

**EFFECT OF SEMI-FORMAL CREDIT USE ON RURAL FARM HOUSEHOLD
INCOME IN KAKAMEGA COUNTY, KENYA**

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**A Thesis Submitted to the Graduate School in Partial Fulfilment of the Requirements
for the Master of Science Degree in Agricultural and Applied Economics of Egerton
University**

EGERTON UNIVERSITY

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DECLARATION AND RECOMMENDATION

Declaration

This research thesis is my original work and has not been presented in any university or institution of higher learning for any award.

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Recommendation

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DEDICATION

This thesis is dedicated to my wife Maxbiller Jeptoo, my son Kevin Wanjia and my parents Mr. and Mrs. Mukhwami Joshua Wanjia.

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ABSTRACT

Recently, there has been emergence in the use of semi-formal credit provided by devolved government in enhancing farm and off-farm enterprises. Despite the potential of the credit offered by devolved governments in terms of enhancing rural farm household welfare, little is known about the effect of this type of credit on household income. This study therefore, examined the effect of semi-formal credit use on household income in Kakamega County, Kenya. The study aimed to contribute towards improving farmers' household welfare by examining the contribution of semi-formal credit offered by devolved government on rural farm household income. Specifically, it sought to profile enterprises supported by the semi-formal credit obtained by rural households; determine factors influencing rural farm allocation of the credit obtained on different enterprise and estimate the effect of semi-formal credit use on household income. The study used primary data that was collected from a sample size of 179 farm households from Malava and Lugari Sub-counties in Kakamega County. The sample size consisted of 83 beneficiaries of the county credit program and 96 respondents who served as a control group for the study. A stratified multiple sampling approach was used to arrive at the sample size. The study used descriptive statistics to profile enterprises which benefited from the credit accessed by households. Besides, Seemingly Unrelated Regression Model (SUR) was used to determine factors influencing the household allocation of credit obtained to different types of enterprises. Finally, the endogenous switching regression model was used to estimate the effects of semi-formal credit use on household income. The results indicated that most farmers allocated the credit obtained on farm and off-farm agriculture related enterprises. Credit allocation on farm enterprises was positively influenced by the gender of household head, land ownership, and the role played by an individual in the socio-economic group. Conversely, allocation of credit on off-farm enterprises was positively influenced by ownership of off-farm enterprises, age of household head, and off-farm income. Additionally, semi-formal credit use had a significant and positive effect on rural farm household income. In counterfactual cases, households that used semiformal credit obtained from the county government have a 17.7% probability of increasing their income, while those that did not use the credit had a 28.9% probability of becoming worse off in terms of household income. In conclusion, semi-formal credit use contributed towards improving rural farm household income. The study recommends diversifying household income through engaging in sustainable off-farm activities, offering agricultural financial training and promoting the use of semi-formal credit offered by the county government among rural farm households.

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LIST OF ABBREVIATIONS AND ACRONYMS

ESR	Endogenous Switching Regression
GDP	Gross Domestic Product
KNBS	Kenya National Bureau of Statistics
MFI	Microfinance Finance Institutions
NGOs	Non-Governmental Organizations
PSM	Propensity Score Margin
ROSCA	Rotating Saving and Credit Association
SACCOs	Savings and Credit Cooperative Societies
SSEs	Small-Scale Enterprises
SUR	Seemingly Unrelated Regression

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Agriculture plays a significant role in enhancing food security and economic development in Sub-Saharan Africa (Conceição *et al.*, 2016). However, there is a need to increase agricultural investment hence improve the productivity and profitability of the sector. Micro-credit services are, therefore, essential in enhancing investments of farm enterprises (Nwibo *et al.*, 2019). This is because they eliminate the barriers that hinder small scale enterprises from accessing credit. According to Reyes *et al.* (2012), limited access to credit is a significant challenge facing the agricultural sector in the Sub-Saharan Africa region. Several factors, such as culture, individual attributes, and high transactional costs, act as barriers to credit access (Banerjee *et al.*, 2017). For instance, some cultures do not allow women to own assets such as land; therefore, they cannot access credit facilities due to lack of collateral (Wellalage *et al.*, 2018). Furthermore, risk-averse farmers may opt not to participate in the credit market due to the fear of losing their assets in case of enterprise failure (Reyes *et al.*, 2012). On the other hand, high transaction costs due to lengthy procedures of accessing credit may discourage borrowers.

Credit constraints harm the productivity of small-scale enterprises (Mukasa *et al.*, 2017). For instance, small-scale farmers who do not access credit have inadequate finance to adopt technology and also purchase farm inputs. Also, inadequate funding due to lack of access to credit hinders farm households from expanding their farm enterprises. Credit access is also a significant challenge facing off-farm small-scale enterprises in developing nations (Ahiawodzi and Adade, 2012). Research done in Brazil indicated that the performance of credit-constrained enterprises steadily improved after accessing a loan (Desousa and Ottaviano, 2014). Relaxing credit constraints, therefore, is a better means of enhancing the performance of enterprises.

According to Auma and Mensah (2014), developing countries suffer from underdeveloped and inefficient financial markets. For instance, most of the financial institutions in these countries are located in the urban regions, thereby making it expensive for rural households to access credit markets. Also, the formal lending institutions have constraining policies which discourage borrowers. For instance, formal financial institutions demand collateral such as land, livestock, income, and wage account before allowing an individual to access credit.

Several policy measures have been put in place to enhance access to credit by poor households in developing countries (Tchamyou and Asongu, 2017). One of these measures is the

development of the semi-formal lending sector. The sector has contributed towards minimizing credit constraints by enabling poor households to access credit (Kanake and Mahesh, 2018; Dutta and Banerjee, 2018). For instance, poor households can be able to obtain credit through the formation of groups. In this case, group members act as guarantors for a member who applies for credit. Besides, access and use of credit obtained from semi-formal institutions can enable poor households to save by using borrowed funds to invest and commit themselves to repay later on (Singh & Abate, 2018).

According to Pham and Lenisik (2007), semi-formal credit is offered by several national and international credit programs that are responsible for offering micro-finance services to selected groups of borrowers. It is worth noting that semi-formal lending institutions conform to certain development targets. The chances of using semi-formal credit increases when the credit is borrowed for business purposes. In Kenya, semi-formal lending sector is promoted since it provides loans to small scale enterprises and low-income borrowers (Johnson, 2016). The implication is that semi-formal lending institutions contributes towards job creation and alleviation. The common semi-formal lending institutions includes Non-Governmental Organizations (NGOs), government support programs, Savings and Credit Cooperative Societies (SACCOs) and Micro-Finance Institutions (MFIs).

It is worth noting that credit access alone is not a sufficient condition for better performance of small-scale enterprises. The credit accessed must be appropriately allocated to realize a positive outcome (McIntosh *et al.*, 2013). For instance, using credit for the intended purpose would result in a positive outcome in terms of improved performance (Sossou *et al.*, 2014). Rural households operate several enterprises to spread risk. The enterprises are conducted on the farm or off the farm. Small-scale enterprises are preferred because they are flexible in terms of operation and require less amount of initial capital to be established (Liedholm and Mead, 2013). The household can, therefore, shift resources from farms to finance off-farm activities and vice versa.

Kakamega is one of the counties in Kenya that have favorable ecological conditions that support agriculture. However, its residents experience poverty and food insecurity challenges (Liedholm and Mead, 2013). According to KNBS (2017), the poverty incidence rate in Kakamega County is approximately 49.2%. It is attributed to a high population growth rate, which has created pressure on land, thereby reducing landholding per individual. This has, in

turn, led to a reduction in the portion of land available for agricultural production (Rotich *et al.*, 2014).

The residents in the County undertake several small-scale enterprises. The typical farm enterprises practiced in the county include; dairy, poultry, and vegetable, among others (Lay *et al.*, 2007). On the other hand, off-farm enterprises include mobile banking, shop operation, market stalls operation, carpentry, welding, and hairdressing, among others. However, inadequate finance is the main challenge hindering the performance of these enterprises. Most households are discouraged from borrowing loans from commercial banks due to high interests and transaction costs involved (Obulinji, 2016). Besides, there are few micro-finances and savings and SACCOs in the county, thus limiting household access to credit. According to Maingi (2011), the number of registered micro-finance operating in Kakamega County is approximately ten. Also, the number of SACCOs that provides secure and convenient means for saving and obtaining credit in the county is about 330 (KNBS, 2017).

The county government of Kakamega introduced a credit program known as *Mkopo mashinani* to support the development of small scale enterprises (Okwach, 2015). The program was an intervention aimed at alleviate poverty among rural households. It was implemented in the period 2015 to 2017. The program targeted individuals who had membership in well-established socio-economic groups. In this case, group members guaranteed each other to obtain the semi-formal credit that was offered by the county government. The credit was offered at an affordable interest rate that was paid on a reducing balance basis. The lowest amount to be applied a potential beneficiary was KES 5000 while the maximum amount was KES 250,000.

1.2 Statement of the Problem

According to KNBS, poverty incidence in Kakamega County is approximately 49.2%, contributing 4.8% to the national poverty level. High population density is among major causes of the high poverty level in the county since it has exerted pressure on land, thus reducing landholding per individual, thereby leading to low production. Promoting small scale enterprises is considered as an approach to alleviating poverty. This can be facilitated by enhanced access to credit hence boost the performance of these enterprises. However, factors such as high interest on loans offered by commercial banks, a low number of micro-finances and SACCOs have limited household access to credit. In 2015, the County government of Kakamega came up with an initiative of providing credit at an affordable interest rate to its

residents to promote small scale enterprises. This initiative aimed to reduce the poverty level among households through improved income. Since it was launched, several households have benefited, but little is known about the effect of the credit use on household income. Based on these observations, the study aimed at filling the knowledge gap by examining the effect of semi-formal credit use on rural farm household income.

1.3 Objectives of the Study

1.3.1 General Objective

To contribute towards improving farmers' household welfare by examining the contribution of semi-formal credit use on household income among rural households in Kakamega County

1.3.2 Specific Objectives

- i. To profile types of enterprises supported with the semi-formal credit obtained by rural farm households in Kakamega County.
- ii. To determine factors influencing rural farm households' allocation of the credit obtained to different types of enterprises in Kakamega County.
- iii. To estimate the effect of semi-formal credit use on rural farm household income in Kakamega County.

1.3.3 Research Questions

- i. Which types of enterprises are supported with the semi-formal credit obtained by rural farm households in Kakamega County?
- ii. What are the factors influencing rural farm household allocation of semi-formal credit to different enterprises in Kakamega County?
- iii. What is the effect of semi-formal credit use on rural farm household income in Kakamega County?

1.4 Justification of the Study

Small-scale enterprises play an essential role in improving household income in developing countries. This is because they require low initial capital. Also, the enterprises enjoy flexibility; hence their owners can quickly shift to other better alternatives in case of poor performance. However, the performance of these enterprises is affected by inadequate finance. Availing credit to poor households who own these enterprises is the best approach to improving household income. This will, in turn, lead to poverty alleviation, thus contributing towards achieving the vision 2030. The results from the study will inform relevant policymakers to promote utilization of credit that is offered by semi-formal sectors. Besides, the study provides

insight that strengthens better resource allocation. The study also contributes to existing knowledge since little has been documented on the contribution of semi-formal credit programs offered by devolved government on household income. In addition, it highlights the possible areas of future research.

1.5 Scope and Limitations of the Study

This study only focused on the effect of credit access on household income in Kakamega County. This was due to time and financial constraints that cannot allow for an increase in scope. The study targeted households that are engaged in small-scale enterprises in the County. The small-scale enterprises that were considered in the study involved both on-farm and off-farm. The study was limited by inaccurate information from some respondents who viewed the information on credit access as confidential. This limitation was overcome through the use of the triangulation technique that allowed for counter checking the information provided through observation and further interrogation.

1.6 Definition of Terms

Household: Refers to a group of people living in the same homestead and sharing the same meal for at least three months before the study (Beyene, 2008).

Off-farm agricultural-related enterprises: Refers to enterprises that are conducted away from the farm but have a link to agriculture. These include buying and selling agricultural produce or selling agricultural inputs, for example, selling vegetables, selling cereals, and agro vet, among others (Babatunde, 2013).

Off-farm non-agricultural related enterprises: Refers to enterprises that are operated away from the farm that involves selling services and products which are not directly related to agriculture, for example, welding, operating a general shop, and operating a salon/ barbershop among others (Babatunde, 2013).

On-farm enterprises: Refers to enterprises that are operated on the farm and are directly related to agriculture, for example, dairy, poultry, and vegetable growing, among others (Babatunde, 2013).

Poverty: Refers to living on less than US\$1.90 per day (World Bank, 2018)

Semi-formal credit: Refers to a type of credit that is offered by semi-formal lending institutions that includes SACCOs, NGOs and government support programs. For the purpose of this study, semi-formal credit refers to the credit that was offered to individuals within groups by the county government of Kakamega.

Small-scale enterprise: Refers to an enterprise that requires little initial capital to be started (Mwangi and Ngugi, 2014). For this study, it will range from a minimum of KES 10,000 to a maximum of KES 100,000.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter gives a literature review related to the study by clearly describing the credit market sector in Kenya. The section also discusses the contribution of small-scale enterprises to the economy in developing countries. Besides, it examines the determinants of credit access among households and the effect of credit access on household income. Furthermore, the chapter concludes by discussing the theoretical and conceptual framework of the study.

2.2 Overview of Credit Market Sector in Kenya

The credit market in Kenya is made up of both formal and informal lending institutions. The market has been growing at a higher rate since the year 2012. The growth is attributed to enhanced technology, which supports digital access to credit (World Bank, 2018). Also, the digital credit market is supported by both commercial banks and telecommunication companies. These institutions have embraced mobile banking, thus transforming the Kenyan financial and credit market (Ndung'u, 2017). Formal lending institutions allocate scores to clients before allowing them to access digital credit. This is done basing on information obtained from the Credit Bureau of Kenya. The digital credit market has contributed towards reducing borrowing transaction costs and lengthy borrowing procedures. Also, it has enabled individuals living in the rural part of the country to access credit by the use of mobile phones (Ndung'u, 2017).

Access to credit is one of the factors necessary for economic growth in Kenya (World Bank, 2017). The government of Kenya has formulated policies and rules to enhance access to credit. For instance, in the year 2016, interest rate cap law was enacted to reduce the cost of borrowing in the country. According to the World Bank report, this law created an unfavorable environment for lending institutions (World Bank, 2017). Commercial banks diverted lending to government and corporate clients leaving out small and medium-sized enterprises. This, in turn, affected the performance of these enterprises, thus resulting in unemployment. It is therefore clear that the introduction of interest rate cap has contributed to a reduction of credit growth in Kenya.

The informal lending sector acts as an alternative source of credit for individuals who cannot access credit from the formal sector (Kibet *et al.*, 2015). In Kenya, this sector includes semi-formal lending institutions such as SACCOs, Rotating and Savings Credit Association

(ROSCA), microfinance institutions, and table banking among others. The law recognizes the industry; hence informal lending institutions are registered (Omino, 2005). An informal sector is an essential tool that contributes to the success of small-scale enterprises in the country. This is because; low-income earners can be allowed to access credit in the informal sector. The sector has, therefore, contributed towards meeting the demand for credit by the low-income earners who are usually sidelined by the formal lending sector (Okibo and Makanga, 2014). Individuals are advised to form groups to access credit from informal lending institutions. Other informal institutions such as SACCOs lend money to members who have deposited money on their accounts.

2.3 Role of Small-Scale Enterprises (SSEs) to the Economies of Developing Countries

Small enterprises play an essential role in enhancing economic growth in developing countries (Bunyasi *et al.*, 2014). For instance, these enterprises increase production within an economy. This ensures that there are adequate products for consumption within a country. Also, excess products produced are exported, thus earning foreign income for a country. Furthermore, through continuous production, SSEs ensure that there is no scarcity of products, thus contributing to stabilizing product prices in an economy (Liedholm and Mead, 2013). On the other hand, these enterprises provide employment opportunities for many individuals.

A study done in South Africa assessed the role of SSEs on economic development using a qualitative approach (Fiseha and Oyelana, 2015). The study concluded that SSEs are critical drivers of alleviating poverty in developing countries. Besides, the enterprises not only contributed to wealth creation but also the generated income for rural households. However, the study noted that several challenges constrained SMEs. Among the problems mentioned in the survey included inadequate finance, lack of enterprise management skills, and deficient operating environment. The study recommended policies aimed at supporting SMEs through engaging all sectors in the economy.

According to Keskin *et al.* (2010), small-scale enterprises are critical drivers for globalization through enhancing a healthy business environment. Also, small-scale enterprises do not only contribute to economic efficiency but also act as a powerful tool for economic growth and development, particularly in developing countries. Furthermore, small-scale enterprises are less affected by financial crises due to their flexibility. SSEs can quickly adapt to any economic environment, and they require less capital to be established (Ngugi, 2012). Another advantage of small-scale enterprises is the low management cost that is used in their operation. These

enterprises, therefore, have the capability of producing cheaper products, thus gaining a competitive edge in any industry. SSEs are also considered to be important actors for promoting competitiveness, innovation, and entrepreneurship in developing countries.

Ayodeji (2013) established the impact of small-scale enterprises on economic growth and development in Nigeria. The study noted that small-scale enterprises had a significant positive effect on economic growth and development. However, several constraints hindering the growth of these enterprises were identified. These included; inadequate finance, poor management, corruption, deficient infrastructures, low demands for their products, small profits, insufficient experience, and training. The study recommended policies aimed at enhancing enterprise access to finance. Also, there was a need for small-scale business owners to be provided with useful information. This would enable them to access investment opportunities, the market for their products, and innovative technology that will help them to have low operation costs thus become competitive in the market.

Small-scale enterprises create multiple employment opportunities for several people in developing nations. This, in turn, helps to reduce social problems such as prostitution and theft. Obi (2015) researched the roles of small-scale enterprises on the performance of the economy in Nigeria using a qualitative approach. The study indicated that small scale enterprises provide employment opportunities to both rural and urban households. The study also noted that social ills such as robbery, fraud, prostitution, and kidnapping reduced in society as a result of employment creation by SSEs. The enterprises also boosted trade within the economy. Besides, over 77.7% of the respondents acknowledged the fact those small-scale enterprises enhance economic growth and development.

Awoyemi (2011) indicated that off-farm SSEs play an essential role in enhancing household income. This led to increased household consumption, which in turn translated to improved household welfare. The study showed that there was a significant positive relationship between SSEs and household income. It entailed comparing the income of households engaging in SSEs with that of their counterparts. The results showed that the overall income of households owning SSEs was higher than that of households that did not participate in SSEs. This is a clear indicator that SSEs play an essential role in enhancing household incomes.

Kenya is one of the developing countries that rely on small-scale enterprises for economic growth and development. The enterprises are critical drivers for employment creation, poverty

reduction, and enhancing productive investment. According to Mugeru and Karfakis (2013), small-scale agricultural enterprises are essential for strengthening rural household's incomes in developing countries. This is an indicator that they have a significant effect on the performance of the economy. On the other hand, Fiseham and Oyelana (2015) investigated the impact of off-farm small-scale enterprises on the poverty eradication in Murang'a County, Kenya. The study focused on the grocery and transport business. It reported that SSEs played a vital role in household poverty reduction. In this case, households who were engaged in these off-farm activities earned extra income that enabled them to purchase household items. The study, therefore, recommended that there is a need to boost SSEs in hence improve household incomes.

However, small scale enterprises in the country face severe challenges such as inadequate finance, administrative bottlenecks, and lack of support services, among others. These challenges constrain their ability to innovate and become sustainable. Several interventions have been considered to stimulate small-scale enterprises. For instance, the International Finance Corporation launched a program that enhances small scale enterprises in the country (World Bank, 2010). The program aims to improve enterprise access to finance, important market information, advisory services, and a favorable operating environment.

Besides, informal lending institutions in the country play an essential role in supporting small-scale enterprises. This is because the institutions have fewer restrictions and lend at a lower interest compared to the formal lending institutions. Mungiru and Njeru (2015) investigated the effects of informal lending institutions on the performance of small enterprises in Kiambu County, Kenya. The study used descriptive statistics and regression analysis on primary data to come up with results. In the study, several sources of informal lending institutions were found to have a significant positive effect on the performance of small-scale enterprises. These included; family finance, friends finance, trade credit finance, and self-help group finance. However, the study reported that shylock finance harmed the performance of SSEs since they were lending at a high-interest rate. The study, therefore, recommended that SSEs should avoid shylocks due to their unfavorable terms. SSEs should instead opt for other informal lending institutions that are friendlier in terms of interests. This study confirmed the results of the Nanyama (2012), who reported that informal lending sectors contributed to the growth of the SSEs.

2.4 Factors Influencing Access and Use of Credit from Semi-Formal Financial Institutions among Small Scale Farmers

There are various factors which influences farmers' decision to use or not use credit from semi-formal sector. These includes institutional factors, socioeconomic factors and individual's perceptions among others. Isitor *et al.* (2014) used logistic regression to investigate utilization of credit obtained from semi-formal and formal institutions. Semi-formal lending institutions included cooperatives, government support programs and non-governmental organizations. The findings of the study indicated that participation in cooperatives, past loan size, awareness of credit sources, and possession of collateral were positive and significant in determining farmer's decision to use credit. However, distance to credit source and household size were negative and significant. While the study focused on determinants credit utilization among farm households, it did not separate credit from different sources.

Auma and Mensah (2014) sought to establish factors determining credit access and use among smallholder farmers in Ethiopia using a bivariate probit model. The study focused on credit from various sources that included informal, semi-formal and formal institutions. The results indicated that land, farm size, education level, and family size had a positive and significant effect on credit access and use among small holder farmers. In this case, individuals with larger farm size could generate more income hence would be able to repay the loan with minimal default. This increased their creditworthiness; therefore, they could quickly get a loan from a lending institution. Furthermore, a large family could be associated with having larger farm sizes hence they could easily access credit. Conversely, educated individuals could be better informed about the regulation and procedure of loan application.

A study on determinants of utilization of table banking credit among micro agri-enterprises in Kenya identified entrepreneurship training, age of agri-enterprise, size of agri-enterprise and location of agri-enterprise to be positive significant factors (Chepkwony *et al.*, 2019). However, gender of household head was negative and significant. The implication was that men were less likely to utilize table banking loans as compared to women. Another study done in Uganda on determinants of credit utilization in the SACCOs reported that access to extension services was a positive and significant factor which determined credit utilization (Alio *et al.*, 2017). However, loan contract characteristics, monitoring of credit utilization, duration of membership and collateral requirements were negative and significant.

A research by Amanuel and Degye (2018) sought to find out the factors influencing utilization of micro-finance from semi-formal institution among smallholder farmers in Ethiopia. Independent double hurdle model was used in data analysis. The results of the study indicated that household size, farm size and literacy status were positive and significant determinants. Conversely the perception about loan repayment period and distance to the credit source were negative significant and significant determinants of micro-finance credit among smallholder farmers. The results contradicted the findings of Isitor *et al.* (2014) which indicated that household size had a negative and significant utilization of credit among rural farm households.

2.5 Effect of Semi-Formal Credit Use on Rural Farm Household Income

Literature has indicated a positive influence of credit access on household incomes. This is because household access to credit can enhance the performance of both on-farm and off-farm enterprises. For instance, credit obtained can be allocated to these enterprises hence generate more income. A study by Owuor (2008) sought to find out how group-credit linkages influenced smallholder farmer's productivity and poverty reduction in Kenya. The study used quantitative data that was collected from 600 respondents. The data was then analyzed using ANOVA, logistic regression model, propensity score margin approach, and switching regression models. It was reported that microfinance institutions played a significant role in improving product performance, input use, and reducing poverty. However, credit access was constrained by factors such as high-interest rates, gender bias among some micro-finance, and short loan servicing periods, among others. The study pointed out the need for microfinance institutions to not only embrace gender equity but also offer a variety of loans to the borrowers. Based on these findings, it is worth noting that the study did not investigate factors that influenced the household allocation of credit to different enterprises; hence the proposed research aimed at filling the gap.

Olagunju and Babatunde (2011) investigated the effect of utilizing credit sourced from cooperatives on the productivity of poultry enterprise using logistic and multiple models. Productivity was estimated by finding the difference in household average net income before and after using the credit. The study indicated that credit use had a significant positive effect on the productivity of poultry enterprises. Furthermore, the results showed that farmers who had access to credit used resources efficiently as compared to those who did not receive credit.

However, this study did not consider the unobservable characteristics that influence individual access to credit.

Ibrahim and Bauer (2013) sought to establish the impact of using credit sourced from semi-formal institutions on-farm gross margin using a Heckman selection model. According to the study, credit use had a positive but limited effect on the farm gross margin. This implied that the credit obtained by the households was used in enhancing farm enterprises. However, the credit was inadequate and, therefore, did not have a significant impact on farm production. The study recommended that there should be a gradual increase in loans provided to farmers based on their ability to repay. This would enable them to invest in technology, thus realize increased gross margin.

Essien and Arene (2014) analyzed the effects of credit use on the performance of agro-based enterprises using qualitative analysis. The study reported that enterprises which accessed credit from the formal institutions performed better than those that received credit from the informal and semi-formal sector. This was attributed to the more substantial amount of money was borrowed from formal sectors. An enterprise that borrowed from the formal industry, therefore, invested a more significant amount leading to better performance. However, it is worth noting that semi-formal institutions allow poor households to borrow credit.

Awotide *et al.* (2015) investigated the impact of access to credit on productivity among smallholder cassava farmers in Nigeria using switching endogenous regression models. The study indicated that farm size and the total number of livestock were negative and statistically significant, thus explaining the variations in production among households who accessed credit. On the other hand, farm size, household size, assets, and access to information had statistically significant negative coefficients, thus explaining the variation in production among the households that did not access credit. Also, the study reported that households who accessed credit had a significant positive effect on cassava productivity. The study recommended the adoption of the policy aimed at increasing access to credit by rural households.

Rotich *et al.* (2015) conducted a study on the effects of micro-finance services SSEs performance in Kenya. This study considered 270 registered enterprises and analyzed the data collected using multiple regression. The study reported that credit period and access to managerial training had a positive effect on enterprise productivity. The study recommended that policies aimed to promote micro-finance should be developed. On the other hand, Akudugu

(2016) researched the relationship between farm production and access to credit using both qualitative and quantitative analysis approach. The study reported a significant positive effect of credit access on farm productivity. The study considered both loans from the semi-formal, formal and informal sectors. The study also pointed out those relevant policymakers should consider enhancing access to credit by farmers to improve agricultural productivity. The same findings were reported by some other studies (Awotide *et al.*, 2015; Olagunju and Babatunde, 2011).

Owusu (2017) investigated the effect credit access and utilization on farm productivity in Ghana. The study used primary data, which was collected from 166 cassava farmers. Also, PSM was used in analyzing the data. The results from the study indicated that access to credit had a positive and significant effect on enhancing cassava productivity. The study recommended that policies aimed at improving agricultural production should focus on ensuring that farmers have access to credit. This study concurred with the findings of Olagunju and Babatunde (2011), who reported that access to credit had significant positive effects on agricultural productivity. However, the study used the PSM approach, which does account for the unobservable characteristics that determine household access to credit. The proposed research will, therefore, overcome this weakness by using a model that accounts for unobservable characteristics among respondents. Inclusion, utilizing credit offered by semi-formal institutions leads to improved household income through enhanced performance of farm and off-farm enterprises.

2.6 Study Gap

From the literature reviewed in this chapter, it is evident that extensive research has been done on the effect of using credit offered by semi-formal institutions on rural farm household income. However, little efforts have been focused on evaluating credit programs offered to small scale farmers by devolved government. The current study sought to reflect new insight on the contribution of devolved governments in Kenya by evaluating the Kakamega County credit program that is commonly known as *Mkopo mashinani*. It is therefore unique from the previous studies which have evaluated the effects of credit from micro-finance, SACCOS, cooperatives, NGOs and table banking.

2.7 Theoretical Framework

This study adopted a random utility theory to explain the decision-making process of a household in accessing credit (McFadden, 1974). The theory makes an assumption that provided a set of choice h in this case credit source, individual i will assign a perceived utility to each alternative and select a specific source that will maximize his/her utility. Choosing one source of credit over another will imply that the utility derived from the chosen source is higher than that of the source not chosen. The utility derived from a given source of the credit depends not only on its features but also on those of the alternative choices. Also, the theory considers utility as a latent construct within the mind of individuals; hence it cannot be directly observed or measured. This implies that an external observer cannot certainly know the utility assigned by household i to alternative j . The theory assumes that the latent utility can be divided into a random and systematic component. Discrete choice modeling is concerned with analyzing the choices of a household. The proposed study entails households making decisions on whether or not to access credit and on which source of credit to consider. The available sources include county credit, informal credit, and formal credit. Based on the random utility theory, a household is subjected to a set of h options from which it chooses the best alternative.

Following the principle of utility maximization alternative j , a credit source will be chosen by individual i if and only if $u_{ij} > u_{im}$ (Jaeger and Rose, 2008). Since utility is not observable, coefficients cannot be estimated directly. According to McFadden (1974), the difference is based on utilities and not the absolute levels. Suppose an individual i is presented with two alternatives, the probability (P) that the consumer chooses alternative j over m can be estimated as:

$$P_{ij} = \text{prob}(u_{ij} > u_{im}) = \text{prob}(u_{ij} - u_{im} > 0) = \text{prob}(v_{ij} + \varepsilon_{ij} > v_{im} + \varepsilon_{im}) = \text{prob}(\varepsilon_{im} - \varepsilon_{ij} < v_{ij} - v_{im}) \quad \forall j \neq m \dots \dots \dots 2.1$$

2.8 Conceptual Framework

Figure 2.1 illustrates the interrelationship between different variables to be used in the study. The decision to use semi-formal credit offered by the county government was assumed to be influenced by socio-economic factors, enterprise characteristics, and institutional factors. Besides, the factors were also expected to influence the household allocation of credit to different enterprises. Individuals who used the semi-formal credit were expected to benefit from low interest rates. In addition, they were expected to invest in farm and off-farm enterprises hence enhance their performance. This in turn, could contribute towards enhancing household income.

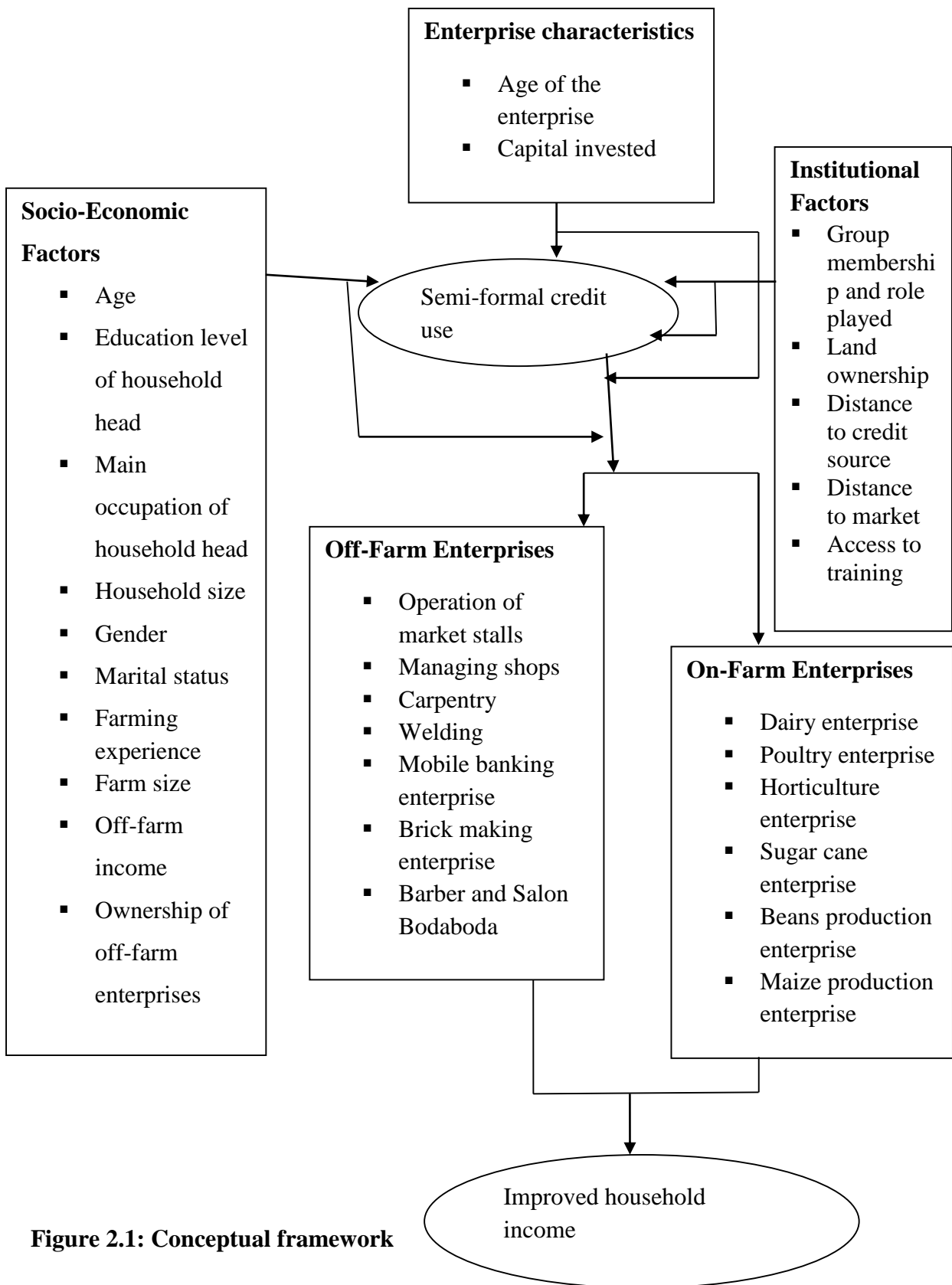


Figure 2.1: Conceptual framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the research design of the study. It also describes the study area and sampling design. It indicates how the sample size will be determined. Besides, it provides information on the methods that were used to collect the data. The chapter also discusses the analytical framework of the study. The analytical techniques discussed in the chapter includes descriptive and inferential statistics.

3.2 Research Design

This study was based on a cross-sectional survey that was conducted in Malava and Lugari Sub-counties. The approach is suitable for non-experimental descriptive designs that aim at describing reality (Walliman, 2017). It is an appropriate approach for collecting information on people's behavior and attitudes. The survey approach is efficient since it embraces a random sampling technique to select participants; hence the findings of small sample size can be generalized to the whole population.

3.3 Study Area

The study was conducted in Kakamega, the county that initiated the credit program. Kakamega County borders Siaya and Busia Counties to the West, Nandi County to the East, Vihiga County to the South, Trans Nzoia and Bungoma Counties to the North and Uasin Gishu County to the North East. The county covers an approximate area of 3051.3 km² (KBS, 2015). Also, it has an estimated population of 1,660,651 residents. The county has favorable agricultural conditions with two rain seasons per year. Its primary economic activity is agriculture and small scale business enterprises. It has two ecological zones, namely the Lower Medium and the Upper Medium. The Lower Medium covers a substantial portion of the southern part of the county, which includes Khisero, Matungu, Butere, and Mumias. Sugar cane production is the main economic activity in this zone. However, some farmers engage in maize, groundnuts, tea, sweet potatoes, and cassava production. On the other hand, the Upper Medium covers the Northern and the Central parts of the county, which includes Ikolomani, Lurambi, Shinyalu, and Malava that intensively deals with beans, maize, and horticultural production mainly in small scale; and Likuyani and Lugari where large scale farming takes place.

Other agricultural enterprises practiced in the county include poultry and dairy farming. Moreover, there are several off-farm enterprises practiced in the county. The enterprises include market stalls, shops, carpentry, welding, mobile banking, brick making, barber and saloon, and Bodaboda, among others. These enterprises are constrained with inadequate finance due to limited credit access. Kakamega County government has therefore established a program aimed at issuing credit at an affordable interest to its residents. The program started in the year 2015 to improve livelihood income and eradicate poverty. The initiative required borrowers to be members of a registered economic group to qualify for the application of credit. After accessing the loan, beneficiary groups could share the amount obtained among their group members basing on the guidance provided by their specific group constitution.

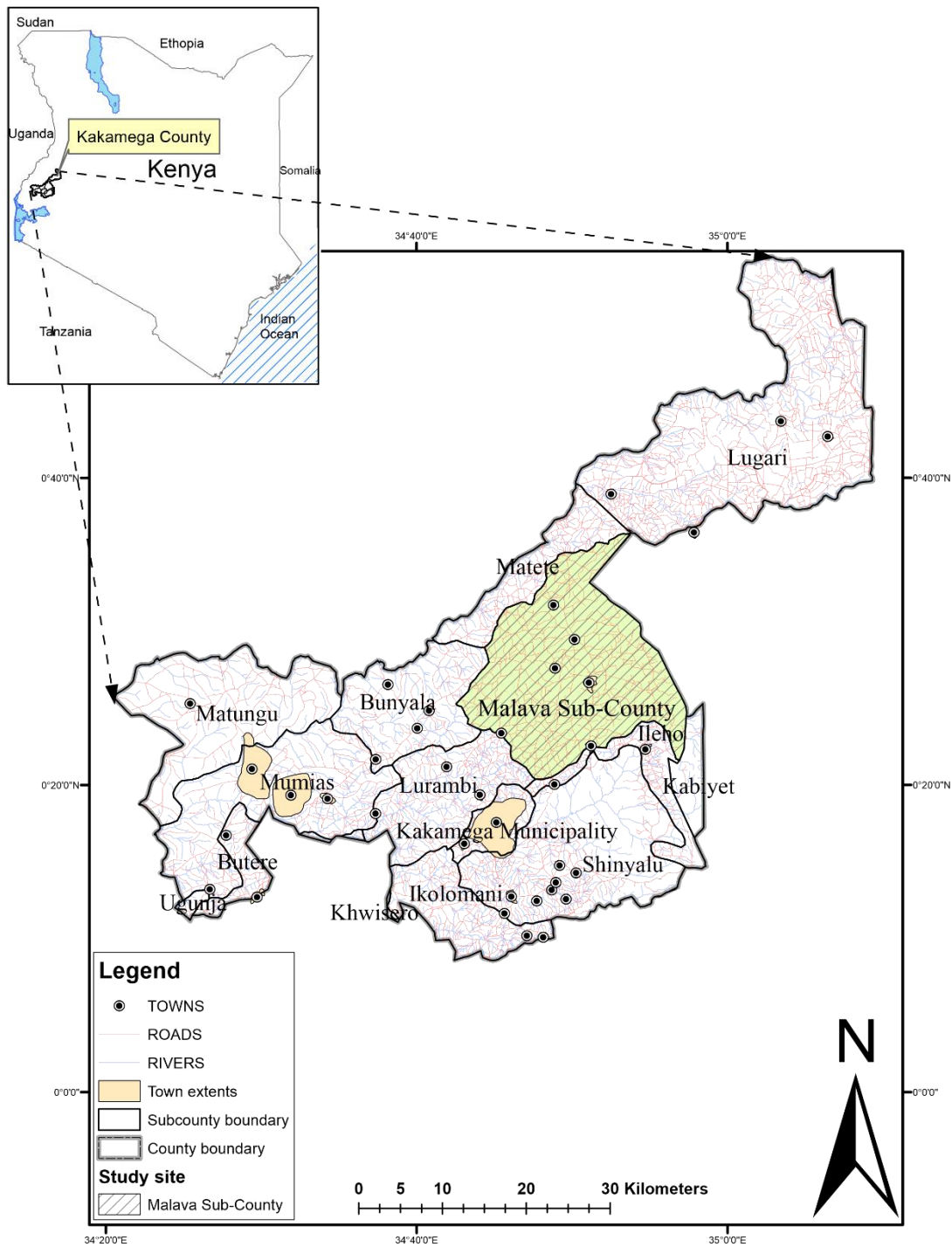


Figure 2: Map of Kakamega County showing the study area
Source: Geography Department, Egerton University (2018)

3.4 Sampling Design and Techniques

The study embraced stratified multi-stage sampling approach in the selection of respondents. The approach is useful in dividing the population into sub-groups hence providing greater precision (Taherdoost, 2016). The first stage involved purposive selection of Kakamega County and two sub-counties; beneficiary and non-beneficiary. In line with this, Malava Sub-county was selected since it had the highest number of beneficiary groups compared to the other sub-counties. On the other hand, Chevaywa and Lwandeti wards of Lugari sub-county were selected to serve as a control for the study since no group from the wards benefited from the credit program. Lugari was among the sub-counties that were left out to be considered in the subsequent roll-out of the programme. The second step entailed purposive selection of all beneficiary groups in Malava sub-county. Systematic sampling was then used to select 83 respondents from a randomized list of 105 beneficiaries from all groups. The list was obtained from the county micro-credit office.

In the third stage, ten non-beneficiary self-help groups were purposively selected from a list of registered groups in Lugari sub-county since they were based in the two wards. These groups engaged in a range of activities which included marketing agricultural produce, table banking and merry go round. Systematic sampling was then used to select 96 respondents from a randomised list of 127 non-beneficiaries from the ten groups to give a total sample size of 179. The list of group members was obtained from their respective group leaders. It is worth noting that all the beneficiaries and non-beneficiaries could not be included in the study due to technicalities associated with data collection. For instance, participation in the study was based on the consent and free will of the respondents.

Systematic sampling approach ensured that all respondents had an equal opportunity of being included in the sample (Levy and Lemeshow, 2013). The sampling interval was computed as follows;

$$k = \frac{N}{n} \dots\dots\dots(3.1)$$

$$k_1 = \frac{105}{83} \approx 1 \text{ ; interval for beneficiaries}$$

$$k_2 = \frac{127}{96} \approx 1 \text{ ; interval for non-beneficiaries}$$

Where k refers to the interval for the for the beneficiary and non-beneficiary samples respectively, N refers to the population and n refers to the desired sample size.

In this case, $N \neq kn$ implying that the systematic samples were not equal in size and the sample mean was a biased estimator of the population mean. Circular systematic sampling was used to overcome the weakness (Levy and Lemeshow, 2013). Integers ranging from 1 to 105 were used to label pieces of papers after which one piece of paper was randomly picked to determine the starting integer on which the sampling interval was based. Afterwards, each k^{th} unit on the list was selected in a circular manner until the desired sample was attained. The k^{th} unit was computed based on the following formula;

$$\left. \begin{array}{l} i + jk, \quad \text{if } i + jk \leq N \\ i + jk - N, \quad \text{if } i + jk > N \end{array} \right\} \quad j = 0, 1, 2, \dots, (n-1) \dots \dots \dots (3.2)$$

Where i refers to the randomly selected integer.

3.5 Sample Size Determination

The sample size for the beneficiary respondents was determined using a finite population correction formula (Yamane, 1967). The formula is as specified below;

$$n = \frac{N}{1 + N(e)^2} \dots \dots \dots (3.3)$$

$$n = \frac{105}{1 + 105(0.05)^2}$$

$n \approx 83$ beneficiaries

$$n = \frac{127}{1 + 127(0.05)^2}$$

$n \approx 96$ non-beneficiaries

Where n is the desired sample size, N is the population size and e refers to the acceptable error that is set at 0.05 (Yamane, 1967).

3.6 Methods of Data Collection

Data collection was done using semi-structured questionnaires. The questionnaires were administered through a personal interview with the help of research assistants. Both qualitative and quantitative data were collected. These data included; whether or not a household has access to credit, source of confidence and type of small-scale enterprises that benefited from the credit accessed. The enterprises were classified into two categories, namely on-farm

enterprises and off-farm enterprises. Also, data on the cost incurred in operating the enterprises and the expected revenue was captured in the questionnaire. Furthermore, data on household socio-economic characteristics included age, education level of household head, farm size, household size, gender, and marital status, among other variables. Finally, data on institutional factors included individual membership in a group, distance to nearest formal credit source, and land ownership, among others.

3.7 Analytical Framework

Both descriptive and inferential methods of data analysis were used. Excel spreadsheet and STATA version 14 software was used to analyze the gathered data. The method of data analysis for each objective is as discussed in detail in the next sub-topics.

3.7.1 Profiling Types of Enterprises Supported with Credit Accessed

Rural households in Kakamega county engages in both on-farm and off-farm enterprises (Mulinya, 2017). The credit obtained by farm households was expected to be invested in these enterprises. This study used descriptive statistics to profile the type of enterprises that benefit from accessed credit. This approach is suitable for analyzing qualitative data (Chikwama, 2010). The objective was achieved by using descriptive statistics. The results were presented using tables of percentages and frequencies.

3.7.2 Determinants of Household Allocation of Semi-Formal Credit Obtained to Different Types of Enterprises

Household allocation of credit obtained depends on their perception of the available investment options in terms of the returns expected and the risks entailed (Bartolini, Andreoli and Brunori, 2014). For instance, a household may allocate credit to enterprises that guarantee high returns regardless of the risks incurred. This study postulated that households that access credit have three options of investments. These include; on-farm, off-farm, and a combination of both on-farm and off-farm enterprises. When allocating credit obtained to different enterprises, a household aims at maximizing utility. The amount allocated to a specific enterprise should, therefore, enable a household to maximize returns. Ordinary Least Squares (OLS) can be used to determine the factors influencing household allocation of credit to different enterprises. However, this model is only suitable for a single linear model. It was not ideal in this case because of several linear system equations entailed. Another model that would have been appropriate was the multinomial regression, but it would have yielded biased estimates due to the assumption that the error terms are independent (Taddy, 2015).

$$E[\mu_i \mu_i' | X_1, X_2, X_3] = \sigma_{ii} I_T = \Omega = \begin{pmatrix} \sigma_{11} I & \sigma_{12} I & \sigma_{13} I \\ \sigma_{21} I & \sigma_{22} I & \sigma_{23} I \\ \sigma_{31} I & \sigma_{32} I & \sigma_{33} I \end{pmatrix} \dots\dots\dots (3.5)$$

where I is an identity matrix and σ_{ij} refers to the contemporaneous correlation between error terms.

In this case, the correlation of stochastic terms between farm enterprise, off-farm non-agricultural, and off-farm agricultural-related enterprises allowed the implementation of a joint estimation procedure, which is more efficient and better than separate Least Square Estimation (Hill *et al.*, 2012). This implies that;

$$Cov(\mu_1, \mu_2, \mu_3) = \sigma_{123} \text{ and } \sigma_{123} \neq 0 \dots\dots\dots (3.6)$$

This equation indicates that the error terms are contemporaneously correlated. The three error terms consist of the effect of household-specific factors omitted from the three equations. The reason why the errors are correlated is that households who engage in the different types of enterprises are the same. SUR model, therefore, accounted for differences in variances of error terms and the possible correlation between the equations. The general SUR model can be specified as follow;

$$Y_1 = \beta_0 + \beta_1 gendhhh + \beta_2 agehhh + \beta_3 edhhh + \beta_4 frm exp + \beta_5 hhs + \beta_6 occh + \beta_7 mrst + \beta_8 ngrps + \beta_9 rgrp + \beta_{10} distcr + \beta_{11} distmkt + \beta_{12} ntrngs + \beta_{13} extcont + \beta_{14} frmsize + \beta_{15} landown + \beta_{16} landareacult + \beta_{17} offentr + \beta_{18} ageent + \beta_{19} ffinc + \mu \dots\dots\dots (3.7)$$

$$Y_2 = \beta_0 + \beta_1 gendhhh + \beta_2 agehhh + \beta_3 edhhh + \beta_4 frm exp + \beta_5 hhs + \beta_6 occh + \beta_7 mrst + \beta_8 ngrps + \beta_9 rgrp + \beta_{10} distcr + \beta_{11} distmkt + \beta_{12} ntrngs + \beta_{13} extcont + \beta_{14} frmsize + \beta_{15} landown + \beta_{16} landareacult + \beta_{17} offentr + \beta_{18} ageent + \beta_{19} ffinc + \mu \dots\dots\dots (3.8)$$

$$Y_3 = \beta_0 + \beta_1 gendhhh + \beta_2 agehhh + \beta_3 edhhh + \beta_4 frm exp + \beta_5 hhs + \beta_6 occh + \beta_7 mrst + \beta_8 ngrps + \beta_9 rgrp + \beta_{10} distcr + \beta_{11} distmkt + \beta_{12} ntrngs + \beta_{13} extcont + \beta_{14} frmsize + \beta_{15} landown + \beta_{16} landareacult + \beta_{17} offentr + \beta_{18} ageent + \beta_{19} ffinc + \mu \dots\dots\dots (3.9)$$

where Y_1, Y_2 and Y_3 refers to the amount allocated to on-farm, off-farm non agriculture and off-farm agriculture related enterprises respectively and μ refers to the error term. The priori expectation was that socio-economic, institutional and enterprise related factors would either have a positive or negative effect on household income. Table 3.1 provides the variables that were used in the SUR model.

Table 3.1. Description of variables to use in the SUR model

Variable	Description	Measurement	Expected sign
Dependent			
Amnt on-farm	Amount allocated to farm enterprises	Continuous	
Amnt off-farm non agric	Amount allocated to off-farm non-agricultural enterprises	Continuous	
Amnt off-farm agric rel	Amount allocated to off-farm agricultural-related enterprises	Continuous	
Independent			
hhs	Household size	Continuous	±
gendhhh	Gender of household head 0=Female;1= Male	Binary	±
mrts	Marital status; 1=Single, 2=Married, 3=Separated, 4=Divorced, 5=Widowed	Discrete	±
agehhh	Age of house housed head	Continuous	±
edhhh	Years of schooling	Continuous	±
frmexp	Farming experience (number of years)	Continuous	±
occh	Main occupation of household head	Descriptive	±
extcont	Number of extension contacts	Continuous	±
farmsize	Farm size in acres	Continuous	±
dister	Distance to credit source	Continuous	±
dismkt	Distance to the market	Continuous	±
ngrps	Number of socio-economic groups		
rgrp	Membership and role played in groups. 1=Member and leader; 0 otherwise	Binary	±
landown	Land ownership; 1= Inherited, 2= Purchased 3= Rented in 4= Borrowed 5=Community 6=Government 7=Others	Discrete	±

Table 3.1 continues

Variable	Description	Measurement	Expected sign
landareacult	Land area under cultivation (Acres)	Continuous	±
ageent	Age of the enterprise	Continuous	±
offentr	Ownership of off-farm enterprise 0=No; 1=Yes	Binary	±
ffinc	Off-farm income	Continuous	±
ntrngs	Number of trainings (agricultural and financial training)	Continuous	±

3.7.3 Effect of Semi-Formal Credit Use on Household Income

Heterogeneity and selection bias are key issues encountered in impact assessment studies. The assumption that credit allocation to households is done in random manner results into the ambiguity (Bocher *et al.*, 2017). In reality, a household's decision to utilize semi-formal credit could be influenced by unobservable individuals' behaviour. In addition, lending institutions selects households that are resource endowed to reduce the chances of defaults by households that have received credit. Unobserved characteristics of the household also influence the impact of credit utilization household income. The implication is that the decision to participate in the credit programme is endogenous to the desired outcome; household income. Endogeneity problem occurs when the variables estimated are correlated with the error terms. The sources of endogeneity include measurement error, simultaneity and unobserved household characteristics.

When investigating the effect of credit use on household income, cautious analysis is required to differentiate the credit impact on household income from other correlated features. This cannot be attained through the use of ordinary least square approach (Bocher *et al.*, 2017). However, control functions methods can be used in the analysis. In line with this, control functions consider household decision to use credit to be non-random. Control functions approach, therefore, allows for self-selection into a decision, thus accounting for endogeneity problem (Tesfaye and Tirivayi, 2016). The propensity score margin approach can be used to determine the effect of credit access on household incomes. However, the model does not control for the unobserved characteristics that could influence household access to credit. For instance, household heads with high education levels are more likely to have access to credit

compared to the ones who have low education levels. The study, therefore, used the endogenous switching regression model (ESR) to estimate the effect of credit access on household income. In this case, ESR addressed the sample selection bias that could arise in household decisions to apply for credit (Seng, 2018). Besides, ESR helped in solving the problem of endogeneity since it accounted for correlation in the unobserved characteristics that could influence household access to credit and its effect on income levels. Two steps were involved in estimating ESR. The first step entailed the estimation of the probit model, which specified factors that influence household access to credit. The second step required the estimation of the effect of credit access on household income.

This study adopted the model used by Lockshin and Sajaia (2011), Rao and Qaim (2011), Alene and Manyong (2007), and Asfaw *et al.* (2010). Decision to participate in the credit program can be perceived as a binary choice decision by farm households whose aim is to maximize utility. A household will participate in the program only if $U_{i1}^* > U_{i0}^*$; implying that the expected net benefits exceeds the cost. In this case, U_{i1}^* and U_{i0}^* represent latent variables. What is observed is the actual decision of participating in the program, U , with $U = 1$ if $U_{i1}^* > U_{i0}^*$ and $U = 0$ if $U_{i1}^* \leq U_{i0}^*$. Decision to take credit can therefore be represented as follows;

$$U = Z\alpha - \varepsilon \dots \dots \dots (3.10)$$

Where ε represents the error term and α represents the vector parameters.

Suppose Y denotes average household income which is determined by both endogenous and exogenous variables. Then, the income effects can be modelled as follows;

$$Y = X\beta + \gamma U + \mu \dots \dots \dots (3.11)$$

Where X is vector of parameters and U is decision to participate in the credit program. The effect of participating in the credit program is captured by γ . However, the coefficient may be biased due to unobservable household characteristics which influences the decision to take credit. Switching regression can therefore be used to correct the bias by accounting for systematic differences across groups. The model treats household decision to take credit as regime shifters. These regimes can be presented as follows;

$$\begin{aligned} y_q &= X_q \beta_q + \mu_q \\ y_r &= X_r \beta_r + \mu_r \dots \dots \dots (3.12) \end{aligned}$$

$$U^* = Z\alpha - \varepsilon$$

Where y_q and y_r represent household income for those who participated in the program and those who did not respectively. In addition, β_q and β_r are vectors of parameters to be measured while U^* is a latent variable that determines the type of regime that applies. The sets variables X and Z can overlap. However, the requirement of proper identification is that at least one variable in Z does not appear in X (Rao and Qaim, 2011). It is worth noting that y_q and y_r are only partially observed when dealing with cross section sample. The implication is that y_q is only observed in the sub-sample of farmers who participated in the program while y_r is only observed in the sub-sample of farmers who did not participate in the program. However, a single variable y_i is totally observed, it can be defined as follows;

$$y_i = \begin{cases} y_q & \text{if } U^* > 0 \\ y_r & \text{if } U^* \leq 0 \end{cases} \quad \text{and} \quad Y = \begin{cases} 1 & \text{if } U^* > 0 \\ 0 & \text{if } U^* \leq 0 \end{cases} \quad \dots\dots\dots(3.13)$$

In equation 4, μ_q , μ_r and ε are stochastic terms that are only contemporaneously correlated. They have a trivariate normal distribution, with zero mean and no-singular covariate matrixes that can be illustrated as follows

$$Cov(\mu_q, \mu_r, \varepsilon) = \begin{bmatrix} \sigma_q^2 & \sigma_{qr} & \sigma_{q\varepsilon} \\ \sigma_{qr} & \sigma_r^2 & \sigma_{r\varepsilon} \\ \sigma_{q\varepsilon} & \sigma_{r\varepsilon} & \sigma^2 \end{bmatrix} \dots\dots\dots(3.14)$$

Where

$$\sigma_q^2 = Var(\mu_q); \sigma_r^2 = Var(\mu_r); \sigma^2 = Var(\varepsilon); \sigma_{qr} = Cov(\mu_q, \mu_r); \sigma_{q\varepsilon} = cov(\mu_q, \varepsilon); \sigma_{r\varepsilon} = COV(\mu_r, \varepsilon); \sigma^2$$

is the variance of the error term in the selection equation. Moreover, σ_q^2 and σ_r^2 represents variance of the error term of the outcome equation. It is worth noting that the variance of ε is set at one due to the fact that α can be approximated only up to a scale factor(Greene, 2007). Moreover, $\sigma_{qr} = 0$ because i_q and i_r are observed partially. Based on the switching model presented, correlation between stochastic terms of selection equation and regime equation would indicate the presence of significant critical unobservable factors. The implication is that covariate terms can be used to test for endogeneity. In line with this, a model with endogenous switching is attained if σ_{qr} or $\sigma_{r\varepsilon}$ is non-zero. Conversely, if $\sigma_{q\varepsilon} = \sigma_{r\varepsilon} = 0$, then there is exogenous switching (Maddala, 1986). The test of endogeneity is done by testing for

significance correlation between error terms μ_q and ε ($\rho_{q\varepsilon}$) computed as $\sigma_{q\varepsilon}/\sigma_q\sigma_\varepsilon$ and between μ_q and ε ($\rho_{r\varepsilon}$) computed as $\sigma_{r\varepsilon}/\sigma_r\sigma_\varepsilon$ (Lokshin and Sajaia, 2011). The correlations can be used to express the expected values of the truncated error term as follows;

$$E(\mu_q/U=1) = E(\mu_q/\varepsilon > Z\alpha) = -\sigma_{q\varepsilon} \frac{\varphi(Z\alpha/\sigma)}{\Phi(Z\alpha/\sigma)} = -\sigma_{q\varepsilon} \lambda_q \dots \dots \dots (3.15)$$

$$E(\mu_r/U=1) = E(\mu_r/\varepsilon \leq Z\alpha) = \sigma_{r\varepsilon} \frac{\varphi(Z\alpha/\sigma)}{\Phi(Z\alpha/\sigma)} = \sigma_{r\varepsilon} \lambda_r \dots \dots \dots (3.16)$$

where Φ and ϕ are the cumulative distribution and the probability density function of the standard normal distribution respectively. Hence λ_q and λ_r are the IMRs (Inverse Mills Ratios) assessed at $Z\alpha$ (Green, 2008). Apart from providing a test for endogeneity, the signs of $\rho_{q\varepsilon}$ and $\rho_{r\varepsilon}$ have economic implications. For instance, alternate signs of $\rho_{q\varepsilon}$ and $\rho_{r\varepsilon}$ would imply that households decide to participate in the credit program based on its comparative advantage. Conversely, same signs would indicate that there is hierarchical sorting.

Based on logarithmic likelihood function assumption, the distribution of error terms can be expressed as follows;

$$\ln L_i = \sum_{i=1}^N U_i \left[\ln \varphi \left(\frac{\mu_{qi}}{\sigma_q} \right) - \ln \sigma_q + \ln \Phi(\theta_{qi}) \right] + (1-U_i) \left[\ln \varphi \left(\frac{\mu_{ri}}{\sigma_r} \right) - \ln \sigma_r + \ln (1-\Phi(\theta_{ri})) \right] \dots \dots \dots (3.17)$$

where $\theta_{gi} = (Z\alpha/\sigma + \rho_g \mu_{gi}/\sigma_g) / \sqrt{1-\rho_g^2}$, $g=1,2$, with ρ_g indicating correlation coefficients between the error term μ_{qi} and μ_{ri} of equation 3.11.

The effect treatment on the treated (TT) is computed by finding the difference between the expected household income before and after accessing credit. This can be represented as follows;

$$TT = E[y_{qi}/U_i=1] - E[y_{ri}/U_i=1] = X_{qi}(\beta_q - \beta_r) + (\sigma_{q\varepsilon} - \sigma_{r\varepsilon}) \lambda_{qi} \dots \dots \dots (3.18)$$

This represents the impact of credit access on household income. Conversely, the effect of credit access on household income for the control group is represented by the effect of treatment on the untreated which can be expressed as shown below;

$$TU = E[y_{qi} / U_i = 0] - E[y_{ri} / U_i = 0] = X_{ri} (\beta_q - \beta_r) \dots \dots \dots (3.19)$$

It is worth noting that ESR allows the estimation of the impact of variable under consideration for counterfactual and actual conditions as shown in Table 3.2.

Table 3.2. Conditional actual and counterfactual expected household income

Sub-sample	Decision level	
	Using the credit	Not using the credit
Beneficiaries	a) $E(y_{qi} / U_i = 1) = X_{qi} \beta_q + \sigma_{q\mu} \lambda_{qi}$	b) $E(y_{qi} / U_i = 0) = X_{ri} \beta_q + \sigma_{q\mu} \lambda_{ri}$
Non-beneficiaries	c) $E(y_{ri} / U_i = 1) = X_{qi} \beta_r + \sigma_{r\mu} \lambda_{qi}$	d) $E(y_{ri} / U_i = 0) = X_{ri} \beta_r + \sigma_{r\mu} \lambda_{ri}$

The column difference measures the effect of credit access on beneficiary and non-beneficiary households under counterfactual and actual and regimes. Moreover, the row difference measures the effect of credit on household income that is not associated with heterogeneity effect. The elements in diagonal cells (a) and (d) presents the actual expected logarithmic of total household income for beneficiaries and non-beneficiaries respectively. Conversely, cells (b) and (c) represent the counterfactual expected household income conditions for beneficiary and non-beneficiary households respectively. The difference between cells (a) and (b) represents heterogeneity effect for the beneficiary households which can be presented as follows;

$$BH_q = E[y_{qi} / U_i = 1] - E[y_{ri} / U_i = 0] = (X_{qi} - X_{ri}) \beta_{qi} + \sigma_{q\epsilon} (\lambda_{qi} - \lambda_{ri}) \dots \dots \dots (3.20)$$

Conversely the effect of base heterogeneity for non-beneficiary households can be represented by the difference between cells (c) and (d) as expressed below;

$$BH_r = E[y_{ri} / U_i = 1] - E[y_{ri} / U_i = 0] = (X_{qi} - X_{ri}) \beta_{ri} + \sigma_{r\epsilon} (\lambda_{qi} - \lambda_{ri}) \dots \dots \dots (3.21)$$

It is worth noting that transitional heterogeneity can be computed by taking the difference between equation 3.19 and 3.20. The empirical model for the first stage of the ESR model can be represented as follow;

$$A^* = \beta_0 + \beta_1 Gendhhh + \beta_2 agehhh + \beta_3 edhhh + \beta_4 frm exp + \beta_5 hhs + \beta_6 occh + \beta_7 mrts + \beta_8 frmsize + \beta_9 landown + \beta_{10} offentr + \beta_{11} extcont + \beta_{12} rgrp + \beta_{13} distcr + \mu \dots \dots \dots (3.22)$$

where A^* refers to decision to use credit.

On the other hand, the empirical model for the second stage of the ESR model can be specified as follows;

$$Y_1 = \beta_0 + \beta_1 Gendhhh + \beta_2 agehhh + \beta_3 edhhh + \beta_4 frm\ exp + \beta_5 hhs + \beta_6 occh + \beta_7 mrts + \beta_8 frmsize + \beta_9 landown + \beta_{10} offentr + \beta_{11} extcont + \beta_{12} rgrp + \beta_{13} distcr + \mu \dots \dots \dots (3.23)$$

$$Y_2 = \beta_0 + \beta_1 Gendhhh + \beta_2 agehhh + \beta_3 edhhh + \beta_4 frm\ exp + \beta_5 hhs + \beta_6 occh + \beta_7 mrts + \beta_8 frmsize + \beta_9 landown + \beta_{10} offentr + \beta_{11} extcont + \beta_{12} rgrp + \beta_{13} distcr + \mu \dots \dots \dots (3.24)$$

where Y_1 and Y_2 refers to income for households that utilized and those that did not use the credit respectively.

The priori expectation was that socio-economic and institutional factors would either have a positive or negative effect on household income. For instance, utilization of credit was expected to be positively associated with household income because the decision to use credit is driven by the desire to maximize returns on investments. However, it is worth noting that access to credit could be negatively associated with income in a case where credit accessed was not allocated correctly. Also, socio-economic factors such as educational level, age, household size, and marital status, among others, are likely to be positively or negatively related to household income. Furthermore, institutional factors such as membership in a group, social network, and land ownership are also expected to have a positive or a negative effect on household income. Table 3.3 describes the variables that were used in the ESR model and their expected priori signs.

Table 3.3. Description of variables used in the endogenous switching regression model

Variable	Description	Measurement	Expected sign
Dependent			
hhi	Household income	Continuous	
Independent			
hhs	House hold size	Continuous	±
gendhhh	Household Head Gender; 0=Female, 1=Male	Binary	±
agehhh	Age of house housed head	Continuous	±
mrts	Marital status; 1=Single, 2=Married, 3=Separated, 4=Divorced, 5=Widowed	Descriptive	±
edhhh	Years of schooling	Continuous	±
occh	Main occupation of household head	Descriptive	±
dister	Distance to credit source	Continuous	±
rgrp	Membership and role played in groups. 1=Member and leader; 0 otherwise	Binary	±
landown	Land ownership; 1= Inherited, 2= Purchased 3= Rented in 4=Borrowed 5=Community 6=Government 7=Others	Binary	±
frmexp	Farming experience (number of years)	Continuous	±
farmsize	Farm size in acres	Continuous	±
offentr	Ownership of off-farm enterprise 0=No; 1=Yes	Binary	±
extcont	Number of extension contacts	Continuous	±

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

The chapter presents the empirical findings, and it is divided into three major sections based on the objectives of the study. It begins by presenting descriptive statistics of socio-economic and institutional features of small-scale farmers based on their credit access status. It also presents the type of enterprises that benefited from the credit obtained by farmers. Additionally, the chapter presents factors determining household allocation of credit obtained to different enterprises. Finally, it presents the ESR results on the effect of semi-formal credit use on household income. The results of the study are discussed while making a comparison to the findings of other studies.

4.2 Descriptive Results

Table 4.1 presents the mean difference of household characteristics by farmer credit use status for continuous variables. The aggregate mean household size was 7 hence exceeding the national average of 5 persons (KNBS, 2017). Additionally, the mean household size for the non-user group was 6 persons, while those that used the loan had an average of 8 persons. On the other hand, the aggregate mean age of household head was 48. However, the mean age of household head in the category of non-users and the users was 47 years and 48 years, respectively. The result indicates that the majority of households in the study area are young; hence they belong to the economically active group.

The aggregate mean of schooling years among household heads in the study area was 10, indicating that most household heads in the county had attained at least primary and secondary levels of education. However, the average schooling years among the group that did not use the credit was 11, while that of the group that used the loan was 10 years. This result indicates that household-heads with more schooling years are more likely to access opportunities that can enable them to earn income as compared to those with less schooling years. This, in turn, helps them to have more savings; hence they do not heavily rely on credit in financing their budget. Generally, an increase in schooling years has been reported to have a positive influence on household credit access (Dzadze *et al.*, 2012).

The aggregate mean of farming experience was 21 years. This consisted of a mean of 19 years among the group that did not use the credit and 24 years among the group which used the loan. The t-test results indicated that the difference in the years of experience between the two groups

of farmers was significant at 5%. The results showed that farmers with fewer years of farming experience were less likely to use the credit as compared to those with high farming experience. This is because an increase in farming experience significantly improves productivity, thus boosting farm income. In this case, an increase in farm income increases a farmers' financial ability, thereby enabling them to access credit easily. Similar results were reported by Chandio *et al.* (2017).

Table 4.1. Mean difference of household characteristics by farmers' credit use status (continuous variables)

Sample size	Non users =96		Users =83		Aggregated	
	Std. Dev.	Mean	Std. Dev.	Mean	mean =179	t-test
Household size	2.81	6.38	3.53	7.07	6.70	-1.4703
Age of household head(years)	13.82	46.82	11.53	49.58	48.10	-1.4351
Schooling years of household head	3.62	10.50	3.29	10.18	10.35	0.6143
Farming experience	13.86	19.15	14.09	24.05	21.42	-2.342**
Farm size (acres)	1.83	2.28	1.80	2.25	2.27	0.1242
Land area cultivated (acres)	1.53	1.96	1.66	1.99	1.97	-0.0922
Off-farm income (KE)	333084.10	269888.40	519628.70	321257.20	293707.50	-0.7976
Household income (KES)	392749.60	293353.00	543258.00	551927.80	413250.80	-3.6821**

****:** Significant at 1%, 5% and 10% respectively

The aggregate mean of farm size in the study area was 2.27 acres. The mean farm size of households that used the credit was 2.28 acres, while that of the group that did not use the credit was 2.25 acres. Besides, the aggregate mean of land under cultivation in the study area was 2.28 acres. Farm size plays a critical role in accessing credit. In line with this, farmers who have large farm sizes are more likely to obtain credit compared to those who have less farm

size (Kosgey, 2013). This may be attributed to increased farm income as a result of economies of scale that is associated with large farms.

The aggregate mean of off-farm income among the sampled small scale farmers was KES 293,707.50. However, the mean of off-farm income among the non-user group was KES 269,888.40, while that of their counterpart group was KES 321, 257.20. The results indicated that the group of farmers who used the credit were able to attain more off-farm income as compared to their counterpart group. In this case, the credit obtained enabled them to either start new off-farm enterprises or boost the existing ones. On the other hand, the aggregate mean of household incomes among the sampled respondents was KES 413,250.80. Additionally, the mean household income of the group that used the credit was KES 551,927.80, while that of their counterpart group was KES 293,353. The t-test results indicated that; the difference in household income between the two groups of farmers was significant at 5%. In line with these observations, credit use generally leads to improved household incomes (Seng, 2018). This is because the credit obtained can be invested in farm and off-farm enterprises, which in turn generate income.

The results in Table 4.2 present the association of household characteristics by farmers' credit use status with respect to their gender, the main occupation of household head, marital status, and ownership of off-farm enterprises. A large proportion of the sampled households (69.27%) were headed by males while those that were headed by females constituted only 30.73%. However, among households that used the credit, 71.08% were headed by males, while 28.92% were headed by females. On the other hand, 67.71% of the households that did not use the credit were headed by males, while 32.29% were headed by females. The results were as expected since males customarily lead households in the study area. Moreover, land and other fixed factors of production are also traditionally owned by men (Wangari, 2016). They can, therefore, easily access credit using these fixed assets as security. However, the Chi-square test revealed that the association between gender of household head and credit use was not significant.

There was a significant association between the main occupation of household head and semi-formal credit use access at a 5% level. The major occupation of the household head in the study area was farming, which consisted of 49.16%. Also, 13.97% of household heads were employed in the public sector, 3.91% mainly worked in the private sector, 0.56% earned wages

from on-farm work, 28.49% operated businesses, and 2.79% were benefiting from the pension while 1.12% engaged in other occupations.

Table 4.2. Association of household characteristics by farmers' credit use status (Dummy variables)

Variable		Non- users%	Users %	Aggregate %	Chi- square	
Gender of the household head	Female	32.29	28.92	30.73	0.2384	
	Male	67.71	71.08	69.27		
Main occupation of household head	Farming	56.25	40.96	49.16	15.7024**	
	Salaried public sector	14.58	13.25	13.97		
	Salaried private sector	5.21	2.41	3.91		
	Wage, on-farm	1.04	0.00	0.56		
	Business	20.83	37.35	28.49		
	Pension/retired	0.00	6.02	2.79		
	Others	2.08	0.00	1.12		
	Single	6.25	6.02	6.15		0.8798
	Married	83.33	79.52	81.56		
	Divorced	1.04	2.41	1.68		
Marital status	Widowed	9.38	12.05	10.61		
Ownership of off-farm enterprise	No	37.50	26.51	32.40	2.4564	
	Yes	62.50	73.49	67.60		

****:** Significant at 5%

Among the semi-formal credit users, 40.96% mainly engaged in farming, 13.25% were employed in the public sector, 2.41% primarily worked in the private sector, 37.35% operated businesses, and 6.02% benefited from pension schemes. However, no household head earned wage from on-farm work. On the other hand, among the non-users, 56.25% mainly practiced farming, 14.58% worked in the public sector, 5.21% earned a salary from the private sector, 1.04% earned wage from on-farm work, and 20.83% operated businesses. In comparison, 2.08% were engaged in other occupations. However, no household head was benefiting from a pension scheme. The main occupation of household head greatly influences household access

to credit. In line with this, salaried individuals may easily obtain credit due to their ability to repay (Sekyi, 2017). On the other hand, they may not need credit since they can finance their budgets using their salaries.

On the marital status, the majority of household heads (81.56%) were married, 6.15% were single, 1.68% divorced, and 10.61% widowed. However, those who used the credit consisted of 6.02% singles, 79.52% married, 2.41% divorcees, and 12.05% widowed. On the other hand, the group that did not use the credit consisted of 6.25% singles, 83.33% married, 1.04% divorced, and 9.38% widowed. Marital status is among crucial variables that may influence household access to credit. In line with this, household heads that are married have a higher chance of obtaining credit as compared to those who are single, divorced, or widowed. This could be attributed to potential financial stability among married couples as a result of combined efforts between partners (Ibrahim and Aliero, 2012). However, the Chi-square test revealed that the association between the marital status of household head and semi-formal credit use was not significant.

The results showed that 67.6% of the households owned and operated off-farm enterprises, while 32.4% purely engaged in farming. Among the credit users, 73.49% owned off-farm enterprises, while 26.51% did not possess such enterprises. Off-farm enterprises play a critical role in enhancing household income. Individuals who own off-farm enterprises besides engaging in farming are likely to be more financially stable as compared to those who engage in agriculture alone. This may be attributed to the fact that engaging in off-farm activities increases household income, which in turn increases the chance of accessing credit (Chikwama, 2010).

The mean difference of household institutional characteristics by farmers' credit use status is presented in Table 4.3. The aggregate mean number of groups a member belonged to was 3. However, the mean number of groups for households that used the credit was 3 while their counterparts had a mean of 2 groups. The t-test results show a statistical difference in the number of groups at a 5% significance level. In line with this, households that had membership in a few groups were less likely to use the credit as compared to those that were associated with several groups. This is because having membership in several groups probably increases individuals' social network, which, in turn, enables them to easily access useful information concerning available credit opportunities (Hananu and Zakaria, 2015).

The aggregate mean of distance to the nearest formal credit source in the study area was 2.51km. On the other hand, the mean distance to the closest credit source among the group that used the credit was 5km while that of their counterpart group was 3km. The t-test result shows a significant difference in distance to the nearest formal credit source at a 1% level between the two categories of respondents. Distance to the credit source plays a vital role in determining household access to credit. Long-distance to credit source minimizes the chances of obtaining credit among rural households (Kiplimo *et al.*, 2015).

Table 4.3. Institutional characteristics by farmers' credit use status (continuous variables)

Variable	Non-users =96		Users =83		Aggregated mean =179	t-test
	Std. Dev.	Mean	Std. Dev.	Mean		
Number of groups a member belongs to	1.88	2.2	1.63	2.88	2.51	-2.5657**
Distance to the nearest formal credit source	3.31	3.22	3.03	4.54	3.88	-2.6166***
Distance to the nearest market centre	1.42	1.85	2.93	2.12	2.12	-1.7090*
Number of trainings (per year)	1.56	1.49	1.35	1.6	1.54	-0.5138
Number of extension contacts (per year)	2.90	1.74	2.14	1.58	1.58	0.8858
Land use period (Years)	13.38	17.88	14.60	19.75	18.74	-0.8947

***, **, *: Significant at 1%, 5% and 10% respectively

The aggregate mean of distance to the nearest market center was 2km. The mean distance to the nearest market centre among the households that used the credit and that of their counterpart was 2km. There was a significant difference in the distance to the nearest market centre at a 10% level. Long-distance to the market may increase transaction costs of transporting farm produce to the consumers hence reduce household income, which in turn may limit them from borrowing (Bocher, Alemu and Kelbore, 2017).

The aggregate mean number of training was 2 times per year. The mean number of training among the credit users was higher at 2 times per year as compared to that of non-users at 1. Increased number of training increases the performance efficiency of individuals, which in turn translates to improved income (Beyene, 2008). This may increase the chance of obtaining credit since a financially stable individual can repay the borrowed loan within the stipulated period.

The aggregate mean number of extension contacts in the study area was 2 times per year. However, the mean number of extension contacts among the credit users and non-users was 2 times per year. Extension services play a critical role in enhancing household access to credit (Kiplimo, 2015). An increase in the number of extension services may increase the chances of not only accessing useful information concerning available credit facilities but also technical assistance on agricultural activities.

The aggregate mean of land use period among the respondent small scale farmers was 19 years. However, the mean of land use period of the credit users was higher at 20 years as compared to that of the non-user group, which was 18 years. It is, therefore, worth noting that a long land-use period increases an individual's chance of obtaining credit. This is because a longer period of land use may enable a farmer to acquire more experience hence increasing their productivity (Chandio *et al.*, 2017). Also, a longer period of land use may allow a farmer to establish a stronger relationship with lenders as compared to those who have used the land for a shorter period.

Table 4.4 presents the association of institutional characteristics by farmers' credit use status for dummy variables. There was a significant association between the role played by an individual in the socio-economic group and semi-formal credit use at a 1% level. Besides, the results revealed that 51.96% of households in the study area had members who undertook leadership roles in their socio-economic groups. In comparison, 48.04% had members who did not assume any role in their groups. Among households that used the credit, 65.06% had members who assumed leadership roles in groups, while 34.94% had members who were not leaders in their groups. On the other hand, among households that did not use the credit, 40.63% consisted of those whose members were leaders in their socio-economic groups. In comparison, 59.38% entailed those whose members did not play any leadership role. Taking a leadership role in a group provides an individual with an opportunity to influence the decision on how the credit obtained by a group should be shared (Iyanda *et al.*, 2014).

Table 4.4. Association of institutional characteristics by farmers' credit access status
(Dummy variables)

Variable		No credit access %	Credit access %	Aggregate %	Chi- square
Group memb and role played					
No		59.38	34.94	48.04	10.6477***
Yes		40.63	65.06	51.96	
Access to training					
No		32.29	25.30	29.05	1.0554
Yes		67.71	74.70	70.95	
Land ownership					
Inherited		71.88	69.88	70.95	0.7192
Purchased		21.88	20.48	21.23	
Rented in		6.25	9.64	7.82	

***: Significant at 1%,

Access to financial and agricultural training plays a significant role in enhancing rural household access to credit (Chebet, 2013). The majority of farmers in the study area (70.95%) had access to financial and agricultural training, while 29.05% had no access to training. Additionally, among households that used the credit, 74.7% had access to training, while 25.3% did not access any training. On the other hand, the group which did not used the credit consisted of 67.71% households that had accessed training and 32.29% which had not accessed. However, the Chi-square test revealed that the association between access to training and household credit use was not significant.

A large proportion of farmers (70.95%) had inherited land, while 21.23% had purchased, and 7.82% had rented. The results indicated that 69.88% of the households that used the credit had inherited land, 20.48% had purchased while 9.64% had leased. On the other hand, 71.88% of the non-users had inherited land, 21.88% had purchased, and 6.25% hand rented. Land ownership plays a critical role in enhancing household credit access (Kosgey, 2013). This is because; land ownership documents can be used as security when applying for credit. However,

the Chi-square test revealed that the association between land ownership and household access to credit was not significant.

4.2.1 Farm and Off-Farm Enterprises Supported by the Credit Accessed

Table 4.5 indicates the enterprises which were supported by the credit accessed by rural farm households.

Table 4.5. Showing types of enterprises which benefited from the credit accessed

Enterprise	Frequency	Percentage
Dairy	7	8.43
Poultry	5	6.02
Vegetables	4	4.82
Tomatoes	5	6.02
Maize/beans	19	22.89
Sugarcane	15	18.07
Shop	14	16.87
Buying and selling farm produce	23	27.71
Welding	2	2.41
Brick making	3	3.61
Barber/salon	6	7.23
Bodaboda	3	3.61
Agrovet	3	3.61
selling clothes	7	8.43
Posho-mill	3	3.61
Tailoring	5	6.02
Others	7	8.43

Note: n=83

Agricultural enterprises that benefited from the credit obtained included dairy, poultry, vegetables, tomatoes, maize/beans, and sugarcane, among others. Most farmers (22.89%) preferred to invest in maize/beans, followed by sugarcane (18.07%). These results are as expected because sugarcane and maize/beans are the major crops planted in the study area. It is worth noting that maize and beans are inter-cropped. On the other hand, few farmers (4.82%) invested the borrowed fund in the vegetable enterprise. This could be attributed to the culture in the study area, which considers vegetables as a ‘women enterprise.’ Off-farm enterprises

that benefitted from the credit obtained by rural farm households included shops, selling farm produce, welding, brick making, barber/saloon, bodaboda, and agro vet, among others. A comparatively more significant proportion (27.71%) of rural farm households invested the borrowed credit in buying and selling farm produce, followed by those engaged in selling clothes (8.43%). On the other hand, few (2.41%) farm households invested in welding. It is worth noting that off-farm enterprises play a critical role in enhancing household income (Chikwama, 2010).

4.2.2 Association of Gender by Enterprise Continuity

Gender plays a critical role in determining the continuity of both on-farm and off-farm enterprises. For instance, some cultures may force women to quit operating off-farm enterprises to create time for household chores (Su *et al.*, 2016). Table 4.6 presents the association between the continuity of enterprises and the gender of the household head.

Table 4.6. Association of enterprise continuity of by gender of the household head

Variable		Female %	Males %	Aggregate	Chi-
				%	square
Enterprise continuity	No	12.5	10.17	10.84	0.757*
	Yes	87.5	89.83	89.16	

***: Significant at 10%**

The chi-square results indicated a significant association between the continuity of an enterprise and the gender of the household head. Most enterprises (89.16%), which benefited from the credit accessed by farm households, continued to operate in the long run while 10.84% collapsed. Among the enterprises that were owned by men, 89.83% continued to operate while 10.17% collapsed. Conversely, among the enterprises which were owned by women, 87.5% continued to operate in the long run. In comparison, 12.5% collapsed due to low-profit margin, lack of security, lack of commitment by the enterprise owners, and inadequate supporting infrastructures, among others.

4.3 Factors Determining Household Allocation of Credit Accessed to Different Enterprises

4.3.1 Preliminary Diagnostics of the Variables Used in the Regression Model

Prior to econometric analyses, variance inflation factor (VIF) and pair-wise correlation were used to evaluate the degree of multicollinearity for all continuous and categorical explanatory

variables. Yang and Wu (2016) define multicollinearity as a statistical phenomenon in which there exists a perfect association between predictor variables. The problem of multicollinearity occurs when several of the predictor variables that are considered in the analysis are highly associated with other predictor variables hence leading to ineffective estimation of the outcomes that are sought through the use of regression techniques. According to Hair *et al.* (2011), VIF values should be less than 5. However, the recommended VIF values should be less than the standard cut-off threshold of 10 (Yang and Wu, 2016). Tables 4.7 show the VIF test results for continuous and categorical explanatory variables, respectively. All the VIF values are below 10, thereby meeting the recommended standard.

Table 4.7. Variance inflation factor test for continuous variables in SUR regression equations

Variable	VIF	1/VIF
frmexp	5.73	0.1746
agehhh	4.17	0.2399
landusep	2.88	0.3474
frmsize	1.54	0.6499
edhhh	1.44	0.6957
extcont	1.37	0.7298
ntrngs	1.25	0.8024
hhs	1.23	0.8112
ngrps	1.21	0.8275
offinc	1.18	0.8485
dismkt	1.14	0.8797
dister	1.08	0.9280
Mean VIF	2.02	

The degree of association between each discrete/ dummy variable was assessed using pairwise correlation test as presented in Table 4.8. According to Rumsey (2019), any value greater than 0.5 or lesser than -0.5 indicate high correlation. The correlation coefficient were below the required thresholds to consider multicollinearity issue hence the independent variables were appropriate for running the model.

Table 4.8. Pairwise correlation test for discrete/dummy variables in SUR regression equations

Variable	gendhhh	occh	mrts	rgrp	landown	offentr
gendhhh	1.0000					
occh	-0.0533	1.0000				
mrts	-0.3652	-0.1227	1.0000			
rgrp	0.0867	0.0859	-0.0257	1.0000		
landown	-0.0722	0.1861	-0.1178	0.0844	1.0000	
offentr	-0.0989	0.2955	-0.0395	0.0271	0.0456	1.0000

Test for autocorrelation was also conducted. Autocorrelation measures how the original version of a variable’s value is related to the value of its lagged version in a time series (Abdulhafedh, 2017). It occurs when error terms are correlated with each other in terms of geographical distance, seasonality and trends. Autocorrelation may result into inconsistent and misleading regression results. The Breusch-Godfrey LM test with the hypothesis “H₀: No serial correlation” gave the result Prob > chi2 = 0.0578, rejecting the H₀ at a significance level of 10%. The presence of autocorrelation validated the use of Seemingly Unrelated Regression model.

4.3.2 Factors Influencing Household Allocation of Credit Accessed on Farm and Off-Farm Enterprises

The enterprises that benefited from the credit obtained by rural households were placed into three categories, namely on-farm, off-farm agriculture-related, and off-farm non-agricultural enterprises. The SUR results are presented in Table 4.9. The columns 1, 2, and 3 provide the estimates for the amount allocated on-farm enterprise, off-farm non-agricultural enterprises, and off-farm agricultural-related enterprises, respectively. The results indicated that variations in the independent variables used in the model explained 33-75% of the variation observed in the credit allocation among different enterprises. The un-explained variation of credit allocation can be attributed to other factors that are not considered in the study. These could include political, and historical factors. The decline of the R square values from 75 to 40 and finally 33 could be attributed to uncaptured complex human behaviour of the sampled respondents. For instance, the perception of farmers towards different types of enterprises could influence allocation of credit obtained.

Table 4.9. Showing the SUR model results

Variable	Amount allocated on-farm		Amount allocated on off-farm non-agric		Amount allocated on off-farm agric related	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
gendhhh	0.1191*	0.065	-0.0163	0.1273	-0.0565	0.0952
agehhh	-0.0030	0.0051	-0.0084	0.0100	0.0168**	0.0075
edhhh	0.0034	0.0101	0.0089	0.0197	-0.0178	0.0148
frmexp	0.0094**	0.0045	-0.0096	0.0089	-0.0107	0.0066
hhs	-0.0019	0.0080	0.0181	0.0156	0.0005	0.0117
occh	-0.0185	0.0118	0.0360	0.0230	-0.0186	0.0172
mrts	0.0159	0.0439	-0.0546	0.0859	0.0620	0.0643
ngrps	0.0188	0.0177	0.0196	0.0347	0.0230	0.0259
rgrp	0.1223**	0.0601	-0.3072***	0.1176	0.0374	0.0880
dister	-0.0041	0.0094	0.0102	0.0183	-0.0095	0.0137
distmkt	-0.0009	0.0102	0.0362*	0.0199	-0.0277**	0.0149
trng	0.0171	0.0902	0.0746	0.1765	0.0459	0.1320
ntrngs	-0.0532*	0.0294	0.0132	0.0575	-0.0586	0.0431
extcont	0.0079	0.0145	0.0008	0.0283	0.0081	0.0212
frmsize	0.0210	0.0178	-0.0609*	0.0347	0.0282	0.0260
landown	0.0962**	0.0438	0.0895	0.0857	-0.1292**	0.0641
offentr	-0.6209***	0.073	0.1512	0.1428	0.2929***	0.1068

ageent	-0.0003	0.003	0.0017	0.0058	-0.0059	0.0044
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Table 4.9 continues

Variable	Amount allocated on-farm		Amount allocated on off-farm non-agric		Amount allocated on off-farm agric related	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
ffinc	-0.1073	0.0675	0.3335**	0.1322	-0.1547	0.0989
_cons	0.9768	0.4407	-1.1047	0.8624	0.6435	0.6453
Observations(parameters)	83(19)		83(19)		83(19)	
R-Square	0.75		0.40		0.33	
Chi ² (probability)	250.06(0.0000)		54.42(0.0000)		40.05(0.0032)	

***, **, *: Significant at 1%, 5% and 10% respectively

The result in the first column (amount allocation on farm enterprise) indicates that the gender of the household head is significant at 10% level. The male-headed household was more likely to allocate credit received on farm enterprises. This can be attributed to the fact that men headed households have more access and control over productive resources such as land; hence can make decisions aimed at enhancing on-farm enterprises. Mason *et al.* (2015) reported that, unlike men, women have limited access to not only information but also land and other resources due to social-cultural barriers; hence they are less likely to allocate resources on farm enterprises. For instance, in some cultures, widows are denied rights to inherit land hence limiting their ability to allocate their resources on farm enterprises (Dillon and Voena, 2017). Similar findings were reported by Ayodele, Fasina, and Awoyemi (2016), who indicated that limited access to production resources constrains agricultural productivity among female-headed households. Also, in some cultures, women are restricted from engaging in specific farm enterprises such as owning livestock since it is treated as a ‘men’s enterprise.’ Such traditions may limit a female-headed household from engaging in diversified farm enterprises. However, some studies have indicated that female-headed households are more likely to allocate their financial resources in enhancing farm production since they do most of the farm work as compared to men who opt to stay in urban areas (Baten and Khan 2010).

Farming experience had a significant positive influence on the amount allocated on farm enterprises at a 5% level. Farmers who had great experience were more likely to invest the credit obtained on farm enterprises as compared to those that are less experienced. This could be attributed to increased productivity that is attributed to high farming experience. The results were consistent with the findings of Anang and Yeboah (2019) who argued that experienced farmers tend to commit their resources on farm enterprises as compared to off-farm enterprises.

Households whose members did not only belong to socio-economic groups but also assumed leadership roles in the groups were more likely to allocate the credit accessed on farm enterprises. The association between the role played by a household in a socio-economic group, and the amount of credit allocated on farm enterprises was positive and significant at a 5% level. Taking leadership roles in a group enables individuals to access useful information such as new technology that can enhance farm production and how to overcome some challenges associated with farming. According to Mignouna *et al.* (2011), farm households who belong to a group are likely to benefit from significant investment and technology information that could be shared by members within the group. However, the role played by a household member in

socioeconomic groups had a significant negative relationship with the allocation of credit obtained on off-farm non-agricultural enterprises at a 1% level. The result implied that most socio-economic groups in the study area were agriculturally oriented.

The number of training received by farmers had a negative and significant effect in determining the household allocation of credit accessed on farm enterprises at a 10% level. An increase in the number of training received by farmers reduced the probability of allocating the credit accessed on the farm and agriculture-related enterprises. This could be attributed to the fact that most of the training received by households focussed on enhancing financial and business skills. This, in turn, resulted in the shifting of resources from the farm to finance off-farm activities. Beyene (2008) reported that attending training that focuses on promoting off-farm enterprises and enhancing variables of human capital had a positive effect on participation in off-farm activities by male members of farm households. This is because attending training enabled household members to gain knowledge and skills, which in turn helped them to engage in operating off-farm enterprises. However, access to agriculture-related training could increase the probability of allocating resources on farming activities among rural farm households.

Land ownership increased the chances of allocating credit accessed by households on farm enterprise at a 5% significance level. Farmers owning purchased or rented land were more likely to invest credit obtained on agricultural enterprises. This could be attributed to the fact that farmers had full rights of land ownership usage; hence they could decide to initiate long term farm projects. On the other hand, farmers who had rented land were more likely to invest their borrowed resources on farm enterprises due to limited time associated with this type of land. A study by Kokoye *et al.* (2013) indicated that having full rights of land ownership acted as an incentive for farmers to invest their scarce resources in the long term and risky farm enterprises. In line with this, farmers could use financial resources to acquire new technology aimed at enhancing agricultural productivity.

On the other hand, land ownership had a significant adverse effect on allocating credit obtained on off-farm agricultural-related enterprises at a 5% level. Individuals who owned land through purchase or inheritance; were less likely to allocate the credit accessed on off-farm agricultural-related enterprises as compared to those who used rented land. Owning land increased the tendency of specializing in farming among rural farm households. The results of this study concur with the findings of Awoniyi and Salman (2011), who reported that ownership of land

reduced the likelihood of engaging in off-farm enterprises among rural households. However, the results contradict the findings of Ullah and Shivakoti (2014), who reported a positive relationship between land ownership and the allocation of resources on off-farm enterprises.

Ownership of off-farm enterprise had a significant negative influence on the amount allocated on farm enterprises at a 1% level. Farmers who owned off-arm enterprises were less likely to invest the credit obtained on farming enterprises. Conversely, ownership of off-farm enterprise had a positive significant influence on the amount allocated on off-farm agriculture at a 1% level. Owning an off-farm enterprise increased an individual's probability of allocating the loan obtained on off-farm agriculture related enterprises. The results concur with the findings of Kansiime *et al.* (2018) who pointed out that farm households that are off-farm specialized tend to allocate their resources towards pursuing off-farm livelihood strategies.

There was a significant positive relationship between off-farm income and the allocation of credit accessed on off-farm agricultural related and off-farm non-agricultural enterprises at a 10% significance level. An increase in off-farm income increased the chances of allocating credit obtained on off-farm enterprises. The implication of the result is that; households preferred to allocate their scarce resources on off-farm enterprises that had higher returns. In line with this, an increase in off-farm income acted as an incentive for farmers to invest their financial resources on off-farm enterprises. These results are consistent with the findings of Kohansal *et al.* (2008), who reported that income obtained from the previous off-farm and farm investments was significant in determining the farmer's credit use behavior. Farmers were likely to invest in enterprises that had proved to be profitable previously.

Distance to the nearest market centre had a significant positive influence on household allocation of the credit obtained on off-farm non-agriculture enterprises at a 10% significance level. Farmers who lived closer to the market centre were more likely to allocate their resources on the enterprises as compared to those who were allocated far away from the market. Short distance to the market centre reduced transaction costs thereby acting as an incentive for farm households to invest in off-farm non-agricultural enterprises. Conversely, distance to the nearest market centre had an adverse effect on household allocation of the credit obtained on off-farm agricultural related enterprises at a 5% significance level. Long distance to the market probably increased transaction cost of engaging in in off-farm agricultural enterprises thus discouraging farm households from investing their resources in the enterprises. The results concur with the findings of Gebru *et al.* (2018) who pointed out that farm households located

far away from the market centre are more disadvantaged in terms of diversifying their livelihood into off-farm options.

Farm size had an adverse effect on household allocation of the credit obtained on off-farm non agriculture enterprise at a 5% significance level. Increase in farm size reduced the probability of investing in off-farm non agriculture enterprises among rural farm households. This could be attributed to the fact that farmer with large farm size tend to invest their resources on farm enterprises (Meraner *et al.*, 2015). The results contradict the findings of Demeke and Zeller (2012) who reported a significant positive relationship between farm size and household allocation of resources on off-farm enterprises.

The age of household head had a significant positive influence on the amount allocated on off-farm non agriculture enterprises at a 5% level. These results indicated that older household heads were more likely to invest their borrowed resources in off-farm non agriculture enterprises as compared to young household heads. This may be attributed to the fact that these enterprises require significant initial capital to start, which may act as a barrier to young household heads. Also, older household heads may probably have more experience in operating off-farm non agriculture enterprises as compared to young household heads; hence they preferred investing their resources in these enterprises. The results are consistent with the findings of (Ullah *et al.*, 2016) who indicated that older farmers were more likely to invest their resources on off-farm enterprises.

4.4 Effect of Semi-Formal Credit Use on Household Income

4.4.1 Exclusion Restriction

ESR model was used to estimate the effects of semi-formal credit use on household income. An exclusion restriction was used to enhance the identification of endogenous switching regression. This was done basing on empirical studies and economic theory. Studies by Ayuya *et al.* (2015), Khonje *et al.* (2015), Shiferaw *et al.* (2014) and Asfaw *et al.* (2012) used agricultural information sources such as farmer to farmer extension, government extension, and distance to inputs among others as their exclusion restrictions. This study used three exclusion restrictions, which included access to extension services, distance to the nearest credit source, and the role played by a farmer in a socio-economic group. Firstly, extension services play a critical role in equipping farmers with knowledge and information about available financial opportunities such as grants and loans, especially in a case where the cost of knowledge and information is unaffordable (Krishnan and Patnam, 2013; Genius *et al.*,

2014). On the other distance to the nearest credit source and role by an individual in social-economic groups are among crucial variables that influence household credit use. Table 4.10 shows the tests which indicated that the selected instruments are valid.

Table 4.10. Showing the validity of selected instruments

Variable	Semi-formal credit use	
	Coef	Std error
extcont	-0.0405	0.0356
rgrp	0.5138**	0.2008
dister	0.0580**	0.0262
Constant	-1.4968*	0.8887*
Wald test	-128.6309***	

***, **, *: Significant at 1%, 5% and 10% respectively

The Wald test is very significant hence indicating the goodness of fit of the endogenous switching regression model used. The implication is that there exists a problem of endogeneity; hence the use of the ESR model is justified. Additionally, the likelihood ratio test of independence of the selection and outcome equations indicates that there exists a correlation between access to credit and household income. Furthermore, the Sargan test was $Pr > \chi^2(2) = 0.8595$, thereby indicating that the excluded instruments were not correlated with the error terms.

4.4.2 Endogenous Switching Regression Estimates for the Selected Outcome

Table 4.11 gives the results of the endogenous switching regression model. The first column presents the determinants of semi-formal credit use among rural farm households. In contrast, the second and the third column provides determinants of household income for the semiformal credit users and non-users respectively.

Table 4.11. Endogenous switching regression model estimates for the selected outcome

	Semi-formal credit use		Household income			
	Coef.	Std. Err.	Users		Non-users	
			Coef.	Std. Err.	Coef.	Std. Err.
						Std. Err.
gendhhh	0.1923	0.2406	-0.0568	0.0899	0.0493	0.0765
agehhh	-0.0147	0.0158	0.0045	0.0061	-0.0025	0.0050
edhhh	-0.0086	0.0358	0.0316**	0.0118	0.0323**	0.0111
frmexp	0.0301**	0.0153	-0.0056	0.0057	-0.0014	0.0054
hhs	0.0284	0.0338	-0.0019	0.0109	-0.0004	0.0143
occh	0.0977**	0.0474	-0.0351**	0.0159	-0.024	0.0201
mrts	0.2083	0.1662	-0.0512	0.0561	0.0362	0.0579
frmsize	-0.0543	0.0666	0.0943 ***	0.0231	0.0907**	0.0218
landown	-0.0475	0.1648	-0.1283**	0.0535	0.0403	0.0578
offentr	0.3730	0.2363	0.0842	0.0859	-0.0093	0.0801
extcont	-0.0405	0.0356				
rgrp	0.5138**	0.2008				
dister	0.0580**	0.0262				
_cons	-1.4968*	0.8887	5.4650***	0.3911	4.6323***	0.2655
/lns1	-1.0606***	0.1788				
/lns2	-1.0794***	0.1558				
/r1	-1.3239**	0.6044				
/r2	-0.8855*	0.5167				
sigma_1	0.3462	0.0619				
sigma_2	0.3398	0.0529				
rho_1	-0.8678	0.1493				
rho_2	-0.7092	0.2569				
LR test of indep. eqns.: chi2(1) = 3.15***						
Wald chi2(10) = 51.46						
Log likelihood = -128.6309						

***, **, *: Significant at 1%, 5% and 10% respectively

4.4.2.1 Determinants of Household Access to Credit

Farming experience had a significant positive effect on household use of semi-formal credit at a 5% level. Farmers with more experience were more likely to use the credit as compared to those with less experience. This could be attributed to the fact that experienced farmers have more social networks than those who are less experienced. Additionally, an increase in farming experience leads to improved productivity, which in turn increases a farmers' financial ability to repay credit. The findings of this study concur with Obisesan (2013), who reported that farming experience significantly and positively influenced household access and use of credit.

Occupation of the household head had a significant positive effect on semi-formal credit use at a 5% level. In line with this, household heads who engaged in farming, business, or any other form of employment in public and private sectors were more likely to access credit as compared to those who had retired. This is because individuals who earn regular income tend to be financially secure; hence they can afford to repay their loans. The result of this study concurs with Sekyi (2017), who reported that the occupation of the household was significant in determining household access and use of credit. Additionally, Gautam and Andersen (2016) argued that accessing employment in the private and public sectors had a significant positive effect on enhancing household welfare.

Membership and role played by an individual in a socio-economic group also had a significant positive effect on household access to credit at a 5% level. Having a membership in a socio-economic group did not only enable an individual to access useful information but also acted as a channel to accessing credit since many financial institutions prefer lending to groups. Additionally, individuals who took leadership roles in socio-economic groups were more likely to obtain loans as compared to their counterparts since they could influence the decision concerning credit sharing among group members. Similar findings were reported by Hananu and Zakaria (2015), who argued that having membership in the social group was significant in determining household access to credit. Formation of socio-economic groups helped an individual to benefit from a joint guarantee by group members.

Distance to the credit source had a significant positive effect on semi-formal credit use at a 5% level. The implication is that shorter distance to credit source encouraged more farm households to apply for credit due to reduced transaction costs. In line with this, the common nearest credit source in the study area was County government credit that was offered through farmers' respective Ward offices. The results of this study were contrary to the findings of

Kiplimo *et al.* (2015). They reported that distance to the credit source had a significant adverse effect on household credit access. This implied that long distance to the credit source reduces the likelihood of accessing and using credit among rural households.

4.4.2.2 Factors Influencing Household Income

Regardless of the household credit use status, the education level of the household head had a significant positive effect on household income at 1% level. An increase in the number of schooling years probably enabled household heads to secure jobs in the private or public sector, which in turn boosted household income. Additionally, individuals with high education levels were more likely to be aware of the available financial opportunities and how to utilize them as compared to those with low education levels. Furthermore, having more schooling years enabled individuals to acquire the business and financial management skills, thus enhancing the productivity of their enterprises. The results of this study concur with the findings of Turčínková and Stávková (2012) who reported that household whose heads had long schooling years were more likely to have more income as compared to those headed by individuals with low education. However, the study noted that the high education level of household heads was not a guarantee to attaining high household income.

Among households who used the credit, occupation of the household had a significant adverse effect on household income at a 5% level. This could be attributed to the fact that most household heads engaged in an occupation that had low payment. For instance, households whose leaders mainly relied on off-farm wages were more likely to have a low income as compared to those who were engaged in well-paying enterprises or formal employment. Additionally, households whose heads had retired were likely to have less income as compared to those whose heads were working. The implication is that older adults are less likely to engage in productive economic activities as compared to young people. However, some studies have indicated that the main occupation of the household head has a significant positive effect on household income (Wanjiku, 2017; Atsiaya, 2017).

On the other hand, farm size had a significant positive association with a household income at a 1% level for the credit users and a 5% level for the non-users. An increase in farm size increased the likelihood of having more income among rural households. Households which have large farm size are more likely to produce more as compared to those with small farm size. Additionally, having a large farm size enables a household to have diversified farm enterprises hence spread the risk of crop failure or marketing. The result of this study confirms

the findings of Anupama and Falk (2018), who reported that households which owned large farm size had higher income from agriculture as compared to those that had small farm size. This was attributed to increased output that is associated with large farm size.

4.4.4 Mean Treatment Effects on Household Income

The results in Table 4.12 show the effect of semi-formal credit use on household income, which was estimated by equation 3.9a and 3.9b, as explained by Lokshin and Sajaia (2011).

Table 4.12. Mean treatment effects on household income

Treatment effects	Decision stage		
	To use semi-formal credit	Not to use semi-formal credit	Average treatment effects (ATE)
ATT (Group A; Credit users)	a) 5.5436 (0.0260)	b) 5.3664 (0.0249)	0.1772***
ATU (Group B; Non users)	c) 5.5748(0.0237)	d) 5.2863(0.0224)	-0.2885***
Heterogeneity effects	-0.0312	0.0801	-0.1113

***, **, *: Significant at 1%, 5% and 10% respectively

The values in the cell (a) and (d) represent the mean values of household income for the credit users and non-users. On the other hand, cell (b) and (c) represent the counterfactual expected values. Additionally, the figures in the brackets represent the standard errors. The average treatment effect on the treated (ATT) was 0.1772. This represents the actual effect that farm households (group A) experience through using the credit. This result implies that using the credit increased the likelihood of having higher income as compared to the counterfactual case of not using it. Therefore, credit use substantially improved household income among the beneficiary households.

Surprisingly, the findings on average treatment effects on the untreated (ATU) shows that for the non-user group, their household income would decline by 28.85% if they were to use the credit. These households probably could be constrained socially and economically hence are likely to be indebted if they would have used the credit. For instance, cultural barriers in the study do not allow women to own assets such as land; hence women are more economically

disadvantaged as compared to men (Wangari, 2016). Additionally, there could be a high interest in the loans offered; hence the borrowers could be over-indebted by using the credit.

The last row of the table indicates that the base heterogeneity effects were insignificant. However, if the non-users had decided to use the credit, they would be expected to have attained more household income by 3.12% than the users. The implication is that the users would be worse off than the non-users. Probably, the non-users would be more efficient in terms of allocating resources as compared to the users. The second column shows that if the credit users had decided to be non-users, they would be expected to realize more income by 8.0% than the non-users. The transitional heterogeneity effect is negative, implying that the effect realized on income is attributed to unobservable household characteristics and not credit utilization. The results have a significant implication on the government policymakers and non-governmental organizations. This is because; their interest is to understand what would be the effects of credit utilization on household income for the non-users if they were to use the credit. The results are consistent with the findings of several studies (Seng, 2018; Schicks, 2013; Pytkowska and Spannuth, 2012; Garikipati, 2008) which indicate that utilization of credit can harm household welfare due to factors such as high-interest rates on loans and use of credit accessed for non-productive activities among others. This may, in turn, bring about over-indebtedness among borrowers.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The investigated the effect of semi-formal credit use on household income in Kakamega County. It aimed at contributing towards improving farmers' household welfare by examining the contribution of semi-formal credit offered by devolved government on rural farm household income. The data used in the study was gathered from a sample size of 179 farm households from Malava and Lugari Sub-counties in Kakamega County. The study used descriptive statistics to profile enterprises which benefited from the credit accessed by households. Besides, Seemingly Unrelated Regression Model (SUR) was used to determine factors influencing the household allocation of credit obtained to different types of enterprises. Finally, the endogenous switching regression model was used to estimate the effects of semi-formal credit use on household income.

The descriptive results indicated that semi-formal credit obtained by rural farm households in the study area was allocated to both on-farm and off-farm enterprises. Among the farm enterprises which benefited from the credit accessed included dairy, poultry, beans/maize, sugarcane, vegetables, and tomatoes. On the other hand, off-farm enterprises included selling farm produce, welding, barber/Salon, brick making, Bodaboda, agro vet, selling clothes, and Posho-mill, among others. Additionally, some of the enterprises that benefited from the credit obtained collapsed in the long run due to reasons such as shallow profit margin, lack of security, lack of commitment by the enterprise owners, and inadequate supporting infrastructures, among others.

The SUR results indicated that the allocation of the semi-formal credit obtained by rural households on farm enterprises was positively influenced by the gender of household head, farming experience, land ownership, and the role played by an individual in the socio-economic group. However, access to training and ownership of off-farm enterprise had a negative influence on the allocation of the credit on farm enterprises. In addition, the probability of allocating the credit obtained on off-farm agriculture related enterprises was positively influenced by ownership off-farm enterprises and age of household head. Conversely, allocation of the credit obtained on off-farm non-agriculture enterprises was positively influenced by distance to the nearest market centre and off-farm income. Finally, the ESR results revealed that semi-formal credit use had a positive effect on rural farm household income. However, the counterfactual results indicate that farm households that did not access

credit would have become worse off if they had accessed the credit. This could be attributed to social and economic constraints that could probably make these households to become over-indebted had they accessed credit.

5.2 Conclusions

The following conclusions were drawn from the study;

- i) Most farmers allocated the credit obtained on farm and agriculture related enterprises as opposed to off-farm non-agriculture enterprises
- ii) Findings indicated that access to training was significant and negatively influenced household allocation of the credit obtained on farm enterprises.
- iii) Semi-formal credit use had a positive effect on rural farm household income.

5.3 Recommendations

Based on the findings of the study, the following recommendations provide a framework for improving household income;

- i) Encouraging farmers to diversify their income by engaging in sustainable off-farm activities.
- ii) Offering both agricultural and financial training to the farmers hence enable them to allocated resources efficiently.
- iii) Promoting the use of semi-formal credit offered by the county government among rural households through provision of frequent extension services to sensitize farmers.

5.4 Area of Further Studies

While this study focused on the effect of semi-formal credit use on household income, future studies may focus on the extent of semi-formal credit use and its impact on household food security, which is not covered in this study. In addition, future studies may also investigate the effect of digital credit use on household income. The study has used standard econometric techniques based on existing literature. However, it is limited in terms of data used since it is difficult to establish causal effects based on cross-sectional data. Future studies should, therefore, use better data sets such as time series and panel to overcome this limitation.

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APPDENDICES

Appendix 1: Questionnaire

The purpose of this study is to examine the effect of semi-formal credit use on household income. Kindly spare a few minutes for this exercise. The survey will take approximately 45-60 minutes. I would like to assure you that your answers will be handled with strict confidentiality, and the information will only be used for research purposes. I would be happy if you would voluntarily allow me to continue with the interview. Will you lend me 5-10 minutes of your valuable time to get data for this study?

[1= Yes, 0= No]

1.0 SECTION A: IDENTIFICATION

Sub-county _____ Ward _____ Village _____

Date _____ Start-time _____ End-time _____

Enumerator _____ Name of respondent _____

Gender of respondent _____, 0=Female, 1=Male Relation to HHH _____ 1=Head, 2=Spouse

Contact _____

2.0 SECTION B: HOUSEHOLD INFORMATION

B1: Gender of household head [0=Female, 1=Male]	B2: Age of HHH (Years)
B3: Education of HH Head (Years of education)	B4: Farming experience
B5: Household size	B6: Main occupation of HHH
B7: Marital status	
Occupation 1=Farmer, 2=Salaried, public sector, 3=Salaried, private sector, 4=Wage, on-farm, 5=Wage, off-farm, 6=Business, 7=Pension/Retired 8=Other, specify _____	Marital status 1= Single, 2= Married, 3=Divorced, 4=Widowed

3.0 SECTION C: HOUSEHOLD INSTITUTIONAL INFORMATION

3.1 Is there any member of your household who belongs to a socioeconomic group?

_____ 0=Yes, 1=No

3.1.2 How many groups do the member(s) belong to?

1. Head _____ 2. Spouse _____ 3. Other member(s) _____

3.1.3 Please, indicate the type of a group and the role played by the household members who belongs to them.

	Household member	Position held
1	Head	
2	Spouse	
3	Another member (s)	
	Group code 1= SACCO, 2= Merry Go Round, 3= Table banking, 4= Others; specify _____	Position code 0=None, 1=Chairperson, 2=Secretary, 3=Treasurer, 4= other; Specify _____

3.2 Distance to the nearest formal credit source? _____ in walking minutes.

3.3 Distance to the nearest market centre? _____ in walking minutes.

3.4 Have you ever attended training or a seminar focusing on agricultural or business development? _____ 0= No, 1= Yes

3.4.1 If yes, indicate the type of training received. _____

1=Crop production, 2=livestock production, 3=Crop management, 4=Livestock management, 5= Marketing, 6= Agribusiness, 5= Financial management, 6=Other, specify _____

3.4.2 Who provided the training? Provider 1. ____ Provider 2. ____ Provider 3. _____

1=Government, 2= NGO, 3=input companies, 4=Research institution, 5= university, 6=Others; specify _____

3.5 Number of extension contacts per year _____

4.0 SECTION D: CREDIT INFORMATION

4.1 Did you need credit in the last 3 years? _____ 0= No, 1= Yes

4.1.1 Why did you need credit? _____

Codes: 1= To buy food, 2=To buy other household items, 3=Invest in crop production 4=Buy land, 5=Invest in livestock (buy new livestock, vet services, etc), 6=Invest in off-farm business, 7=Medication 8=Social reasons 9=School fees, 10=Other, specify _____

4.1.2 If yes, did you receive the credit? _____ 0= No, 1= Yes 4.1.3 If yes, please provide the following details.

SN	Source	Credit type	Amount obtained in KES		
			Oct 2015 –Sept 2016	Oct 2016-Sept 2017	Oct 2017-Sept 2018
1					
2					
3					
4					
5					
6					
7					
Credit source codes 1= County government, 2=Commercial bank, 3=SACCO, 4= Micro-finance, 5= Informal groups, 6= Local money lender 99=Other, specify				Credit type codes 1=Financial, 2= In-kind	

4.1.3 If you have never accessed credit, give reason. _____

1=Did not need it, 2= No collateral, 3= High interest rates, 4= Lenders not available,5=Unfavourable terms 4= Others; specify_____

4.2 Please provide a break-down of how the credit was utilized on a different farm and non-farm enterprises

SN	Enterprise	Age of the enterprise	Amount invested		
			Oct 2015 –Sept 2016	Oct 2016-Sept 2017	Oct 2017-Sept 2018
1					
2					
3					
4					
5					
6					
7					
8					
Enterprise code 1=Dairy, 2=Poultry, 3=Vegetables, 4=Tomatoes/onions, 5=Maize/Beans, 6= Sugar cane, 7=Roots and tubers, 8= Shop, 9= Purchasing and selling agricultural related products/produce, 10=Carpentry, 11=Welding, 12= Mobile banking, 13= Brick making, 14= Barber/Saloon, 15= Bodaboda, 16= Others, specify_____					

4.2.1 Are you still operating all the enterprises listed above? _____ 0= No, 1= Yes

4.2.2 If otherwise, which of the enterprises ceased to exist? (Enterprise code)

4.2.3 What are the reasons why you stopped operating the enterprises?

Codes 1= The enterprise(s) were not profitable, 2= Lack of technical skills to operate the enterprise(s), 3= Lack of security 4= Lack of supporting infrastructures 5= Lack of finances 6=Others; specify_____

5.0 SECTION E: LAND AREA AND OWNERSHIP

5.1 Total land size cultivated in Jan– Sept 2018 _____ acres

Cultivated land size by type of land ownership

	Ownership type	Land area in acres	Land cultivated in acres	How long has it been used
1				
2				
3				
4				
5				
6				
1=Inherited, 2=Purchased, 3=Rented in, 4=Borrowed, 5=Community,6=Government, 7= Other, specify _____				

6.0 SECTION F: INFORMATION ON HOUSEHOLD INCOME

6.1 Provide the following details about the enterprises identified above

Enterprise	Variable cost			Revenue			Income		
	Oct15-Sep16	Oct16-Sep17	Oct17-Sep18	Oct15-Sep16	Oct16-Sept17	Oct17-Sep18	Oct15-Sep16	Oct16-Sep17	Oct17-Sep18
Total									

6.2 Did you have any other income sources apart from that received from the enterprises identified above? _____ 0=No, Yes=1

6.2.1 If yes, provide the following details about the income sources.

	Income source	Amount Received from the source		
		Oct 2015-Sep 2016	Oct 2016-Sep 2017	Oct 2017-Sep2018
1				
2				
3				
4				
5				
Income source code				
1=Crop income, 2=Livestock income, 3=Livestock product income, 4=Business income, 5= Other, specify_____				

6.3 Provide details about other household income in the table below;

SN	Income source /Period	Who received	Frequency	Amount received each time
	Oct 2015 –Sept 2016			
1				
2				
3				
4				
5				
	Oct 2016 –Sept 2017			
1				
2				
3				
4				
5				
	Oct 2017 –Sept 2018			
1				
2				
3				
4				
5				
Income source		Who received		
1=Salary,2=Wage, 3=Remittances, 4=Pension, 5=Transfer payments, 6=Other, specify_____		1=Head, 2=Spouse, 3=Son/daughter		

END, THANK YOU FOR YOUR INFORMATION

Appendix 2: STATA Results

VIF test

```
. reg crdacc1 gendhh agehh edhhh hhs occh mrts grpmemb ngrps rgrp distcr distmkt trng ntrngs extcont frmsize
> landown landusep offentr ffinc
```

Source	SS	df	MS	Number of obs	=	179
Model	10.9946881	19	.578667795	F(19, 159)	=	2.74
Residual	33.5192784	159	.210813072	Prob > F	=	0.0003
				R-squared	=	0.2470
				Adj R-squared	=	0.1570
Total	44.5139665	178	.250078463	Root MSE	=	.45914

crdacc1	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
gendhhh	.0326957	.0859293	0.38	0.704	-.1370144 .2024057
agehhh	.0025655	.0041093	0.62	0.533	-.0055504 .0106814
edhhh	-.0139979	.0124665	-1.12	0.263	-.0386191 .0106234
hhs	.012663	.0124135	1.02	0.309	-.0118537 .0371796
occh	.0367645	.0167458	2.20	0.030	.0036916 .0698374
mrts	.0416969	.0587525	0.71	0.479	-.0743391 .1577328
grpmemb	.3802105	.132347	2.87	0.005	.1188256 .6415953
ngrps	.0073825	.0262232	0.28	0.779	-.0444083 .0591733
rgrp	.1398368	.0816082	1.71	0.089	-.021339 .3010127
distcr	.0160376	.0115129	1.39	0.166	-.0067004 .0387756
distmkt	.0218236	.0164295	1.33	0.186	-.0106247 .0542718
trng	.1438277	.1087791	1.32	0.188	-.0710106 .3586659
ntrngs	-.0028734	.0333376	-0.09	0.931	-.068715 .0629682
extcont	-.032563	.0161472	-2.02	0.045	-.0644536 -.0006724
frmsize	-.0107265	.0240211	-0.45	0.656	-.0581682 .0367152
landown	.005679	.0592825	0.10	0.924	-.1114036 .1227617
landusep	.0029617	.0038298	0.77	0.440	-.0046021 .0105255
offentr	.0583884	.0823027	0.71	0.479	-.1041592 .2209359
ffinc	7.48e-08	9.01e-08	0.83	0.407	-1.03e-07 2.53e-07
_cons	-.5033351	.3000895	-1.68	0.095	-1.096011 .0893406

```
. vif
```

Variable	VIF	1/VIF
landusep	2.41	0.414808
agehhh	2.35	0.424886
trng	2.07	0.482895
ntrngs	2.01	0.498595
ngrps	1.88	0.531574
frmsize	1.60	0.624336
edhhh	1.57	0.635997
grpmemb	1.48	0.677478
extcont	1.46	0.685453
rgrp	1.41	0.708438
mrts	1.39	0.718735
gendhhh	1.33	0.749348
hhs	1.31	0.762703
occh	1.28	0.778727
ffinc	1.26	0.791559
offentr	1.26	0.793796
distmkt	1.16	0.858759
landown	1.16	0.861057
distcr	1.14	0.880611
Mean VIF	1.56	

Pairwise Correlation Test

```
. pwcorr gendhhh occh mrts grpmemb rgrp landown offentr
```

	gendhhh	occh	mrts	grpmemb	rgrp	landown	offentr
gendhhh	1.0000						
occh	-0.0533	1.0000					
mrts	-0.3652	-0.1227	1.0000				
grpmemb	0.0329	0.1229	-0.0424	1.0000			
rgrp	0.0867	0.0859	-0.0257	0.3333	1.0000		
landown	-0.0722	0.1861	-0.1178	0.0675	0.0844	1.0000	
offentr	-0.0989	0.2955	-0.0395	0.1712	0.0271	0.0456	1.0000

```
. reg amntofffarm gendhhh agehhh edhhh frmexp hhs occh mrts ngrps distcr distmkt rgrp ntrngs f
> rmsize landown landareacult offentr offinc
```

Source	SS	df	MS	Number of obs	=	83
Model	9.3854207	17	.552083571	F(17, 65)	=	2.29
Residual	15.6825882	65	.241270588	Prob > F	=	0.0089
				R-squared	=	0.3744
				Adj R-squared	=	0.2108
Total	25.0680089	82	.305707426	Root MSE	=	.49119

amntofffarm	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
gendhhh	.0075085	.1414677	0.05	0.958	-.275022	.2900389
agehhh	-.0050593	.0114206	-0.44	0.659	-.0278678	.0177492
edhhh	.0171098	.0214181	0.80	0.427	-.0256652	.0598848
frmexp	-.0109702	.0101843	-1.08	0.285	-.0313097	.0093693
hhs	.0135635	.0174682	0.78	0.440	-.0213229	.0484499
occh	.0326878	.0250533	1.30	0.197	-.017347	.0827226
mrts	-.066884	.0935698	-0.71	0.477	-.2537558	.1199879
ngrps	.0166805	.038634	0.43	0.667	-.0604768	.0938379
distcr	.0104634	.0203789	0.51	0.609	-.0302361	.0511629
distmkt	.028069	.0218152	1.29	0.203	-.015499	.0716371
rgrp	-.2780504	.1317197	-2.11	0.039	-.5411128	-.014988
ntrngs	.0115949	.0471447	0.25	0.807	-.0825596	.1057493
frmsize	.0576973	.1557135	0.37	0.712	-.253284	.3686787
landown	.0651869	.0929035	0.70	0.485	-.1203542	.250728
landareacult	-.1337273	.1678663	-0.80	0.429	-.4689794	.2015249
offentr	.1238902	.159551	0.78	0.440	-.1947552	.4425356
offinc	1.96e-07	1.24e-07	1.58	0.119	-5.18e-08	4.45e-07
_cons	.568794	.5919507	0.96	0.340	-.6134131	1.751001

```
. reg uhat l.uhat l2.uhat gendhhh agehhh edhhh hhs occh mrts ngrps distmkt distcr rgrp ntrngs
> frmsize landown landareacult offentr ffinc
```

Source	SS	df	MS	Number of obs	=	81
Model	10.9596271	18	.608868171	F(18, 62)	=	9.56
Residual	3.94762884	62	.063671433	Prob > F	=	0.0000
				R-squared	=	0.7352
				Adj R-squared	=	0.6583
Total	14.9072559	80	.186340699	Root MSE	=	.25233

uhat	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
uhat						
L1.	-.0269579	.0720581	-0.37	0.710	-.171	.1170841
L2.	.1090828	.0747891	1.46	0.150	-.0404186	.2585841
gendhhh	-.0569566	.0764204	-0.75	0.459	-.2097189	.0958056
agehhh	.0062562	.0029212	2.14	0.036	.0004167	.0120957
edhhh	-.0036282	.01197	-0.30	0.763	-.0275558	.0202994
hhs	-.0002404	.0089255	-0.03	0.979	-.0180821	.0176014
occh	-.0180041	.0131715	-1.37	0.177	-.0443337	.0083254
mrts	.0366561	.0465403	0.79	0.434	-.0563767	.1296889
ngrps	.0126987	.0202643	0.63	0.533	-.0278091	.0532066
distmkt	-.0052087	.0109223	-0.48	0.635	-.0270421	.0166247
distcr	-.0078864	.0106252	-0.74	0.461	-.0291258	.013353
rgrp	.1201049	.0672567	1.79	0.079	-.0143394	.2545492
ntrngs	-.0309258	.0256176	-1.21	0.232	-.0821348	.0202831
frmsize	-.0050434	.0800123	-0.06	0.950	-.1649858	.154899
landown	.0941005	.0492054	1.91	0.060	-.0042597	.1924607
landareacult	.0567607	.0862073	0.66	0.513	-.1155653	.2290867
offentr	-.6082615	.0820253	-7.42	0.000	-.7722277	-.4442954
ffinc	-.1095911	.0767917	-1.43	0.159	-.2630954	.0439132
_cons	.5298835	.4632908	1.14	0.257	-.3962216	1.455989

```
. estat bgodfrey, lag(1)
```

Breusch-Godfrey LM test for autocorrelation

lags (p)	chi2	df	Prob > chi2
1	3.599	1	0.0578

H0: no serial correlation

Objective 2: Seemingly Unrelated Model

```
. sureg (amntfarm amntofffarm amntfrmrel = gendhhh agehhh edhhh frmexp hhs occh mrts ngrps rgrp dist
> cr distmkt trng ntrngs extcont frmsize landown landusep offentr ageent ffincc)
```

Seemingly unrelated regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
amntfarm	83	20	.2118444	0.7652	270.49	0.0000
amntofffarm	83	20	.4358406	0.3711	48.97	0.0003
amntfrmrel	83	20	.3124571	0.3551	45.71	0.0009

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
amntfarm					
gendhhh	.1183571	.0627799	1.89	0.059	-.0046892 .2414035
agehhh	-.0054383	.0050532	-1.08	0.282	-.0153424 .0044659
edhhh	.0004178	.0094085	0.04	0.965	-.0180225 .018858
frmexp	.0064535	.0046396	1.39	0.164	-.0026399 .0155469
hhs	-.001418	.0077789	-0.18	0.855	-.0166643 .0138284
occh	-.0068228	.0119215	-0.57	0.567	-.0301886 .0165429
mrts	.0168527	.0430538	0.39	0.695	-.0675311 .1012366
ngrps	.0232155	.0171755	1.35	0.176	-.0104478 .0568788
rgrp	.1188019	.0574234	2.07	0.039	.0062541 .2313498
distcr	-.003033	.0091038	-0.33	0.739	-.0208761 .0148101
distmkt	-.0004618	.0097475	-0.05	0.962	-.0195667 .018643
trng	.058811	.0837096	0.70	0.482	-.1052568 .2228789
ntrngs	-.0509579	.0290322	-1.76	0.079	-.10786 .0059442
extcont	.0066681	.0143345	0.47	0.642	-.021427 .0347631
frmsize	.0245896	.0173277	1.42	0.156	-.0093721 .0585514
landown	.1123059	.0412154	2.72	0.006	.0315251 .1930867
landusep	.0066001	.0026307	2.51	0.012	.0014441 .0117562
offentr	-.6166714	.0707938	-8.71	0.000	-.7554248 -.477918
ageent	-.0008102	.0029113	-0.28	0.781	-.0065163 .0048958
ffinc	-4.79e-08	5.28e-08	-0.91	0.364	-1.51e-07 5.55e-08
_cons	.3944884	.2781371	1.42	0.156	-.1506503 .9396271
amntofffarm					
gendhhh	.0371065	.129161	0.29	0.774	-.2160444 .2902575
agehhh	-.0052295	.0103963	-0.50	0.615	-.025606 .0151469
edhhh	.0194818	.0193566	1.01	0.314	-.0184565 .0574201
frmexp	-.0122585	.0095453	-1.28	0.199	-.0309669 .0064499
hhs	.0134604	.016004	0.84	0.400	-.0179069 .0448277
occh	.0324403	.0245269	1.32	0.186	-.0156316 .0805122
mrts	-.059087	.0885772	-0.67	0.505	-.2326951 .1145211
ngrps	.0149643	.0353362	0.42	0.672	-.0542934 .084222
rgrp	-.2613032	.1181408	-2.21	0.027	-.4928549 -.0297515
distcr	.0116694	.0187298	0.62	0.533	-.0250402 .0483791
distmkt	.0279139	.0200542	1.39	0.164	-.0113917 .0672194
trng	-.0489028	.172221	-0.28	0.776	-.3864498 .2886442
ntrngs	.0335933	.0597298	0.56	0.574	-.0834749 .1506615
extcont	-.0115069	.0294912	-0.39	0.696	-.0693085 .0462948
frmsize	-.0561169	.0356494	-1.57	0.115	-.1259884 .0137547
landown	.0492902	.0847951	0.58	0.561	-.1169052 .2154855
landusep	.0022774	.0054123	0.42	0.674	-.0083305 .0128852
offentr	.1712525	.1456486	1.18	0.240	-.1142134 .4567185
ageent	-.0002746	.0059896	-0.05	0.963	-.0120141 .0114649
ffinc	1.81e-07	1.09e-07	1.66	0.096	-3.21e-08 3.94e-07
_cons	.4949575	.5722288	0.86	0.387	-.6265904 1.616505
amntfrmrel					
gendhhh	-.0942166	.0925964	-1.02	0.309	-.2757022 .0872691
agehhh	.0152625	.0074532	2.05	0.041	.0006545 .0298705
edhhh	-.0208448	.0138769	-1.50	0.133	-.048043 .0063535
frmexp	-.0060809	.0068431	-0.89	0.374	-.0194931 .0073313
hhs	.0043766	.0114734	0.38	0.703	-.0181108 .0268641
occh	-.0253434	.0175835	-1.44	0.149	-.0598064 .0091197
mrts	.074465	.0635016	1.17	0.241	-.0499959 .1989258
ngrps	.0215076	.0253328	0.85	0.396	-.0281437 .0711589
rgrp	.0170406	.0846959	0.20	0.841	-.1489604 .1830416
distcr	-.0110886	.0134275	-0.83	0.409	-.0374061 .0152288
distmkt	-.022691	.014377	-1.58	0.115	-.0508694 .0054874
trng	.099058	.1234664	0.80	0.422	-.1429317 .3410477
ntrngs	-.0801224	.0428207	-1.87	0.061	-.1640494 .0038045
extcont	.0205388	.0211424	0.97	0.331	-.0208996 .0619772
frmsize	.0253677	.0255573	0.99	0.321	-.0247237 .0754591
landown	-.121152	.0607902	-1.99	0.046	-.2402986 -.0020054
landusep	-.0063452	.0038801	-1.64	0.102	-.01395 .0012596
offentr	.284335	.1044164	2.72	0.006	.0796825 .4889874
ageent	-.0042287	.004294	-0.98	0.325	-.0126448 .0041874
ffinc	-1.64e-07	7.79e-08	-2.11	0.035	-3.17e-07 -1.14e-08
_cons	-.0340615	.4102347	-0.08	0.934	-.8381068 .7699838

Objective 3: Switching Endogeneous Regression

```
. movestay loghh gendhhh agehhh edhhh frmexp hhs occh mrts frmsize landown offentr, select( crdaccl= extcont rgrp distr)
```

```
Fitting initial values ....
Iteration 0: log likelihood = -129.19765
Iteration 1: log likelihood = -129.08876
Iteration 2: log likelihood = -128.65457
Iteration 3: log likelihood = -128.63102
Iteration 4: log likelihood = -128.63088
Iteration 5: log likelihood = -128.63088
```

```
Endogenous switching regression model          Number of obs =      179
                                                Wald chi2(10) =      51.46
Log likelihood = -128.63088                   Prob > chi2 =      0.0000
```

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
loghh_1						
gendhhh	-.0567652	.0898536	-0.63	0.528	-.2328751	.1193447
agehhh	.0044687	.0060797	0.74	0.462	-.0074473	.0163847
edhhh	.0315885	.0118312	2.67	0.008	.0083998	.0547772
frmexp	-.0055618	.0056983	-0.98	0.329	-.0167303	.0056067
hhs	-.0019348	.0108994	-0.18	0.859	-.0232972	.0194276
occh	-.0351079	.0158747	-2.21	0.027	-.0662217	-.0039942
mrts	-.0511799	.0560723	-0.91	0.361	-.1610796	.0587198
frmsize	.0942733	.0230784	4.08	0.000	.0490403	.1395062
landown	-.1283211	.0535033	-2.40	0.016	-.2331856	-.0234565
offentr	.0842299	.0858896	0.98	0.327	-.0841105	.2525704
_cons	5.544113	.3911444	14.17	0.000	4.777484	6.310742
loghh_0						
gendhhh	.0492963	.0765409	0.64	0.520	-.1007211	.1993138
agehhh	-.0025239	.0050412	-0.50	0.617	-.0124045	.0073567
edhhh	.0323278	.0111011	2.91	0.004	.0105701	.0540855
frmexp	-.00137	.0053796	-0.25	0.799	-.0119139	.0091739
hhs	-.0003626	.0142807	-0.03	0.980	-.0283522	.027627
occh	-.0240431	.0200648	-1.20	0.231	-.0633694	.0152832
mrts	.0361773	.0579391	0.62	0.532	-.0773813	.1497359
frmsize	.0907343	.0217924	4.16	0.000	.048022	.1334465
landown	.0403428	.0578327	0.70	0.485	-.0730072	.1536928
offentr	-.0092994	.0801215	-0.12	0.908	-.1663347	.1477358
_cons	4.632259	.2655359	17.44	0.000	4.111818	5.1527
crdaccl						
gendhhh	.1923257	.2405916	0.80	0.424	-.2792252	.6638767
agehhh	-.0147408	.0157779	-0.93	0.350	-.0456649	.0161832
edhhh	-.0086345	.0357907	-0.24	0.809	-.078783	.061514
frmexp	.0300572	.0152954	1.97	0.049	.0000787	.0600357
hhs	.0284095	.0337853	0.84	0.400	-.0378086	.0946275
occh	.0977087	.0473711	2.06	0.039	.0048631	.1905542
mrts	.2082801	.1662123	1.25	0.210	-.1174899	.5340501
frmsize	-.0542617	.0666332	-0.81	0.415	-.1848604	.0763369
landown	-.0475004	.1648275	-0.29	0.773	-.3705564	.2755557
offentr	.3730004	.2362772	1.58	0.114	-.0900943	.8360951
extcont	-.0405286	.035625	-1.14	0.255	-.1103524	.0292951
rgrp	.5138148	.2007625	2.56	0.010	.1203276	.907302
distr	.0579583	.0261597	2.22	0.027	.0066863	.1092303
_cons	-1.496749	.8886821	-1.68	0.092	-3.238534	.2450361
/lns1						
/lns1	-1.060638	.1788561	-5.93	0.000	-1.41119	-.7100867
/lns2						
/lns2	-1.079428	.1558198	-6.93	0.000	-1.384829	-.774027
/r1						
/r1	-1.323816	.60448	-2.19	0.029	-2.508575	-1.1390567
/r2						
/r2	-.8854964	.5167256	-1.71	0.087	-1.89826	.1272672
sigma_1						
sigma_1	.3462348	.0619262			.243853	.4916016
sigma_2						
sigma_2	.3397898	.052946			.2503665	.4611523
rho_1						
rho_1	-.8677297	.1493339			-.9868404	-1.1381672
rho_2						
rho_2	-.7091622	.2568586			-.9560883	.1265845

```
LR test of indep. eqns. :          chi2(1) =      3.15   Prob > chi2 = 0.0759
```

```

. mspredict mymills1, mills1
. mspredict xx, yc1_1
. mspredict xy, yc1_2
. mspredict yy, yc2_2
. mspredict yx, yc2_1
. summarize xx xy yy yx

```

Variable	Obs	Mean	Std. Dev.	Min	Max
xx	83	5.543603	.2371205	5.049522	6.183668
xy	83	5.366438	.2264608	4.924355	6.068867
yy	96	5.286263	.2191036	4.827728	6.030162
yx	96	5.57477	.2324431	5.057383	6.126288

```

. ttest xx=xy

```

Paired t test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
xx	83	5.543603	.0260274	.2371205	5.491826	5.59538
xy	83	5.366438	.0248573	.2264608	5.316989	5.415887
diff	83	.177165	.0151508	.1380307	.1470251	.2073048

```

mean(diff) = mean(xx - xy)          t = 11.6934
Ho: mean(diff) = 0                  degrees of freedom = 82

```

```

Ha: mean(diff) < 0                 Ha: mean(diff) != 0                 Ha: mean(diff) > 0
Pr(T < t) = 1.0000                 Pr(|T| > |t|) = 0.0000                 Pr(T > t) = 0.0000

```

```

. ttest yy=yx

```

Paired t test

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
yy	96	5.286263	.0223622	.2191036	5.241869	5.330658
yx	96	5.57477	.0237236	.2324431	5.527673	5.621867
diff	96	-.2885065	.0137723	.1349401	-.3158479	-.2611651

```

mean(diff) = mean(yy - yx)          t = -20.9484
Ho: mean(diff) = 0                  degrees of freedom = 95

```

```

Ha: mean(diff) < 0                 Ha: mean(diff) != 0                 Ha: mean(diff) > 0
Pr(T < t) = 0.0000                 Pr(|T| > |t|) = 0.0000                 Pr(T > t) = 1.0000





```

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Appendix 3: Research Licence

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Appendix 4: Paper Publication

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Econometric Modelling of Rural Farm Household Credit Allocation in Kakamega County, Kenya

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Abstract

Enhanced household access to credit is essential in boosting the performance of small and medium enterprises in developing nations. Despite the role played by micro-finance in enhancing access to credit among poor rural households, there is dearth information on factors determining credit allocation. This study sought to fill the gap by investigating determinants of household allocation of credit accessed to different enterprises. Stratified multiple sampling approaches were used to select 179 smallholder farmers in Kakamega County. The study used semi-structured questionnaires to collect data which was then analysed using Seemingly Unrelated Regression Model (SUR). The results revealed that; gender of household head, land ownership and role played by an individual in socio-economic group were positive and significant determinants of credit allocation on farm enterprises. Moreover, access to training and ownership of off-farm enterprises were negative and significant. Concerning allocation of credit obtained on off-farm non-agriculture enterprises, off-farm income was positive and significant while membership and role played in group was negative and significant. On the other hand, age of household head, ownership of off-farm enterprise and off-farm income were positive and significant determinants of household allocation of credit on off-farm agriculture related enterprises. However, access to training and land ownership were negative and significant. The study recommends the adoption of policy measures aimed at encouraging farmers to diversify their income through engaging in sustainable off-farm activities. It also points out the need to empower women in order to enable them to own productive assets.

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