used, which is the parametric approach of estimating the technical efficiency in agricultural production according to Chogou et al. (2017).

##### **4.4.1 Controlling for unobservable bias in Stochastic Frontier**

To address unobservable selection bias arising from the migration decision, we first model migration with a probit model to generate propensity scores that are subsequently used to match households and control for differences in observable characteristics before estimating the stochastic frontier. This approach is consistent with recent empirical work in agricultural efficiency analysis, where the first stage probit and propensity score matching are used to mitigate selection bias before stochastic frontier estimation (Prah *et al.*, 2025). However, following Abdulai *et al.* (2025), common support was imposed, and the propensity scores were matched using nearest neighbour with replacement of 1 matched per actual to the counterfactual within a calliper distance of 0.05 to control observable bias. Figure 4.6 below shows the region of common support of the propensity score, which ranges from  $2.68e-13$  to 1. Also, in the process, the propensity scores of migrants outside the common support interval were excluded from the matching procedure.





**Figure 4.6: Distribution of propensity score and the Region of Common Support**

Furthermore, the standardised mean difference of the covariates between farm households with migrants and those without migrants is presented as follows, showing a significant observable bias.

**Table 4.7: Standardized mean difference of covariates between farm households with migrants and farm households without migrants before and after matching**

Variables	Unmatched Matched	Sample Mean		%bias	% Reduce bias	t-test	V(T)/V(C)
		Treated	Control				
SexHH	U	0.711	0.909	-52.000	-227.700	-4.830***	-
	M	0.704	0.057	170.300		19.170***	-
Hsize	U	5.789	5.792	-0.200	-5834.500	-0.020	1.060
	M	5.817	6.030	-13.100		-1.930**	29.84*
Tmarriage	U	1.504	1.617	-22.800	-304.700	-2.210***	6.01*
	M	1.5	1.044	92.300		12.790***	1.76*
AgeHH	U	46.618	46.455	1.9	-1885.700	0.180	1.76*
	M	46.535	43.291	38.700		5.060***	17.26*
NonfarmAct	U	0.337	0.208	29.300	-373.000	2.810***	.
	M	0.348	0.961	-138.800		-18.040***	-
YearEdu	U	4.276	4.468	-5.100	-1635.900	-0.490	1.100
	M	4.391	7.709	-87.800		-12.120***	7.98*
Hdebt	U	0.370	0.130	57.600	-137.300	5.390***	-
	M	0.383	0.952	-136.600		-16.240***	-
AccessCredi	U	0.293	0.299	-1.300	11025.4	-0.130	.
	M	0.296	0.965	-146.3-		-20.600***	.
AwareMigrat	U	0.988	0.305	203.300	100.000	22.210***	.
	M	0.987	0.987	0		0.000	1.000
ClimatEffect	U	0.862	0.870	-2.400	-1411.600	-0.240	-
	M	0.874	1	-36.900		-5.750***	-

RuralUnemploy	U	0.862	0.584	65.000	56.100	6.590***	.
	M	0.857	0.978	-28.500		-4.850***	-
UrbanEmploy	U	0.805	0.091	205.700	81.100	19.340***	-
	M	0.826	0.961	-38.800		-4.790***	-
FarmExp	U	24.764	24.474	6.4	-1416.200	0.620	1.030
	M	24.743	20.343	96.300		13.240***	4.34*
AgremHH	U	0.760	0.377	83.800	-93.800	8.270***	-
	M	0.778	0.035	162.400		24.780***	-
FamilyMem	U	0.728	0.078	176.400	-13.800	16.310***	-
	M	0.752	0.013	200.700		25.060***	-

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

#### 4.4.2 Determinants of the Migration Decision of a Member in a Farm Household

Prior to the stochastic frontier that corrects for selection bias, the propensity score matching model was used to estimate the determinants of migration decision among the members of a farm household following Bravo-Ureta *et al.* (2012). However, the determinants were estimated before and after the matching, and the results are presented as follows. For this, the likelihood ratio chi2 test was statistically significant for both estimations, suggesting the joint significance of the explanatory variables in determining the migration decision.

The results from these estimations have confirmed the determinant of migration decisions as the first objective of this study has found. Then, on the negative side, variables such as the sex of the head of households and access to credit are statistically significant, indicating a decrease in the probability of having a migrant member. This aligns with the study conducted by Katsaiti & Khraiche (2023), who found that access to credit is negatively associated with migration intention.

Conversely, variables such as household debt, awareness of migration, the effect of climate change, rural unemployment, urban employment, approval by the head of households, and having a relative family member at the destination are all positively correlated, suggesting an increase in the probability of a family member migrating.

**Table 4.8: Results of migration selection model for the stochastic frontier**

Variables	Before Matching		After Matching	
	Coefficient	Std. Err	Coefficient	Std. Err
SexHH	-1.733***	0.608	-1.62**	0.64
Hsize	0.135	0.145	0.141	0.15
Tmarriage	0.118	0.472	0.158	0.504
AgeHH	0.009	0.032	0.014	0.033
NonfarmAct	-0.685	0.447	-0.558	0.466
YearEdu	-0.014	0.052	0.015	0.054
Hdebt	2.156***	0.560	1.907***	0.555
AccessCredi	-0.957**	0.479	-0.88*	0.478
AwareMigrat	2.321***	0.477	2.115***	0.481
ClimatEffect	1.166**	0.520	1.35**	0.591
RuralUnemploy	0.822*	0.452	0.77*	0.465
UrbanEmploy	2.400***	0.435	2.231***	0.425
FarmExp	0.038	0.045	0.022	0.05
AgremHH	1.978***	0.432	1.866***	0.422
FamilyMem	3.105***	0.556	2.832***	0.514
cons	-6.978***	1.922	-7.023***	2.031
LR chi2(15)	459.87***		449.94***	
Pseudo R2	0.8625		0.8700	
Log likelihood	-36.649		-33.625	
Observation	400		384	

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

This is consistent with the findings of Orkoh *et al.* (2025) and Kanga *et al.* (2024), who have found that push factors, such as unemployment, low wages, financial instability, and debt in rural areas, while pull factors, including better job opportunities, and the presence of relatives in destination areas, are the drivers of rural migration.

#### 4.4.3 Efficiency Level among the Farm Households in the Migration Context

To evaluate the level of efficiency between farm households with migrants and farm households without migrants in agricultural production, this study uses the stochastic frontier analysis. First of all, the AIC, BIC and LR chi2 tests were all used to choose the appropriate production function, and the results are presented in the table below.



**Table 4.9: Evidence for the choice of Translog PF over Cobb-Douglas PF**

Choice of PF	AIC	BIC	LR Test
Cobb-Douglas PF	601.943	621.901	88.38***
Translog PF	548.126	607.998	

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Based on the test, the value of 548.126 for translog is smaller than 601.043 for Cobb-Douglas. Also, the LR chi2 of 88.38 is statistically significant at 1% level. These tow evidence validate that the Translog production function fits the data better than Cobb-Douglas. This is consistent with the finding of Azumah et al. (2019) in relation to the choice of functional form.

Furthermore, knowing the appropriate production function, both the conventional production function and the sample selection production function were estimated using a stochastic frontier and the results are presented in the table below. However, the correlation coefficient, which measures the presence of selection bias, is different from zero for both farm households with migrants and farm households without migrants, but not statistically significant. This suggests that there is weak evidence of the correlation between unobservable variables in the migration decision and the noise in the frontier. This is consistent with some evidence studies conducted in China by Ren *et al.* (2023) and in Ghana by Prah *et al.* (2025), who have found no evidence of large bias from unobserved selection in migration and efficiency studies.

In addition, the coefficient of  $\sigma_u$  is not statistically significant, while the  $\sigma_v$  is significant at 1% level for farm households with migrants under the sample selection, implying that the difference between the observed farm income and frontier is associated with the disturbance noise, instead of inefficiency. This corroborate with finding of Kodua *et al.* (2022), who found that the inefficiency term ( $\sigma_u$ ) is not significant, implying that inefficiency effects are negligible in explaining deviations from the frontier, and that observed variation is mostly



explained by the symmetric noise component ( $\sigma_v$ ) rather than a one-sided inefficiency term. Furthermore, the coefficient of  $\sigma_u$  is statistically significant, whereas  $\sigma_v$  is not for the farm households without migrants under the sample selection. This suggests that the discrepancy between the achieved farm income and the frontier is related to the inefficiency of the farm household, which align with Ntakirutimana *et al.* (2025), who discover that technical inefficiency accounts for a large and statistically significant share of the variation in output, with the inefficiency component ( $\sigma_u$ ) dominating the stochastic noise ( $\sigma_v$ ) in sugarcane production in Rwanda.

Concerning the revenue generated from agriculture by farm households in the study area, the estimated parameters from the stochastic frontier with sample selection have highlighted the inputs that influence this revenue, with some being positive and some negative.

On the negative side, the single inputs such as the cost of chemical is significant for farm households with migrant and the cost of labour used is statistically significant for the farm household without migrant, indicating a decrease in the agricultural revenue, *ceteris paribus*.

Conversely, the cost of seed and the cost of chemical are significant and positive as single inputs for only farm households without migrants, suggesting an increase in the agricultural revenue holding other variables constant. About the squared term of the inputs, only the cost of seed and the cost of chemical are positive and statistically significant for farm households with migrants, implying that continuously increasing these inputs will lead to an increase in the output, holding other inputs constant.



Table 4.10: Estimated Parameters from the Stochastic Frontier with Sample Selection

VARIABLES (AgriRevenu)	Conventional SPF			Sample Selection SPF	
	Pooled	Migrants	N-Migrants	Migrants	N-Migrants
lnFarmsize	0.202 (0.216)	0.0173 (0.330)	0.261 (0.421)	0.103 (0.340)	0.219 (0.408)
lnCostSeed	0.0171 (0.0131)	0.0146 (0.0139)	0.179 (0.109)	0.0140 (0.0141)	0.168** (0.0759)
lnCostchemical	-0.0307** (0.0120)	-0.0512*** (0.0160)	0.176 (0.109)	-0.0481*** (0.0161)	0.156* (0.0909)
lnCostLabor	-0.0197** (0.00791)	-0.0134 (0.0126)	-0.0669*** (0.0172)	-0.0165 (0.0130)	-0.0669*** (0.0144)
lnFarmsize_sq	-0.0452 (0.104)	-0.124 (0.151)	-0.0671 (0.126)	-0.136 (0.155)	-0.0796 (0.0885)
lnCostSeed_sq	0.00946*** (0.00313)	0.0120*** (0.00427)	-0.00292 (0.00862)	0.0114** (0.00442)	-0.00261 (0.00715)
lnCostchemical_sq	0.00797*** (0.00263)	0.0154*** (0.00280)	0.00283 (0.00561)	0.0150*** (0.00292)	0.00311 (0.00356)
lnCostLabor_sq	0.00212 (0.00439)	0.00740 (0.00605)	-0.00258 (0.00554)	0.00456 (0.00642)	-0.00208 (0.00491)
lnFarmsizeCostSeed	-0.00501 (0.0110)	-0.00130 (0.0105)	0.0287 (0.0350)	-0.000797 (0.0107)	0.0282 (0.0335)
lnFarmsizeCostchemical	0.0266** (0.0104)	0.0513*** (0.0139)	0.00818 (0.0278)	0.0457*** (0.0145)	0.0165 (0.0282)
lnFarmsizeCostLabor	0.00704 (0.00634)	0.000781 (0.00947)	0.0363*** (0.0131)	0.00212 (0.00963)	0.0376*** (0.00666)
lnCostSeedCostchemical	0.000632 (0.000714)	0.00110 (0.000921)	-0.0195 (0.0126)	0.000955 (0.000985)	-0.0182* (0.0102)
lnCostSeedCostLabor	-0.000225 (0.000330)	0.000129 (0.000468)	-0.000857 (0.000817)	0.000174 (0.000488)	-0.000971*** (0.000376)
lnCostchemicalCostLabor	0.000349 (0.000479)	0.000193 (0.000708)	0.00172* (0.000932)	0.000526 (0.000737)	0.00145 (0.000880)
Constant	11.29*** (0.545)	9.561*** (0.821)	11.24*** (1.362)	9.755*** (1.197)	11.30*** (1.206)
Lambda	4.441*** (0.099)	0.026 (0.548)	27.378*** (0.084)	-	-
Variance ( $\sigma^2$ )	0.612*** (0.07)	0.208*** (0.020)	0.577*** (0.068)	-	-
Sigma (u)	-	-	-	0.038 (1.160)	0.765*** (0.045)
Sigma (v)	-	-	-	0.456*** (0.041)	0.023 (0.019)
Selectivity Bias $\rho(w, v)$	-	-	-	0.141 (0.212)	0.0194 (0.123)
Log likelihood	-257.169	-156.138	-72.328	-146.439	-72.176
Observations	400	246	154	230	154

Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1



The second interaction of the Translog production function, which measures the complementarity or substitutability of the inputs, has some of the statistically significant coefficients. However, for the farm household with migrants, only Farmsize\*Costchemical is positive and statistically significant, showing that these inputs are complementary. Conversely, for the farm household without migrant, the coefficient of Farmsize\*CostLabor is positive and statistically significant, suggesting complementary inputs, while the coefficient of CostSeed\*CostLabor is negative and statistically significant, indicating substitute inputs.

Additionally, the efficiency level of farm households with migrant and farm households without migrants was estimated, and the results are presented in the table below.

**Table 4.11: Mean efficiency across the subsample**

TE Scores	Conventional PF			Sample Selection PF	
	Pooled	Migrants	Non-Migrants	Migrants	Non-Migrants
Min	0.165	0.989	0.146	0.967	0.143
<b>Mean</b>	<b>0.585</b>	<b>0.990</b>	<b>0.603</b>	<b>0.969</b>	<b>0.600</b>
Max	0.937	0.990	0.977	0.972	0.975
Observation	400	246	154	230	154

The insight from this table shows that farm households with migrants initially appear nearly fully efficient under the conventional production frontier (0.99), while farm households without migrant have a much lower efficiency level (0.60). However, after correcting for selection bias arising from migration decision, the efficiency level of the farm household has declined slightly (0.97), indicating that unobservable factors related to migration decision have inflated the conventional estimates. Conversely, the efficiency level of the farm household without migrant has remained



around 0.60 across models, implying persistent inefficiency. These results corroborate recent findings by Prah *et al.* (2025), who have shown that sample selection correcting reduces the advantage of farm households in efficiency estimation, underscoring the necessity of addressing self-selection in stochastic frontier analysis.

#### 4.5 Effect of Rural-Urban Migration on Agricultural Revenue

To estimate the effect of rural-urban migration on agricultural revenue in the study area, the multinomial endogenous switching regression was employed, as used by Wang *et al.* (2021), allowing for the measurement of the effect on households with migrants and their counterparts if they were to have migrants. However, as the rule of this model, an instrumental variable has to be used, which has to be correlated with the treatment variable (migration status) and not correlated with the outcome variable (agricultural revenue).

**Table 4.12: Average treatment effect of rural-urban migration on agricultural revenue**

Migration Status	Migration Decision		ATT	% Change
	Migration	No-Migration		
	Actual	Counterfactual		
	<b>Average Treatment on Treated</b>			
Temporary	0.748 (0.038)	0.136 (0.016)	0.612 (0.043) ***	450
Permanent	0.860 (0.018)	0.155 (0.013)	0.705 (0.025) ***	454
	<b>Average Treatment on Untreated</b>		<b>ATU</b>	
Temporary	0.828 (0.054)	0.811 (0.020)	0.017 (0.059)	2.09
Permanent	1.011 (0.021)	0.811 (0.020)	0.199 (0.026) ***	24.53
	<b>Heterogeneity Effect</b>		<b>HE</b>	
Temporary	0.748 (0.038)	0.772 (0.026)	-0.023 (0.045)	-2.97
Permanent	0.860 (0.018)	0.690 (0.025)	0.169 (0.033) ***	24.49

Source: Own survey result, 2025.

\*\*\*, \*\* and \* means significant at the 1 %, 5 % and 10 % probability levels, respectively. The numbers in the parentheses are standard errors.

The result of the test has shown that the variable agreement of the head of the family before migrating is correlated with the migration status, and is statistically significant at 1 %. While it is





not correlated with any of the outcome equations across the migration status, suggesting that the variable agreement is valid as an instrumental variable for this model, following Eshetu et al. (2023b). The following table shows the findings of our comparison of the mean expected value of agricultural revenue across the various migration types using multinomial endogenous switching regression.

The results from Table 4.12 above show that families with temporary migrants earn an average of 0.748 CFA of agricultural revenue, whereas those who remain earn an average of 0.136 CFA of agricultural value productivity. This results in an ATT of 0.612 CFA, which is statistically significant at the 1% level and represents a 450% increase in agricultural revenue. In the case of households with permanent migrants, they have earned an average of 0.860 of agricultural revenue, while those that do not have permanent migrants have earned an average of 0.155 CFA, yielding an ATT of 0.705 CFA, which is statistically significant at 1 %, leading to a 454 % increase in the agricultural revenue. These results show an average treatment effect on treated for permanent migration, slightly greater than that of temporary migration. This implies that the families with permanent migrants are likely to earn more agricultural revenue than their counterparts, confirming that the living expenditure of the permanent migrants has been covered by the households, and they have to farm more. This is in line with the findings of Adaku (2013), where households with temporary migrants face a decrease in agricultural revenue compared to households with permanent migrants in Ghana. It also supports the result of Paudel et al. (2025), who have found that internal migration negatively affects agricultural productivity and profitability due to labour shortages in Nepal.

*“According to one head of family with permanent migrants, all the cost of living for their migrants is covered by them since the purpose of the migration is education or training. This increases the*

*expenditure of the households who have to farm more to be able to earn more money and face the household expenditure, and the migrants.”*

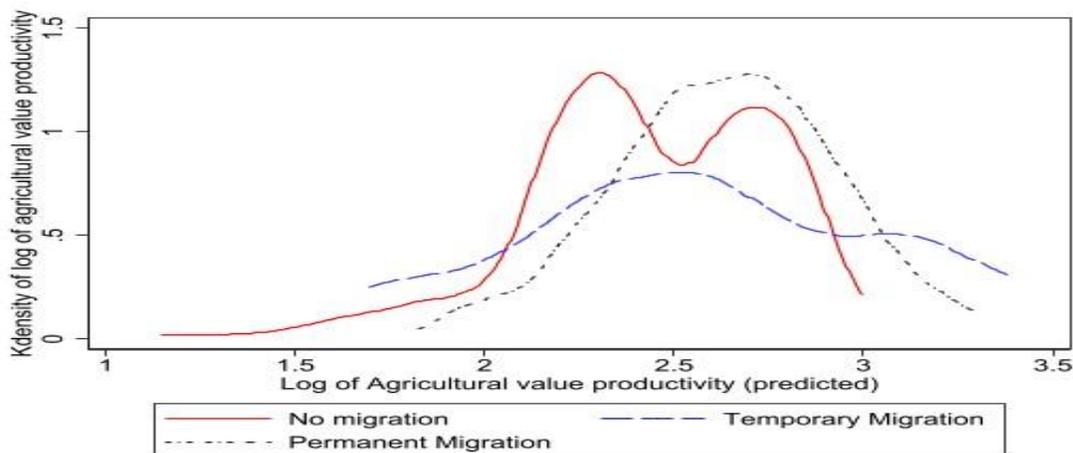
Additionally, the data confirm this by showing that the mean farm size of households with permanent migrants is 3 hectares, with a maximum of 9 hectares, while the mean farm size of households with temporary migrants is 2.89 hectares, with a maximum of 5 hectares. This implies that households with permanent migrants are likely to increase the farm size due to the rise in household expenditure.

On the other side, the results indicate that households without migrants have earned an average of 0.811 CFA of agricultural revenue, while they would have earned an average of 0.828 CFA if they were to have temporary migrants, resulting in an average treatment effect on untreated households of 0.017 CFA, increasing the agricultural revenue by 2.09 %. This suggests that having temporary migrants has not had much impact on the agricultural revenue of the households in the study area. Nevertheless, the households without migrants would have gained an average of 1.011 CFA if they were to have permanent migrants, which generated an average treatment effect on the untreated of 0.199 CFA, increasing the agricultural revenue by 24.53 %. This suggests that in the study area, having permanent migrants is likely to make the households work more on the farm, which significantly increases their agricultural revenue.

The findings of this research have also provided valuable insights into the heterogeneity effect of migration on the agricultural revenue of farm households in the study. The results have shown that only permanent migration has a significant impact on the outcome, implying that if the choices were to be exchanged, permanent migration would have been more beneficial for households with temporary migrants and households without migrants who were to engage in migration.



Additionally, Figure 4.7 below presents the kernel density estimation of the log of agricultural revenue (predicted) across three migration categories.

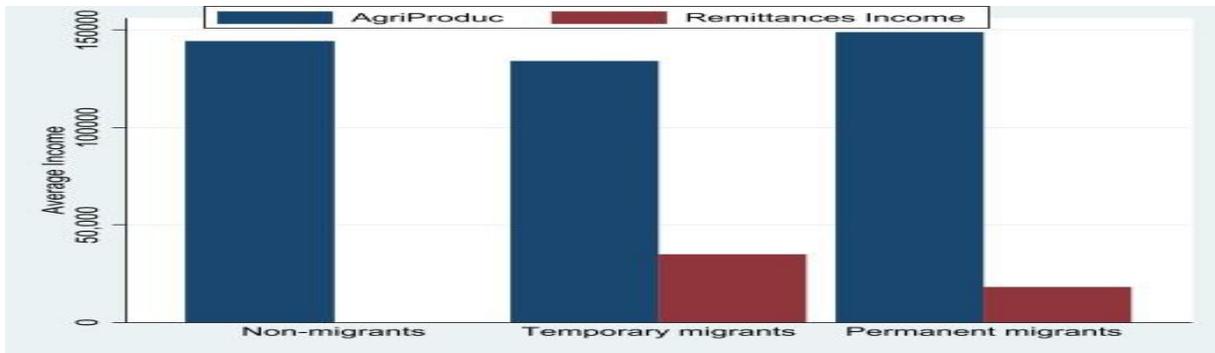


**Figure 4.7: Kernel density distribution of agricultural revenue**

This graph compares the distribution of agricultural revenue (in log form) across households grouped by migration status. However, it highlights that the permanent migration curve has a strong peak and is shifted to the right more than the other type of migration curve, indicating that households with permanent migrants are likely to achieve higher agricultural revenue compared to their counterparts in the study area. This is in line with the results of Degfachew et al. (2025), who have found that migration positively impacts agricultural productivity in Ethiopia.

We also compare the remittance incomes received from the migrants with the level of agricultural value productivity achieved by the farm households across the status of migration, to investigate whether the remittance incomes were invested in the farm activities. The results are presented in Figure 4.8 below.





**Figure 4.8: Comparison of the remittance’s income and agricultural revenue**

The results from this graph indicate that the households with temporary migrants receive an average of 34,911.39 CFA of remittance income and achieve an average of 134,261.3 CFA of agricultural value productivity. While the households with permanent migrants have received an average of 18,035.93 CFA, with an achievement of agricultural value productivity of 149,046 CFA on average. This shows that households with temporary migrants, which have received the highest remittance incomes, have yielded lower agricultural revenue, while the households with permanent migrants, which have received lower remittance incomes, have achieved the highest agricultural revenue. This implies that the remittance incomes were not invested in the farm activities by the left-behind households, which is likely to justify the inverse level of agricultural revenue achieved by each left-behind household. This is in line with the study of Paudel et al. (2025), who revealed that remittances from migrants boost off-farm income more than agricultural productivity in Nepal.

*“A head of family with permanent migrants has declared that having a migrant increases the likelihood for the households to use hired labour and decreases the probability of getting hired labour due to the shortage of labour in the community. This increases the time spent and farm activities for the left behind family members to achieve a significant level of agricultural value productivity, which has to helps them face their expenditures.”*

While

*“A head of household with temporary migrants has reported that having a migrant increases the probability of using hired labour, which is not possible in the short term due to the financial situation of the households. He also notes that it often takes time for migrants to send remittances due to job insertion issues, which has led to a reduction in farm size, ultimately affecting agricultural value productivity. According to him, by the time the migrants have sent the remittances, it is already off-season and they are likely to use it for another purpose.”*

#### **4.6 Impact of Rural-Urban Migration on Agricultural Households' Welfare**

This section aims to explore the multifaceted relationship between rural-urban migration and farm household welfare in the study area, using a multinomial endogenous switching model. This model allowed for the comparison of the actual value of households' income as a measure of households' welfare of those who have participated in internal migration, with the counterfactual values if they had not engaged. However, the key test for using a multinomial endogenous switching regression model (MESRM), including the test for the validity of the instrumental variable, is presented as follows.

However, to improve identification and model stability, having a family member at the destination and the agreement of the head of household were used as instrumental variables. Over-identification tests through the Sargan and Basman tests were used to evaluate the validity of the instruments used in the model, where the Sargan test yields a statistic of 1.69071 with a p-value of 0.1935, while the Basman test shows a statistic of 1.64271 with a p-value of 0.2000, as employed by Degfachew et al. (2025). Neither result is significant, suggesting that the null hypothesis can't be rejected. This implies that the instruments are valid and not correlated with the error term. Additionally, the falsification test was performed to confirm this result, and the instrumental variable (FamilyMem) was relevant at 1% level with  $\text{Chi}^2(2) = 34.56$ , while none of the exogeneity

tests were significant, indicating that FamilyMem is valid as an instrumental variable. The result from the MESR is presented in the following table.

**Table 4.13: Average treatment effect of rural-urban migration on farm household welfare**  
**Decision of the Household's Members**

	Migration Actual	No-Migration Counterfactual		
<b>Migration Status</b>	<b>Average Treatment on Treated</b>		<b>ATT</b>	<b>%Change</b>
Temporary	88,552.13 (4,068.359)	50,439.32 (3,195.934)	38,112.81(3,021.918) ***	75.56
Permanent	65,448.66 (2,125.804)	45,179.58 (2,130.961)	20,269.09(1,853.122) ***	44.86
<b>Migration Status</b>	<b>Average Treatment on Untreated</b>		<b>ATU</b>	
Temporary	374,670.9 (32493.13)	89,520.62 (3,295.343)	285,150.3(31,346.77) ***	318.5
Permanent	164,018.4(28,462.02)	89,520.62 (3,295.343)	74,497.74(28,588.21) ***	83.21
<b>Migration Status</b>	<b>Heterogeneity Effect</b>		<b>HE</b>	
Temporary	88,552.13 (4,068.359)	103,354.3 (30,549.34)	-14,802.2 (30,160.99)	-14.32
Permanent	65,448.66 (2,125.804)	74,201.69 (2224.859)	-8,753.027***(1494.374)	-11.80

**Source: Own survey (2025)**

\*\*\*, \*\* and \* means significant at the 1 %, 5 % and 10 % probability levels, respectively. The numbers in the parentheses are standard errors.

The results of this study have provided valuable insight into how internal migration choices affect the farm households' welfare outcomes. Then, households with temporary migrants have an average per capita income of 88,552.13 CFA, compared to 50,439.32 CFA for those who remain. This yields an ATT of 38,112.81 CFA, significant at 1 % level and representing a 75.56 % increase in per capita income for temporary migration. In the case of permanent migration, these households have an average per capita income of 65,448.66 CFA, whereas their counterparts have an average per capita income of 45,179.58 CFA. Here, the increase is less pronounced, with an ATT of 20,269.09 CFA, which is statistically significant at 1 % level, leading to a 44.86 % rise in per capita income compared to households without permanent migrants. These results indicate that temporary migration is more beneficial than permanent migration for households with migrants. This result is in line with the findings of Prah et al. (2025), who found that the households with





internal migrants experienced a significant improvement in welfare, where the food security and the per capita consumption have increased by 10% and 22%, respectively.

*“Heads of households with migrants have reported that they are more likely to agree with their family member to migrate temporarily than permanently. This is because temporary migration includes seasonal migration, which allows migrants to come back within a short time and help on the farm. Additionally, since their migration is based on the head of the family’s agreement, they have to send more remittance income compared to other migrants”.*

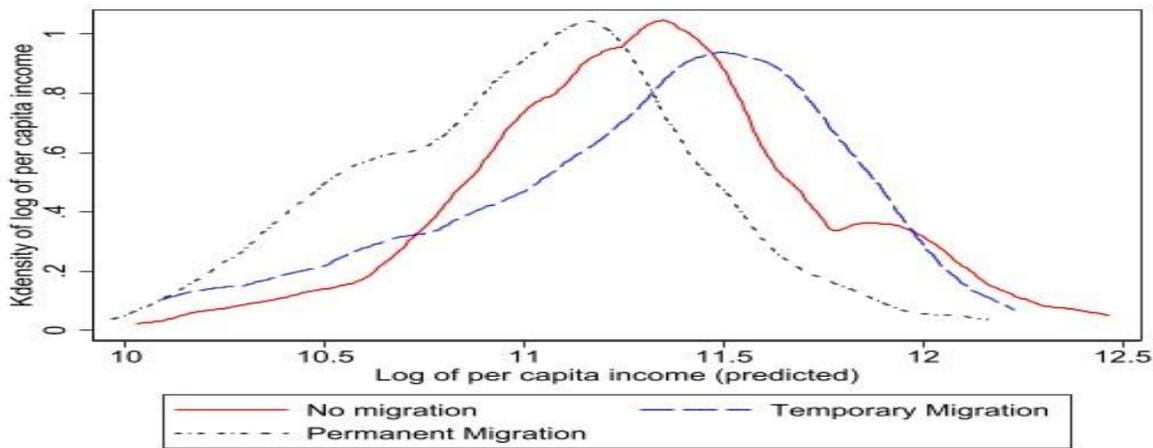
For confirmation of this, 80% of temporary migrants have gotten the agreement of their head of family to come back within a short time before leaving the village.

On the other hand, the result of this research indicates that the households earn an average of 89,520.62 CFA without migrants, while they would have earned 374,670.9 CFA if they were to have temporary migrants. This led to a statistically significant average treatment effect on untreated (ATU) of 285,150.3 CFA, representing a 318.5 % increase in their per capita income. In contrast, households without migrants would have earned an average of 164,018.4 CFA per capita income if they were to participate in permanent migration, resulting in 74,497.74 CFA average treatment effect on untreated (ATU), statistically significant at 1 %, which would have raised their per capita income by 83.21 %. From the results above, the ATT and ATU are both positive, with the ATU larger than the ATT, indicating that the households without migrants would have increased their per capita income more if they were to engage in rural-urban migration, with temporary migration being much better than permanent migration.

The analysis of heterogeneity effects has shown a negative impact for both types of migration on the households’ welfare in the study area. This indicates that the choice of migration type has been

done well by each group, and the inverse of their choices would have yielded a negative impact for them.

Figure 4.9 below illustrates the yield effects of the migration participation using kernel densities of predicted per capita income distributions by migration status. Then, the kernel density distribution of per capita income (log) for temporary migration is positioned to the far right of permanent migration, indicating better per capita income for households with temporary migrant compared to their counterpart. This result supports the finding of Sarkar (2025), which reveals that temporary migration has significantly increased the share of non-agricultural income of the farm households in rural India.



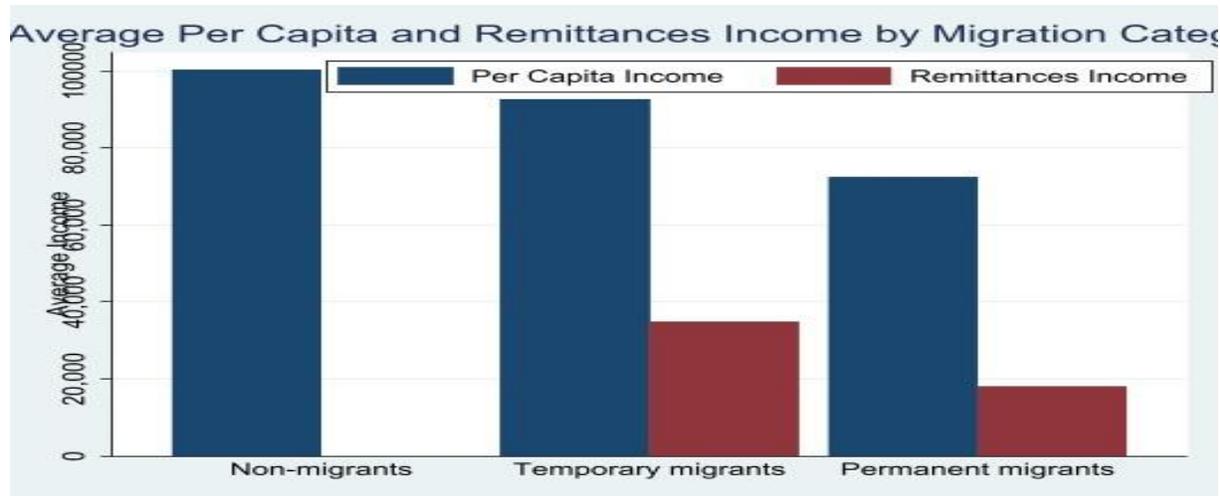
**Figure 4.9: Kernel density distribution of per capita income across the status of migration**

Additionally, Figure 4.9 compares the average per capita income and remittance income across the types of migration in the study area. The result has shown that households without migrants earn an average of 100,324.3 CFA per capita income, while those that do receive remittances. However, households with temporary migrants earn an average of 92,672.53 CFA per capita income, with an average of 34,911.39 CFA as remittance income, implying that households with temporary migrants are likely to be better financially than households without migrants, all things considered. Also, the households with permanent migrants have an average of 72,402.3 CFA per capita income,



with 18,035.95 CFA as remittance income, indicating that households with permanent migrants are likely to be better financially than the other two based on remittance income. In conclusion, the remittance income received by households with temporary migrants is approximately double that of their counterparts, which confirms their better situation based on remittance incomes. This supports the result of Shair et al. (2024), which found that cash remittances play a pivotal role in expanding household expenditures. But it is in contrast with the results of Adaku (2013), who found that households with permanent migrants received more remittances than those with temporary migrants.

*“One head of household with permanent migrants has reported that, mostly, the purposes of the migration of their migrants are education or training, where all the costs, such as the journey fee, school fee, training fee, living expenditure, and others, are in charge by the left behind family. Hence, they do not expect any remittances from them.”*



**Figure 4.10: Average per capita and remittance incomes across the types of migration**

## CHAPTER FIVE

### SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

#### 5.0 Introduction

This chapter highlights the summary of the significant findings and the conclusion based on the key findings. Also, the last section of this chapter gives some actionable policy recommendations from the study and suggestions for future research.

#### 5.1 Summary of Key Findings

The research aimed to examine the relationship between rural-urban migration and agricultural value productivity, as well as the welfare of the farm households in northern Benin. The study objectives were achieved using primary data collected from a sample of 400 farm households in Northern Benin. As a sampling technique, a multi-stage sampling was used to select and collect data from the respondents. Concerning the method of analysis, an appropriate econometric model was employed, such as the multinomial endogenous switching regression, where the first step examined the determinants of rural-urban migration and the second step estimated the impact of rural-urban migration on agricultural value productivity and household welfare through the per capita income. Also, the stochastic frontier correcting for selection bias was used to determine the efficiency level of the farm households with migrants and farm households without migrants in northern Benin.

First of all, the descriptive statistics of the socio-economic characteristics of the respondents have shown that there is no statistically significant difference between the heads of households with migrants and without migrants. In terms of the farm size under cultivation, there is a statistically significant difference at 1 % level, indicating that households without migrants have a larger farm size compared to those with migrants. This suggests that households without migrants are less





likely to face labour shortages for agricultural activities. Talking about gender, there is a statistically significant difference between the two groups of households. The data have shown that at 90.09%, the head of households without migrants are likely to be male-headed, while 71.1% of the households with migrants are male-headed, suggesting that households with female heads are more likely to engage in rural-urban migration than their counterparts with male heads. The descriptive analysis has also found that the household income is statistically different across the two groups of households. The data shows that those without migrants are more likely to earn more income compared to those with migrants, implying that the household's income is more likely to be farm income than remittance. Furthermore, households with debt issues are likely to have one of their members migrate compared to households without debt.

Additionally, we compared the migrants based on the type of migration chosen and found that permanent migrants are more likely to be younger than temporary migrants, and also, temporary migrants are mainly male compared to permanent migrants. In terms of remittance, temporary migrants are more likely to send remittances compared to their counterparts, permanent migrants. To end the descriptive analysis, the data show that the temporary migration of a family member is likely to be a family decision rather than an individual decision.

Secondly, the drivers of rural-urban migration in the study area have been examined using the multinomial logit. The results from this model have shown that many factors are the causes of rural-urban migration of household members in northern Benin, which can be classified into two groups following the two theories of migration used to back this research. The first group is the push-pull factors, developed by Lee as a theory of migration, where the push factors are the things in the rural area that people don't like, while the pull factors are the good and attractive things in the urban area that people like. Then, in the context of this study, rural unemployment, climate

effects, no access to agricultural equipment, and household debt are all significant as push factors. Whereas urban employment is a significant pull factor. On the other hand, the second group is the new economics of labour migration, developed by Stark and Bloom (1985), which reveals that migration is a family decision rather than an individual decision as a household strategy to deal with poverty. For that, variables such as agreement of the head of households, family member at the destination, and the necessity to send remittance have been used, where two of them are statistically significant. In summary, the average probability of each type of migration to occur has shown the highest probability for permanent migration, indicating that people are more likely to migrate permanently than temporarily in the study area.

Regarding the efficiency level among the farm households, after correcting for selection bias arising from migration decision, the stochastic frontier shows that the efficiency level of the farm household with migrants has declined slightly (0.97), indicating that unobservable factors related to migration decision have inflated the conventional estimates. Conversely, the efficiency level of the farm household without migrant has remained around 0.60 across models, implying persistent inefficiency.

Concerning the intensity of rural-urban migration on the agricultural value productivity of farm households in northern Benin, a comparative analysis was done using the ATT from the multinomial endogenous switching regression. The result indicates that migration has a positive and statistically significant effect on agricultural value productivity, with permanent migration being larger than temporary migration. This suggests that households with permanent migrants are likely to achieve the highest agricultural value productivity compared to households with temporary migrants.



The study further examined the impact of rural-urban migration on the farm households' welfare (proxy by per capita income) using the average treatment effect on treated (ATT) from the multinomial endogenous switching regression. Then, the predicted per capita income across the types of migration has revealed that the welfare of the households has been positively impacted. The impacts are both statistically significant, with temporary migration higher than permanent migration. This implies that households with temporary migrants are more likely to have better well-being compared to their counterparts.

## 5.2 Conclusions

From the key empirical finding, the following policy conclusions are drawn.

The factors such as age and sex of the household heads, household size and debt, access to migration information, rural unemployment, urban employment, agreement of the household's head, and family members at the destination are the drivers of rural-urban migration in the study area, which validates the two theories of migration used in this research.

This study determines the efficiency level among the agricultural households and found that after correcting for selection bias arising from migration decision, the efficiency level of the farm household has declined slightly (0.97), indicating that unobservable factors related to migration decision have inflated the conventional estimates. Conversely, the efficiency level of the farm household without migrant has remained around 0.60 across models, implying persistent inefficiency. This suggests that using a simple stochastic frontier would have led to biased efficiency estimates.

Concerning the effect of rural-urban migration on the agricultural outcome of the households, the result of this study reveals that having a migrant in the household is likely to increase the agricultural revenue of the households, especially households with permanent migrants, where the



increment is slightly pronounced compared to households with temporary migrants. Also, the average treatment effect on the untreated has highlighted that those who do not have migrants would have earned more if they were to have permanent migrants. From these, we conclude that having permanent migrants is a kind of incentive factor for farm households.

Lastly, the impact of the migration on the farm household welfare through the average treatment effect on treated (ATT) has shown that there is a positive and statistically significant effect. This indicates that there is a positive correlation between migration and household welfare. The results have shown that households with temporary migrants are likely to earn more per capita income compared to households with permanent migrants, indicating better well-being of the households. In addition, the average treatment effect on the untreated (ATU) has found to be that households without migrants would have earned more per capita income if they were to have temporary migrants. This implies that temporary migration is likely to have a greater impact on the welfare of the farm households compared to permanent migration in the study area.

The analysis of the remittance income received by the left-behind households was done to investigate its effect on the agricultural value productivity and household welfare. First of all, the data have shown that temporary migration generates more remittances than permanent migration. In other words, the households with temporary migrants are likely to receive more remittances compared to households with permanent migrants. Furthermore, the results have revealed that households with temporary migrants are likely to have better well-being than their counterparts, suggesting that the effect is likely to come from the remittance income received from the migrants. Whereas households with permanent migrants who have received less remittance income have achieved higher agricultural value productivity, implying that this achievement does not come

from remittance investment in agriculture. Hence, we conclude that remittances received from migrants are likely to be invested in household expenditure rather than in agricultural activities.

### **5.3 Recommendations**

The study has collected primary data from the farm households to examine the effect of rural-urban migration on agricultural value productivity and household welfare in northern Benin. Based on the study's empirical findings, the following policy recommendations are made.

#### **5.3.1 Recommendations for Farm Households**

- Farm household heads and potential migrants should accurately assess the benefits and risks of rural-urban migration before making a decision, using reliable information on migration pathways and employment opportunities.
- Farm households with migrants should strategically use remittances for productive farm investments and livelihood improvement rather than short-term consumption.
- Farm households are encouraged to maintain strong economic and social ties between migrants and the left behind family, particularly in the case of temporary or seasonal migration, to maximize welfare gains.

#### **5.3.2 Recommendations for Government and Development Agencies**

- Governments should establish and strengthen information platforms that provide accurate guidance on migration opportunities, risks, and labour market conditions in the urban area to support informed migration decisions.
- Agricultural efficiency-enhancing interventions should be differentiated by migration status, with targeted support, such as improved technologies, extension services, and labour-saving innovation, directed especially toward non-migrant households facing persistent inefficiencies.



- Policies should promote financial inclusion and secure remittance systems, alongside investment-oriented extension and agribusiness support, to encourage productive uses of remittances in agriculture.
- Government programs should facilitate safe, seasonal, and circular migration by reducing transaction costs, offering skills training, and improving labour market access, thereby enhancing household welfare while sustaining agricultural productivity.

### **5.3.4 Recommendation for Future Research**

The study proffers the following recommendations for future research in the study area.

- This study did not take into account the political instability and conflict, or terrorism, as drivers of rural-urban migration.
- Future research should consider the migration and adoption of sustainable agricultural practices.
- Also, the effect of sustained outmigration of youth on the adoption of agricultural innovations, land productivity, and food security among the households left behind.



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APPENDICES

Appendix 1: Questionnaire

SURVEY INFORMATION

Region: Atacora	Municipality:..... .....	Community:..... .....
Household N° :..... .....	Enumerator :.....	Date of Interview:.....

Section A: Socio-Economics and Demographics Information

SA <sub>1</sub>	Head of Household Sex		[ 1 ] Male [ 0 ] Female					
SA <sub>2</sub>	Marital Status of HH <sup>1</sup>	Code A						
SA <sub>3</sub>	Household size (Number of members in that household)	Number						
SA <sub>4</sub>	Type of marriage the HH is practising	Code B						
SA <sub>5</sub>	The age of the HH (In the year)	Number						
SA <sub>6</sub>	The Religion of the Household	Code C						
SA <sub>7</sub>	Level of education of the HH	Code D						
SA <sub>8</sub>	Years of education	Years						
SA <sub>9</sub>	Ethnic Group of the Household	Code E						
SA <sub>10</sub>	Settler or Indigene in the community		[ 1 ] Indigene [ 0 ] Settler					
SA <sub>11</sub>	Sources of Income (Possibility of multiple answers)	Code F						
SA <sub>12</sub>	Status of the income	Code G						
SA <sub>13</sub>	Access to credit		[ 1 ] Yes [ 0 ] No					
SA <sub>14</sub>	If no, provide the reasons	Code H						
SA <sub>15</sub>	If yes, how much per year?	Amount						
SA <sub>16</sub>	What is the source of the credit?		[ 1 ] Formal [ 0 ] Informal					
SA <sub>17</sub>	Is the Household having Debt		[ 1 ] Yes [ 0 ] No					
SA <sub>18</sub>	If yes, how much?	Amount						
SA <sub>19</sub>	What is the main occupation of the HH?	Code I						
SA <sub>20</sub>	Does the Household have non-farm activities?		[ 1 ] Yes [ 0 ] No					
SA <sub>21</sub>	If yes, how much is the monthly income for non-farm activities?	Amount						
<b>Code A</b> 1 Married 2 Consensual union 3 Separated 4 Divorced 5 Widowed 6 Never married	<b>Code B</b> 1 Monogamous 2 Polygamous 3 Others	<b>Code C</b> 1 No religion 2 Christianity 3 Islam 4 Traditionalist/Spiritualist 5 Atheist 6 Other (specify)	<b>Code D</b> 0 None 1 Primary 2 First Cycle 3 Second Cycle 4 University	<b>Code E</b> 1 Batonu 2 Berba 3 Waama	<b>Code F</b> 1 Agriculture 2 Business Income 3 Salaries 4 Investment income	<b>Code G</b> 1 Stable 2 Seasonal	<b>Code H</b> 1 No Financial Institution around 2 No farming credit 3 Difficult conditions 4 Could not get a guarantor	<b>Code I</b> 1 Farming 2 Trading 3 Other

<sup>1</sup> HH=Head of Household

				4 Peulhs	5 Remittances			
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## Section B: Migration Information

If SB<sub>2</sub> is No, then move to Section C.

<b>SB<sub>1</sub></b>	Have you heard of migration?				
<b>SB<sub>2</sub></b>	Has one member of the household migrated?				
<b>SB<sub>3</sub></b>	Number of migrated members	<b>Number</b>			
	<b>Members Migrated</b>		<b>Member 3</b>	<b>Member 4</b>	<b>Member 5</b>
<b>SB<sub>4</sub></b>	The status of the migration <sup>2</sup>	<b>Code J</b>			
<b>SB<sub>5</sub></b>	Number of years of being in migration	<b>In years</b>			
<b>SB<sub>6</sub></b>	Sex of migrated member	[ 1 ] Male [ 0 ] Female			
<b>SB<sub>7</sub></b>	Level of education of the migrated members	<b>Code L</b>			
<b>SB<sub>8</sub></b>	Age of migrated member (in years)	<b>number</b>			
<b>SB<sub>9</sub></b>	Purpose of migration	<b>Code M</b>			
<b>SB<sub>10</sub></b>	Destination of the migrated member	<b>Code N</b>			
<b>SB<sub>11</sub></b>	Is there a family member at the place of destination?	[ 1 ] Yes [ 0 ] No			
<b>SB<sub>12</sub></b>	Is the migrated member sending remittances?	[ 1 ] Yes [ 0 ] No			
<b>SB<sub>13</sub></b>	How often does the member send remittances?	[ 1 ] Monthly [ 0 ] Annually			
<b>SB<sub>14</sub></b>	How much is he/she sending?	<b>Amount</b>			
<b>SB<sub>15</sub></b>	Use of remittance sending	<b>Code O</b>			
<b>SB<sub>16</sub></b>	Does the migrated member travel with the HH agreement?	[ 1 ] Yes [ 0 ] No			
<b>SB<sub>17</sub></b>	What is the relationship of the migrated member to the HH?	<b>Code P</b>			
<b>SB<sub>18</sub></b>	Distance from community to migrated town (Km)	<b>Number</b>			
<b>SB<sub>19</sub></b>	Was the migrated member assisting in labour provision on the farm?	[ 1 ] Yes [ 0 ] No			

<sup>2</sup> **Temporary Migration** is defined as any movement from the original residence for at least six (6) months but involves a return to the origin of migration.

**Permanent Migration** is defined as movement from the original residence to another destination that does not involve a return to the origin of migration.

<b>SB<sub>20</sub></b>	What is the combined extent of the effects of the migration of the members on agricultural labour allocation?	0 No negative effect 1 Low negative effect (10% reduction) 2 Moderate negative effect (25% reduction) 3 High negative effect (50% reduction) 4 Very high negative effect (75% reductions)
<b>SB<sub>21</sub></b>	What is the combined extent of the effects of the remittances sent by migrated members on agriculture labour hiring?	0 None effect 1 Able to hire 10% of labour required 2 Able to hire 25% required 3 Able to hire 50% labour required 4 Able to hire 75% of the labour required

<b>Code J</b>	<b>Code L</b>	<b>Code M</b>	<b>Code N</b>	<b>Code O</b>	<b>Code P</b>
0 Non-migration 1 Temporary migration 2 Permanent migration	0 None 1 Primary 2 First Cycle 3 Second Cycle 4 University	1 Study 2 Training Purpose 3 Searching for jobs 4 Modern lifestyle 5 Better amenities 6 Climate Shocks 7 Mariage	1 Natitingou 2 Parakou 3 Malanville 4 Abomey-Calavi 5 Cotonou 6 Porto-Novo 7 Outside the country 8 Others	1 Investment in Education 2 Investment in the Farm Activities 3 Investment in the non-farm Activities 4 Household Consumption 5 Others	1 Head 2 Spouse (wife/husband) 3 Child (son/daughter) 4 Grandchild 5 Parent/parent-in-law 6 Son/daughter-in-law 7 Other relatives 8 Adopted/foster/stepchild 9 House help (other relative)

## Section C: Agriculture Activity Information

SC <sub>1</sub>	How do you acquire land for farming?	<b>Code Q</b>	
SC <sub>2</sub>	Experience in farming (in years)	<b>Years</b>	
SC <sub>3</sub>	The natural fertility of the land cultivated	<b>Code R</b>	
SC <sub>4</sub>	Cost of production in one Hectare	<b>Amount</b>	
SC <sub>5</sub>	Does the farm activity depend on the rainfall?		[ 1 ] Yes [ 0 ] No
SC <sub>6</sub>	The type of cropping you adopted		[ 1 ] Mono cropping [ 0 ] Multi cropping
SC <sub>7</sub>	Purpose of crop farming	<b>Code S</b>	
SC <sub>8</sub>	Do you belong to FBO <sup>3</sup> ?		[ 1 ] Yes [ 0 ] No
SC <sub>9</sub>	If yes, the name		
SC <sub>11</sub>	If No, why?	<b>Code T</b>	
SC <sub>12</sub>	Do you have an insurance policy?		[ 1 ] Yes [ 0 ] No
SC <sub>13</sub>	If yes, how much do you buy the insurance policy?	<b>Amount</b>	
SC <sub>14</sub>	If no, why?	<b>Code U</b>	
SC <sub>15</sub>	How much is the revenue from agriculture production per year?	<b>Amount</b>	
SC <sub>16</sub>	Are all the family members involved in farm activity?		[ 1 ] Yes [ 0 ] No
SC <sub>17</sub>	Does the climate change affect your farm activity?		[ 1 ] Yes [ 0 ] No
SC <sub>18</sub>	Does the household have access to agricultural land?		[ 1 ] Yes [ 0 ] No
SC <sub>19</sub>	Is the agricultural labour availability a challenge?		[ 1 ] Yes [ 0 ] No

<b>Code Q</b>	<b>Code R</b>	<b>Code S</b>	<b>Code T</b>	<b>Code U</b>
1 Family 2 Chief 3 Purchase	1 Fertile 2 Moderately fertile 3 Less fertile 4 Infertile	1 Primarily for consumption 2 Primarily for market 3 Both	1 Non-existent 2 Difficult conditions of access	1 Non-existent 2 Very expensive 3 Difficult conditions of access

<sup>3</sup> FBO is the Farmer Based Organization (Farmer Association)





<b>SE14</b>	Are you into irrigation?		[ 1 ] Yes [ 0 ] No
<b>SE15</b>	If yes, how much is it?	<b>Amount</b>	
<b>SE16</b>	If no, why?	<b>Code Z</b>	
<b>SE17</b>	Access to extension service		[ 1 ] Yes [ 0 ] No
<b>SE18</b>	If yes, how many times?	<b>Number</b>	
<b>SE19</b>	If no, why?	<b>Code AA</b>	

<b>Code V</b> 1 Family labour 2 Hired labour 3 Exchange Labour 4 Mechanized labour	<b>Code W</b> 1 No idea 2 No available 3 Expensive	<b>Code X</b> 1 No idea 2 No available 3 Expensive	<b>Code Y</b> 1 No idea 2 No available 3 Expensive	<b>Code Z</b> 1 No idea 2 Very expensive 3 Need a lot of work	<b>Code AA</b> 1 Non-available 2 Due to the distance
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### Section F: Household Welfare Information

<b>SF1</b>	Total household income <sup>4</sup> (Yearly)	<b>Amount</b>	
<b>SF2</b>	Total household expenditure (Monthly)	<b>Amount</b>	
<b>SF3</b>	Access to basic services (electricity, clean water, sanitation)		[ 1 ] Yes [ 0 ] No
<b>SF4</b>	If yes, which one	<b>Code AB</b>	
<b>SF5</b>	How much per month?	<b>Amount</b>	
<b>SF6</b>	Ownership of physical assets (land, livestock, vehicles)	<b>Code AC</b>	
<b>SF7</b>	How much can we evaluate all?	<b>Amount</b>	
<b>SF8</b>	Access to healthcare		[ 1 ] Yes [ 0 ] No
<b>SF9</b>	If yes, how much per month?	<b>Amount</b>	
<b>SF10</b>	If no, why?	<b>Code AD</b>	
<b>SF11</b>	Access to school for children		[ 1 ] Yes [ 0 ] No
<b>SF12</b>	Distance to the market (in km)		
<b>SF13</b>	Agricultural equipment held by the household	<b>Code AE</b>	

<sup>4</sup> The Total Household income can be calculated as: **SA<sub>21</sub> + SB<sub>14</sub> + SC<sub>14</sub>** for household with migrant member and **SA<sub>21</sub> + SC<sub>14</sub>** for household without migrant member.

<b>Code AB</b>	<b>Code AC</b>	<b>Code AD</b>	<b>Code AE</b>
1 Electricity 2 Clean waters 3 Sanitation	1 land 2 livestock 3 vehicles 4 House for rent	1 Financial issue 2 No hospital around	1 Land Preparation Equipment 2 Planting Equipment 3 Irrigation Equipment 4 Harvesting Equipment 5 Processing Equipment 6 Transportation Equipment



## Appendix 2: Appropriateness of Production Function between Cobb-Douglas and Translog

### ➤ Estimation of Cobb-Douglas Production Function

```
. regress lnAgriRevenu lnFarmsize lnCostSeed lnCostchemical lnCostLabor
```

Source	SS	df	MS	Number of obs	=	400
				F(4, 395)	=	18.56
Model	19.2734922	4	4.81837306	Prob > F	=	0.0000
Residual	102.534705	395	.259581532	R-squared	=	0.1582
				Adj R-squared	=	0.1497
Total	121.808197	399	.305283702	Root MSE	=	.50949

lnAgriRevenu	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
lnFarmsize	.3379781	.0576286	5.86	0.000	.2246811	.4512752
lnCostSeed	.0208344	.0037444	5.56	0.000	.0134729	.0281959
lnCostchemical	.0022035	.0049873	0.44	0.659	-.0076014	.0120084
lnCostLabor	.1939648	.0908004	2.14	0.033	.0154522	.3724773
_cons	12.08024	.0765022	157.91	0.000	11.92984	12.23065

### ➤ Estimation of the Translog Production Function

```
. regress lnAgriRevenu lnFarmsize lnCostSeed lnCostchemical lnCostLabor lnFarmsize_sq lnCostSeed_sq lnCo
> stchemical_sq lnCostLabor_sq lnFarmsizeCostSeed lnFarmsizeCostchemical lnFarmsizeCostLabor lnCostSeedC
> ostchemical lnCostSeedCostLabor lnCostchemicalCostLabor
```

Source	SS	df	MS	Number of obs	=	400
				F(14, 385)	=	13.25
Model	39.6012633	14	2.82866166	Prob > F	=	0.0000
Residual	82.2069339	385	.213524504	R-squared	=	0.3251
				Adj R-squared	=	0.3006
Total	121.808197	399	.305283702	Root MSE	=	.46209

lnAgriRevenu	Coefficient	Std. err.	t	P> t	[95% conf. interval]	
lnFarmsize	.4902066	.2379516	2.06	0.040	.0223592	.9580539
lnCostSeed	-.0026193	.0123252	-0.21	0.832	-.0268524	.0216139
lnCostchemical	-.0452747	.0132882	-3.41	0.001	-.0714012	-.0191482
lnCostLabor	.7712786	.295617	2.61	0.009	.1900527	1.352505
lnFarmsize_sq	-.3109547	.1155473	-2.69	0.007	-.5381374	-.083772
lnCostSeed_sq	.0137679	.0034853	3.95	0.000	.0069154	.0206204
lnCostchemical_sq	.0113293	.0021661	5.23	0.000	.0070705	.0155882
lnCostLabor_sq	-1.271153	.3409224	-3.73	0.000	-1.941455	-.6008496
lnFarmsizeCostSeed	.008626	.0092042	0.94	0.349	-.0094708	.0267227
lnFarmsizeCostchemical	.0376248	.0120218	3.13	0.002	.0139883	.0612614
lnFarmsizeCostLabor	-.4644361	.2305531	-2.01	0.045	-.9177369	-.0111354
lnCostSeedCostchemical	.0013927	.0008113	1.72	0.087	-.0002026	.0029879
lnCostSeedCostLabor	-.0071058	.0113973	-0.62	0.533	-.0295144	.0153029
lnCostchemicalCostLabor	-.0406642	.0176488	-2.30	0.022	-.0753642	-.0059641
_cons	10.45483	.3960513	26.40	0.000	9.676136	11.23352



➤ **Likelihood Ratio Test**

```
. lrtest cobb translog
```

Likelihood-ratio test

Assumption: **cobb** nested within **translog**

LR chi2(10) = 88.38

Prob > chi2 = 0.0000



**Appendix 3: Multinomial Logit About the Determinants of Rural-Urban Migration**

**Table 14: Multinomial Logistic Regression Result (Coefficients)**

Explanatory Variables	Coef.	Migration Decision		
		Temporary Migration	Permanent Migration	
		z-value	Coef.	z-value
SexHH	-8.151** (4.131)	-1.97	-8.593** (4.12)	-2.09
AgeHH	0.285*(0.168)	1.70	0.3*(0.167)	1.80
Boukoumbe_group1	-5.544(4.756)	-1.17	-8.555*(4.697)	-1.82
Materi_group2	-6.609*(3.707)	-1.78	-8.242**(3.673)	-2.24
Natitingou_group3	-4.783(3.805)	-1.26	-7.532**(3.766)	-2.00
Pehunco_group4	-9.989** (4.287)	-2.33	-11.959*** (4.251)	-2.81
SendingRem	23.248(1639.24)	0.01	23.903(1639.24)	0.01
TotalLivestocks	0(0)	-1.21	0(0)	-1.28
Hsize	1.435(0.905)	1.59	1.719*(0.9)	1.91
Tmarriage	-2.033(1.953)	-1.04	-1.306(1.924)	-0.68
NonfarmAct	-.916(2.005)	-0.46	-1.392(1.985)	-0.70
YearEdu	-.237(0.309)	-0.77	-0.384(0.307)	-1.25
Hdebt	7.056**(2.26)	3.12	6.273*** (2.236)	2.80
AccessCredi	-1.118(1.483)	-0.75	-.584(1.444)	-0.40
AwareMigrat	6.881** (3.084)	2.23	8.899*** (3.041)	2.93
NoAgriEquip	5.586** (2.374)	2.35	4.521* (2.335)	1.94
ClimatEffect	4.245* (2.44)	1.74	4.596* (2.417)	1.90
RuralUnemploy	5.764*** (2.04)	2.82	4.013** (1.957)	2.05
UrbanEmploy	5.134*** (1.918)	2.68	5.094*** (1.886)	2.70
FarmExp	-0.159(0.214)	-0.74	-0.188(0.211)	-0.89
AgremHH	7.226*** (2.627)	2.75	6.126** (2.599)	2.36
FamilyMem	12.73*** (3.577)	3.56	11.941*** (3.56)	3.35
Constant	-29.082*** (10.268)	-2.83	-26.628*** (10.159)	-2.62

Pseudo-R<sup>2</sup> 68.07

Sample size 400

Likelihood Ratio 573.15

p-value 0.0000\*\*\*

